

ECB FORUM ON CENTRAL BANKING

28–29 September 2021

Event held online

Beyond the pandemic: the future of monetary policy

Conference proceedings



EUROPEAN CENTRAL BANK

EUROSYSTEM

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Programme

Tuesday, 28 September 2021

- 14:00-14:30 **Introductory speech**
- Christine Lagarde, President, European Central Bank
- Session 1: Micro and macroeconomic perspectives on corporate indebtedness**
- 14:30-15:30 **Corporate insolvency rules and zombie lending**
- Victoria Ivashina, Professor, Harvard Business School (together with Bo Becker, Professor, Stockholm School of Economics).
Discussant: Simeon Djankov, Director, Financial Markets Group, London School of Economics.
Chair: Luis de Guindos, Vice-President, European Central Bank.
- 15:30-15:45 Break
- 15:45-16:45 **Corporate indebtedness and macroeconomic stabilisation from a long-term perspective**
- Moritz Schularick, Professor of Economics, Sciences Po and University of Bonn.
Discussant: Egon Zakrajšek, Senior Adviser, Monetary and Economic Department, Bank for International Settlements.
Chair: Fabio Panetta, Member of the Executive Board, European Central Bank.
- 16:45-17:00 Break
- 17:00-18:00 **Panel 1: The future of inflation**
- Charles Goodhart, Professor Emeritus, London School of Economics.
Gita Gopinath, Economic Counsellor and Director of the Research Department, International Monetary Fund.
Francesco Lippi, Professor, Luiss Guido Carli University.
Chair: Isabel Schnabel, Member of the Executive Board, European Central Bank.

Session 2: Structural change and the implications of climate change for monetary policy

- 14:00-15:00 **Productivity and business dynamics through the lens of COVID-19: the shock, risks and opportunities**
- Chiara Criscuolo, Head of Productivity Innovation and Entrepreneurship Division, Organisation for Economic Co-operation and Development.
Discussant: John Van Reenen, Professor, London School of Economics
Chair: Luis de Guindos, Vice-President, European Central Bank.
- 15:00-15:15 Break
- 15:15-16:15 **Climate policies and monetary policies in the euro area**
- Warwick McKibbin, Professor, Australian National University (together with Beatrice Weder di Mauro, Professor, Graduate Institute, Geneva and Maximilian Konradt, PhD Student, Graduate Institute, Geneva).
Discussant: Anna Breman, Deputy Governor, Sveriges Riksbank.
Chair: Frank Elderson, Member of the Executive Board, European Central Bank.
- 16:15-16:30 Break
- 16:30-17:30 **Panel 2: Monetary policy, employment and inequality**
- Juan Dolado, Professor, Universidad Carlos III de Madrid.
Antonella Trigari, Professor, Bocconi University.
Gianluca Violante, Professor, Princeton University.
Chair: Philip Lane, Member of the Executive Board, European Central Bank.
- 17:30-17:45 Break
- 17:45-18:45 **Policy panel**
- Andrew Bailey, Governor, Bank of England.
Haruhiko Kuroda, Governor, Bank of Japan.
Christine Lagarde, President, European Central Bank.
Jerome Powell, Chair, Board of Governors of the Federal Reserve System.
Moderator: Alessandra Galloni, Editor-in-Chief, Reuters.
- 18:45-19:00 **Young economists' award announcement and closing remarks**
- Conference moderation:** Claire Jones, Financial Times.

Beyond the pandemic: the future of monetary policy - takeaways from the ECB's online Sintra Forum

By Philipp Hartmann and Glenn Schepens¹

Abstract

The 2021 ECB Forum on Central Banking was designed to assess which traces the COVID-19 crisis will likely leave in the euro area economy in the medium to long run, as well as how they and parallel structural changes would influence the implementation of the ECB's monetary policy. In this article, two of the organisers highlight some of the main points from the papers and discussions, including whether corporate indebtedness would have a bearing for the recovery, how the pandemic affected business dynamics, productivity and which growth policies are needed for the recovery, scenarios for and determinants of future inflation, how climate shocks and climate policies affect the macroeconomy and monetary policy, and how monetary policy interacts with labour markets and inequality.

1 Introduction

One and a half year after the onset of the COVID-19 pandemic, the euro area economy was recovering from previous infection waves. The 2021 ECB Forum on Central Banking looked into the future and endeavoured to assess which traces the pandemic would likely leave in the euro area economy in the medium to long run as well as how they would influence the implementation of the ECB's monetary policy under its [new monetary policy strategy](#), which was announced on 8 July 2021. Moreover, in a world characterised by a tremendous rate of change and disruption, it was timely to consider which further structural and other changes may affect core aspects of the ECB's monetary policy.

In this chapter we summarise some of the main issues discussed at the Forum and group them in five themes: corporate indebtedness, insolvency frameworks and the recovery from the COVID crisis; business dynamics, productivity and growth policies during and after the COVID crisis; the future of inflation; macroeconomic effects of climate change and monetary policy; and monetary policy, employment and inequality. The papers, presentations and video recordings of all sessions can be found at the [ECB website](#).

¹ Philipp Hartmann is the Deputy Director General for Research and Glenn Schepens a Senior Economist in the European Central Bank's Directorate General Research. Any views expressed in this chapter are summarised to the best of the authors' understanding from the various participants' Forum contributions and should not be interpreted as the views of the ECB or the Eurosystem.

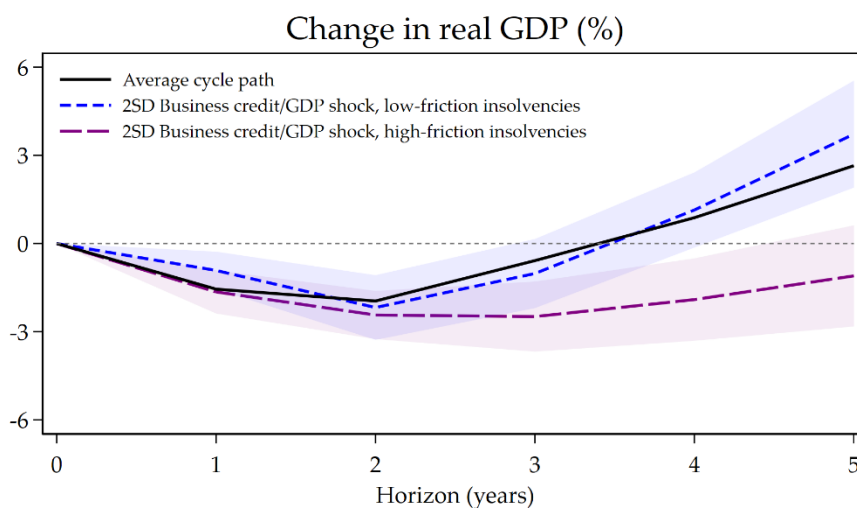
2 Corporate indebtedness, insolvency frameworks and the recovery from the COVID crisis

The COVID-19 pandemic severely reduced the cash flows and profitability of firms at a time when corporate leverage was already elevated. Once the established government support schemes and exemptions from insolvency laws are phased out, affected firms may find themselves saddled with high levels of debt, many remaining nevertheless viable, others not. A key question emerging is whether and how the potentially resulting corporate debt overhang might affect the recovery from the health crisis.

Based on a novel historical data set for 18 advanced economies since 1870, Moritz Schularick (in Schularick 2022 and Jorda et al. 2020) argued that the macro-economic aftermath of corporate debt booms is typically relatively benign, in particular when compared to household or mortgage debt booms. There are, however, three important caveats to take into account. First, the sectoral composition of corporate debt matters: the work by Müller and Verner (2021) suggests that the higher the share of credit going into non-tradable sectors, such as construction, transportation, distributive trade or accommodation and food services, the more recessionary the aftermath of a corporate credit boom becomes. Second, in bank-based financial systems, such as the case for the euro area, stringent banking supervision must prevent the financing and survival of zombie companies. Third, legal institutions for debt reorganisation must work efficiently, so that the resolution or restructuring of over-indebted firms can proceed smoothly. This is illustrated in Chart 1, which shows that recessions that occur after corporate credit booms are much more protracted when the bankruptcy regime is weak (dashed red line compared to dashed blue line). Schularick (2022) judged, however, that none of these caveats seems to ring alarm bells for the euro area in the aftermath of the COVID-19 pandemic. Nevertheless, it seemed advisable to further harmonise and unify insolvency frameworks at high levels of efficiency in Europe.

Chart 1

Dependence of recoveries from corporate credit boom-bust cycles on the quality of insolvency frameworks



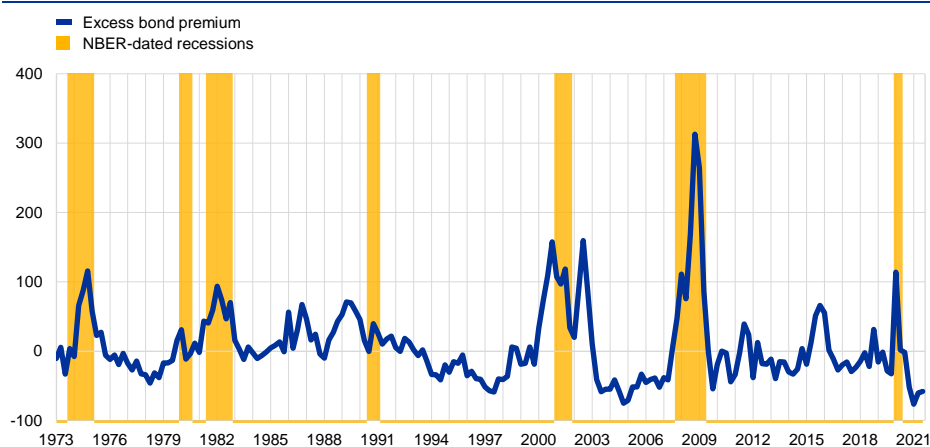
Sources: Schularick (2022, Chart 13), reproduced from Jordà, Kornejew, Schularick and Taylor (2020).

Notes: Estimations are based on a sample of 18 advanced economies over the time span 1978-2019. Lines show predicted recession paths after quinquennial credit/GDP booms of 2-standard-deviation above the long-term mean. Low- and high-friction insolvencies are proxied by country, using the creditor rights indicator of Djankov, McLiesh, and Shleifer (2007) for the period 1978-2003 and recovery rates from World Bank survey data collected using the methodology of Djankov, Hart, McLiesh, and Shleifer (2008) for the period 2004-2019. Low (high) friction insolvencies refer to the quality of countries' insolvency frameworks in terms of the highest (lowest) decile of these indicators for each year. Shaded areas mark 90 per cent confidence intervals.

In contrast with this relatively benign view on corporate debt booms, Egon Zakrajšek (in Zakrajšek 2022) argued that, given the unprecedented complexity and severity of the COVID-19 shock, the historical experience with aggregate corporate credit cycles might not necessarily be informative about the macroeconomic consequences of a corporate debt build-up induced by the pandemic. Moreover, considering only credit quantities and not prices could provide an incomplete picture. Sustained corporate debt build-ups could lead to elevated and over-optimistic credit market sentiment, which could be disappointed in the future and result in an abrupt tightening of credit conditions. Chart 2 uses the excess bond premium of Lopez-Salido, Stein and Zakrajšek (2017; blue line) as an inverse proxy for market sentiment (a low premium indicates elevated market sentiment). Sharp reversals of the premium and recessions in the US (yellow areas) seem indeed preceded by periods of optimistic market sentiment. And market sentiment reached very high levels during the second half of 2020 and during 2021. As a consequence, Egon Zakrajšek warned that the combination of historically high levels of corporate debt together with the exceedingly buoyant credit market sentiment could be indicative of a situation that is highly vulnerable to unexpected changes in both fiscal and monetary policies, as well as to an endogenous unwinding of investors' over-optimistic beliefs.

Chart 2

Reversals of credit market sentiment and recessions in the US



Sources: Zakrajšek (2022, Chart 3), using BIS and Board of Governors of the Federal Reserve System data.
Notes: The excess bond premium measures the variation in the average compensation for bearing U.S. corporate credit risk above and beyond the compensation that investors in the corporate bond market require for expected firm defaults. An increase in the premium thus implies a reduction in the risk appetite of corporate bond investors.

Victoria Ivashina (in Becker and Ivashina 2022) further explored the importance of insolvency frameworks for the economic recovery after crises. Using data for European Union (EU) countries, the United Kingdom and the United States between 2004 and 2020, she estimated that in times of economic distress countries with strong insolvency frameworks exhibit more active firm restructuring than countries with weak frameworks and less zombie lending (relative to good economic times). Moreover, the former countries develop more active private debt securities markets. Importantly, Becker and Ivashina (2022) stress that their results imply that zombie lending cannot only be tackled through the means of bank supervision, as traditionally the case. Highly efficient insolvency frameworks are also a key factor for avoiding the capital misallocation that can result from firm zombification.

In his discussion, Simeon Djankov (in Djankov and Zhang 2022) stressed the importance of bankruptcy law reforms in Europe to deal with a potential increase in bankruptcy filings. Once COVID-19 related government support programmes and solvency law moratoriums run out, the unusually low default rates during the pandemic may reverse substantially. Changes to existing regimes should be done immediately, with a particular focus on reorganisation and debt restructuring processes, so that they are already in place when the wave of bankruptcies may come. While a few European countries have gone in this direction in the recent past, several harmonised European initiatives have received a lukewarm reception. For example, Djankov urged member states to implement the EU Restructuring and Insolvency Directive of 2019, which requires to include restructuring features in bankruptcy legislation. At the time of his presentation, the directive was still to be transposed into national legislation in 85 per cent of the EU Member States.

The two papers and discussions on post-COVID corporate debt and insolvency frameworks gave rise to a lively discussion in which most commentators agreed on the great importance of high-quality bankruptcy rules and on the need for a swift implementation of recent EU initiatives at national levels. This would not only support

the recovery but also limit the risk of firm zombification. Luis de Guindos pointed out that in order to make further progress with reforms justice ministers, usually in charge of national bankruptcy laws, and finance ministers would need to find forums for effectively working together. Martin Oehmke reported the concern of a recent paper that formal and informal frameworks for small firms may not work as efficiently as needed in Europe (Becker and Oehmke 2021). Dan Andrews pointed out that particularly for small firms also interactions between corporate and personal bankruptcy rules would have to be taken into account, e.g. regarding the treatment of personal collateral of entrepreneurs (Adelet McGowan, Andrews and Millot 2017). Sebnem Kalemli-Ozcan and Moritz Schularick agreed that the microeconomic literature tends to find stronger effects of corporate debt on firm investment and firm growth and that further research is needed to fully reconcile the discrepancy with Schularick's historical macro work. Francois Villeroy de Galhau recalled that the greater equity orientation in the United States implied greater innovation capacity. Fabio Panetta concluded that in the months ahead it is paramount that European policy makers ensure that no adverse feedback loops between insolvencies, financial conditions and the real economy can emerge.

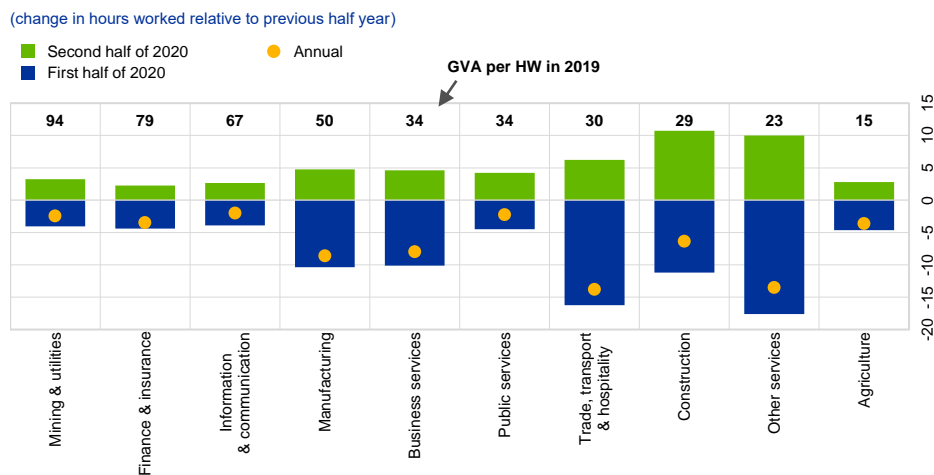
3 Business dynamics, productivity and growth policies during and after the COVID crisis

The COVID-19 pandemic has affected firms in a very heterogeneous way, depending on their ability to allow for remote work and on how social distancing measures affected their operations and customer relationships. Chiara Criscuolo (in Criscuolo 2022) provided an overview of the channels through which the COVID-19 crisis affected productivity and business dynamics in the short-term and discussed how they could potentially evolve in the long term, with a strong emphasis on the heterogeneous impact across firms and sectors.

In terms of cross-sectoral reallocation, the COVID pandemic adversely affected most low-productivity sectors, such as construction, transport and hospitality or other services, as the blue columns and yellow dots in Chart 3 illustrate. But as overall hours worked declined by more than output, somewhat paradoxically measured productivity first increased in parallel with a 6.3 per cent destruction of euro area output. Whether the productivity growth is going to last will depend on changes in consumer behaviour and whether high-productivity sectors will sufficiently expand in the future.

Chart 3

Changes in hours worked and productivity for different euro area sectors during the COVID pandemic



Sources: Criscuolo (2022, Chart 3), using Eurostat's National Accounts database.

Notes: Euro area corresponds to weighted average of 19 member countries. GVA per HW stands for gross value-added per hour worked as a productivity indicator. Variables in 2015 prices.

In terms of creative destruction and within-sector reallocation during the pandemic, in addition to the declines in firm default rates already observed by Ivashina and Djankov, Criscuolo pointed to recoveries in firm entry rates in a number of euro area countries (in contrast to the Great Financial Crisis) but not in others, notably Italy and Portugal. This could give rise to a “missing generation” of firms in the latter countries. Although the evidence does not bear it out yet, the “cleansing” effect of the crisis could also be weakened by long-lasting government support measures stifling the reallocation process.

Criscuolo regards the fast adoption of digital technologies and the rise of teleworking as perhaps the most striking effect of the crisis. A priori, however, the link to productivity is ambiguous and there are also risks. Notably, the loss of (physical) meeting and agglomeration benefits could weigh on innovation and the disadvantages of low-skilled workers and small firms could increase inequalities. Moreover, the greater ability of larger, more productive and more digital firms to adopt these technologies and to make more effective use of complementary intangible assets (e.g. management capabilities and software development), seems to reinforce some pre-crisis trends towards concentration, high mark-ups and dispersion in firm performance. Therefore, structural policies are a “strategic ally” of monetary and fiscal policies towards a green, digital and inclusive recovery. They should facilitate the development of skills and labour mobility, establish the necessary digital infrastructure and support the investment of young and small firms in the necessary intangible assets.

In his discussion, John van Reenen (in van Reenen 2022) recalled that the COVID pandemic was preceded by a long trend of slowing productivity growth and that the assessment of productivity during the crisis is stricken with severe measurement problems. The key issue is not only how to recover from the pandemic, but rather how to ensure strong enough productivity growth when things return to normal. So, he

added to Criscuolo's framework a stronger emphasis on innovation expanding the production frontier, on frontier firms and on the right direction of technical change (e.g. has non-digital innovation declined?). What is needed on the policy side, in his view, is an ambitious growth plan – a new “Marshall Plan” – based around innovation and the diffusion of best practices, both for managerial and technological issues. Research suggests that successful innovation policies include research and development (R&D) tax credits, direct government grants and human capital development through universities and a growing STEM (sciences, technology, engineering and mathematics) work force, immigration and the mobilisation of under-represented parts of society for the inventor pool. Such policies should be bundled together around important missions, such as the climate agenda, and be supported by institutional reform ensuring their stability as well as a balance between protection and reallocation in the short term.

The subsequent floor discussion revolved around the risk that the pandemic and the teleworking it induced could reinforce different forms of inequality, whether governments' firm and worker support programmes could have distortive side effects and about the role of competition policy. Criscuolo and van Reenen agreed that the learning gaps that distancing measures create for pupils, students and young workers are a very serious concern, in particular for young people from low-income environments. Answering to a question from Elizaveta Sizova, Criscuolo could see various mechanisms through which women's pay or careers could also suffer compared to men's, but as there are also countervailing effects this remains speculative at this juncture. The (limited) European evidence so far seems to suggest that government support went to the companies most affected and most financially constrained and would not be indicative of significant misallocation effects (see e.g. Cœuré 2021). According to Van Reenen, this is in contrast to the Great Financial Crisis in which productive but financially constrained firms went under, with adverse implications for productivity. He also felt strongly that, in order to avoid that the digital giants use their powers in detrimental ways, competition policy would have to change. It should move from a focus on existing market shares to a focus on future competition, in that the existing platforms would have the burden of proof that further takeovers would not limit the ability of new platforms to enter the market.

4 The future of inflation

One of the questions that attracted particular attention in the 2021 Forum was whether the recently increased inflation in the euro area would be sustained or remain a temporary phenomenon, and which factors will likely be driving inflation over the following years.

In her introductory speech about the atypical nature of the recovery from the COVID pandemic, President Lagarde (in Lagarde 2022) first recalled that the last decade was characterised by strong disinflationary forces, including a structural slowdown of transmission channels to inflation. The higher inflation readings at the reopening of the economy is largely the result of two exceptional factors: strong base effects due to the collapse in inflation during the first quarters of the pandemic and supply bottlenecks

from global value chain disruptions meeting a sharp recovery in demand, including for energy. The base effects should drop out in early 2022, while the persistence of supply chain disruptions is harder to predict and it cannot be excluded that their resolution may take longer.

While nurturing the positive demand forces that could lift inflation durably towards the ECB's symmetric 2 per cent inflation target, the key challenge for monetary policy makers – Lagarde said – is not to overreact to transitory supply shocks that have no bearing on the medium term and do not risk to de-anchor inflation expectations. During the policy panel, Governor Bailey noted that monetary policy cannot solve supply side shocks – it cannot produce computer chips or van drivers, so to speak –, but it can focus on potential second-round effects, should inflation broaden, e.g. through labour markets and wage growth. Chair Powell added that even though the current period of higher inflation ultimately is very likely to prove temporary, if it lasts long enough, the important question to ask is whether and when it will start affecting and changing the way people think about inflation.

Looking at different components of underlying inflation, President Lagarde reasoned that meeting the ECB's medium-term target would particularly depend on more dynamic services inflation at the transition out of the pandemic. Much like for services, however, also some long-run factors could push inflation either up or down. For example, digitalisation could reduce unit labour costs (even as wage growth becomes stronger) and create initial skill mismatches and scarcities leading to further wage increases (even in the presence of persistent aggregate slack). Similarly, in what concerns the green transition, the necessary taxation of carbon emissions would increase inflation but if the receipts are not distributed to vulnerable groups affected and to green investments the rising headline inflation could go hand-in-hand with declining underlying inflation (see also McKibbin, Konradt and Weder di Mauro 2022).

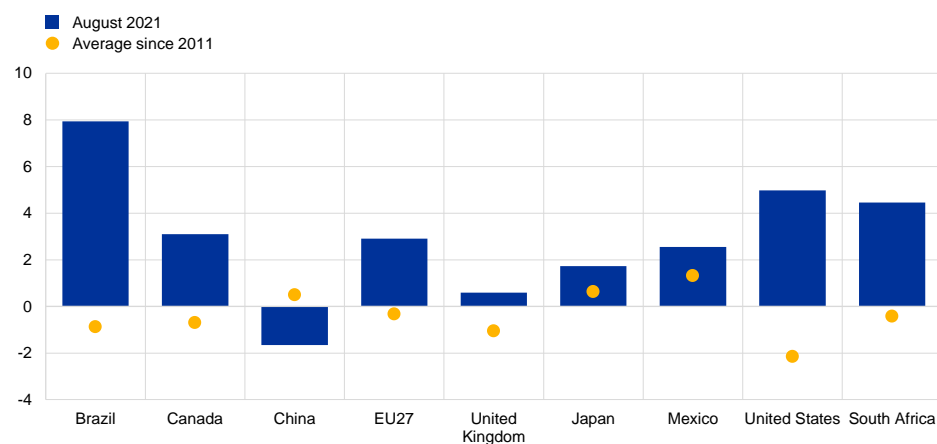
In the subsequent panel on “The future of inflation” Gita Gopinath (in Gopinath 2022) showed the International Monetary Fund's latest forecasts for the United States and the euro area, which confirmed that elevated inflation levels were expected to come down in the course of 2022. She stressed, however, that there were upside risks to these forecasts. As pointed out by Krishna Guha during the discussion, this has a different meaning for the US, where inflation is predicted to remain above the Fed's inflation target, and the euro area, where inflation is predicted to return below the ECB's target. Gopinath observed an anomaly compared to the past decade, as for many constituencies around the world the rise in inflation is mainly driven by goods rather than services (Chart 4).

Chart 4

Goods rather than services prices drive inflation during the recovery from COVID

Excess of goods over services inflation

(economy, percent)



Sources: Gopinath (2022, Chart 2), using Haver Analytics and IMF staff calculations

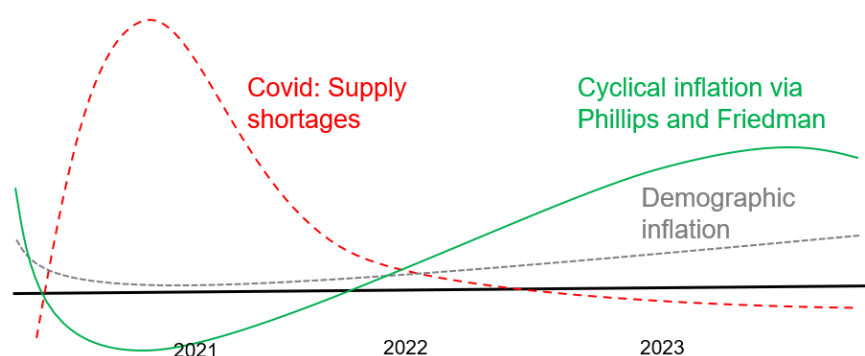
Notes: For Japan, average since 2016.

The main reasons for the upside risks in the IMF inflation forecasts are that the supply bottlenecks do not seem to go away any time soon and that the pass-through from certain sectors to inflation are still missing. This applies to certain services and housing. The point on the pass-through of housing prices was also illustrated in the panel contribution by Charles Goodhart (in Goodhart 2022, Chart 2), who showed the lagged relationship between house prices and owner equivalent rents for the US. While he applauded the ECB for its decision to consider in the future owner-occupied housing in its inflation assessment, he also warned that this will make measured inflation more volatile. Moreover, there has never been an as highly coordinated increase in housing prices around the world as presently the case and this will sooner or later show in the contribution of rents to inflation.

Goodhart further criticised that the inflation analyses presented so far did not pay enough attention to reversals in labour supply. As the competition from workers in emerging economies and the working age population in many European countries decline, disinflationary forces from globalisation will give way to increased wage pressures from labour shortages. Therefore, Goodhart predicts a return of inflation (see also Goodhart and Pradhan 2020), which is not transitory and illustrated in Chart 5 as the combination of three forces. While the COVID-related supply bottlenecks will vanish over time (may be slower than illustrated in the dashed red line in the chart), they will be replaced by cyclical inflation (driven by the desire to maintain accommodative monetary policy; green line) and the more lasting “demographic inflation” (dashed grey line).

Chart 5

Varying sources of inflation over time



Source: Goodhart (2022, Chart 2).

Gita Gopinath (in Gopinath 2022) objected that demand is also negatively affected by population aging, so the net effect could as well be disinflationary. For example, Japan has a shrinking labour force since the mid-1990s and no inflation. Additionally, she and Francesco Lippi agreed that well-run monetary policy would be able to control any undue inflationary pressures.

This was actually the main point of Francesco Lippi's contribution (in Lippi 2022) to the panel. The key to neither too high nor too low inflation is the systematic response by monetary policy. Good and credible monetary policy will stabilise inflation, induce the agents in the economy to also expect this for the future, thereby lead inflation expectations to remain anchored, which in turn stabilises current inflation. He illustrated this with two examples from the oil price shocks of the 1970s, a comparison of German and Italian inflation outcomes (Sargent 2013) and the split of inflation expectations in the US (Reis 2021). In contrast, the distribution of euro area inflation expectations did not show growing tails at the time of the Forum.

Charles Goodhart (in Goodhart 2022), however, expressed concern that inflation expectations might presently be used by some policy makers in a "dangerous" way (see also Rudd 2022). Based on a bootstrap-type of theory (as long as expectations are anchored, inflation will follow them), there seem to be attempts to engineer that agents raise their inflation expectations in order to escape from the previous low-inflation period. The hope seems to be that people pay more attention to inflation and that it would therefore respond more to economic conditions again. The problem is, however, that inflation expectations tend to be adaptive and backward looking, rather than reflecting future economic developments.

In the ensuing discussion Ricardo Reis responded that one should not downplay the value of inflation expectations for monetary policy making, as they still convey important signals, albeit not being a causal driving factor of future inflation. Governor Bailey added that, while he disagrees with Charles Goodhart that inflation expectations are irrelevant, we might need to re-think how inflation expectations are incorporated in the economic models used. For example, private agents might become inattentive after a period of low and stable inflation. Francesco Lippi argued

that there is already a lot of ongoing research about the behaviour of inflation expectations. For example, Ricardo Reis pioneered work suggesting that inattentiveness of firms and household may mean that it takes time for them to react to, say, increasing energy prices (Reis 2006a, Reis 2006b).

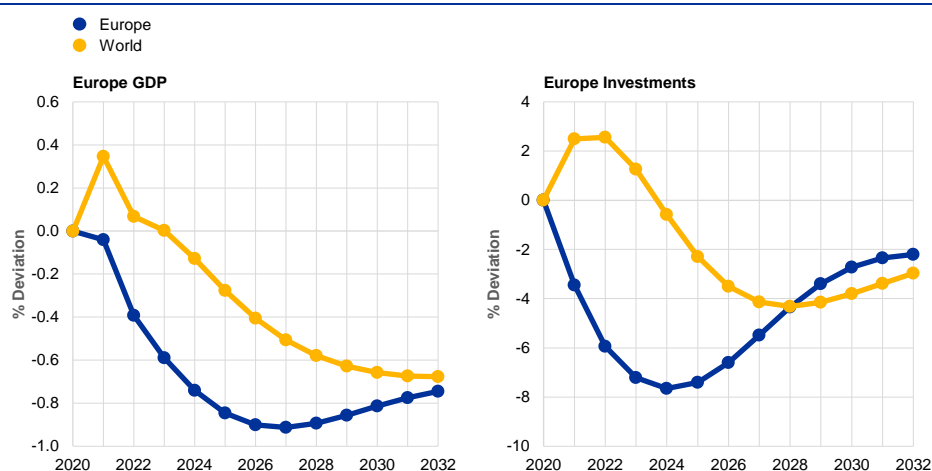
5 Macroeconomic effects of climate change and monetary policy

One of the more pervasive structural changes that will shape economic developments over the next decades is climate change and the carbon transition. Warwick McKibbin (in McKibbin, Konradt and Weder di Mauro 2022) addressed the short- and longer-term macroeconomic implications of both factors, using particularly a new version of the G-cubed model (see e.g. McKibbin and Wilcoxon 2013). This is a large global intertemporal general equilibrium model with granular representations of countries or regions and their economic sectors, including various fossil and non-fossil energy sub-sectors, with country/region-specific fiscal and monetary policy rules as well as with frictions in capital accumulation and labour markets. Differences in the sector structure of countries/regions are important for the assessment of climate shocks and policies, as elasticities of substitution and relative price changes transmit them widely. For example, the empirical analyses of both Konradt and Weder di Mauro (2021) and Moessner (2022) find relative price changes from carbon taxes or carbon pricing schemes, although the Philips-curve estimations for a larger set of countries by the latter do not uncover disinflationary effects on core inflation.

The simulations of the G-cubed model suggest that GDP typically declines after climate shocks (represented by a no-climate policy baseline with global warming to 2.4° Celsius by 2100 and the associated productivity trends as well as extreme weather events) or after the introduction of a euro area wide carbon tax (set to 50 EUR per ton of CO₂ emissions and increasing by 3 per cent per annum), both in the short run and after 10 years, accompanied by important reductions in investment (Chart 6). A global carbon tax (of the same magnitude) has a short-lived positive effect on euro area GDP, which then declines more slowly than for the European tax (as capital flows in from even more carbon intensive economies, temporarily stimulating euro area investment; see right panel of Chart 6), leading overall to smaller cumulative output losses after 10 years. The largest cumulative impact on GDP is found for the climate shocks (“physical risks”), not for the “transition risks” from carbon taxation. An important caveat is that the growth results depend crucially on the assumptions for countries’ fiscal policies, including how carbon tax revenues are used. For example, running green infrastructure programmes would stimulate investment and could reverse the deleterious output effects. Another caveat pointed out by the discussant, Anna Breman (in Breman 2022), is that transition risks and physical risks are modelled separately in this type of models. In practice, however, they are likely to interact, which would be a valuable area for further developing such models. She also suggested to extend standard monetary policy through interest rates with asset purchases and collateral policies.

Chart 6

Effects of a euro area versus a global carbon tax on euro area GDP and investment



Sources: McKibbin, Konradt and Weder di Mauro (2022, Chart 12).

Notes: The chart shows the implications for euro area GDP and investment of implementing a 50 euro per ton carbon tax in 2020, which subsequently increases by 3 per cent per year until 2100. The chart compares two scenarios: in the first scenario (blue line) the tax is only implemented in the euro area ("Europe"). In the second scenario (yellow line) the tax is implemented on a world-wide scale ("World"). The underlying model is the version of the G-cubed model described in McKibbin, Konradt and Weder di Mauro (2022). This model is a global intertemporal general equilibrium model, including 10 regions/countries and 20 sectors as well as monetary and fiscal policy rules. All results are expressed as deviations from steady state values.

The simulations of the model also find that the effects of climate shocks or carbon taxes on inflation are relatively limited, both in the short and the long run. This is in line with empirical estimates for eight euro area countries that had introduced (relatively small) carbon taxes in the past (McKibbin et al. 2022, section 2). Based on a comparison of two Orphanides-type monetary policy rules (Orphanides 2003, Orphanides and Wieland 2013 and Hartmann and Smets 2018) in the G-cubed model, however, the authors express concern that a central bank that focuses mostly on future inflation and output, rather than giving enough weight to contemporaneous data, could overreact to such supply shocks and therefore create additional short-term output losses.

The winner of the Sintra Young Economists' Prize, Diego Känzig (in Känzig 2022), analyses in his prize-winning paper the uneven effects of changes in the European Union carbon emission trading system (ETS). Using an event study approach, he finds that unexpected increases in ETS prices lead to higher energy prices and green innovation (as measured by low-carbon patenting) as well as lower green-house gas emissions, investment, consumption and output. As low-income households consume a larger share of their income for energy and are more employed in carbon-intensive sectors, they reduce their expenditure significantly more than high-income households and persistently so after such a carbon price policy. Känzig concludes from these uneven effects that targeted fiscal policies may be advisable for reducing the economic costs of carbon pricing. Previous empirical research, however, has found limited or positive effects of carbon taxes on growth and employment (e.g. Metcalf and Stock 2020a, 2020b), indicating that the differential results in this evolving literature still need to be reconciled.

Anna Breman (in Breman 2022) pointed out in her discussion that one of the key challenges for monetary policy is that, in real time, it is difficult to distinguish between

relative price changes, as caused by climate shocks or policies, and changes in the price level overall. She illustrated this with an episode in the COVID pandemic, when three types of shocks combined at the same time: supply shocks from social distancing, associated demand shocks and shocks to electricity prices, as warm, wet and windy winter weather let electricity prices fall sharply in a country like Sweden, which depends heavily on hydro and wind power. This combination made inflation very volatile, rendering it difficult to forecast its persistence, second-round effects and implications for inflation expectations.

During the floor discussion Elga Bartsch pointed out that climate policies reaching the Paris policy targets of an economy with net zero carbon emissions would have much more drastic macroeconomic effects than the McKibbin et al. simulations for moderately sized carbon taxes. But they can still be done, if fiscal policy does the right thing and it is coordinated alongside monetary policy with the climate policies. In what concerns central bank behaviour she reckoned that it is key to understand whether monetary policy focuses on headline or on core inflation. Anything else would be second order. In response to a question by Diego Känzig, McKibbin clarified that optimal monetary policy is not derived in the paper but that – in his view – central banks should target nominal GDP rather than inflation, as this would require less information and does not rely on problematic forecasts of potential output. In response to a question by Jim Bullard, he suggested the climate asset liability mechanism (CALM), which he had developed together with Richard Holden and Mike Young, for both economically optimal and politically credible climate policy (see Academy of the Social Sciences in Australia 2020, section 4).

6 Monetary policy, employment and inequality

The connection between monetary policy and employment has been one of the longest running topics in macroeconomics. For one, as pointed out by Philip Lane during the panel on monetary policy, employment and inequality, it is very difficult to have inflation run at a 2 percent target in the medium term without commensurate wage growth.

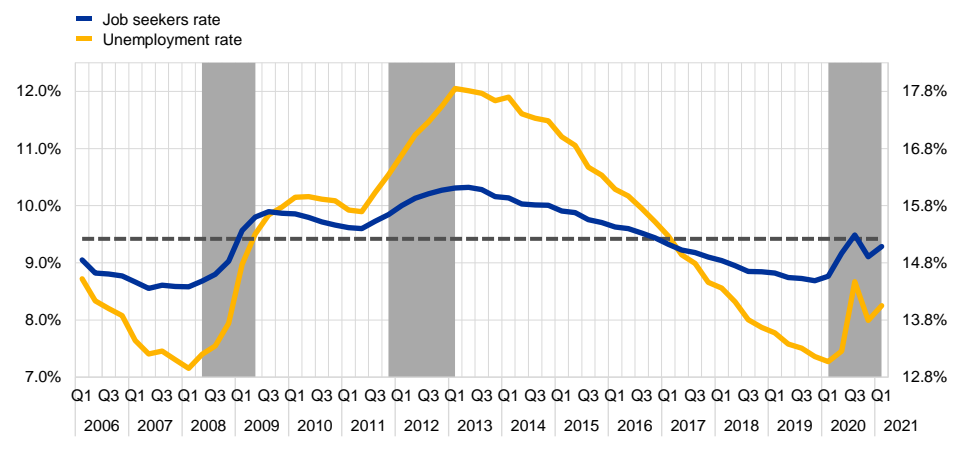
In her panel contribution, Antonella Trigari (see Trigari 2022) emphasised the importance of labour market underutilization (“slack”) as a key input to monetary policy, as it is a major determinant of current (and expected) wages. Unemployment rates, however, do not capture all components of labour market slack (unmet demand of labour), as they do not cover the whole pool of effective job seekers. For example, depending on their variant, they do not capture the sizeable flows from non-participation (in the labour force) to employment, from one employment to another or varying search intensities across groups. Therefore, she proposes a novel measure of effective job seekers to better capture labour market slack in the euro area (Chart 7). This measure is a sum of different types of unemployed, non-participating and employed people, weighted by their respective transition rates to employment (as reported by Eurostat). The different types include, for example, short and long-term unemployed, seeking but not immediately available non-participants as well as available but not seeking non-participants. As can be seen in Chart 7, the novel job

seekers rate (blue line) is less volatile than the usual unemployment rate (yellow line). Standardising both rates to the same volatility (not shown in the chart), it turns out that in the Great Recession and the COVID pandemic the latter has underestimated slack relative to the former, at the peak by about 1 percentage point. In upturns, however, the standard unemployment rate seems to underestimate labour market tightness, and therefore wage pressure, relative to the job seekers rate.

Chart 7

Comparison of the effective job seekers rate and the standard unemployment rate in the euro area

(left scale: percentage of workforce; right scale: percentage of working-age population)



Sources: Trigari (2022, Chart 2), using Eurostat data.

Notes: Unemployment rate is a "standard" unemployment rate, taken from Eurostat. An unemployed person is defined by Eurostat according to the guidelines of the International Labour Organization: a person aged 15 to 74 without work during the reference week who is available to start work within the next two weeks and who has actively sought employment at some time during the last four weeks. The unemployment rate is then defined as the number of people unemployed as a percentage of the labour force. The job seekers rate is an alternative measure of labour market slack which, in contrast to the unemployment rate, tries to take into account that the pool of job seekers is heterogeneous and that the group of unemployed people does not necessarily corresponds to the group of job seekers, e.g. due to people looking to switch jobs. In other words, the job seekers rate tries to incorporate all margins of unmet demand for labour. The amount of job seekers is calculated as follows:

$$S_t = \frac{\rho^{ST} U_t^{ST} + \rho^{LT} U_t^{LT}}{\text{Unemployed, } U_t} + \frac{\rho^{SNA} N_t^{SNA} + \rho^{ANS} N_t^{ANS} + \rho^{ONP} N_t^{ONP}}{\text{Nonparticipants, } N_t} + \frac{\rho^E E_t}{\text{Employed, } E_t}$$

where U^{ST} is the number of short-term unemployed, U^{LT} that of long-term unemployed, N^{SNA} is the number of persons seeking work but not immediately available, N^{ANS} the number of persons available to work but not seeking, N^{ONP} that of other nonparticipants, and E the number of employed workers. The weights ρ are relative transition rates to employment for the above groups (taken from Eurostat), where the weight for the short-term unemployed is normalised to 1, i.e. the short-term unemployed are the group with the highest job-finding rate. The jobseekers rate is then equal to the amount of job seekers (S_t) as a share of the labour force.

Juan Dolado (in Dolado 2022) dedicated his intervention to the effects of conventional monetary policy on inequality. Distinguishing five channels through which a rate cut would have distributional effects, he focused on two "earnings heterogeneity" mechanisms that work through investment and the skill level of workers (Dolado, Motyvovski and Pappa 2021). First, lower interest rates increase investment and thereby the demand for high-skilled labour, as this type of labour is complementary to the additional capital created. Second, the relative income share of high-skilled workers also rises with the enhanced production from investment as their lower separation rates and higher matching efficiency translate into greater wage bargaining power. The two forces tend to reinforce each other but are still somewhat moderate in size. They also operate for fiscal policy (and other demand shocks), but are further reduced due to the crowding out of private investment. The theoretical findings and simulations are supported by an empirical vector autoregression analysis for US data before the Great Financial Crisis, which suggests that a 100 basis points reduction in the monetary policy rate is associated with 40 basis points increase of the employment

and wage premiums that high-skilled workers benefit from relative to low-skilled workers (Dolado 2022, chart 3). Dolado concludes that the analysis should not be taken as recommending that central banks react to measures of inequality. Fiscal and education policies are better suited to do so. But it is still worth being aware of the distributional consequences of monetary policy at business-cycle frequency and how they can be dampened through demand stabilisation.

Gianluca Violante (in Violante 2022) provided an overview of what monetary policy has learned so far from novel Heterogeneous Agent New Keynesian (HANK) models. These models replace the representative consumer in conventional New Keynesian models (NKM) with heterogeneous households that behave according to modern consumption and saving theory. Therefore, they can capture empirically observed income and wealth distributions. Violante identified four lessons. First, HANK models provide a much richer representation of channels through which monetary policy is transmitted to consumption. For example, household saving and dissaving in response to interest rate changes in NKMs (intertemporal substitution channel) is dominated by a series of direct income, asset price and labour income effects. This is particularly valuable for assessing unconventional monetary policy, which works through asset prices. Second, they feature various amplification mechanisms in monetary transmission, related to the re-distribution of income or wealth across households with different propensities to consume, precautionary savings behaviour or fiscal policy reactions to rate changes. Third, they show the redistributive effects of monetary policy and their role in monetary transmission. Against the background of communications by the US Fed to contribute to an “inclusive recovery” from the COVID pandemic, Violante was wondering whether the ECB – with its different mandate – could try to achieve price stability “in the most equitable way”. Even though fiscal re-distribution can be targeted more accurately, institutional delays and political compromises may hamper its effectiveness. Fourth, HANK models call for the establishment of granular household data sets to empirically validate their predictions.

During the general discussion all three panellists agreed that it would be problematic to ignore the implications of the various forms of heterogeneity captured in HANK models for monetary policy. In what concerns the complexity of using them, Violante clarified that most new transmission channels would already be captured by a moderate step going from a standard representative agent NKM to a two-agent NKM, or TANK model. In terms of the relative importance of amplification versus dampening effects of heterogeneity for monetary transmission he explained that they can operate at the same time for households in different parts of the income distribution. In response to a question by Kristin Forbes, Violante confirmed that with a HANK model one can generate the same stimulus, e.g. for growth, with adequately designed conventional or unconventional monetary policy measures in order to understand their different distributional effects.

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Monetary policy during an atypical recovery

Introductory speech by Christine Lagarde¹

1 Introduction

The economy is back from the brink, but not completely out of the woods. After a highly unusual recession, the euro area is going through a highly atypical recovery.

This atypical recovery is leading to rapid growth, but also to supply bottlenecks appearing unusually early in the economic cycle. It is also causing inflation to rebound quickly as the economy reopens. And it is helping to accelerate pre-existing trends and new structural changes brought about by the pandemic, which could have implications for future inflation dynamics.

But it is important today to take a step back. To understand how monetary policy should operate in this environment, we need to recognise where we have come from and where current trends suggest we are going. As John Maynard Keynes wrote, policymakers must always “study the present in light of the past for the purposes of the future”.

We are coming from a decade of strong disinflationary forces that have depressed the whole inflation process. And while the robust recovery is supporting underlying inflation trends, what we are seeing now is mostly a phase of temporary inflation linked to reopening. Structural changes could create both upward and downward pressures on prices.

2 The inflation process before the pandemic

In the decade before the pandemic, inflation across advanced economies consistently surprised on the downside. The inflation process appeared to have slowed down along the transmission chain: from activity and employment to wages, and then from wages to prices. This was largely down to three factors.

First, gauging the true level of slack in the economy became harder.² Estimates of structural unemployment were consistently revised down as the economy

¹ President of the European Central bank.

² See Jarociński, M. and Lenza, M. (2018), “An Inflation-Predicting Measure of the Output Gap in the Euro Area”, *Journal of Money, Credit and Banking*, Vol. 50, No 6, pp. 1189-1224; Eser, F., Karadi, P., Lane, P.R., Moretti, L. and Osbat, C. (2020), “The Phillips curve at the ECB”, *The Manchester School*, Vol. 88, pp. 50-85; Koester, G., Lis, E., Nickel C., Osbat, C. and Smets, F. (eds.) (2021), “Understanding low inflation in the euro area from 2013 to 2019: cyclical and structural drivers”, *Occasional Paper Series*, No 280, ECB, Frankfurt am Main, September.

strengthened.³ And even as unemployment came down, many more people were drawn into the labour market, especially women and older people.⁴

Second, structural changes in labour markets meant that receding slack fed more slowly into wage growth. Employment increased rapidly after 2013 but was mainly channelled into lower-paying jobs.⁵ In parallel, global forces – such as globalisation and automation – reduced workers' bargaining power.⁶

Third, when wage growth did eventually pick up, firms were reluctant to pass on cost increases to consumers. Instead, we saw firms squeeze their profit margins.⁷ This also reflected broader structural trends such as the digitalisation of services and the expansion of e-commerce.⁸

3 Recession and reopening

Then, the pandemic hit, which led to a highly unusual recession followed by a highly atypical recovery.

In conventional business cycles, the depth of the slump normally determines the pace of the recovery. After exceptionally deep recessions, both demand and supply are often impaired for many years. From the onset of the great financial crisis, for example, it took seven years for euro area GDP to get back to its pre-crisis level. Growth never reconnected with the trend we thought possible before 2008.

But during the pandemic, though GDP saw its steepest collapse on record, the overall economy has reopened largely intact.⁹ We now expect GDP to exceed its pre-pandemic level by the end of this year – three quarters earlier than we forecast last December – and it should come close to reconnecting with its pre-crisis trend in 2023. From its trough, the recovery in GDP is the steepest in the euro area since 1975.

³ In 2013, the European Commission estimated that structural unemployment (measured by the non-accelerating wage rate of unemployment (NAWRU)) in the euro area would rise to 11.6% in 2015. In 2019, after several years of strong demand growth, that rate was estimated at 7.7%.

⁴ The employment rate in the euro area rose to 73% by the end of 2019 – the highest on record. The participation rate for women in the euro area reached a record high of 68.7% in the fourth quarter of 2019.

⁵ See Kouvavas, O., Kuik, F., Koester, G. and Nickel, C. (2019), "The effects of changes in the composition of employment on euro area wage growth", *Economic Bulletin*, Issue 8, ECB.

⁶ See Nickel, C., Bobeica, E., Koester, G., Lis, E. and Porqueddu, M. (eds.) (2019), "Understanding low wage growth in the euro area and European countries", *Occasional Paper Series*, No 232, ECB, Frankfurt am Main, September.

⁷ See Hahn, E. (2019), "How are wage developments passed through to prices in the euro area? Evidence from a BVAR model", *Applied Economics*, Taylor & Francis Journals, Vol. 53, No 22, May, pp. 2467-2485; Hahn, E. (2020), "The wage-price pass-through in the euro area: does the growth regime matter?", *Working Paper Series*, No 2485, ECB, Frankfurt am Main, October; Bobeica, E., Ciccarelli, M. and Vansteenkiste, I. (2019), "The link between labor cost and price inflation in the euro area", *Working Paper Series*, No 2235, ECB, Frankfurt am Main, February.

⁸ Anderton, R., Jarvis, V., Labhard, V., Morgan, J., Petroulakis, F. and Vivian, L. (2020), "Virtually everywhere? Digitalisation and the euro area and EU economies: Degree, effects, and key issues", *Occasional Paper Series*, No 244, ECB, December.

⁹ There is, however, still heterogeneity across sectors. For example, as of the second quarter of 2021 real gross value added in high-contact services was still 10.5% below its level in the fourth quarter of 2019, while the overall economy was only 2.5% lower. See Battistini, N. and Stoevsky, G. (2021), "The impact of containment measures across sectors and countries during the COVID-19 pandemic", *Economic Bulletin*, Issue 2, ECB.

This outcome is largely attributable to the combined response of monetary and fiscal policy, which has preserved both demand and supply. For instance, real labour income fell by 3.6% in 2020, but household real disposable income dropped by only 0.2%, because government transfers filled the gap. This is in stark contrast with the sovereign debt crisis, when disposable income fell by 2% year-on-year.

The atypical nature of the recovery is creating frictions in the economy, which can produce opposing effects on growth and inflation.

In certain sectors, supply shortages are holding back production, which is unusual so early in the business cycle. ECB analysis finds that exports of euro area goods would have been almost 7% higher in the first half of this year were it not for supply bottlenecks.¹⁰ These risks to growth could mount if the pandemic continues to affect global shipping and cargo handling as well as key industries like semiconductors.

At the same time, the reopening is also pushing up inflation, which reached 3% in August and is expected to rise further over the coming months. Higher inflation today is largely the result of two exceptional effects.

First, inflation collapsed last year when lockdowns were imposed, which is creating strong base effects as activity recovers. Half of total inflation in the euro area today is due to energy prices, which are making up the lost ground from 2020. Base effects from last year's German VAT rate cut and the unusual timing of sales periods are also playing a role.

In fact, the low inflation rate last year and the high inflation rate this year equal, on average, the inflation rate observed in 2019 before the pandemic. So the price level now is roughly the same as if inflation had remained stable at its pre-pandemic level.

Second, imbalances between demand and supply in some sectors are pushing prices up.

Goods inflation rose to 2.6% in August, well above its historical average of 0.6% as – in addition to base effects – global supply chain disruptions met a sharp recovery in demand for durable goods.¹¹ Consumption of durables is already 1% above its pre-crisis trend,¹² while shipping costs are around nine times higher today than in June last year.

Services inflation has also been rising – to 1.1% in August¹³ – and it would have reached 2% using the consumption weights of last year, slightly above its historical average. This is also largely the result of demand returning to the sectors hardest hit by the lockdowns. Inflation in high-contact services accounts for virtually all of the rise we are seeing in services.

¹⁰ Frohm, E., Gunnella, V., Mancini, M. and Schuler, T. (2021), "The impact of supply bottlenecks on trade", *Economic Bulletin*, Issue 6, ECB.

¹¹ Shifts in the timing of seasonal sales are also playing a role.

¹² At the end of the second quarter.

¹³ The weights of the Harmonised Index of Consumer Prices (HICP) were updated in January 2021 reflecting the changes in consumption patterns brought about by the pandemic.

Once these pandemic-driven effects pass, we expect inflation to decline.

Base effects should drop out of the year-on-year calculation early next year, although we are seeing further increases in oil and gas prices.

It is harder to predict how long supply chain disruptions will last, but their ultimate impact on inflation will depend on how persistent they are and whether they feed through into higher than anticipated wage rises. Following the Japanese earthquake and nuclear disaster in 2011, production is estimated to have returned to normal after seven months for Japanese firms.¹⁴ However, given the special nature of the pandemic and the recovery, it cannot be excluded that the resolution of supply-side bottlenecks may take longer now.

Monetary policy should normally “look through” temporary supply-driven inflation, so long as inflation expectations remain anchored. Indeed, we are monitoring developments carefully but, for now, we see no signs that this increase in inflation is becoming broad-based across the economy. A “trimmed mean”¹⁵ of inflation – which removes the items with the highest and lowest inflation rates – stood at 2.1% in August. Furthermore, wage developments so far show no signs of significant second-round effects.

Inflation expectations also do not point to risks of a prolonged overshooting. Long-term market-based measures have risen by around 50 basis points since the start of the year – to around 1.75%¹⁶ – and survey-based measures have risen slightly to 1.8%.¹⁷ This represents a move in the right direction. But it is still some distance away from our symmetric 2% target.

4 Inflation dynamics beyond the pandemic

In fact, looking beyond the pandemic, we expect inflation to only slowly converge towards 2%.

This is visible in the outlook for underlying inflation, which is a good indicator of where inflation will settle over the medium term. We currently project core inflation – which is one measure of underlying inflation – at 1.5% in 2023. Our survey of monetary analysts also points to a gradual convergence of inflation, which is expected to climb to 2% and stabilise at that level only five years from now.¹⁸

This partly reflects the continuing pull of the structural factors that depressed inflation before the pandemic. But the pandemic has also created some new trends, which may have implications for the inflation outlook. Let me point to three.

¹⁴ See Boehm, C.E., Flaaen, A. and Pandalai-Nayar, N. (2019), “Input Linkages and the Transmission of Shocks: Firm-Level Evidence from the 2011 Tōhoku Earthquake”, *The Review of Economics and Statistics*, MIT Press, Vol. 101, No 1, March, pp. 60-75.

¹⁵ The trimmed means remove around 15% from each tail of the distribution of price changes in the euro area HICP each month.

¹⁶ Five-year forward five years ahead inflation-linked swap.

¹⁷ ECB (2021), *Survey of Professional Forecasters*, July.

¹⁸ ECB Survey of Monetary Analysts, September 2021.

4.1 The demand side

The first relates to changes on the demand side of the economy.

Historically, core inflation in the euro area has mostly been driven by services inflation, which has contributed 1.1 percentage points to the long-term average of 1.3 percentage points. This is both because services have a higher weight in consumption,¹⁹ and because goods inflation has been held down by global forces of automation and competition.

Services inflation is closely linked to the strength of the domestic economy. It depends heavily on wage growth, as wages make up around 40% of the inputs for consumer services – double the share for goods. And robust domestic demand is crucial for a strong pass-through from wages to services prices.²⁰

So the key question today is whether the transition out of the pandemic could lift the outlook for domestic demand and thereby contribute to more dynamic services inflation. Here we see forces that point in different directions.

First, owing mainly to lockdowns, households are sitting on a large stock of savings that they have accumulated during the pandemic. Our new consumer expectations survey suggests that households are not currently planning to spend those savings. But this might change if the economy continues along a dynamic recovery path, causing people to adjust their risk assessment.

Indeed, research suggests that consumption is influenced by people's past experience of recessions, and the previous recessions in the euro area hit consumers especially hard.²¹ From the onset of the great financial crisis and the sovereign debt crisis, it took seven years for consumption to get back to where it was at the start of 2008.

But by the end of 2022, we expect consumption to be almost 3% above its pre-pandemic level. And if that positive outlook is appropriately supported by the right policy mix, it could produce a virtuous circle, where people become more optimistic, upgrade their expectations of future income, and then spend more of the savings they have built up. This would help close the output gap from the demand side and put upward pressures on wages.

At the same time, there are forces that point to a slower pick-up in services inflation.

As I said in my speech here last year²², there are limits to how much services can be consumed, meaning they are unlikely to benefit from the same kind of pent-up

¹⁹ Services are 61% of the core HICP basket.

²⁰ When demand is higher, firms can pass on cost increases over-proportionally, such that profit margins increase. See Gumiel, J. E., and Hahn, E. (2018), "The role of wages in the pick-up of inflation", *Economic Bulletin*, Issue 5, ECB, Frankfurt am Main.

²¹ See Malmendier, U. and Sheng Shen, L. (2018), "Scarred Consumption", *NBER Working Paper*, No 24696.

²² See Lagarde, C. (2020), "Monetary Policy in a Pandemic Emergency", keynote speech at the ECB Forum on Central Banking, Frankfurt am Main, 11 November.

demand as goods. At the end of the second quarter, services consumption was still about 15% below its pre-pandemic trend, even as restrictions were being eased.

The pandemic has also produced considerable slack in the labour market. Employment is now recovering quickly, but we have so far observed that labour force participation is rising even faster. This is good news for the economy, but it also means that we expect unemployment to fall below its pre-crisis level only in the second quarter of 2023, and wages to grow only moderately.

4.2 The supply side

The second trend is related to changes on the supply side of the economy.

The pandemic has delivered a major shock to global supply chains and domestic labour markets. It has significantly accelerated the process of digitalisation – by seven years in Europe, according to one estimate.²³ And it may have distributional consequences that lead to changes in social contracts.²⁴

In the long run, some of these changes might dampen inflationary pressures.

For example, digitalisation could trigger a second wave of globalisation based on the virtualisation of services. It might lead to higher trend productivity, which could temper unit labour cost growth even as wage growth becomes stronger. And it could also shift activity more towards digital “superstar” firms that have considerable market power and whose pricing is less sensitive to the business cycle.²⁵

But over the coming years, there is also a chance that prices will be pushed up.

For instance, today’s supply shortages may induce firms to diversify their supply chains or re-shore some of their production. Previous pandemics like SARS were found to have had this effect.²⁶ That process could lead to higher cost structures that prioritise resilience over efficiency, which are then passed on to consumers. Geopolitics might also interfere in trade patterns and accelerate these shifts.

In parallel, faster digitalisation in Europe could initially create skill mismatches and scarcities, leading to wage increases even in the presence of persistent slack. The rate of job reallocations in major economies is estimated to double between 2019 and

²³ See McKinsey (2020), “How COVID-19 has pushed companies over the technology tipping point—and transformed business forever”, October.

²⁴ See Basso, G., Boeri, T., Caiumi, A. and Paccagnella, M. (2020), “The New Hazardous Jobs and Worker Reallocation”, OECD Social, Employment and Migration Working Papers No. 246.

²⁵ Kouvavas, O., Osbat, C., Reinelt, T. and Vansteenkiste, I. (2021), “Markups and inflation cyclicality in the euro area”, mimeo.

²⁶ See Shingal, A. and Agarwal, P. (2020), “How did trade in GVC-based products respond to previous health shocks? Lessons for COVID-19”, *EUI RSCAS Working Paper*, No 2020/68, Global Governance Programme 415.

mid-2022.²⁷ This dynamic could also be reinforced by a renewed focus on inequality, which could lead to upward pressure on wages via rising minimum wages.²⁸

4.3 The green transition

The third trend – which is probably the most important yet least explored – is the green transition, the shift towards a low-carbon economy.

The pandemic has given the green transition a boost. It could lead to an accelerated increase in auction prices in the EU Emissions Trading System, the introduction of carbon prices covering a wider range of economic activities, and the adoption of a Carbon Border Adjustment Mechanism – all of which could have a direct inflationary impact.

The Network for Greening the Financial System estimates that implementing ambitious transition policies in Europe could gradually increase inflation relative to its previous trend by up to one percentage point over the transition period, before returning to that trend.²⁹

The green transition is also likely to make the pass-through of energy prices to consumer prices more complex. As energy supply shifts towards renewable sources, it will no longer be sufficient to look mainly at oil prices: we will also have to understand the energy mix and how the different sources are linked and can be substituted for each other. Renewable energy in the euro area has increased from 5% of total available energy in 1990 to about 15% today. Similarly, the share of natural gas has increased from 17% to 24%. Oil, meanwhile, has dropped from 43% to 38%.

The ongoing rise in natural gas prices is testament to the complexity this creates, as that rise partly reflects unusually low wind energy production in Europe this summer and the need to fill the gap with conventional energy sources that can be mobilised quickly. This, in turn, is having knock-on effects on other industries that rely on natural gas, like fertiliser manufacturing, and the industries that are dependent on by-products of fertiliser production, such as food packaging.

So we will need to understand these various transmission channels better. The impact of the green transition on inflation will ultimately hinge on the development of energy supply and the net effects of fiscal measures.

The increased use of natural gas to stabilise electricity production is only a bridge technology and will over time subside as new technologies for energy storage and distribution are more widely deployed. And the impact of carbon pricing will depend on

²⁷ Anayi, L., Barrero, J. M., Bloom, N., Bunn, P., Davis, S., Leather, J., Meyer, B., Oikonomou, M., Mihaylov, E., Mizen, P. and Thwaites, G. (2021), “Labour market reallocation in the wake of Covid-19”, VoxEu, 21 August.

²⁸ Cengiz, D., Dube, A., Lindner, A., and Zipperer, B. (2019), “The Effect of Minimum Wages on Low-Wage Jobs”, *The Quarterly Journal of Economics*, Vol. 134, Issue 3, August, pp. 1405-1454.

²⁹ Network for Greening the Financial System (2021), “NGFS Climate Scenarios for central banks and supervisors”, slide deck, June.

whether the additional revenue is used to cut other consumption taxes, such as electricity taxes or VAT, directly support vulnerable groups or foster green investment.

If it is not, there is a risk that higher carbon pricing might reduce purchasing power and lead to relative price changes that push down underlying inflation. Research finds that introducing carbon taxes in euro area countries tends to raise headline inflation but lower core inflation.³⁰

5 Policy implications

So how should monetary policy behave in this environment?

The key challenge is to ensure that we do not overreact to transitory supply shocks that have no bearing on the medium term, while also nurturing the positive demand forces that could durably lift inflation towards our 2% inflation target.

Our new forward guidance on interest rates is well-suited to manage supply-side risks. This guidance ensures that we will only react to improvements in headline inflation that we are confident are durable and reflected in underlying inflation dynamics. And the fact that inflation can move moderately above target for a transitory period allows us to be patient about tightening policy until we are certain that such improvement is sustained.

In terms of supporting demand, our monetary policy will continue to provide the conditions necessary to fuel the recovery. Indeed, our forward guidance has already led to a better alignment of rate expectations with our new inflation target, while helping to strengthen inflation expectations, which lowers real interest rates. We expect to see further progress toward an even tighter alignment between the expected time of lift-off for our policy rates and the most likely inflation outlook as markets continue to absorb the rationale and key purpose of our forward guidance.

All this should provide a decisive boost to private spending once the uncertainty brought about by the pandemic fades, especially given the new investment needs created by the green and digital transition. The European Commission estimates that we need to see investment of around €330 billion every year by 2030 to achieve Europe's climate and energy targets³¹, and around €125 billion every year to carry out the digital transformation.³²

Going forward, the contribution of fiscal policy, and therefore the appropriate policy mix, will remain important. Fiscal policy is likely to stay supportive, with the cyclically-adjusted primary balance expected to be -4.1% this year, -1.6% next year and -1.5% in 2023. But the scope of pandemic-related fiscal transfers will need to change from a blanket-based approach to a more targeted action plan.

³⁰ McKibbin, W., Konradt, M. and Weder di Mauro, B. (2021), "Climate Policies and Monetary Policies in the Euro Area", paper for ECB Forum 2021.

³¹ European Commission (2020), "Impact Assessment" accompanying the document "Stepping up Europe's 2030 climate ambition: Investing in a climate-neutral future for the benefit of our people", 17 September.

³² European Commission (2020), "Identifying Europe's recovery needs", 27 May.

Fiscal policy will need to be surgical, meaning focused on those who have suffered particular hardship. It will need to be productivity-enhancing, meaning that it facilitates structural changes in the economy and shifts activity towards future-oriented sectors, and delivers on the agreed reform programmes under the Recovery and Resilience Facility. And, taking a medium-term perspective, fiscal policy will need to follow a rules-based framework that underpins both debt sustainability and macroeconomic stabilisation.

For our part, monetary policy is committed to preserving favourable financing conditions for all sectors of the economy over the pandemic period. And once the pandemic emergency comes to an end – which is drawing closer – our forward guidance on rates as well as purchases under the asset purchase programme will ensure that monetary policy remains supportive of the timely attainment of our medium-term 2% target.

6 Conclusion

Let me conclude.

The pandemic has caused a recession like no other, and a recovery that has few parallels in history. The inflation response reflects the exceptional circumstances we are in. We expect that those effects will ultimately pass.

But the pandemic has also introduced new trends that could affect inflation dynamics in the years to come. Those trends could produce both upward and downward price pressures. So, monetary policy must remain focused on steering the economy safely out of the pandemic emergency and lifting inflation sustainably towards our 2% target.

Corporate insolvency rules and zombie lending

By Bo Becker and Victoria Ivashina¹

Abstract

Bank lending to less productive firms at subsidized rates has long been recognized as an important mechanism that can help banks in the short run, but deepens and prolongs economic crises. Explanations of such “zombie lending” are underpinned by misaligned bank incentives. We propose an additional driver of zombie lending: the inefficient resolution of insolvency. We provide supporting evidence consistent with insolvency playing a critical role. Using substantial variation in the efficiency of resolution systems across Europe, we show that better insolvency systems are associated with more cyclical use, and high development of private debt markets which rely heavily on the private resolution of insolvency. We also find that, at the firm level, cheaper credit is more common in bad times when insolvency works worse. Critically, insolvency-driven zombie lending cannot be moderated through bank targeted policies, thus, making insolvency reform a key complement to bank capital requirements and supervision.

1 Introduction

Zombie credit—that is, lending to otherwise insolvent firms—has been shown to slow economic growth through the misallocation of credit and the suppression of normal competitive forces. (For example, Hoshi and Kashyap (2004), Peek and Rosengren (2005), Caballero, Hoshi, and Kashyap (2008), Banerjee and Hofman (2018), McGowan, Andrews, Millot (2018), Blattner, Farhino and Rebello (2019), Acharya, Eisert, Hirsch (2019), and Andrews and Petroulakis (2019).) The prevailing view of what drives zombie lending is rooted in the Japanese experience, and it tends to put banks and government assistance administered through banks at the heart of the problem. This paper postulates that another important determinant of zombie credit is insolvency resolution rules. We argue that a substantial cost of restructuring insolvent firms will narrow borrowers’ and banks’ choices, and foster superficial or insufficient remedies, including—in extreme cases—sham loan restructurings.

To be clear, we do not dispute the relevance of perverse bank incentives for zombie lending. Our claim is that this is only half of the problem, and consequently, any policy

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efforts that target banks are only half of the solution. A typical mechanism envisioned behind zombie lending is that a bank wants to avoid recognizing the deteriorated condition of the borrower due to a risk-shifting motive as in Jensen and Meckling (1976). Caballero, Hoshi, and Kashyap (2008) stress the importance of regulatory capital constraints: banks try to avoid recognition of non-performing loans in order to maintain regulatory capital requirements, and by extending loans they can avoid borrower later payments and defaults (which trigger increased capital requirements). Through zombie lending, banks stay afloat in the hope of a macroeconomic recovery or a public bailout.² The central implication is that—for capital constrained banks—this leads to misallocation of credit away from firms with better investment opportunities. Since this view of zombie lending abstracts from insolvency resolution, inefficiencies are seen as driven by bank incentives alone. A standard policy implication, therefore, is ex-post realignment of incentives through the removal of troubled assets from insolvent banks' balance sheets, or ex-ante policies aimed at reducing risk-shifting motives.

The mechanism we propose interacts with how borrower insolvency is resolved: if insolvency is very costly, restructuring is less attractive for lenders, and hence zombie lending becomes more prevalent. It is well known that there is significant and persistent cross-country heterogeneity in the efficiency of insolvency procedures. Djankov, Hart, McLeish and Shleifer (2008) use survey methodology to construct a measure of efficiency for debt enforcement that is comparable across a wide set of countries and shows that these measures are strongly correlated with economic growth, and debt market development. Davydenko and Franks (2008) use micro data on corporate defaults in France, Germany and the U.K. to highlight that differences in creditors' rights across these countries impact banks' lending and restructuring practices that try to mitigate the costs of insolvency proceedings. Focusing on productivity growth, Adalet McGowan and Andrews (2018) discuss policies relevant for firm exit and identify gaps in terms of OECD countries and time series coverage of key insolvency indicators.

More recently, a widespread economic shutdown related to the 2020 pandemic raised world-wide alarms regarding the potential amplification of economic distress due to unsuitability of many insolvency regimes to handle restructuring in a timely and effective manner, and on a high scale. (For example, see Greenwood, Iverson and Thesmar (2020), Group of Thirty (2020), Becker and Oehmke (2021), and Elias, Iverson and Roe (2020)).

Because efficiency losses resulting from lack of proper and timely restructuring procedures, and consequent misallocation of credit, this may deepen a crisis and delay recovery. Minimizing zombie lending through implementation of improved restructuring systems—and not solely through bank-targeted actions—is key to economic crisis management. This intuition can be illustrated in the framework of Diamond and Rajan (2011), which focuses on bank holdings of illiquid assets. In their model, a negative shock leads to a fire sale of illiquid assets. We can reinterpret their model with the cost of insolvency resolution taking the place of the fire sale discount of

² Zombie lending could also be encouraged by the government as a form of financial repression, but such centrally-driven zombie lending has different policy implications.

illiquid assets. In our setting, a negative shock leads to borrower insolvency and losses associated with restructuring. An important difference is that in the Diamond and Rajan (2011) model, the illiquid assets are not directly affected by the shock. So, ultimately, the inefficiency results from banks' forced sales. This leads to the policy recommendation that to unfreeze the credit market, ex-post, the authorities should seek to move—in one way or another—illiquid assets away from the balance sheets of banks. Regulations that reduce banks' risk exposure ex-ante can help reduce the likelihood of incentive problems ex-post. This framework delivers the standard policy implications for bank-driven zombie lending. With illiquid assets, however, no inefficiency is realized if assets are held until maturity. This is exactly why moving them away from the bank balance sheet realigns the incentives for efficient credit allocation, and forgoes the losses if assets are held to maturity. With insolvent assets that are facing additional losses due to inefficient restructuring procedures, mere movement of assets cannot resolve the problem, and could even turn the government into the zombie lender. Thus, if zombie lending is caused in part by deficiencies in restructuring systems, it cannot be effectively moderated by ex-ante or ex-post policy action targeting banks alone.

We should clarify that the insolvency regime is relevant for firms that are still operationally viable, but have experienced a negative shock and, as a result, carry a capital structure that is no longer suitable. Underlying the zombie lending problem is capital misallocation. Some of the zombie firms might not be operationally viable, especially in a competitive setting. Evidently, this problem cannot be addressed through financial restructuring, and as such is outside of the scope of the question that we tackle in this study. However, cases where a firm becomes obsolete as a result of a broader economic shock, are likely to be few which, ultimately, is what makes the zombie lending phenomenon so hard to detect in a timely manner.

To illustrate the significance of insolvency frameworks for zombie lending we use World Bank cross-country data that rates several aspects of insolvency procedures. (This study uses a range of variables and data sources; we elaborate on these in the next section.) First, we look at bankruptcies. Our point is that better insolvency procedures make restructurings more likely. Simply put, if bankruptcy proceedings are dysfunctional, empirically we will see no bankruptcies (and, therefore, under our hypothesis, more zombie lending.) The data show that—as one would expect—lower economic growth is associated with an increase in bankruptcies on average. However, this pattern differs by country. In countries with better insolvency proceedings, higher recovery rates, and shorter resolutions time, years with negative GDP growth show more bankruptcies. This pattern is absent in countries with poor systems. In other words, formal restructuring is more likely to fulfil its important cyclical role when it works better.

Additional aggregate supporting evidence emerges from looking at the development of the private markets in several countries. Note that feasibility of restructuring and its direct and implicit costs might affect banks differently from other types of creditors. Ultimately, however, it should affect all types of debt investors. This is a distinct feature of our hypothesis as compared to bank-centred explanations of zombie lending. Outside of bank-originated credit, there are two other significant sources of debt that

we can consider: bond market and (non-bank) private debt. However, the restructuring of bond debt is generally very hard due to coordination reasons (e.g., Bolton and Scharfstein (1996)) and institutional constraints (e.g., Chernenko and Sunderam (2012)).

The private debt segment has mostly developed following the GFC.³ However, it has been growing at a fast pace. According to Preqin, in 2020, global private debt funds had assets under management estimated at \$848 billion, projected to grow at 11.4% annually for the next five years. Like banks, private debt funds are highly sophisticated and “active” lenders. In line with this observation, their debt products tend to be highly customized.⁴ Moreover, private debt creditors not only have the necessary expertise but also have low coordination costs and institutional flexibility to restructure debt of a struggling borrower. Indeed, they depend on the ability to restructure, as they target higher returns than banks and finance riskier debt.⁵ If there is an event of default (either a missed payment or covenants violation), there has to be a way to move forward in a timely and effective way. However, in the absence of effective insolvency procedures, such private resolutions of distress do not tend to emerge even if creditors themselves are flexible in their mandate and do not face high coordination costs.

Our hypothesis, therefore, is that the development of private debt investments is dependent on the strength of the insolvency framework. This is exactly what we find: private debt markets are larger in country-years with better insolvency systems. Note that most of the private debt investment is done by large, global funds. So, one way to think about it is that we are measuring Blackstone’s or CVC’s or Ardian’s desire to pursue private debt transactions in different jurisdictions. This finding also brings new evidence to support the connection between country-wide insolvency resolution rules and growth of debt markets. Among other papers, this literature includes Djankov, Hart, McLeish and Shleifer (2008), Becker and Josephson (2016), and Ponticelli and Alencar (2016)).

Finally, we present a set of results that uses firm level information to measure zombie lending. We use the empirical literature that follows Caballero Hoshi and Kashyap (2008) and focuses on credit “unusual cheapness”. To capture this empirically, we construct a dummy variable indicating if the current interest rate on loans is below the rate on new loans issued over the preceding four quarters and rated “AA” in the benchmark market. For European loans we use benchmark loans issued in the EU and U.K. markets excluding Greece, Ireland, Italy, Portugal, and Spain. Our sample covers 2004-2020, that high rating cut-off and exclusion of some of the countries from the benchmark assures that we are identifying “cheap” credit. To do so we rely on the data that contains accurate new loans and loan amendments. The analysis is done by controlling for borrower size and leverage and loan characteristics. We include industry and year fixed effects and control for economic growth bank-sector

³ As an example, the Blackstone Group, the largest private equity group in the world, acquired GSO, which became its credit arm in early 2008. Specialized debt asset managers such as Owl Rock Capital, which of the leader in the segment where not started until several years later.

⁴ See for example Ivashina, Dione and Boyar (2017).

⁵ Private debt segment is relevant to our study for several reasons. But, as compared to banks, private debt lenders are much more constraint from “pretend” restructurings, as most of these are finite life closed-end funds similar to private equity funds.

capitalization. As before, we are interested in the rise in zombie lending during economic downturns. We find that, in years with negative GDP growth, “cheap” credit is less likely to take place in countries with stronger insolvency frameworks. The results for recovery rates and time to resolution are consistent with our hypothesis and economically meaningful, but not statistically significant at conventional levels.⁶

The question of zombie lending and credit misallocation is especially timely given the rapid growth of debt markets, which reflect increases in corporate loan securitization as well as high-yield markets more broadly. Specifically, corporate leverage has increased in Europe and other developed markets. (See, for example, Lane (2020)). At the same time, the banking sectors has re-emerged from the aftermath of the GFC and Sovereign debt crisis with stronger financial positions. The traditional, bank-centred narrative, therefore, would suggest that the overall risk of zombie lending is low. This, however, puts us in danger of missing pressures for the lending emerging from the lack of effective solvency resolution.

2 Data

We constrain our analysis to the country members of the European Union as of the end of 2003, U.K. and U.S. We use multiple data sources.

Our central explanatory variables measure effectiveness of the restructuring framework at the country level. For this we rely on the World Bank annual “Doing Business” report which compares business regulation in a wide range of countries. We specifically focus on the measures concerning resolution of business insolvency. The methodology used for this section was developed based on the study by Djankov, Hart, McLiesh, and Shleifer (2008).⁷ Generally it is very hard to compare actual outcomes of resolutions across-countries as there is a non-trivial selection into which companies pursue a formal restructuring. (Our study highlights one such source of selection.) The World Bank approach constructs a simple standard scenario of a company in financial distress and then surveys experts to understand the likely outcomes of a hypothetical resolution in different countries.

In what follows we will report four main variables:⁸

- Recovery Rate Score is based on the expected creditor’s net recovery rate for a standardized scenario, which takes into account resolution costs and time among other factors. The score ranges from 0 to 100, with 100 indicating highest efficiency.

⁶ Andrews and Petroulakis (2019) use a set of alternative measures of ease of financial restructuring and find some evidence for “barriers to restructuring” to contribute to zombie lending problem in periods of slower economic growth. They do not find evidence on other measures of the strength of insolvency framework.

⁷ For more information see <https://www.doingbusiness.org/en/methodology/resolving-insolvency>.

⁸ Although the World Bank database provides alternative measures we found that several of them are highly correlated within our sample. The four variable that we choose reflect the four distinct aspects of insolvency reported in the World Bank data.

- Strength of Insolvency Framework Score is based on whether the country adopted international practices in (i) commencement of insolvency proceedings, (ii) management of the debtor's assets, (iii) reorganization proceedings and (iv) creditor participation in insolvency proceedings.⁹ Similarly, this score ranges from 0 to 100, with 100 indicating highest efficiency.
- Insolvency Restructuring Score (or Main Score) is the simple average of the two previous scores.
- Resolution Time is the expected number of years to resolution of insolvency of the standardized, in years. This is one of the separate components of the recovery score. This measure has the opposite sign to the other three, with the shortest duration time being a proxy for most effective resolution framework.

The availability of these measures dictates the period of our analysis which is 2004-2020.¹⁰

The World Bank data are not without caveats. It is a catch-all approach that is intended to be meaningful in all countries participating in the survey. As a result, it is stripped of much granularity. Although, as one can see in Chart 1, it still picks up substantial variation among the countries in our sample and over time. Another related issue with the World Bank data is that it paints a picture that is too positive in that—to create a representative business that would be meaningful in all countries—the survey focuses on a hypothetical firm with real estate assets and a single secured bank loan. There are no international operations, no complex balance sheets, no intangible assets. Realistically, if all these ingredients were included, the U.S. would look better than some of the other countries. While these are important considerations, as of today, we don't have many meaningful cross-country alternatives to measure insolvency system strength. For example, the OECD effort to construct an alternative metric and reflected in Andrews and Petroulakis (2019) has limited power when thinking about zombie lending.

- Chart 1 plots Insolvency Restructuring Score for the countries in our sample. It is easy to see that there is substantial variation even within these relatively narrow samples. In 2020, Finland leads the group with the score of 92.69, followed by the U.S. with 90.48. Greece and Luxemburg, on the other hand, have the lowest scored with 53.13 and 45.48, respectively. There is also time-variation within country with Spain and France showing the largest improvement over the period of our sample. However, both of countries still have relative low score as compared to other countries even in 2020.

⁹ The criteria reflected in this index were developed on the basis of the World Bank's Principles for Effective Insolvency and Creditor/Debtor Regimes (World Bank, 2011) and the United Nations Commission on International Trade Law's Legislative Guide on Insolvency Law (UNCITRAL, 2004).

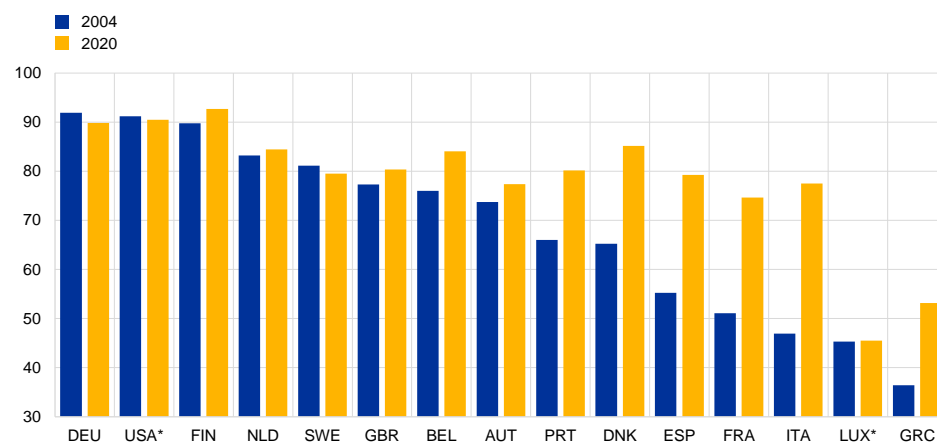
¹⁰ Reported results backfill for the U.S. some of the measure that are not available before 2014, but this is not essential to our conclusions.

Chart 1

Country-level variation in insolvency restructuring scores

World Bank Main Insolvency Score

(the score varies from 0 to 100.)



Sources: World Bank.

Notes: (*) USA and Luxemburg data starts in 2014.

Bankruptcy data has been collected from a range of reliable sources which are reported in the appendix. The major concern with the data collected from individual sources, however, is their comparability across countries. To account for this problem, we instead look at the growth rate in bankruptcies based on the preceding two-year average. Given that bankruptcy filings tend to be concentrated in time, looking at a two-year average allows us to moderate potential gaps.

We use DealScan and Refintiv data which primarily covers syndicated loan origination. These datasets are comparable, but Refintiv has some rating data and better coverage of loan amendments. Thus, we complement DealScan to include this additional information.

We matched loan level samples to CapitalIQ which we use as a source of quarterly financial information. We also use several aggregate variables. In particular, we use IMF data on bank capitalization at the country level as a control variable.

3 Supporting Evidence

To build supporting evidence for the importance of insolvency regimes for zombie lending, we start with the aggregate evidence. We first look at the intensity of use of the formal bankruptcy system as a proxy for effective restructurings (the opposite of zombie lending). If a company has difficulty servicing its debt as a result of an economic shock, its capital structure should be restructured to reflect the new economic reality. In a country with strong insolvency procedures, entering a formal resolution process helps to solve this problem. Absence of bankruptcy filings would be indicative of less efficient resolutions.

In a large sample analysis, we have limited visibility into whether a private negotiation with creditors took place, and whether its outcome was efficient. So, we should consider whether it is plausible that efficient private resolutions are more likely when we see fewer formal bankruptcies. Of course, in an extreme, if the bankruptcy system is very weak, all resolutions will be private. But the question is not whether private resolutions go up, but whether they are efficient. This is why it is important to emphasize that formal insolvency rules set up a benchmark that guides out-of-court restructuring. For example, if filing for bankruptcy allows the firm to operate as a going concern, and achieve mediated restructuring in a relatively speedy manner, then any direct resolution with the creditors will have to be at least as effective (otherwise the firm would file for bankruptcy protection.)¹¹ In sum, what seems most plausible is that the correlation between efficiency of private resolutions (unobservable) and strength of formal bankruptcy procedures is actually positive.

Building on the insight above, we look at the use of the formal bankruptcy system in periods of economic stress. The regression results are reported in Table 1. The dependent variable is the number of bankruptcies in a given year, scaled by the average number of bankruptcies in the preceding two years. Columns (1) and (2) show the basic cyclicity of financial distress: lower GDP growth, and negative GDP growth are associated with spikes in bankruptcy rates. What interests us is cross-country variation in use of bankruptcy in moments of economic stress and its relation to the effectiveness of insolvency procedures. These results are reported in columns (3) to (6). The coefficients of interest are interaction terms between measures of effectiveness of the restructuring framework at the country level and the indicator for whether GDP growth was negative (“stress” year). Consistent with our hypothesis, we find that the better bankruptcy system leads to more bankruptcies (i.e., its higher use.) The results are consistent across all four measures starting with the general Insolvency Restructuring score.

¹¹ When multiple creditors are involved, it might be desirable to use bankruptcy proceedings to lock in a private resolution, since effective bankruptcy resolution does not require a universal creditor consent, and instead is based on supermajority voting thresholds. For example, in the U.S., distressed restructurings are typically achieved through pre-bankruptcy negotiation and creditor voting (in accordance with bankruptcy rules) and formally “ceiled” through a bankruptcy filing. Filing for bankruptcy with a pre-negotiated restructuring plan in turn allows for a quick resolution. Empirically, this means that filings for bankruptcy actually are positively correlated with effective private restructuring.

Table 1

Use of formal bankruptcy resolution and efficiency of insolvency rules

	(1)	(2)	(3)	(4)	(5)	(6)
GDP growth	-0.216*	--	--	--	--	--
	(0.123)					
I (Negative GDP growth)		0.937	-6.383*	-5.830*	-7.519*	5.965***
		(0.805)	(3.711)	(3.067)	(3.940)	(2.111)
Insolvency restructuring score	--	--	-0.0129	--	--	--
			(0.0248)			
Insolvency restructuring score *Stress year	--	--	0.0874*	--	--	--
			(0.0491)			
Recovery rate score	--	--	--	-0.0121	--	--
				(0.0205)		
Recovery rate score *Stress year	--	--	--	0.0796**	--	--
				(0.0397)		
Strength of insolvency framework	--	--	--	--	-0.0276	--
					(0.0237)	
Strength of insolvency framework*Stress year	--	--	--	--	0.114**	--
					(0.0520)	
Resolution time	--	--	--	--	--	-0.312
						(0.598)
Resolution time*Stress year	--	--	--	--	--	-3.533***
						(1.222)
Constant	-49.95***	-50.41***	-49.13***	-49.14***	-48.38***	-49.66***
	(0.353)	(0.348)	(1.919)	(1.682)	(1.767)	(0.933)
N	224	224	184	184	197	184
R2	0.014	0.006	0.018	0.023	0.030	0.069

Notes: The estimates correspond with an OLS regression. The dependent variable is the growth rate in bankruptcies with respect to the preceding two-year average. The underlying data is an unbalance country*year panel. ***, **, * denote the 1%, 5% and 10% level of significance respectively.

Another take at the aggregate tie between the insolvency resolution framework and the prevalence of effective private insolvency resolution can be seen by looking at the volume of private debt transactions (see Table 2). As discussed in the introduction, non-bank direct lenders are highly sophisticated creditors that actively engage in the customization of credit solutions. They lend across the spectrum of firms, with a large emphasis on distressed and mid-cap firms (i.e., higher risk-higher expected return as compared to bank lending).¹² Some additional institutional aspects are important. Similar to private equity, private debt is typically funded through finite life closed end funds. Although assets can be held beyond fund life, it effectively requires a formal sale to the next fund. Thus, between higher risk, and finite horizons, private debt creditors are particularly dependent on effective insolvency systems. To reiterate, between expertise, flexible institutional mandates and low coordination costs (as this debt is not widely held), private debt creditors are also well positioned to put forward private resolutions of insolvency. Ultimately, however, because private resolution is

¹² For more information see 2020 American Finance Association Annual Meeting, Panel: "Shadow Banking: Understanding Private Debt", <https://www.youtube.com/watch?v=kef3uEnvGOQ>.

shaped by the formal insolvency rule, our hypothesis is that we should see that private debt markets are less likely to develop in weaker insolvency regimes.

The results in Table 2 support this view. The dependent variable is the number of private deals closed in the lead three-year window. Panel b includes controls for country-wide bank capitalization. The results are striking. For example, as little as a 1-point difference in insolvency restructuring score leads to 7.4 to 9.9 private deals difference in the next three year. (We purposefully look at the number of deals and not the volume.) This is as compared to the median of 21 for the whole sample and average of 62 deals for European countries. U.S. is an outlier in this market with 1,418 deals on average over the sample. The potential impact of the resolution time is particularly damning, with one extra year to resolution leading to 136.7 or 170.2 difference in the number of deals over three years.

Table 2
Private debt investments and efficiency of insolvency rules

a) Without bank controls

	(1)	(2)	(3)	(4)
Insolvency restructuring score	7.447*** (2.725)	--	--	--
Recovery rate score	--	2.760 (2.278)	--	--
Strength of insolvency framework	--	--	12.60*** (2.398)	--
Resolution time	--	--	--	-136.7** (68.08)
GDP growth	5.481 (13.44)	3.898 (13.65)	9.883 (13.39)	4.080 (13.55)
Constant	-410.9* (213.8)	-60.30 (188.8)	-724.8*** (181.8)	357.3*** (104.7)
N	176	176	188	176
R2	0.042	0.009	0.131	0.023

b) Controlling for bank capitalization

	(1)	(2)	(3)	(4)
Insolvency restructuring score	9.902*** (3.485)	--	--	--
Recovery rate score	--	4.009 (2.813)	--	--
Strength of insolvency framework	--	--	13.68*** (3.148)	--
Resolution time	--	--	--	-170.2** (76.90)
GDP growth	8.821 (15.86)	7.666 (16.17)	11.76 (15.88)	8.225 (16.02)
Bank capitalization	-21.27* (11.94)	-23.51* (12.30)	-18.94 (12.12)	-23.45* (12.11)
Constant	-228.1 (345.6)	258.8 (296.2)	-491.3 (346.6)	828.0*** (249.3)
N	151	151	156	151
R2	0.072	0.034	0.140	0.052

Notes: The estimates correspond with an OLS regression. The dependent variable is the number of private deals closed in the lead three-year window. The underlying data is an unbalance country*year panel. ***, **, * denote the 1%, 5% and 10% level of significance respectively.

In Tables 3 and 4, we move the analysis to the firm level. This requires us to construct an indicator of whether the firm is “subsidized” by the creditors. Measuring “subsidized” credit, however, is challenging as banks can transfer resources to the borrowers in a variety of ways. For example, Caballero, Hoshi and Kashyap (2008) show that—in the context of the Japanese crisis— such assistance can include interest concessions, debt forgiveness, and a moratorium on loan amortizations and/or interest payments. In their sample, they also observe equity injection by lenders, and debt-equity swaps. Post GFC changes had precluded European banks from this type of transaction, but there are several anecdotal examples indicating that equity transactions were common for European banks in the GFC context. The existing literature detects the subsidy by benchmarking the interest rate implied in the firms’ interest expected to what would be conservatively the lower bound on market rate. For example, in European context, Acharya, Eisert and Hirsch (2019) and Acharya, Crosignani, Eisert and Eufinger (2020) look at the firms that have implied interest rates below the AAA-like firms.

We depart from this methodology in two ways. First, we look directly at interest rates of loans, rather than inferring from accounting statements. Caballero, Hoshi and Kashyap (2008) use implied interest rates (interest expenses divided by interest-bearing debt in the balance sheet) due to lack of detailed data on the terms of individual debts. Existing data sources for syndicate credit (which is the relevant credit market segment for firms with available financial data, that is, firms that tend to be the focus of firm-level zombie lending analysis) have a comprehensive cross-country coverage not only of new credit, but also of loan amendments.¹³ Given that the existing narrative focuses on bank-driven zombie lending it makes sense to focus on the cost of bank loans, as opposed to aggregate interest expenses, which may include trade credit, market finance, non-bank loans and so on.

The second way in which our methodology differs from the previous literature is where to draw the line for what we could consider to be unusually “cheap”, and therefore potentially subsidized credit. One approach is to define a potential zombie loan as any loan cheaper than the yield on AAA-rated bonds, in other words, the highest quality credit. This approach suffers from data availability issues: there are very few European bonds rated AAA. In the bank-centric European financial system, there may be a “missing mass” of high-quality credits: loans that would be rated “AAA” do not need to be rated since banks—unlike other large institutional investors—rely on proprietary credit risk assessment methodologies.¹⁴ Instead, we focus on “AA”, the next rating category, and loan ratings instead of bond ratings. There are enough observations of AA credit in our data to construct a reliable benchmark. That is, in a standard methodology to identify zombie lending, one would take yields for “AAA” rated bonds and then examine whether the average debt cost implied in firm’s interest expense is above or below this threshold, regardless of whether the firm in question is

¹³ We should note that zombie lending affects firms of all sizes, including small and medium enterprises. Loan syndication only applies to large loans. But while our data sources only allow us to look at zombie lending for firms that borrow in the syndicated loan market, it is unlikely to be a big departure from other empirical approaches as conditioning the sample to firms with extensive financial information already constrains the sample to the largest firms.

¹⁴ Another contributing factor could be that corporate ratings tend to be capped at sovereign ratings. See Almeida, Cunha, Ferreira, and Restrepo (2017). Only a handful of sovereigns are highly rated in Europe.

rated. Similarly, using data from Refinitiv, we take newly issued loans rated “AA” and construct a quarterly benchmark of all-fees-in interest rates. (Not relying on the pricing of corporate bonds, which have different seniority and tend to be much less standardized on maturity, should reduce noise in our zombie classification.) To identify zombie loans, we then benchmark current rate on all outstanding loans in a given quarter against this benchmark, regardless of whether loans in question are rated. If the interest rate on the loan is below the “AA” mark we code it as a zombie loan.

In addition, to construct benchmark the benchmark, we exclude debt issued by firms in Greece, Ireland, Italy, Portugal, and Spain from the benchmark. Our sample spans the Great Financial Crisis and its aftermath. Country risk might have influenced the rates for even better rated companies in those countries. The exclusion of issuers from the most affected economies leads to a more conservative approach (which is in line with the previous zombie literature) and assured that we are picking truly cheap credit when the firm is classified as a zombie. The benchmark for the U.S., market is computed separately from Europe.

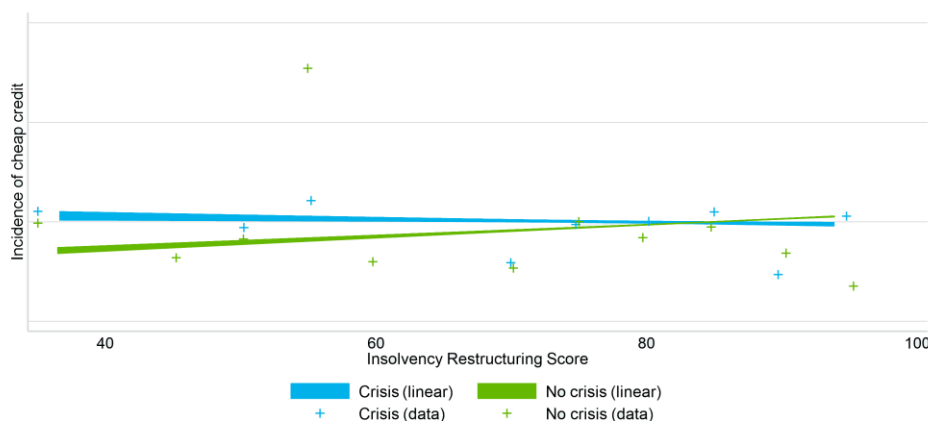
The basic result is plotted in Chart 2, and corresponds to estimates in the first column of Table 3, Panel a. The explanatory variables of interest in Table 3 are a regression of Insolvency Restructure Score and Insolvency Restructuring Score*Stress Year. To generate Chart 2, we first omit these variables and instead plot residuals against Insolvency Restructure Score separately for years with negative GDP growth (“crisis”) and years without positive GDP growth (“no crisis”). (Confidence intervals do not account for clustering, but still help give some sense of precision.) The idea is the following: imagine that we would just plot the zombie dummy against the insolvency score separately for (i) crisis years (blue); (ii) non-crisis years (green), and then draw a linear fit through each of these samples. This is the intuition behind Chart 2, except that in our context there are a few controls. In particular, we ought to account for firm level and loan characteristics. So, instead of plotting raw data we plot residuals from regressing data on controls. To give a sense of residuals dispersion, the chart also plots underlying data grouped in buckets of five on the insolvency score. In sum, Chart 2 suggests that—in a crisis—weak insolvency regimes give cheap credit (which given the firm level controls are used as a zombie proxy).

Chart 2

Use of bankruptcy and strength of insolvency regime

World Bank Main Insolvency Score

(the score varies from 0 to 100.)



Notes: The figure shows the linear regression relationship between zombie lending and the Insolvency Restructuring Score (or Main Score) from the World Bank survey. The blue line refers to crisis years (negative GDP growth) and the green line refers to non-crisis years (positive GDP growth). Data points refer to averages by grouping observations with similar insolvency scores (only buckets with 100 or more borrower-year observations are plotted).

Table 3 reports results of the regressions. The dependent variable is a dummy equal to 100 if the active interest rate on the loan is below the rate on the new loans issued over the preceding four quarters and rated “AA” in the benchmark market, and zero otherwise. All regressions include 2-digit SIC industry controls and year fixed effects. In addition, we control for loan characteristics including loan amount maturity at origination or amendment and dummy for whether the loan is a revolving line.¹⁵ We also control for lagged firm size and leverage. Standard errors are clustered at the country level. Panel a focuses on country-specific “stress years” defined as years with negative GDP growth. In Panel B, stress years are defined as 2008-2013 and 2020.

As before, the explanatory variables of interest are interaction terms between measures of country’s resolution system efficiency and stress years. The results indicate that in countries with better insolvency frameworks and better overall restructuring, scoring cheap credit is less likely to take place in economic downturns. Note that this cannot be merely picking up a differential flight to quality given the firm level controls. Thus, what we see it not that in countries with weaker insolvency systems lenders shift to large or less levered borrowers, but instead shift to substantially cheaper credit controlling for these characteristics. In a year with negative GDP growth, a 10-point increase in the Insolvency Restructuring Score is associated with a 4.8 percentage point increase in the likelihood of there being a zombie loan, which is sizable as compared to the unconditional mean of 12.3%. Although the results on recovery rates and resolution duration are not statistically significant at conventional levels, they are the predicted sign and economically meaningful.

¹⁵ Syndicated loans typically contain multiple facilities. Although many of the facilities are shared through the credit agreement, e.g., the core facilities are *pari passu*, they could have different maturities and interest rates. Given our emphasis on the cost of credit each observation in our sample is a facility.

Table 3

Zombie lending and efficiency of insolvency rules

a) "Stress year" is a year of negative GDP growth in a given country

	(1)	(2)	(3)	(4)
Insolvency restructuring score	0.475** [0.164]	--	--	--
Insolvency restructuring score *Stress year	-0.501** [0.174]	--	--	--
Recovery rate score	--	0.034 [0.112]	--	--
Recovery rate score *Stress year	--	-0.029 [0.148]	--	--
Strength of insolvency framework	--	--	0.321*** [0.070]	--
Strength of insolvency framework*Stress year	--	--	-0.297*** [0.067]	--
Resolution time	--	--	--	-8.377** [3.870]
Resolution time*Stress year	--	--	--	4.940 [4.506]
Log(Loan amount)	-1.101 [0.751]	-0.780 [0.800]	-0.320 [0.369]	-1.098 [0.726]
Loan maturity	-0.016 [0.017]	-0.024 [0.015]	-0.005 [0.009]	-0.014 [0.015]
I(Revolving line)	4.178*** [1.068]	4.448*** [0.951]	4.230*** [0.386]	4.123*** [1.046]
Log (assets), t-1	4.149*** [1.239]	3.959*** [1.295]	3.426*** [0.484]	4.208*** [1.242]
Book leverage, t-1	-13.209 [7.808]	-12.099 [8.093]	-12.705*** [2.150]	-12.501 [8.163]
I (Negative GDP growth)	35.865** [14.517]	-0.088 [11.760]	21.339*** [5.751]	-8.209 [6.741]
Fixed effects: Year/Industry	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
N	103,339	103,339	224,677	103,339
R2	0.122	0.111	0.152	0.116

b) "Stress years" are 2008-2013 and 2020

	(1)	(2)	(3)	(4)
Insolvency restructuring score	0.567***	--	--	--
	[0.178]			
Insolvency restructuring score *Stress year	-0.562***	--	--	--
	[0.186]			
Recovery rate score	--	0.044	--	--
		[0.158]		
Recovery rate score *Stress year	--	-0.036	--	--
		[0.185]		
Strength of insolvency framework	--	--	0.351***	--
			[0.090]	
Strength of insolvency framework*Stress year	--	--	-0.236**	--
			[0.090]	
Resolution time	--	--	--	-9.395**
				[4.350]
Resolution time*Stress year	--	--	--	7.582
				[5.311]
Log(Loan amount)	-1.117	-0.774	-0.280	-1.093
	[0.741]	[0.803]	[0.386]	[0.716]
Loan maturity	-0.018	-0.024	-0.003	-0.017
	[0.017]	[0.016]	[0.010]	[0.016]
I(Revolving line)	4.162***	4.460***	4.263***	4.111***
	[1.057]	[0.915]	[0.356]	[1.036]
Log (assets), t-1	4.102***	3.960***	3.402***	4.182***
	[1.245]	[1.291]	[0.494]	[1.233]
Book leverage, t-1	-13.494	-12.143	-12.699***	-12.621
	[7.698]	[8.072]	[2.154]	[8.143]
Fixed effects: Year/Industry	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
N	103,339	103,339	224,677	103,339
R2	0.124	0.110	0.153	0.117

Notes: The estimates correspond with an OLS regression (this allows inclusion of fixed effects). The dependent variable is a dummy equal to 100 if the current interest rate on the loan is below the rate of the new loans issued over the preceding four quarters and rated "AA" in the benchmark market. Loans to US companies are benchmarked against the rates in the US market, and loans to European companies and benchmarked against loans issued in the EU and U.K. market excluding Greece, Ireland, Italy, Portugal, and Spain. Standard errors are clustered at the country level. ***, **, * denote the 1%, 5% and 10% level of significance respectively.

Table 4 includes controls for country-level bank-sector capitalization. Low bank capitalization sharpens bank incentives to issue zombie loans. Controlling for bank capitalization partially helps to focus on incentives to pursue zombie lending that are grounded in lack of insolvency restructuring solutions. Although, the exact separation of these interlinked effects cannot be achieved without an instrumental approach.

We use country-average Tier 1 bank sector capitalization as reported in the Bank for International Settlements (BIS) database. The results in Table 4 indicate that zombie loans are less likely to take place in countries with higher bank capitalization. This is consistent with the standard prediction and result in the literature (e.g., Schivardi, Sette and Tabllini, 2021). Our focus continues to be on interaction terms between measures of insolvency framework strength and stress years. The results are robust to these additional controls: in a year with a negative GDP, a 10 point higher

Insolvency Restructuring Score is associated with a 4.0 percentage point increase in the likelihood of there being a zombie loan (as compared to the unconditional mean of 12.3%.)

Table 4
Zombie lending and efficiency of insolvency rules, conditional on bank capitalization

a) “Stress year” is a year of negative GDP growth in a given country

	(1)	(2)	(3)	(4)
Insolvency restructuring score	0.398*** [0.123]	--	--	--
Insolvency restructuring score *Stress year	-0.391** [0.164]	--	--	--
Recovery rate score	--	0.180** [0.074]	--	--
Recovery rate score *Stress year	--	-0.054 [0.137]	--	--
Strength of insolvency framework	--	--	0.167** [0.072]	--
Strength of insolvency framework*Stress year	--	--	-0.203** [0.078]	--
Resolution time	--	--	--	-10.038*** [2.522]
Resolution time*Stress year	--	--	--	3.853 [3.748]
Log(Loan amount)	-1.639** [0.586]	-1.599** [0.610]	-0.923** [0.342]	-1.805*** [0.527]
Loan maturity	-0.016 [0.020]	-0.015 [0.021]	-0.008 [0.011]	-0.010 [0.021]
I(Revolving line)	4.138*** [0.942]	4.097*** [0.988]	2.888*** [0.275]	3.866*** [1.081]
Log (assets), t-1	4.283*** [1.341]	4.290*** [1.328]	2.969*** [0.543]	4.428*** [1.274]
Book leverage, t-1	-16.804** [6.188]	-16.505** [6.331]	-10.745*** [1.635]	-16.908** [6.104]
I (Negative GDP growth)	24.488* [12.676]	-2.349 [11.122]	13.010* [7.085]	-10.253* [5.036]
Bank capitalization	-2.333*** [0.373]	-2.831*** [0.370]	-2.151*** [0.308]	-2.646*** [0.357]
Fixed effects: Year/Industry	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
N	87,483	87,483	159,889	87,483
R2	0.145	0.142	0.151	0.147

b) "Stress years" are 2008-2013 and 2020

	(1)	(2)	(3)	(4)
Insolvency restructuring score	0.490***	--	--	--
	[0.149]			
Insolvency restructuring score *Stress year	-0.431**	--	--	--
	[0.171]			
Recovery rate score	--	0.210*	--	--
		[0.101]		
Recovery rate score *Stress year	--	-0.080	--	--
		[0.131]		
Strength of insolvency framework	--	--	0.242**	--
			[0.083]	
Strength of insolvency framework*Stress year	--	--	-0.297***	--
			[0.081]	
Resolution time	--	--	--	-10.702***
				[2.617]
Resolution time*Stress year	--	--	--	4.166
				[3.486]
Log(Loan amount)	-1.596**	-1.576**	-0.909**	-1.777***
	[0.599]	[0.623]	[0.350]	[0.535]
Loan maturity	-0.019	-0.014	-0.008	-0.010
	[0.020]	[0.021]	[0.011]	[0.022]
I(Revolving line)	4.129***	4.120***	2.973***	3.864***
	[0.941]	[0.967]	[0.234]	[1.071]
Log (assets), t-1	4.249***	4.299***	2.954***	4.423***
	[1.341]	[1.318]	[0.549]	[1.263]
Book leverage, t-1	-16.910**	-16.521**	-10.763***	-16.937**
	[6.149]	[6.332]	[1.635]	[6.081]
Bank capitalization	-2.181***	-2.796***	-2.099***	-2.595***
	[0.394]	[0.384]	[0.302]	[0.385]
Fixed effects: Year/Industry	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
N	87,483	87,483	159,889	87,483
R2	0.146	0.141	0.152	0.146

Notes: The estimates correspond with an OLS regression (this allows inclusion of fixed effects). The dependent variable is a dummy equal to 100 if the current interest rate on the loan is below the rate of the new loans issued over the preceding four quarters and rated "AA" in the benchmark market. Loans to US companies are benchmarked against the rates in the US market, and loans to European companies and benchmarked against loans issued in the EU and U.K. market excluding Greece, Ireland, Italy, Portugal, and Spain. Bank capitalization corresponds to country level bank capitalization from Bank for International Settlements. Standard errors are clustered at the country level. ***, **, * denote the 1%, 5% and 10% level of significance respectively.

4 Final discussion

We propose that zombie lending – the practice of issuing bank loans at subsidized rates to otherwise insolvent borrowers – is affected not just by banks' incentive problems and the conventional understanding, but also by the financial outcomes for lenders in insolvency processes. Insolvency processes vary significantly in quality and efficiency across countries. We argue that poor insolvency outcomes encourage zombie lending, as a way of avoiding triggering procedures. Banks incentive still

matter, but policy actions that solely seek to ex-ante better align or ex-post realign banks' incentives cannot singlehandedly resolve zombie problem.

Weak insolvency processes also create zombie lending incentives for all types of creditors and not just banks. This point is central to consider given insurance companies' role in the debt market, and pension funds active expansion into direct lending. It is also relevant for the leveraged loan market, which is originated by banks and largely funded by a wide range of institutional investors including mutual funds and structured products marketed to insurance companies, and pension funds. In sum, even if the problem would be solely constrained to banks, strong insolvency proceedings would be a necessary policy action to address zombie lending. But the problem percolates through a wide range of essential financial institutions and not just banks. (This also highlights a limitation of empirical research focused solely on bank credit.)

Overall, improvement in the insolvency regime is of macroeconomic importance, as zombie lending has been shown to stave economic growth through the misallocation of credit. There is also a practical policy matter: insolvency frameworks, which have deep historical and cultural roots, cannot be fixed overnight, and ex-post set of tools on this front is limited.

As a final matter, we want to raise the observation that reform of formal insolvency procedures is likely to be more effective if it can be broad-based and standardized across countries. A critical issue, beyond the scope of this paper, is the role of insolvency resolution outside of formal procedures. Formal insolvency processes often set a floor for resolution efficiency, and private resolutions can improve upon it. But corporate restructurings – especially for companies with complex capital structures, intangible assets and multinational operations – are unavoidably complex and require profound understanding of both economics and law. For such expertise to emerge and be competitive, there must be sufficient scale to justify this building expertise. In a European setting, if each country has a unique set of rules for insolvency resolution, lack of scale in resolutions will hamper efficiency of private solutions. This is consistent with the evidence that non-bank private debt development lags in countries with weak insolvency systems. For all these reasons, the European Union Insolvency Reform offers the best hope for developing an effective framework that facilitates and fosters efficient resolution, and, among other things, helps to reduce zombie lending.

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Appendix

Bankruptcy data was collected from individual countries official sources. This appendix presents a table that summarizes the sources. After collecting the data, we filtered out NACE Rev2 industry sectors “K - Financial and insurance activities”, “T - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use”, and “U - Activities of extraterritorial organizations and bodies”. For US we only use Chapter 7 and Chapter 11 bankruptcies.

Table A1
Bankruptcy data sources by country

Country	Source
Austria	Statistik Austria
Belgium	Statbel
Denmark	Statbank Denmark
Finland	StatFin
France	Banque de France
Germany	Statistisches Bundesamt
Greece	Hellenic Statistical Authority
Italy	Camera di Commercio delle Marche
Luxembourg	Statistics Portal Grand Duchy of Luxembourg
Netherlands	CBS Open data StatLine
Portugal	Instituto Nacional de Estatística
Spain	Instituto Nacional de Estadística
Sweden	SCB
United Kingdom	CEIC
United States	New Generation Research Bankruptcy Data

When insolvent firms become a worry, revise bankruptcy laws

By Simeon Djankov and Eva Zhang¹

Abstract

Bankruptcies fell sharply in OECD economies during 2020 and the first half of 2021 because of an array of COVID-related support available to businesses, as well as imposed moratoria on bankruptcy filings. Keeping insolvent firms alive drains resources from the healthy parts of the economy. However, public financing for ailing firms will not last long, and a surge in corporate failures is likely in many countries. These failures may be attenuated if governments introduce restructuring plan features in their bankruptcy laws. So far, several OECD countries have reformed bankruptcy, while efforts at the EU level to spur insolvency reform remain weak.

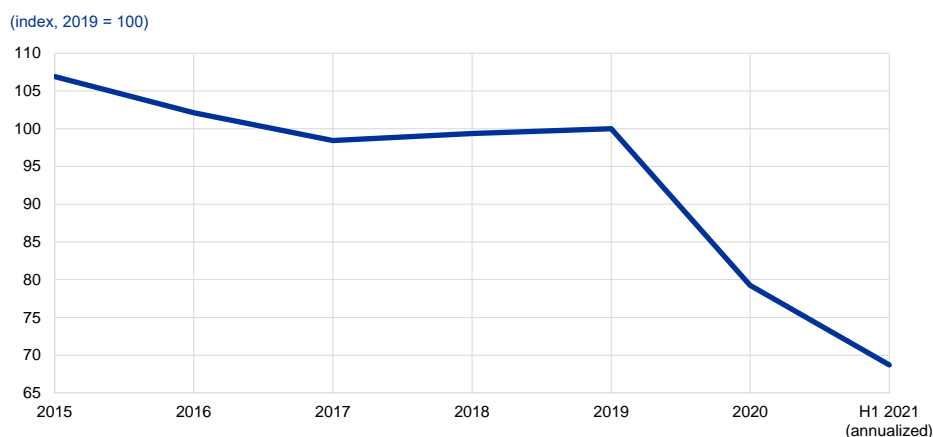
1 Bankruptcy filings declined in most advanced economies during 2020 and the first half of 2021

The COVID-19 economic shock of 2020 cost millions of workers their jobs and shut down countless businesses. Companies suffering losses struggle to survive and many fail. A wave of bankruptcy filings was expected in the wake of COVID-19 (Bailey et al. 2021). Yet during 2020, the number of corporate bankruptcy filings in most advanced economies – members of the OECD – fell by 21% relative to 2019, and by even more relative to previous years (Chart 1). In 2021, bankruptcies fell further to less than 70% of their 2019 level.

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Chart 1

Annual bankruptcy filings in advanced economies



Sources: Statistics Sweden for Sweden, Bank of France for France, ASIC for Australia, U.S. Courts for the US, and National Statistics retrieved from Macrobond (August 27, 2021) for all others.

Notes: The index is based on total number of bankruptcies in 24 advanced economies (Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Iceland, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, South Korea, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. For 12 economies (Australia, Belgium, Canada, Estonia, Finland, Germany, Norway, Spain, Sweden, Turkey and the United Kingdom), and the latest available data (most often from January to June 2021) are annualized to 2021 annual aggregates.

This decline in bankruptcy cases demonstrates the success of the initial COVID-19 response measures. On second glance, however, it brings worries too (Blanchard et al. 2020). There was significant financial distress during the pandemic—for example, by early June 2021, 40 percent of small businesses (that had credit card transaction data prior to March 2020) were temporarily or permanently closed in the United States (Chetty et al. 2020). An April 2021 survey of UK businesses finds that 17 percent were still closed. In Canada, over one-quarter of government-surveyed businesses expected their profitability to decrease in the last quarter of 2021, and one-fifth of businesses reported that they could not take on more debt.

Moreover, many businesses that escaped closure have survived because of downsizing or closing establishment(s) within the firm. The United States' Business Employment Dynamics (BED) data show, for example, that in the second quarter of 2020 gross job losses from closing and contracting private-sector establishments were 20.4 million.² With the economy starting to recover, the monthly losses declined to 6.7 million in the last quarter of 2020, but total employment for low-wage workers remain 20% below the pre-pandemic level in 2021 (Chetty et al. 2020).

Chart 1 uses bankruptcy filings from 24 sizable OECD economies and shows that the total number of corporate bankruptcy filed in 2020 fell by 21 percent in major industrial economies compared with 2019, and the filings dropped by another 10 percentage point in 2021. In the EU, Austria is experiencing the largest decline, with bankruptcy cases dropping by 76% from 2019 to 2021. This is followed by Netherlands and France at around 50% decline by 2021.

The reasons for this decline are twofold. The COVID-19 pandemic has induced governments in advanced economies to finance job support programmes to assist

² These statistics are discussed in historical context in Djankov and Zhang (2021).

workers and to temporarily halt bankruptcy procedures – providing lifelines to keep firms alive through the crisis, at a time when premature bankruptcy can worsen the recession. The job support programmes have been updated and expanded in most OECD countries to 2022 or further still.

For many businesses, the government programmes have worked. Businesses have reacted by keeping employees on board or hiring new ones when restrictions on business operations became less onerous. In turn, the support keeps businesses open, until the economy turns around.

A question arises: Is the observed reduction in bankruptcies a good thing—due to maintaining company value—likely to contribute to future productivity or a bad thing—due to zombification—likely to be a drag on productivity? Our previous research on the effects of bankruptcy regimes around the world (Djankov et al 2008) suggests that on balance keeping companies alive during a downturn is a good thing for the economy. This assistance is particularly valuable for the economy in the case of industries with global or regional business linkages, where firm exit means destruction of relational/human capital. Becker and Ivashina (2021) show that better insolvency systems are also associated with more cyclical use, and high development of private debt markets which rely heavily on private resolution of insolvency.

A large number of firms will need debt restructuring once government support programmes run out. Gourinchas et al. (2021) estimate with European data that the withdrawal of fiscal support and thus the contraction of credit to the corporate sector could have led to a surge in small business failure rates by 8.44 percentage points relative to normal times in 2021. Extensive reorganisation or liquidation procedures, which may work in normal times, will prove insufficient to service a large wave of insolvencies. Changes to existing regimes should be done now, before the wave on bankruptcies comes.

2 Worries about zombie firms

Some economists are concerned that keeping insolvent firms alive will drain resources from the healthy parts of the economy (Acharya 2020). Zombie credit—that is, lending to otherwise insolvent firms—has been shown to slow economic growth through the misallocation of credit and the suppression of normal competitive forces (Becker and Ivashina 2021). The prevailing view of what drives zombie lending puts banks and government assistance administered through banks at the heart of the problem (some recent references include McGowan, Andrews, and Millot (2018), Acharya, Eisert, and Hirsch (2019), and Blattner, Farhino and Rebello (2018).

These fears are misguided on balance. Policies to force businesses to shut down permanently risk slowing down the COVID recovery (Laeven et al. 2020). As businesses shut down, they break a supply chain that affects other businesses, including in healthier sectors. Such breakage should be avoided as much as possible.

The changes in bankruptcy law in some OECD economies are one part of a larger package of recovery measures taken by governments in response to the pandemic.

Previous experience, for example, during the East Asian financial crisis, shows that such legal changes take time to percolate to distressed firms. The likely longer delay in the wave of bankruptcy filings is of assistance to these distressed firms.

In crisis as well as normal times, the possibility for firms to propose a restructuring plan outside of the formal judicial process is beneficial for the economy. This is because as much as 30 percent of the company value is lost in bankruptcy procedures in high-income countries when the business is liquidated or sold piecemeal (Djankov et al. 2008). This loss may be attenuated when governments introduce restructuring plan features in their laws. Research by Becker and Ivashina (2021), using an updated dataset following on Djankov et al. (2008), demonstrates that formal restructuring is likely to fulfil an important cyclical role in the economic recovery.

3 Reforms in several advanced economies

In the aftermath of the pandemic, bankruptcy laws have been revised in seven OECD economies (Australia, Belgium, Germany, Hungary, the Netherlands, Singapore, and the United Kingdom). Three such changes have been common during the pandemic. The first enabled an illiquid company to reach an agreement with its creditors with no involvement from courts. Second, distressed companies are given greater latitude to force a restructuring agreement on every creditor if the majority of creditors agree. And third, suppliers are prevented from stopping deliveries on the ground when the debtor is having trouble paying creditors, as long as the debtor firm pays for its supplies on time—even ahead of bank creditors.

In June 2020, the United Kingdom added three features to its insolvency law. These included introducing a two-month moratorium, allowing a rescue plan to be forced on creditors, and preventing suppliers from stopping deliveries.

Germany also revised its bankruptcy law to enable restructurings. A new insolvency feature is the introduction of a restructuring plan prior to filing for liquidation. Second, it is possible for a company to reach an agreement with its creditors without court involvement. Third, the company in financial distress has the right to a preliminary court meeting to discuss with the competent judge the requirements for a self-administration plan, the composition of the creditors' committee, and protective orders.

Other governments still have time to consider legal reform to make it easier for distressed companies to restructure. Typically, there is a lag between the onset of an economic crisis and a surge in corporate bankruptcy filings. In the Great Recession, for example, it took two years—to 2009—for bankruptcy cases to peak in the United States. The rise was significant, from 19,695 bankruptcy filings in 2006, the last year before the recession, to over triple this number (60,837) in 2009. The lag in bankruptcy filings following the COVID-19 pandemic may be longer still, partly because of the large fiscal lifelines.

In addition, government moratoria on bankruptcy filings have been extended several times. Nearly two-thirds (23 out of 38) of OECD economies introduced temporary debt

payment moratoria in response to the pandemic. For example, France enacted temporary moratorium to the bankruptcy law in May 2020 in response to the pandemic. The decree brought several temporary amendments to French bankruptcy law, including the suspension of insolvency filing duty, extension of conciliation procedure's duration, and the possibility for management to adopt safeguard and restructuring plans. Some of the measures from the May 2020 decree, such as protections for debtors in conciliation, were extended to the end of 2021.

4 Efforts at the EU level

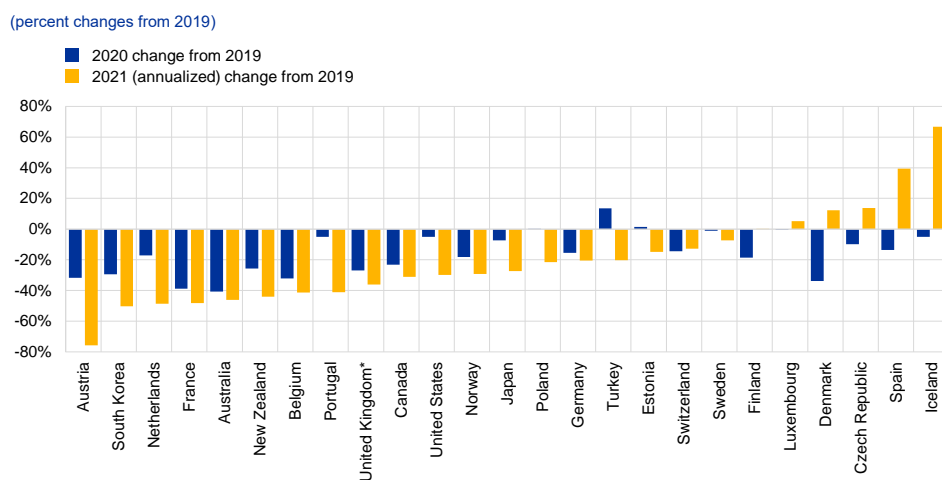
Following the Eurozone crisis of 2008-2012, the European Commission jumpstarted a number of initiatives to update insolvency regimes and be better prepared for coming financial crises (ECB 2021). However, many of these initiatives have not yet been embraced by EU member states. In particular, the Restructuring and Insolvency Directive; the Directive on secondary markets for NPLs; the Directive on harmonised rules for accelerated extrajudicial collateral enforcement have remained in the periphery of national legislative efforts. A future proposal foreseen in the CMU Action Plan 2020, for minimum harmonisation in targeted areas of the insolvency framework, has likewise not been met with much initial enthusiasm.

This lackluster attitude is hard to square with the usefulness of the proposed legislation. For example, the Restructuring and Insolvency Directive, adopted in 2019 just before the pandemic struck, requires EU governments to put in place measures to insert restructuring features in bankruptcy legislation. The directive provides a frame, it does not attempt to harmonise reorganization after a business becomes insolvent, nor does it try to prescribe the conditions for opening insolvency proceedings; the ranking of insolvency claims; and avoidance actions. In 85 percent of the EU the Directive has not yet been transposed. By the original deadline of July 2021 23 out of 27 European governments notified the European Commission that they would meet the extended deadline of July 2022.

This example illustrates that a lot more needs to be done at the European level to ensure preparedness for future crises. Individual national reform efforts can be studied in detail to understand which features of insolvency legislation most directly relate to better economic recovery. Chart 2, based on the fall in bankruptcy filings at the national level, suggests which countries urgently need reform action. In most countries, the fall in bankruptcy filings continued to 2021, particularly in Austria, Netherlands, and France, The larger the fall, the more likely it is that the insolvency system may experience a surge in filings in the coming years.

Chart 2

Annual bankruptcy filings, by economy



Sources: Statistics Sweden for Sweden, Bank of France for France, ASIC for Australia, U.S. Courts for the US, and National Statistics retrieved from Macrobond (August 27, 2021) for all others.
Notes: 2021 annual aggregates are annualized from latest available data (most often to June 2021).

5 Final discussion

The global recession following the 2020 pandemic raised long-forgotten alarms of severe corporate distress due to complexity of many insolvency regimes to handle restructuring (Claessens et al. 2001). This is the departure point of new research by Becker and Ivashina (2021), building on recent work by Greenwood, Iverson and Thesmar and Ellias, Iverson and Roe (2021). These studies provide new evidence consistent with the previous findings in Djankov et al. (2008) that insolvency regimes play an important role in economic recovery after crisis.

In jurisdictions with already-available reorganization options in the bankruptcy law, or in jurisdictions like Germany and the Netherlands that have used the pandemic as an opportunity to update their insolvency regimes, the fear of unproductive firms (“zombies”) dragging down the economic recovery seems unfounded. Rather, recovery may take the form of cross-sectoral shifts in employment and productivity, as consumer preferences have evolved due to the pandemic; and as global supply chains have become more local in nature, providing opportunities for new growth in Europe.

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Corporate indebtedness and macroeconomic stabilisation from a long-term perspective

By Moritz Schularick¹

Abstract

Corporate debt levels have risen sharply in advanced and emerging economies before and during the Covid pandemic. Will corporate debt overhang slow down the recovery from the pandemic? This paper studies the aftermath of corporate debt surges in long-run cross country data. History shows that the macro-economic aftermath of corporate debt booms is typically benign. Three caveats apply, but none of them currently raises alarm bells: (i) the sectoral composition of corporate debt must not be tilted towards investments in the non-tradable sectors; (ii) legal institutions for debt reorganization must work efficiently; (iii) in bank-based financial systems, stringent banking supervision must prevent the emergence or survival of zombie companies.

1 Introduction

Corporate debt stands at historical highs in many countries. In the decade after the global financial crisis, in a time of low interest rates, businesses in many countries have increased borrowing from banks and markets. Time-tested indicators of exuberance in corporate lending markets such as the share of high yield bond issuance, covenant-lite lending and issuance of collateralized loan obligations (CLOs) were all flashing red at some point in recent years. Moreover, while quantities of credit were rising fast, the price of corporate credit risk in financial markets fell substantially. Lower credit spreads despite higher volumes and lighter covenants signalled to many that a supply-driven corporate credit boom had taken hold which could end badly and make a future downturn much more severe (Yellen 2019).

This was the picture before the Covid pandemic. The effects of the pandemic have exacerbated the situation in two important ways. First, corporate earnings have temporarily collapsed in most industries, lowering debt service capacity. Moreover,

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accelerated structural change in the aftermath of the pandemic could mean that some sectors or business models are permanently impaired. Second, to bridge the revenue shortfall government facilities have been set up during the pandemic that have offered liquidity at favourable terms. They increased corporate liabilities even further. In the year 2020 alone, corporate debt to GDP levels surged by about 15pp in emerging markets and by about 10pp in advanced economies, as BIS data show. Looking at the entire post-2008 era, corporate debt has increased by about 20pp relative to GDP both in the Eurozone and the U.S., and by more 50pp in emerging markets.

This paper aims to look into the future by looking back. I will summarize the macroeconomic history of past corporate credit booms and their after-effects that recent research has uncovered (Jordà, Kornejew, Schularick, and Taylor 2020; Mueller and Verner 2021). The core question I want to address is whether the corporate debt surge that we have observed before and during the pandemic means that we have to dial down expectations for a swift recovery when the health restrictions are over. Will corporate debt overhang become a millstone around the neck of the economy?

Two historical analogies are often invoked to highlight the risks that debt overhang could pose for the recovery. The first reference point is the experience after the global financial crisis that highlighted the role of household debt overhang and balance sheet repair for aggregate spending and recovery speed (Dynan 2012; Mian, Rao and Sufi 2013). Since then research has shown that the aftermath of household debt booms is often marked by prolonged recessions and slow recoveries (Jordà, Schularick and Taylor 2013; Mian, Sufi and Verner 2017).

The second example is the Japanese experience in the 1990s. When the Japanese financial bubble burst, corporates were left with significant debt on balance their balance sheets, often asset-based lending linked to the commercial real estate sector. The debt overhang, slow restructuring of bad debts and ongoing lending to “zombie” companies is seen as an important reason behind the prolonged recession and depressed productivity growth in Japan’s lost decades (Peek and Rosengren 2005; Caballero, Hoshi and Kashyap 2008).

In this paper, I aim to move beyond anecdotes and specific references and synthesize what we know about the macroeconomic after-effects of corporate debt booms. I will then apply these insights from recent research to the current situation in Europe and the U.S. My perspective will emphasize macroeconomic evidence coming from long-run cross-country data. This is not because there isn’t anything to learn from micro data. On the contrary, micro data ultimately hold the key to identifying the mechanisms behind macro phenomena. Moreover, the concerns that corporate debt overhang might derail the economy are micro-founded themselves. Following Myers (1977) seminal insight that high debt levels can lead to under-investment by firms, a series of important empirical papers have studied firm-level data and found evidence for the mechanism being at work on the micro level (Lang, Ofek, and Stulz 1996; Hennessey 2004; Kalemli-Özcan, Laeven, and Moreno 2020; Albuquerque 2021).

But do the micro-level effects translate into bigger macro problems? Beyond firm-level behaviour, we need a better understanding of the macroeconomic effects of corporate

debt (Brunnermeier and Krishnamurthy, 2020). The long-run macro data used here have some desirable properties in this regard. They allow us to study the issue over different corporate debt cycles, bringing higher external validity and a better understanding of the role of firm debt for business cycle dynamics. Moreover, macro data capture the general equilibrium effects that are lost in micro data. General equilibrium effects can mean that the findings of micro and macro studies do not always align. If that's the case, it is important for policy-makers to be aware of conflicting evidence from different approaches – and an important task for researchers to investigate the causes of the disagreement.

The overall message of my history of corporate credit cycles will be that the macroeconomic fall-out from corporate credit booms tends to be small. Unlike household credit booms, corporate debt cycles are not systematically associated with subpar macroeconomic performance. The household debt overhang that we witnessed post-2008 is likely not the correct frame of reference at the current juncture. Over the course of modern business cycles, more corporate credit-intensive expansion phases are not followed by deeper recessions and slower recoveries.

But I will also point to three important caveats to this borderline Panglossian view of corporate debt build-ups. First, not all corporate credit booms are alike. The composition of the corporate debt boom matters, as recent research by Mueller and Verner (2021) has shown. Non-tradable debt is associated with macroeconomic boom and bust dynamics akin to household debt booms. The aftermath of non-tradable corporate credit booms is often marked by persistent economic weakness. As a corollary, whether corporate lending is mostly asset-based or cash-flow based following the recent research by Lian and Ma (2021) may also play a role for the aftermath of corporate debt booms. Cash-flow lending could be less prone to asset price boom-bust cycles than asset-based lending booms, although little is known to date about predominant forms of lending in individual sectors and the interaction of contract-types and sectoral lending booms.

Second, debt reorganization regimes and bankruptcy codes must function reasonably smoothly and encourage swift and efficient reorganization of corporate balance sheets (Becker and Josephson 2016; Jordà, Kornejew, Schularick, Taylor 2020). If liquidation or reorganization are slow and costly, the macro-effects of corporate debt overhang become measurable, and in some cases sizeable. Corporate bankruptcy proceedings are complex legal processes and more research is necessary to understand the particular frictions that matter most in this context. Until today, insolvency processes vary widely across EU member states. While progress has been made in recent years, important steps remains to establish an EU-wide counterpart to the Chapter 11 system in the US (Becker 2019).

The third caveat, and possibly a risk in the European context today, relates to the origination side of corporate debt (Caballero, Hoshi and Kashyap 2008; Albuquerque 2021). In particular, in bank-based financial systems the risk exists that weakly capitalized or weakly supervised banks have incentives to avoid losses and evergreen bad loans in the hope of a future recovery of asset values or an improvement in the financial position of the borrower. “Extend and pretend” policies leading to “zombie lending” were arguably a major impediment to Japan’s recovery from the crisis in the

1990s (Caballero, Hoshi and Kashyap 2008). Evidence of zombie lending has also been uncovered in Europe after the global financial crisis (Schivardi, Sette and Tabellini 2017; Storz, Koetter, Setzer and Westphal 2017, Andrews and Petroulakis 2019, Acharya, Crosignani, Eisert, and Eufinger 2020). Macro-historical evidence that I discuss below also shows that corporate debt booms are economically costlier and produce “zombies” in their aftermath when banking supervision is weak.

My main take-away, however, will be that in the current situation all three caveats only apply to a limited extent, albeit with some differentiation between economies. With respect to the sectoral composition of credit in the past decade it was not particularly heavy in the non-tradable sector. With the partial exception of the U.S. and France, non-tradable debt growth has been relatively muted, and even in those two countries tradable credit grew faster than non-tradable credit. Asset-based lending is comparatively rare in the U.S. and Europe so that the potential for knock-on effects from asset prices declines to lending remains limited.

While progress has been made in Europe to align and accelerate corporate debt reorganization, more work needs to be done to establish an efficient “federal” insolvency regime and corresponding specialized courts that rival the American Chapter 11 system (Becker 2019). This being said, European countries such as Italy that are sometimes singled out for lengthy court proceedings did not have corporate debt booms in the past decade but came into the pandemic after a decade of corporate debt reduction. Italy’s corporate debt ratio at the end of 2020 (including the Covid effects) was still about 10pp lower relative to GDP than in 2016.

Arguably, the most relevant caveat in the European context at this stage relates to the origination side. The dominant creditors in European corporate debt markets remain banks. Progress on increasing the role of corporate bond markets and high-yield markets has not been rapid so that corporate lending remains dominated by the banking sector. While the situation of the European banks, both with regard to capitalization and supervision, is better than in Japan in the 1990s, some recent research still points to overly cosy relationships between banks and struggling firms (Andrews and Petroulakis 2019, Acharya, Crosignani, Eisert, and Eufinger 2020). Such evidence could be indicative of larger problems. Europe needs to take its post-2008 lessons on stress tests and half-hearted clean-ups seriously. When the Covid-related loan losses appear, they must be aggressively realized, not hidden in opaque corners of banks’ balance sheets. Precautionary and mandatory recapitalisations after severe stress tests remain an option to minimize the risks and maximize growth potential (Schularick and Steffen 2020; Boot et al. 2020). They could also be a chance to clean up the remaining legacy issues from the last crisis.

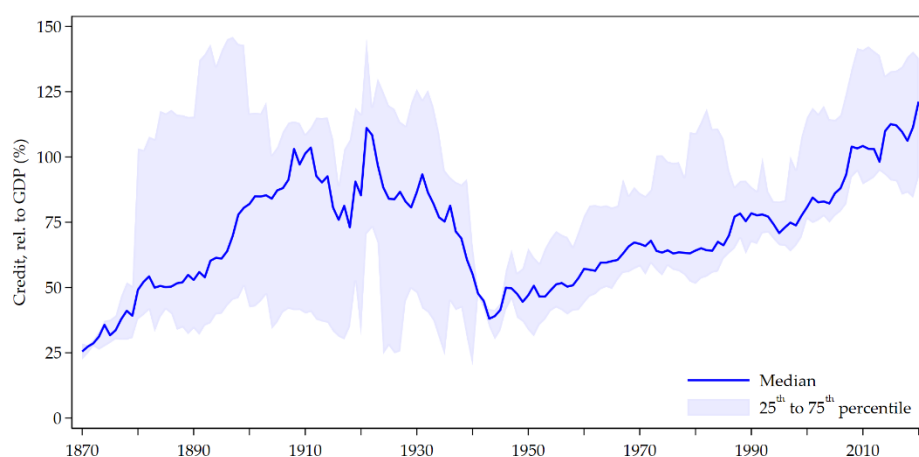
From the perspective of the macroeconomic history of corporate debt booms the main policy implications are reasonably clear. There is nothing to fear but a policy of kicking the can down the road. Default rates will likely rise and not all business models have a future. Swift reorganization or liquidation of insolvent businesses is the single best policy to deal with corporate debt booms. For this to occur, banks must be well supervised and be forced to quickly realize losses when they occur.

2 Corporate indebtedness in historical perspective

I will start the discussion by reproducing a chart from our recent work (Jordà, Kornejew, Schularick and Taylor 2020). Chart 1 shows the evolution of business credit from a long-term perspective. We plot the cross-country mean and the inter-quartile-range of business credit relative to GDP for a sample of 16 advanced economies. Historically, business credit has ranged between 50% and 100% of GDP for most advanced countries. The series trends upwards in the lead-up to WW1 before entering a period of high volatility in the interwar years, followed by a sharp reduction during the Great Depression and WW2. Since WW2, business credit has doubled from about 50% to 100% of GDP today. By this measure, corporate debt today stands at its highest level in the past 150 years albeit not far above previous peaks.

Chart 1

Business Credit-to-GDP ratios since 1870

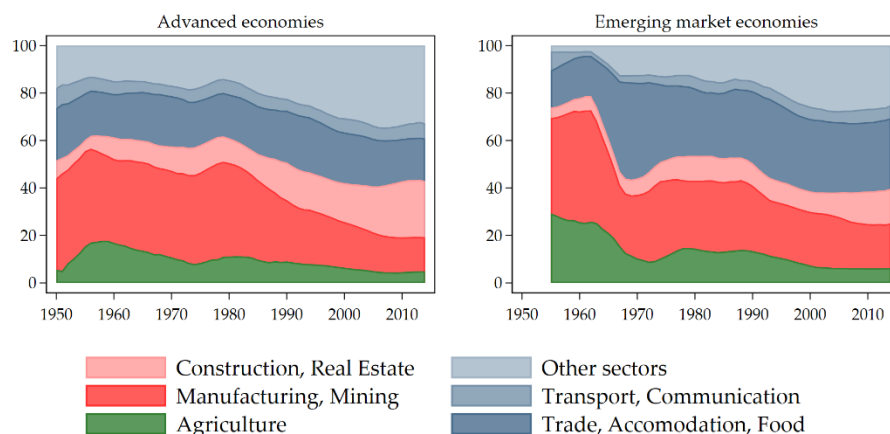


Notes: Cross-sectional statistics based on a sample of 18 advanced economies (Australia, Belgium, Canada, Finland, France, Germany, Italy, Ireland, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK, USA). Data taken from JST Macro-History database and Jordà, Kornejew, Schularick and Taylor (2020).

Thanks to the recent work of Mueller and Verner (2021), we also have information on long-run sectoral trends in corporate debt. They are marked by a fall in the share of manufacturing and a rise of real estate and construction lending. Chart 2 shows that other sectors, predominantly services, have also increased in importance in corporate lending. In emerging markets, mining, trade and manufacturing accounts for a larger share of overall corporate debt, making this share of lending more sensitive to commodity prices.

Chart 2

Decomposition of bank lending to non-financial businesses

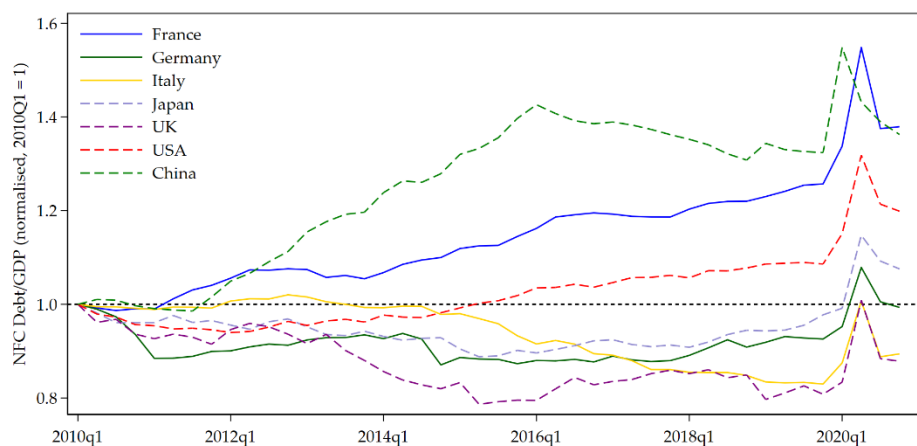


Notes: Reproduced from Müller and Verner (2021).

Chart 1 directs our attention to the fact that, on average, in advanced economies corporate debt had increased substantially before the Covid-shock hit. But the mean is masking substantial heterogeneity across countries. Some countries witnessed rather pronounced increases in corporate debt while others deleveraged. Using BIS data, this heterogeneity is displayed in Chart 3. The graph reveals substantial cross-country differences in corporate credit growth over the past decade. In various European countries, particularly in the south of the Eurozone, the corporate sector has deleveraged and regained balance sheet strength. In other economies, corporates sharply increased borrowing in the decade before the pandemic. Among the major economies, France and China stand out as credit-boomers, with the U.S. coming third. By contrast, business sectors in Japan, Germany, Italy and the UK are barely more leveraged today (relative to GDP) than they were over a decade ago.

Chart 3

Change in corporate debt-to-GDP since 2010, selected countries



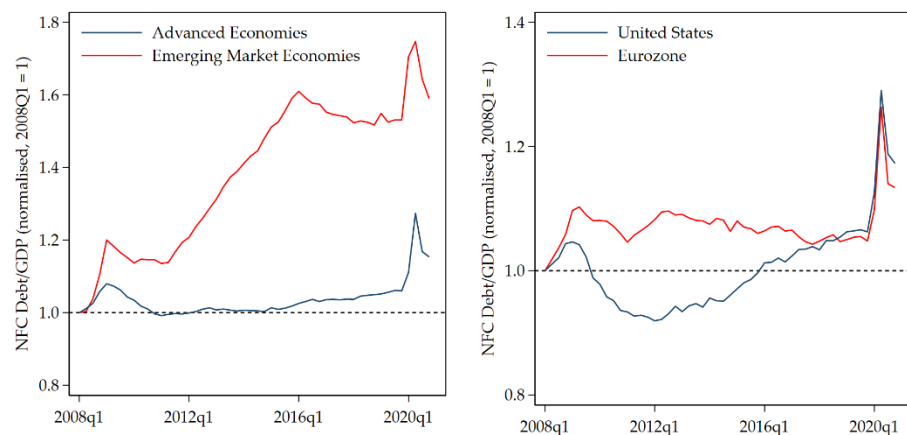
Notes: Calculations based on the BIS database on credit to the non-financial sector.

Aggregating the country trends leads to interesting insights for the different country groups. Chart 4 differentiates the trends for emerging and advanced economies, as well as for the Eurozone and the U.S. Across all countries, the corporate debt over GDP has increased by approximately 25 pp since the global financial crisis, but the increase was much stronger in emerging markets, driven largely by China. In emerging markets corporate debt levels have doubled in relation to GDP since 2008. While China accounts for a large share of this increase, similar trends can be observed in Indonesia, Mexico and South Africa, among others.

Within the advanced economies, corporate debt has risen by similar magnitudes in the U.S. and the Eurozone, but the time path differs markedly. The U.S. business sector deleveraged substantially in the immediate years after the global financial crisis. Yet since 2016, companies have used the low interest environment to leverage up. U.S. corporate debt has risen by 20pp relative to GDP within a short period. In the Eurozone, a similar deleveraging never occurred after the global financial crisis. With the exception of France, corporate debt flat-lined for a decade before increasing sharply in the pandemic.

Chart 4

Change in corporate debt-to-GDP ratios since 2008, by country group

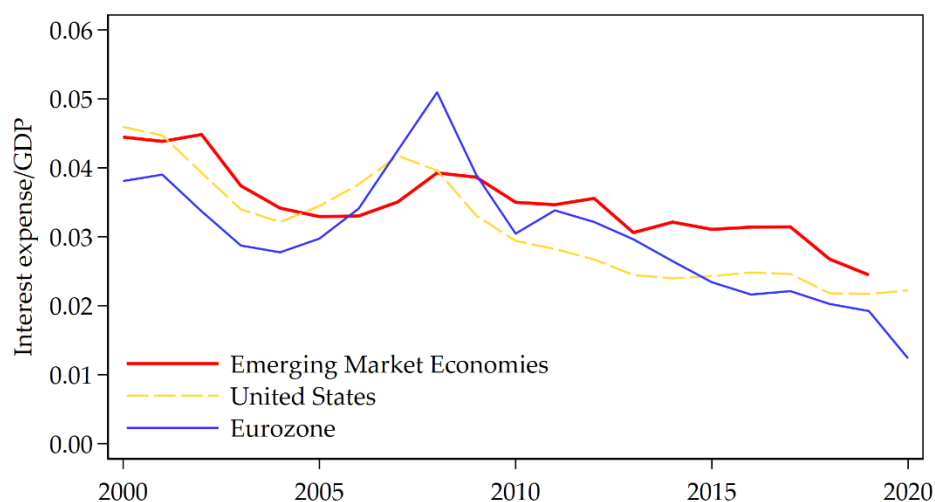


Notes: Calculations based on the BIS database on credit to the non-financial sector, covering 15 emerging market and 21 advanced economies, GDP-weighted averages.

It is important to note that the pricing of corporate debt has not reacted to rising debt levels. As spreads and risk-free interest rates have fallen, interest service costs have dropped sharply, both in advanced and emerging market economies, despite rising corporate debt levels. This is shown in Chart 5. Corporate debt sustainability is highly sensitive to an increase in interest rates, but interest coverage has improved, reducing financial vulnerabilities in the corporate sector (as long as interest rates stay at their current low levels). A similar point can be made with regard to overall leverage ratios (debt-to-asset) that have not increased meaningfully on average as asset prices have remained high throughout the pandemic.

Chart 5

Aggregate interest expense burden low despite higher debt

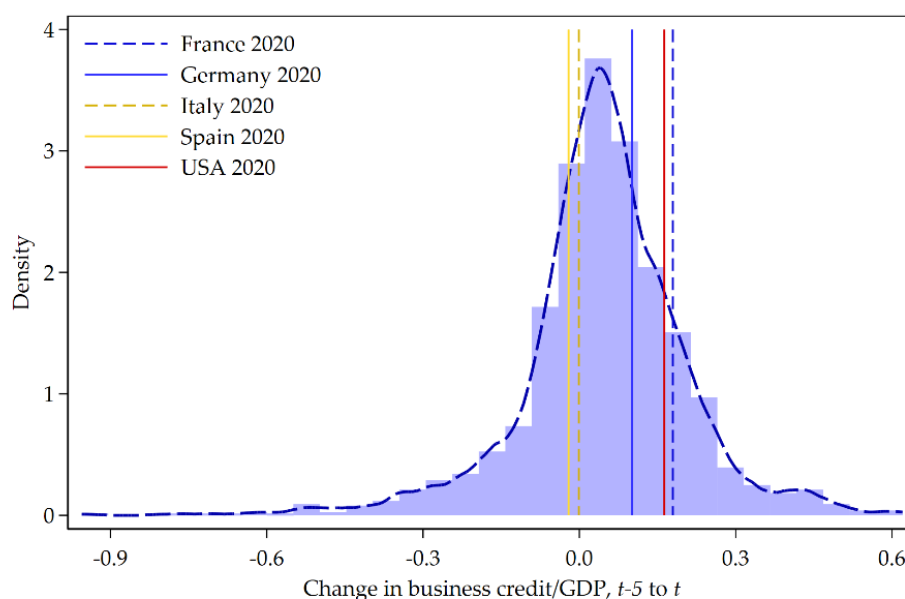


Notes: Calculations based on OECD data, covering 11 emerging market economies and 21 advanced economies, unweighted averages.

Bringing these data together, we can look at the corporate credit boom, including both the pre-Covid rise in corporate indebtedness and the increase that occurred during the pandemic. Chart 6 shows the distribution of all 5-year changes in corporate debt to GDP ratios over the past century and a half in advanced economies. The heterogeneity stands out. Despite the Covid-related debt increase, in Italy and Spain the 5-year debt increase is on the left side of the distribution, while Germany is only slightly above historical norms. The two main exceptions among the advanced economies are France and the U.S. whose corporate credit increases were both pronounced in the past 5-years by historical standards.

Chart 6

The 2015-2020 corporate credit boom in comparison



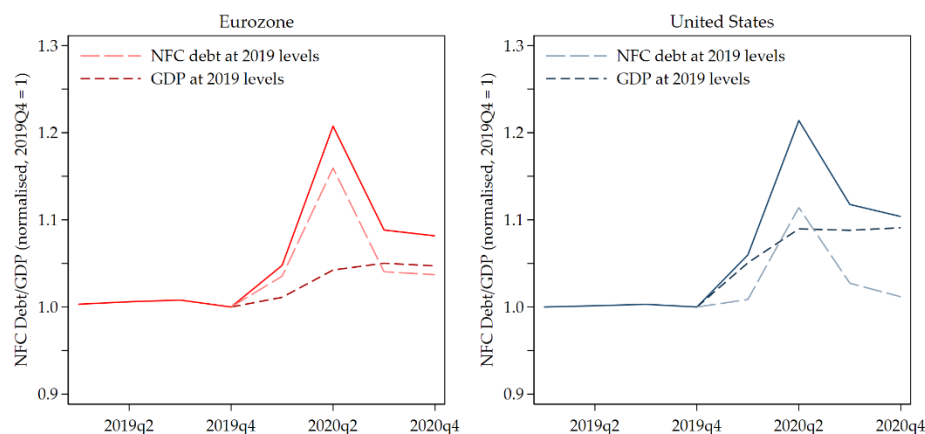
Notes: Reproduced following Jordà, Kornejew, Schularick and Taylor (2020). Histogram and kernel density estimate for all country-year observations of 5-year changes in the business credit/GDP ratio from 18 advanced economies since 1870. Vertical lines mark the current business credit cycle phase (including pandemic emergency credit facilities) for selected countries.

This being said, it is important to note that the change in the corporate credit to GDP ratio is driven both by the numerator and the denominator. Chart 7 breaks down the rise of corporate debt in the pandemic into two contributing factors: the drop in GDP and the increase in borrowing. As it turns out, a substantial part of the increase in corporate was due to GDP effects, especially in the Eurozone. With the rebound in production and further normalization, the increase in the debt ratio will turn out to be much smaller. It is important to acknowledge that the Covid-shock is different. It hit many viable firms that experienced temporary liquidity squeezes, but are otherwise healthy. The European tourism sector comes to mind.

As a consequence, the European corporate debt to GDP ratio will be only a few percentage points above pre-pandemic levels when activity normalizes. The dynamics are somewhat different in the U.S. where the initial GDP drop was less severe so that a larger part of the debt increase was due to higher corporate borrowing. In the U.S., even after the return to 2019 GDP levels, corporate debt to GDP ratios will remain about 10pp higher than before the pandemic.

Chart 7

Decomposition of business credit/GDP dynamics during the pandemic



Notes: Calculations based on the BIS database on credit to the non-financial sector. Eurozone figures are weighted by GDP.

3 Corporate debt and the business cycle

What effects do corporate debt booms have on business cycles? Should we be concerned about the potential effects of corporate debt overhang on investment, growth and productivity going forward? I will approach this question using insights from cross-country long-run data. I will rely heavily on recent work by Mueller and Verner (2021) as well as our own research in Jordà, Kornejew, Schularick and Taylor (2020). Sectoral and macro data can help us identify patterns in the data, test the predictive power of credit aggregates and, in the best of all cases, highlight the crucial mechanisms that are associated with the patterns uncovered. Causality is hard to establish. Exogenous variation in credit growth and leveraged is hard to come by – a problem faced both by micro and macro approaches.

At the microeconomic level, the empirical literature has mostly focused on documenting mechanisms linking corporate debt and firm-level investment decisions and outcomes. Several papers show the adverse investment effects of debt overhang at the firm level (e.g., Lang, Ofek, and Stulz, 1996; Hennessey, 2004; Andrews and Petroulakis 2019, Kalemli-Ozcan, Laeven, and Moreno, 2020; Albuquerque, 2021). These studies suggest that highly levered firms invest less and grow slower. Yet a common issue facing recent micro studies is that the European firm-level data cover the period after the global financial crisis when credit supply disruptions owing to the weak state of the European banking sector are likely to have interacted with firm-level investment decisions.

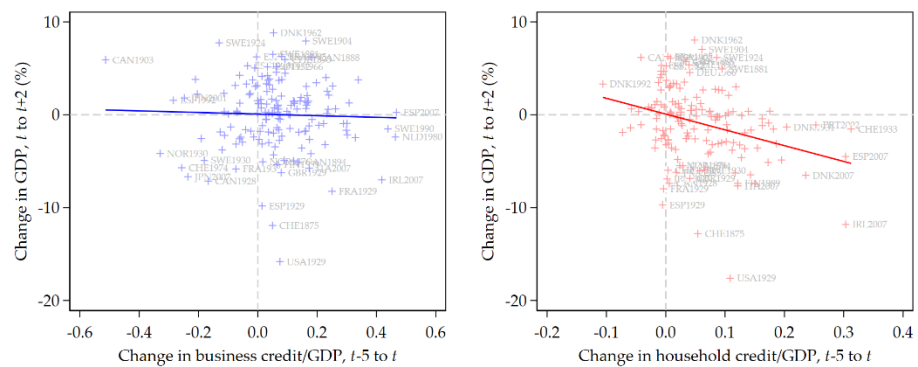
Many empirical studies find support for some effect of debt levels on firm-level investment and capital allocation. As discussed earlier, even if the effects on the firm-level were clearly identified and sizeable, it is still possible that they are not strong enough or compensated by other factors on the macro level. For instance, new firms might enter the market and take over market share from constrained firms.

I will start by discussing the core evidence for 18 advanced economies since 1870 studied in Jordà, Kornejew, Schularick, and Taylor (2020). More precisely, I will turn to the near-universe of business cycles in the modern era and start with a simple question: is there a systematic relationship between corporate credit growth in the expansion and the severity of the following recession? As household debt is widely seen as one of the main factors slowing down the recovery from the global financial crisis, I will repeat exactly the same analysis for household debt.

Consider the correlation between business (household) credit booms during the expansion, with the severity of the subsequent recession and the speed of the recovery. Chart 8 plots this relationship for each of the 150 business cycles in the dataset as the scatter of two-year GDP per capita log-difference in the first two years of the recession (from peak year t to $t+2$) against the five-year change in business credit relative to GDP in the preceding 5 years before the peak (from $t-5$ to t).

The visual impression from the scatterplot in Chart 8 reveals the key relationships and is robust to more sophisticated econometric analysis: household credit booms are associated with costly debt overhang, but not business debt run-ups. Corporate credit booms do not depress growth, nor do they depress aggregate investment. These findings corroborate the results of Mian, Sufi and Verner (2017) in a shorter but broader post-WW2 sample.

Chart 3 Business credit booms and recession depth



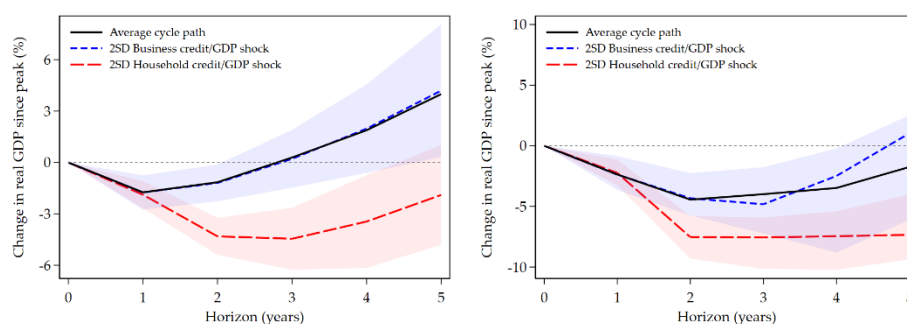
Notes: Reproduced from Jordà, Kornejew, Schularick and Taylor (2020). Scatterplot of business cycle peaks, arranged according to the preceding business credit boom (x-axis) and the subsequent recession trajectory (y-axis). Based on a sample of 18 advanced economies over the time span 1870-2020.

Estimated via local projections (Jordà 2005), Chart 9 shows the effects of a two standard deviation increase in corporate and household debt on the recession trajectory over a 5-year period and controlling for key macro properties of the preceding business cycle expansion. As is visible from the impulse responses, the effects are very different for both types of debt booms. Corporate debt does not impact the business cycle trajectory, while household debt does.

A possible explanation as to why growth and investment are relatively insensitive to a corporate debt boom is that firms may shift to other internal sources of financing, i.e., equity instead of debt. Yet another possibility could be that corporate debt has no

visible mean effects, but it may bring considerable tail risk to the economy. The lower quantiles of the GDP growth distribution may contain potentially extreme losses. Yet once more there is little evidence that corporate debt booms make tail outcomes worse. This is shown on the right hand side of Chart 8 using quantile local projections. Studying the 20th percentile of bad recession outcomes confirms that household credit makes bad recessions even worse. Corporate debt booms do not leave any major traces on growth trajectories.

Chart 4
Recession trajectories after business or household credit booms



Notes: Reproduced from Jordà, Kornejew, Schularick and Taylor (2020). Predicted recession paths after quinquennial credit/GDP booms of 2-standard-deviation above the long-term mean. Predictions for the expected value on the left, predictions for the 20th percentile on the right. Shaded area mark 95% confidence intervals. Estimations based on a sample of 18 advanced economies over the time span 1870-2020.

From the birds-eye perspective of macroeconomic history, the central fact that stands out is that the economic after-effects of household and corporate debt accumulation are very different. Household debt booms are predictive of bad economic outcomes and take a long time to unwind. Corporate debt booms appear to blow over without leaving a lasting imprint on the economy.

Jordà, Kornejew, Schularick and Taylor (2020) discuss that frictions in debt reorganization and insolvency regimes are likely an important reason for the differences between household and business debt. Recent research has pointed to potentially large effects of household debt restructuring (Auclert, Dobbie, and Goldsmith-Pinkham, 2019) if this is possible. Unlike household debt, corporate debt is limited by firm assets and institutions to reorganize debt or liquidate the firm are well established in most economies. More on this below.

Judging by the baseline evidence from macroeconomic history, there is little to fear from corporate debt booms. There exist, however, three important caveats to this benign macro view of the non-phenomenon of corporate debt overhang for business cycle dynamics. I will turn to these now.

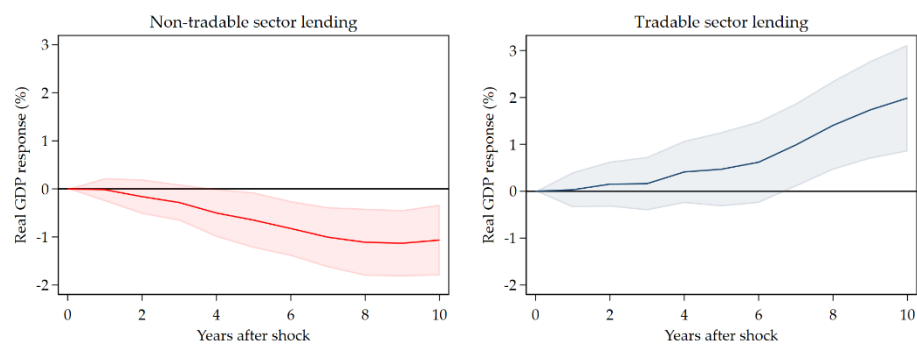
3.1 Caveat 1: not all corporate credit booms are created equal

Research has shown that the sectoral composition of corporate credit booms matters for their aftermath. The work by Mueller and Verner (2021) suggests that tradable vs non-tradable credit booms differ in their real economic outcomes. The higher the

share of credit going into the non-tradable sectors, just like household credit, the more problematic the aftermath of a corporate credit boom becomes. Whereas tradable credit booms often lead to growth spurts and productivity increases, non-tradable credit booms predict negative outcomes as they allocate capital away from the high productivity growth manufacturing sectors into low productivity sectors.

In the words of Mueller and Verner (2021, p.31): “The sectoral allocation of credit—what credit is used for—plays an important role for understanding linkages between the financial sector and the real economy.” Chart 10 below reproduces the key finding of their paper. The impulse responses demonstrate a positive growth impact of credit allocation to tradable sectors, while non-tradable lending booms resemble household credit booms and predict subpar economic outcomes. In short, the allocation and the use of credit matter a great deal for the aftermath of business lending booms.

Chart 10
GDP response to sectoral credit impulse



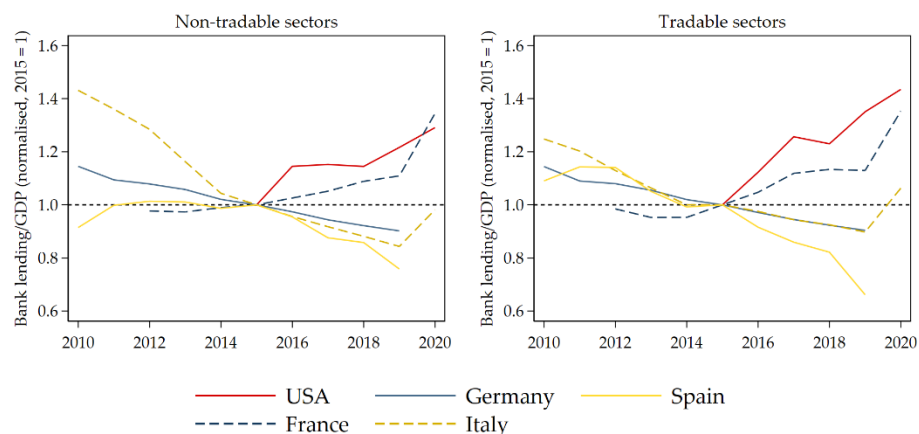
Notes: Reproduced from Müller and Verner (2021). Impulse response functions for a +1 pp. increase in sectoral non-financial business credit/GDP. Shaded area mark 95% confidence intervals. Estimated by local projections on a sample of 116 emerging market and advanced economies over the time span 1940-2014.

It is possible to extend the sectoral credit data of Muller and Verner (2021) for the main economies in the Eurozone and the U.S. until end-2020 and group the sectoral lending data into tradable and non-tradable in a similar way. Chart 11 shows the evolution of both types of credit relative to GDP, indexed to 2015. Note that the data covers both bank lending as well as bond issuance by sector from Bloomberg and include (for most countries) the composition in 2020 as well.

Overall, the picture is quite reassuring on the European side. Among the 4 big Eurozone economies, France, Germany, Italy and Spain, only France witnessed a meaningful non-tradable corporate credit boom. But even in the case of France, the tradable credit boom was larger than the non-tradable one before the pandemic. The same is true for the U.S. where tradable lending boomed after 2015.

Chart 11

Growth in non-financial business credit, by sector aggregate

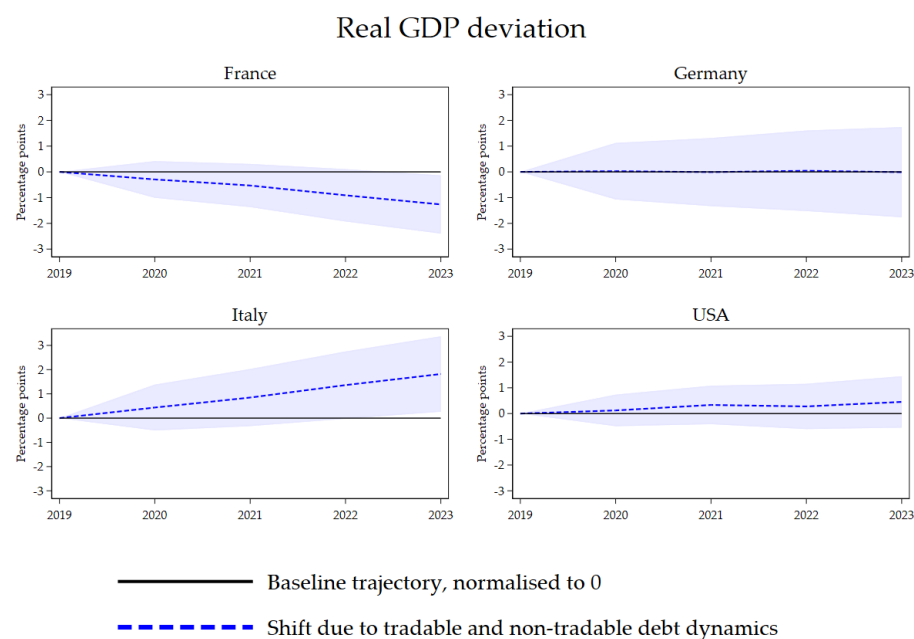


Notes: Data sourced from corresponding national central banks and Bloomberg.

Using the change in sectoral credit shares into the framework of Mueller and Verner (2021) allows us to approximate the potential GDP drag that can be expected due to the sectoral composition of the business credit boom. Unsurprisingly, the picture is quite reassuring. Only in France does the sectoral credit composition signal a negative deviation of output growth from the baseline. For the U.S., Germany and Italy, the deviations are negligible or even positive in the case of Italy (due to the fact that the model is linear and the reduction in non-tradable credit mechanically boosts GDP).

Chart 12

Shift in recession paths due to sectoral credit dynamics



Notes: Based in estimates of Müller and Verner (2021) presented in Chart 7 and sectoral credit data sourced from national central banks. Shaded areas mark 95% confidence interval.

We can also look at the composition of the credit boom from another perspective. In recent work, Lian and Ma (2021) pointed to the important distinction between asset-based and cash flow-based lending to corporates. They show that in the U.S. about 80% of lending to corporates is cash flow-based. Future research will have to study if and how the sectoral composition of corporate lending is correlated with the type of lending and how the interaction between the two shapes firm and macro outcomes. An important implication of this work is that firms are less vulnerable to collateral damage from asset price declines, and fire sale amplifications if lending is predominantly cash flow-based. For instance, anecdotal evidence suggests that a particularly large fraction of lending in the Japanese crisis in the 1990s was asset-based and thereby deepened the macroeconomic fall-out of the asset price bust.

Looking at the composition of the corporate lending boom in the past decade does not raise alarm bells in this regard either. Table 1 relies on the dataset compiled by Lian and Ma (2021) and details the shares of cash flow-based and asset-based lending in the most recent 5-year period that is available, 2013-2018. Reassuringly, in the Eurozone economies covered here, France, Germany, Italy, and Spain the share of asset-based lending is even smaller than the U.S. on average. In particular, in the French case as the main European economy with a meaningful corporate credit boom, the potentially dangerous feedback loops between asset price declines and deleveraging pressures look contained. We should, however, be cautious not to draw far-reaching conclusions as the data only cover public firms and coverage outside of the U.S. is incomplete. Recent work by Ivashina, Laeven and Moral-Benito (2020) shows that the distinction between both types of lending is important for the bank lending channel of monetary policy.

Table 1
Share of total non-financial business debt by type, 2013-2018

Countries	Asset-Based	Cash Flow-Based
France	9.0%	77.9%
Germany	10.7%	73.0%
Italy	12.5%	67.7%
Spain	15.2%	64.0%
United Kingdom	17.6%	68.9%
United States	19.0%	79.5%

Notes: Figures taken from Kermani and Ma (2019). Five-year average over 2013 to 2018.

3.2 Caveat 2: debt reorganization frictions matter

My second caveat regards the efficiency and cost of debt reorganization frameworks for insolvent firms. Such frictions take centre stage in our recent work in which we show that the ease of debt reorganization regimes plays an important role in determining the economic costs of corporate debt booms (Jordà, Kornejew, Schularick, and Taylor 2020). In related work on the micro level, Adalet McGowan and

Andrews (2018) explore the link between insolvency regimes and firms' multi-factor productivity growth and introduce new indicators of the design of insolvency regimes.

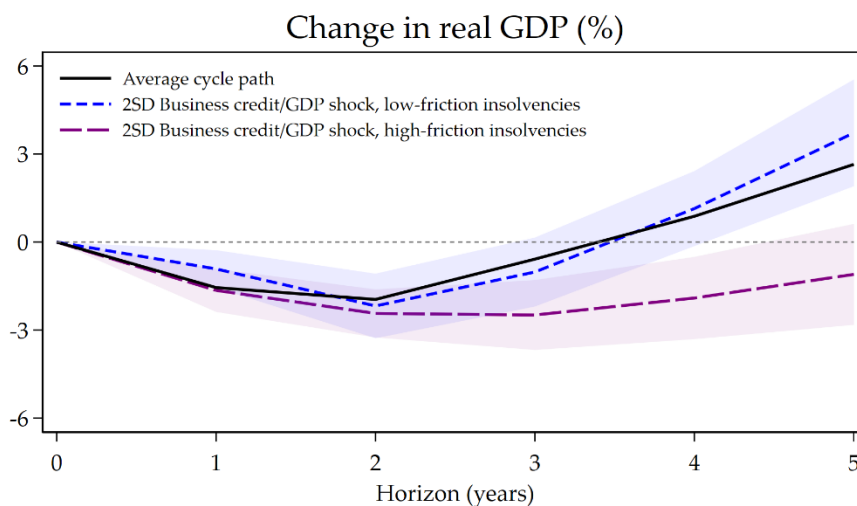
The fundamental insight here is that the aftermath of corporate credit booms is shaped in important ways by the legal infrastructure, in particular by the presence of processes allowing for efficient debt reorganization in insolvency. Such institutions appear crucial to prevent corporate debt overhang following a corporate credit boom to take a toll on the macroeconomy. Put simply, the costlier it is to restructure the bad debts incurred during the boom and the longer it takes, the worse the macroeconomic fall-out of the lending boom becomes.

This key result is shown in Chart 11 that resembles the impulse responses shown earlier, but introduces an interaction between debt growth and the quality of the bankruptcy regime. To measure the characteristics of these legal procedures we draw on the creditor rights indicator of La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997) expanded by Djankov, McLiesh, and Shleifer (2007). Strong protection of creditor claims reduces the possibility that firm owners can withhold assets in bankruptcy, which would weaken owner's incentives to negotiate a restructuring. Mueller (2021) also points to a link between the efficiency of bankruptcy proceedings and recovery values.

Chart 11 shows that recessions that occur after corporate credit booms become much more severe if the bankruptcy regime is weak. Firm-level analysis corroborates that reforms to insolvency regimes that lower barriers to corporate restructuring are associated with higher productivity growth of firms (Adalet McGowan, Andrews, and Millot 2018). In low-cost and efficient debt reorganization regimes, corporate credit booms leave no meaningful traces on business cycle dynamics. We are back to the baseline case that corporate lending booms blow over.

Chart 13

Recessions, business credit booms and legal frictions to bankruptcy



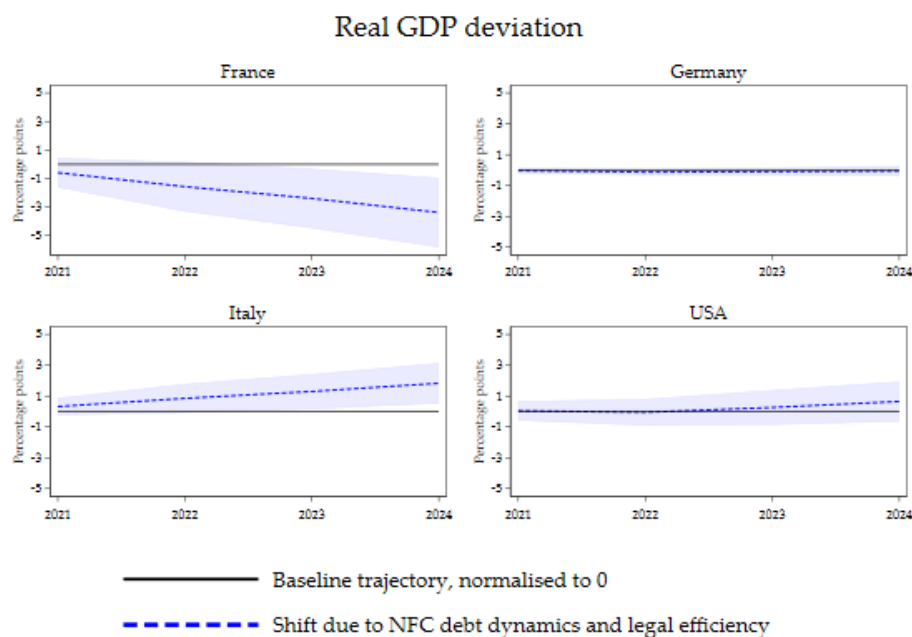
Notes: Reproduced from Jordà, Kornejew, Schularick and Taylor (2020). Predicted recession paths after quinquennial credit/GDP booms of 2-standard-deviation above the long-term mean. Shaded area mark 90% confidence intervals. Estimations based on a sample of 18 advanced economies over the time span 1978-2019.

Some progress has been made in Europe to harmonize bankruptcy processes and streamline the implementation, but a lot remains to be done (Becker 2019). Adalet McGowan, Andrews and Millot (2016) show that insolvency regimes vary significantly across countries along dimensions such as personal costs to failed entrepreneurs and barriers to restructuring. For instance, in some countries creditors are unable to initiate restructuring and no priority is given to new financing over unsecured creditors. Anecdotal evidence also suggest that complex companies are opting for the U.S. bankruptcy system owing to the better protection it offers from messy liquidations (Gilson 2012).

While the measurement of legal institutions and processes always comes with a considerable degree of uncertainty, we can use the available data and combine them with the impulse responses from the estimations in Jordà, Kornejew, Schularick and Taylor (2020) to make a forecast. We will get a sense to what extent the interaction of country-level corporate credit trends and debt reorganization frictions could weigh on the economic recovery. Chart 12 shows the results and underscores that some risks exist for France, whereas the other countries see no negative deviations from the baseline path. In the U.S. and Germany, the forecasts for the recovery speed remains virtually unchanged.

Chart 14

Shift in recovery paths due to business credit and legal frictions



Notes: Based in estimates of Jordà, Kornejew, Schularick and Taylor (2020) presented in Chart 10 and sectoral credit data sourced from national central banks. Shaded areas mark 95% confidence interval.

3.3 Caveat 3: banks and zombies

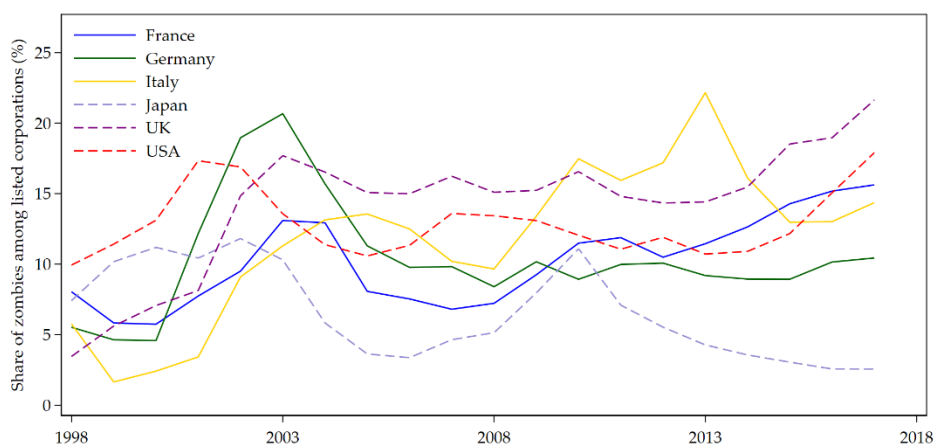
The third caveat relates to a favourite conversation topic of financial economists: the rise of undead zombie firms that roam past their due date and suck the life blood out of healthy companies and even the banking sector. Just like other zombies, their existence is somewhat debated, but interest in their life cycle and survival rates has picked up again in recent years. Are zombies on the march?

In a well-known paper, Adalet McGowan, Andrews, and Millot (2018) study zombification and its link to capital allocation and productivity trends – a theme that also featured prominently in Gopinath, Kalemli-Özcan, Karabarbounis and Villegas-Sanchez (2017). Banerjee and Hofmann (2018) use firm-level data on listed non-financial companies in 14 advanced economies and show a rise in the share of zombie firms. In their definition (which I follow here), zombie firms are unprofitable firms with an interest coverage ratio below 1 that also have a low stock market valuation.

The share of such firms has nearly quadrupled from 4% of the stock market universe in the late 1980s to 15% in 2017. Chart 13 shows that zombie companies, in the definition of Banerjee and Hofmann (2018) and using their data have been on the rise in some countries, especially in the U.S. and the UK. On a sectoral level, zombies appear to be concentrated in the mining and energy sectors. The paper also shows that the zombie share has not declined after the initial rise in the global financial crisis,

raising fears that the low interest environment has allowed unprofitable companies to survive longer than they should.

Chart 15
Share of corporate zombies



Notes: Reproduced from Banerjee and Hofmann (2020). Share of publicly listed corporations defined as “zombie firm” due to insufficient earnings to cover interest rate expenses and low stock market valuation.

My third major caveat to the view that corporate lending booms do not leave major traces on business cycle dynamics relates to the creation and survival of such zombies. Macro evidence exists that suggests that corporate debt booms can turn into a macro problem if such booms are accompanied by slow loss recognition and ever-greening of loans. One might call this the Japanese scenario: situations in which an overly indebted corporate sector, instead of reorganizing the debt or liquidating the firm, is thrown an artificial life line by weak banks that do not want to book the loss (Caballero, Hoshi and Kashyap 2008).

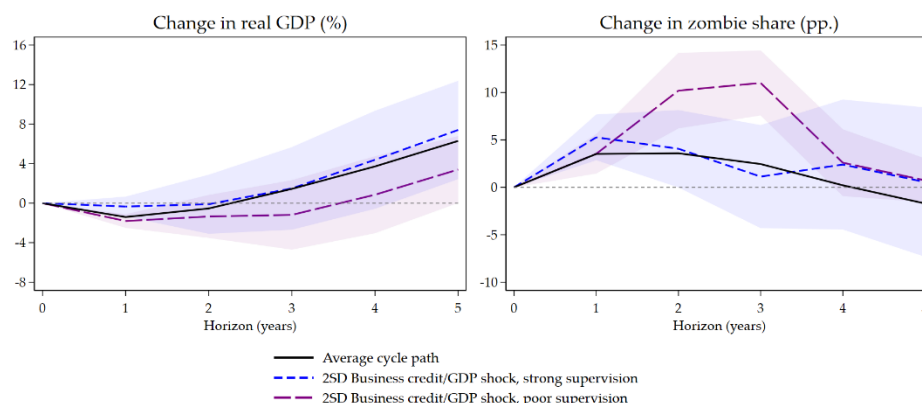
There are different motives why banks might want to do this. The necessary condition is that they are badly supervised so they can actually get away with it. The sufficient condition is that they have an incentive to do it. That incentive typically consists in insufficient capital to account for the losses, or opaque connections to the company in question. But not only weak banks can lead to zombie creation and survival. Liquidation and reorganization frictions discussed earlier can also substantially increase the population of zombie firms. Note, however, that there also is a bright side to throwing life-lines to companies in trouble, provided the companies are only temporarily impaired. Liquidity provision to firms in distress avoids disruptions of supply chains, labor market matches are preserved and solvent companies can continue their operations (Gagnon 2020; Gourinchas, Kalemli-Ozcan, Penciakova, and Sander 2020).

Chart 14 combines an index for the quality of banking supervision from Abiad, Detragiache and Tressel (2010) that spans the decades from the 1970s until the global financial crises with credit and macro data from the Macroeconomy Database (Jordà, Schularick and Taylor 2017). The local projections trace the effects of corporate lending booms in weak (strong) banking supervision regimes on output.

Owing to the smaller sample size, the effects are not as precisely estimated as in the case of bankruptcy frictions, but the estimates also point to sizeable macro after-effects of corporate debt overhang when banks are weakly supervised. Three years after the onset of the recession, the output path in weak supervisory regimes is more than 2pp lower compared to the strong supervisory regime.

The panel on the right investigates a potential mechanism: the emergence and survival of zombie companies (using the Banerjee and Hofmann (2021) definition of zombie companies and their data). The share of unprofitable companies with low stock market valuations (relative to the median) increases in all recessions as companies suffer losses. In normal recessions, however, the zombie company share peaks after about 1 year and then declines. The same path can be observed after a large corporate credit expansion provided that the banking supervisory environment is strong. In poor supervisory environment, the zombie share continues to rise as companies do not exit. The peak is reached after three years, matching the much more severe GDP drag on the left hand side.

Chart 16
Recessions, business credit booms and bank supervision quality



Notes: Based on Jordà, Kornejew, Schularick and Taylor (2020). Index of bank supervision quality from Abiad, Detragiache, and Tressel (2010). Data on zombie shares obtained from Banerjee and Hofmann (2021). Predicted recession paths after quinquennial credit/GDP booms of 2-standard-deviation above the long-term mean. Predictions for real GDP on the left, for the share corporate zombies on the right. Shaded area mark 90% confidence intervals. Estimates on the left based on a sample of 18 advanced economies over the time span 1973-2005. Estimates on the right based on a sample of 14 advanced economies over the time span 1978-2005.

What do these results imply for the future? Banking supervision has clearly improved since the global financial crisis and capital buffers have grown. Both the Eurozone and the U.S. today can be considered a strong supervisory regime in the spirit of the index by Abiad, Detragiache and Tressel (2010). Taken at face value, this would mean that there is little to fear from the corporate debt increase. With appropriate supervision and loss recognition, there is no reason to expect a drag on the recovery.

However, a number of recent papers have reported ongoing zombie sightings in Europe even before the pandemic. Storz, Koetter, Setzer and Westphal (2017) and Andrews and Petroulakis (2019) have studied the zombie firm-weak bank nexus in the Eurozone and found some evidence that financially weak banks are more likely to be associated with zombie firms, albeit causality obviously can run in both ways. Acharya, Crosignani, Eisert, and Eufinger (2020) come to similar conclusion that

zombie linkages between firms and banks are not necessarily a thing of the past in Europe.

In light of this evidence, of all the caveats out there, the persistent doubts about the balance sheet health of parts of the European banking system are likely the clearest and most prominent threat to a smooth workout of corporate debt. While the capital position of many European banks has improved, it is not hard to arrive at substantial numbers for a potential capital shortfall under conservative assumptions (Schularick and Steffen 2020). In this sense, the Covid-pandemic also presents an opportunity to use credible stress tests and precautionary recapitalization to finally leave behind the spectre of the global financial crisis that haunted the European financial system for a decade and learn the key lessons of the past decade with respect to capitalization and growth (Acharya and Steffen 2020; Jordà, Richter, Schularick and Taylor 2021).

4 Implications for monetary policy

What are the broader implications of these findings for monetary policy going forward? To start with, the typically benign aftermath of corporate debt booms means that fears of major post-pandemic headwinds to growth caused by corporate debt overhang – comparable to the post-2008 household debt overhang – are likely unfounded. Many uncertainties remain with respect to the evolution of the virus and the efficacy of protection. But at this juncture, corporate debt overhang does not seem like a likely reason why our forecasts for the recovery speed from the pandemic could turn out to be too optimistic.

A related and much-debated question is whether accommodative monetary policy itself creates or at least throws a life-line to the debt-ridden corporates that suck the lifeblood of healthy firms by crowding out investment. Such fears are regularly voiced on both sides of the Atlantic (Economist 2020). Banerjee and Hofmann (2018) also find that, controlling for other factors, lower interest rates are associated with a higher number of zombie companies as cheap loans potentially keep unsustainable businesses alive for longer.

On closer inspection, arguments linking monetary policy to zombie creation and sluggish productivity growth appear less convincing – and may even have the causality upside down. First, as noted above it is still not clear that zombie firms are actually on the rise. Chart 15 above shows heterogeneous trends across European countries. These findings are echoed in studies for the U.S. Favara, Minoiu, and Perez-Orive (2021) find little evidence that zombie firms are on the rise in the U.S. or benefited disproportionately from monetary policy support.

Second, the fact that zombie company shares vary across countries and along the time path is itself an argument against a dominant role for a single factor such as interest rates in driving the trend and speaks to the importance of other factors. The decline in interest rates has been a common phenomenon across countries while zombie share differ substantially. A prominent example is the Eurozone where countries have similar financing conditions in financial markets but heterogeneous

trends zombie shares. Moreover, the often-debated link between monetary policy and zombie creation fails to differentiate between monetary policy per se and the fall in the natural rate of interest (r^*) that has taken place in recent decades. The drivers of this decline likely include growing inequality, demography and safe-asset accumulation by emerging markets. Monetary policy itself is not the cause for structurally lower natural rates.

Last and most importantly, recent research shows that aggregate demand conditions are paramount for the success of start-ups and firm formation (Ignaszak and Sedlacek 2021). The micro evidence suggests that firm-level survival and growth are to a large extent demand-driven. To the extent that monetary policy creates the demand conditions conducive to firm growth, it supports and accelerates structural change instead of preventing it. These new insights therefore rebuke arguments that a higher interest would deprive zombie firms of access to cheap credit, improve capital allocation and lead to higher growth. A strong demand and supportive policies promote firm growth and structural change.

5 Conclusion

Corporate debt has increased sharply in many countries both before and during the Covid-recession. Against the background of widespread concerns that this debt build-up will turn into a macroeconomic burden, this paper revisited the evidence on the macroeconomic after-effects of corporate debt booms.

The bottom-line is straight forward. Corporate indebtedness and debt overhang problems in the corporate sector are often conjured as key risks for a quick rebound from the pandemic, but recent insights from macro-financial research do not raise alarm bells. The literature makes a clear distinction between the aftermath of household credit booms – which tend to be costly (Jordà, Schularick and Taylor 2013; Mian, Sufi and Verner 2017) – and corporate credit booms that are not systematically associated with subpar economic outcomes.

Recent research has also pointed to three major caveats to this view that I discuss in the context of the current situation. First, the sectoral composition of the credit boom matters (Mueller and Verner 2021). Studying at sectoral lending data, I did not find “smoking gun” evidence that the major advanced economies were caught in an unsustainable non-tradable credit boom.

Second, recent research has emphasized that the aftermath of corporate lending booms is shaped in an important way by the quality of the institutional framework governing corporate debt reorganization. If the processes in place are subpar and swift restructuring is impeded, corporate debt overhang becomes costly for the macroeconomy. It is clearly too early to give the all clear on this account, but at this stage, it happens to be the case that those economies with less efficient bankruptcy frameworks are also those whose corporate sectors deleveraged in the past decade – while the booming economies tend to be those where institutions work quite efficiently. This being said, the importance of debt reorganization institutions can hardly be

overestimated. The implementation of efficient bankruptcy regimes is an important prerequisite to deal with corporate debt problems if and where they exist. A policy priority in the coming years should consist in providing the frameworks for efficient corporate debt reorganization.

Third and potentially most importantly, I discuss the evidence that weakly capitalized or weakly supervised banking systems “ever-green” bad loans, preventing the exit of impaired businesses and depressing productivity growth. More than a decade after the global financial crisis, clearly some risks persist on this account, particularly in Europe. Stringent supervision as well as precautionary recapitalizations following credible stress-tests are the best policy options to deal with such risks.

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Discussion of “Corporate indebtedness and macroeconomic stabilisation from a long-term perspective” by Moritz Schularick

By Egon Zakrajšek¹

Abstract

The Covid-19 shock found businesses in many countries in a highly levered state, and the pandemic has pushed aggregate nonfinancial credit outstanding to GDP to unprecedented levels. Policymakers are naturally wondering how likely is it that the corporate debt “overhang” will hamper the recovery. Analysis of corporate credit cycles over 150 years across 17 advanced economies shows that economic fallout from corporate credit booms tends to be small. While there are caveats to this finding, none of them appear to be especially relevant in current circumstances. Given the unusual nature of the Covid-19 shock, I argue that historical experience with aggregate corporate credit cycles is unlikely to be informative about the macroeconomic consequences of a corporate debt build-up induced by the pandemic. In addition, focus on aggregate credit quantities fails to account for an important dimension of a credit cycle, which may be especially relevant in the current situation.

1 Introduction

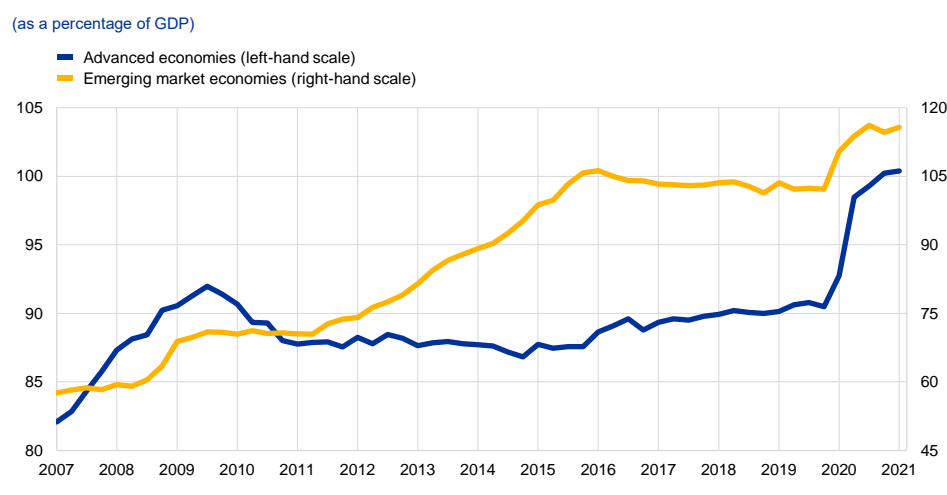
For a fan of economic history, it is a great pleasure to discuss Moritz’s paper, “Corporate indebtedness and macroeconomic stabilisation from a long-term perspective”. The paper tackles an important and timely question: with corporate debt levels up sharply in advanced and emerging market economies because of the Covid-19 shock, how likely is it that the corporate debt “overhang” will slow down the recovery from the pandemic? Moritz tries to answer this question through lenses of 150 years of macro-financial history, building on his work with Oscar Jordà, Martin Kornejew and Alan Taylor (Jordà, Kornejew, Schularick and Taylor 2020, JKST hereafter) and the recent related work by Müller and Verner (2021).

His answer, surprisingly at first glance, is that the pandemic-induced corporate debt build-up is unlikely to become a millstone around the neck of the economy as health-related restrictions are lifted and life returns to “normal”. This sanguine view of

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corporate credit cycles is informed by the JKST's exhaustive analysis of corporate debt build-ups for 17 advanced economies since the 1870s. The key empirical finding of this analysis is that sustained corporate debt booms preceding business cycle peaks are not systematically associated with steeper subsequent declines in investment and output, or more sluggish and prolonged recoveries. Put differently, the growth of corporate credit in the years before a business cycle peak is largely uninformative about how the subsequent downturn and the recovery will turn out to be. This result stands in sharp contrast to the sustained build-ups in household debt, which are strongly associated with significantly deeper recessions and much slower recoveries (Jordà, Schularick and Taylor 2013; Mian, Sufi and Verner 2017).

Chart 1
Credit outstanding to nonfinancial corporate sector



Sources: BIS; author's calculations.
Notes: For advanced economies, AT, AU, BE, CA, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, JP, LU, NL, NO, NZ, PT, SE and US. For emerging market economies, AR, BR, CL, CN, CO, CZ, HK, HU, ID, IL, IN, KR, MX, MY, PL, RU, SA, SG, TH, TR and ZA.

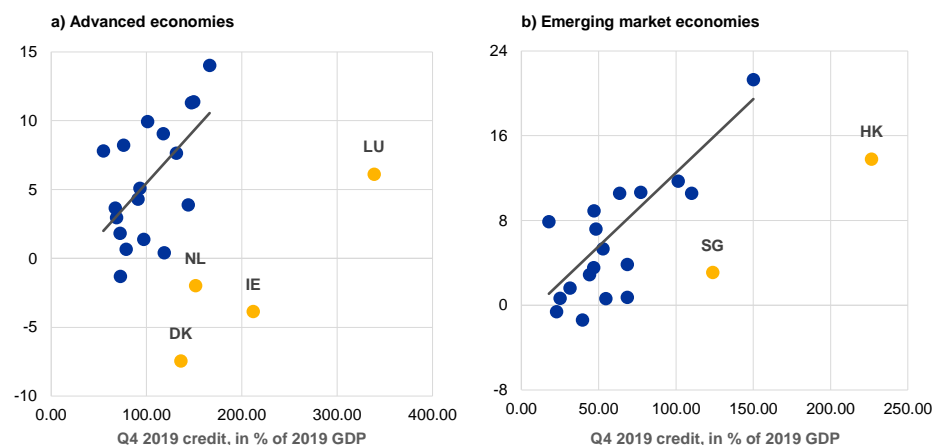
Chart 1 illustrates why policymakers are concerned with corporate debt. The blue line shows the recent evolution of aggregate credit outstanding in the nonfinancial corporate sector – normalised by the corresponding nominal GDP – for 22 advanced economies (AEs), while the yellow line shows the corresponding credit-to-GDP ratio for 21 emerging market economies (EMEs). After substantial deleveraging during the Global Financial Crisis (GFC), borrowing by nonfinancial corporations in AEs was quite subdued, likely reflecting tight credit standards and persistently weak demand. It was not until early 2015 that the pace of borrowing by nonfinancial companies systematically exceeded the rate of growth of nominal income, leaving the nonfinancial-credit-to-GDP ratio in AEs a touch above 90 percent on the eve of the Covid-19 shock, a record level by recent historical standards.

The corresponding evolution of corporate debt in EMEs, by contrast, is quite different. The ratio of aggregate nonfinancial credit to GDP only flattened out in the intermediate aftermath of the GFC and then resumed its upward climb. In late 2015, around the same time that nonfinancial businesses in AEs ratcheted up their borrowing, the pace of borrowing by nonfinancial corporations in EMEs moderated to the rate of growth of nominal income, leaving the resulting credit-to-GDP ratio at a historically high level of 102 percent by the end of 2019.

Chart 2

Corporate debt dynamics during the Covid-19 pandemic

(Q4 2019–Q1 2021 change in credit, in % of 2019 GDP)



Sources: BIS; author's calculations.

Chart 2 focuses on the cross-country differences in corporate debt dynamics during the pandemic. The horizontal axes in both scatter plots show the nonfinancial-credit-to-GDP ratio as of Q4 2019, right before the Covid-19 shock, while the vertical axes show the Q4 2019 to Q1 2021 change in credit outstanding in the nonfinancial corporate sector, normalised by the Q4 2019 GDP.² In both AEs and EMEs, there is a strong positive association between the nonfinancial-credit-to-GDP ratios on the eve of the pandemic and the subsequent surges in corporate borrowing, especially once the obvious outliers (indicated by yellow circles) are eliminated.³ This pattern indicates that the pandemic increased the vulnerability of nonfinancial corporate sectors in economies where corporate leverage was already at historically high levels. Against this background, it is not at all surprising that the first session of the conference is titled “Micro- and macroeconomic perspectives on corporate indebtedness”.

2 A summary of the paper

While policymakers are naturally concerned, Moritz takes a benign view of these developments. As noted in the introduction, JKST’s state-of-the-art econometric analysis of corporate credit cycles over 150 years across 17 AEs tells us that, on average, economic fallout from corporate credit booms – unlike those of household credit booms – tends to be small.

² Normalising the change in credit outstanding during the pandemic by the Q4 2019 level of GDP provides a more accurate cross-sectional picture of the recent surge in corporate debt, as declines in GDP during the pandemic differed notably across countries.

³ The obvious outliers in AEs (the left-hand panel) are Ireland (IE), Luxembourg (LX) and Netherlands (NL), countries where the outsized presence of multinational corporations significantly distorts the reported amount of credit outstanding to the nonfinancial corporate sector; the same concern applies to Hong Kong (HK) and Singapore (SG) among EMEs (the right-hand panel). The only unusual observation among AEs is Denmark (DK), a country that registered an unusually large drop in nonfinancial credit outstanding between Q4 2019 and Q1 2021, especially when measured relative to the Q4 2019 nominal GDP.

Moritz does, however, note some important caveats to what he calls this “borderline Panglossian view of corporate debt build-ups”. First, not all corporate credit booms are alike. As emphasized by Müller and Verner (2021), the composition of corporate debt matters: if the debt build-up is concentrated in non-tradable goods industries, the resulting bust dynamics are much more like those followed by the household debt booms. Second, liquidation/bankruptcy regimes must function smoothly to ensure a quick and efficient reorganization of business balance sheets during the downturn and its aftermath: if liquidation and reorganization of financially unviable firms is costly and slow, the adverse effects of corporate debt overhangs on output and investment can become sizable. And third, economies with bank-centric financial systems are at greater risk that weakly supervised banks will adopt “extend and pretend” lending practices – i.e., zombie lending – to avoid recognizing losses, hoping for an improvement in financial health of borrowers or a recovery in the value of underlying collateral.⁴

According to Moritz’s analysis, none of these caveats are particularly salient in current circumstances in major AEs. With a possible exception of France and the United States, the expansion of debt in the non-tradable goods sector has been quite muted in other major AEs. Although much more work needs to be done in the EU to establish an efficient harmonised insolvency regime and the corresponding specialized court system – a system comparable to the Chapter 11 of the US Bankruptcy Code – the 2019 EU directive, “Increasing the efficiency of restructuring, insolvency and discharge procedures”, along with other measures in train, is an important step in that direction (Becker 2019); moreover, European countries known for especially lengthy bankruptcy proceedings and slow resolution of insolvent businesses appear to have relatively low corporate leverage by recent historical standards.

An important concern singled out by Moritz, a concern that is arguably most relevant for the EU, is the fact that the banking sector continues to play an outsized role in corporate lending in Europe. While the current capital and liquidity positions of European banks appear to be strong, Moritz argues correctly that the EU policymakers must not repeat the mistakes made in the aftermath of the GFC, when botched stress tests and the associated communication failed to restore investors’ confidence in the banking system, further exacerbating the adverse feedback loop between financial conditions and the real economy (Ong and Pazarbasioglu 2013). When the Covid-related loan defaults and bankruptcies materialize, which they inevitably will, supervisory authorities must ensure that banks write off those losses quickly, while at the same time insisting on precautionary and prompt mandatory recapitalisations – if needed, of course – to avoid a credit crunch that could derail the post-pandemic economic recovery.

⁴ Peek and Rosengren (2005) and Caballero, Hoshi and Kashyap (2008) show that the combination of these three factors was in large part responsible for the slow restructuring of bad business debts and prolonged lending to zombie companies in Japan in the aftermath of the bursting of the asset price bubble in the early 1990s; the ensuing corporate debt overhang significantly prolonged the already deep recession, which was followed by a lengthy period of depressed productivity growth.

3 Comments

My first comment evokes a well-known quote by Mark Twain: “History never repeats itself, but it does often rhyme”. The key question is how well does history rhyme in current circumstances? My conjecture is that the current situation is more akin to modern free-style poetry as opposed to a Petrarchan sonnet. In other words, historical experience with aggregate corporate credit cycles is unlikely to be very informative about the macroeconomic consequences of a corporate debt build-up induced by the pandemic.

There are several reasons for this scepticism. First, the nature of the shock that led to the recent surge in corporate debt was highly unusual by historical standards. Due to government-imposed economic and social restrictions, the synchronised global nature of the Covid-19 shock strongly affected the supply-side of the economy in all countries. As such, the shock first ravaged customer-facing services and industries involved in the movement of people, such as airlines and tourism. With each successive infection wave, it then propagated to other sectors, causing unprecedented supply-chain disruptions and significant changes in consumer behaviour patterns, raising a question whether a return to previous status quo will ever take place. Moreover, the crisis is not over, and notable uncertainty surrounds the recovery amidst ongoing public health concerns and tensions over vaccines.

Second, the policy response to the pandemic was unprecedented both in scope and magnitude. While monetary and fiscal responses to the emergence of severe economic dislocations were quick, aggressive and highly complementary, the design of policy was hampered by limited real-time information on which firms and which sectors were most affected and thus in the greatest need of support. As a result, the government-sponsored credit-support programmes, especially in the early stages of the pandemic, had a broad scope and limited conditionality. This makes it difficult to ascertain the impact of the pandemic-induced build-up in debt on firms’ future cash flows and risk of bankruptcy and thus ultimately on the real economy. All told, this suggests that a typical corporate credit boom and bust cycle, albeit one based on 150 years of history, may not offer much guidance in current circumstances, given the unprecedented complexity and severity of the Covid-19 shock and the associated policy responses.

What is critically needed is analysis that captures firm-level heterogeneity across industries, firm size, firm balance-sheet positions and geography. Several recent studies that employ such micro-level data paint, at least at this juncture, a more worrisome picture. An important and highly informative example of such an approach is a study performed by the so-called Cœuré committee (2021), which was tasked by the French parliament with monitoring the financial support available to businesses during the pandemic. The study looked at 3.5 million French companies that had recourse to the main credit-support schemes offered by the government during the first two waves of the pandemic (March to July 2020 and October 2020 to March 2021). Using a comprehensive firm-level database that links the receipt of government funds with the firms’ balance-sheet records and tracing the firms’ subsequent payroll and turnover trajectories, the authors of the study judge the French fiscal support to

businesses a “tentative success”, insofar that support, while broadly scoped ex ante, was channelled ex post to firms most affected by the crisis.

Nonetheless, the study documents a couple of potentially worrisome side-effects of these measures. Most notably, the intensity take-up rate – the amount of government support received relative to turnover – was highest for financially weakest firms. In addition, the share of the amount paid out to small businesses was appreciably higher than their share of employment. In combination, these findings suggest that the pandemic-induced debt build-up in France was concentrated heavily among small and less creditworthy firms, a result that likely generalises to other AEs.

Although government support to businesses in major AEs significantly reduced the number of insolvent or failing firms over the course of the pandemic, economists generally expect a substantial rise in business bankruptcies going forward (Altman 2020; Banerjee et al. 2020; Crouzet and Gourio 2020; Greenwood et al. 2020; Gourinchas et al. 2021). As argued by Greenwood et al. (2020) in the case of the United States, the coming tsunami of financial distress has the potential to overwhelm the bankruptcy courts since it will likely involve an unprecedented number of small and medium-sized companies that are more vulnerable to losses in revenues and generally have higher fixed costs.

Now if the US legal and financial infrastructure that triages amongst financially distressed firms – filtering those that must be liquidated from those that can be restructured – is at serious risk of being overwhelmed, the outlook for the EU would appear to be much more worrisome. Given the unprecedented degree of distress that potentially may materialize, as well as the uncertainty created by the pandemic, the relatively inefficient EU infrastructure for dealing with corporate distress is likely to lead to viable firms being wrongly liquidated, while unviable firms may be kept artificially alive. Such a surge in corporate distress would also involve significant aggregate demand externalities from failing businesses, as well as the deadweight losses from firm-worker separations, which, when combined, could have long-lasting deleterious macroeconomic effects.

Ultimately, much will depend on the duration of the pandemic and what structural shifts in the economy it brings about – i.e., what products or markets will disappear and what technologies will become obsolete. One thing is clear: the longer the crisis, the greater the amount of reallocation that will be needed, a process that will require different forms of restructuring and liquidation, possibly at an unprecedented scale. This unique corporate debt crisis is far from over, and I am a bit sceptical that history can tell us much about its long-term consequences.

My second comment concerns Moritz’s general characterization of the so-called credit cycles – fluctuations in economic activity that are primarily driven by shifts in the supply of credit – the appreciation and understanding of which has increased considerably since the GFC. Informed importantly by Moritz’s influential contributions (Schularick and Taylor 2012; and Jordà et al. 2013), academics and policymakers are now aware that at low frequencies, rapid and sustained growth in aggregate credit outstanding presages adverse macroeconomic outcomes, typically a severe economic downturn, though often a full-blown financial crisis.

A somewhat less appreciated fact is that fluctuations in credit market sentiment are also highly informative about future economic outcomes, above and beyond the information contained in credit aggregates (Gilchrist and Zakrajšek 2012; López-Salido et al. 2017). This strand of research on credit cycles identifies fluctuations in credit market sentiment with variation in expected returns to bearing credit risk and shows that buoyant credit market sentiment – or low expected returns on investments exposed to credit risk – is highly predictive of a downturn in economic activity.

An interesting interpretation of these results that has received considerable attention in the wake of the GFC argues that when sentiment in credit markets is elevated, or equivalently, credit risk is being priced aggressively, there is an increased likelihood that over-optimistic and imperfectly rational investors will be disappointed down the road. This disappointment, which is predictable *ex ante*, results in an abrupt and sharp tightening of credit conditions – corresponding to an inward shift in credit supply – which in turn induces a contraction in employment, investment and output (Gennaioli and Shleifer 2018; Bordalo et al. 2018; Greenwood et al. 2019).⁵ Moritz's account for corporate credit booms omits this important aspect of a credit cycle – namely, the interplay between leverage and mispricing of credit risk – which may be especially important in the current environment, where exceptionally low interest rates and government-sponsored support programmes are significantly compressing risk premia.⁶

To illustrate how sustained corporate debt build-ups influence credit market sentiment, I consider a simple exercise using quarterly US data since the early 1970s. I focus on the US because of the ready availability of an indicator of sentiment in corporate debt markets, the so-called excess bond premium (EBP) of Gilchrist and Zakrajšek (2012). The EBP, which is shown in the left-hand panel of Chart 3, is a corporate bond credit spread net of default risk and thus has a natural interpretation as a measure of credit market sentiment: when the EBP is low, credit spreads are narrow relative to expected defaults – that is, corporate credit risk is being priced aggressively – and vice versa.

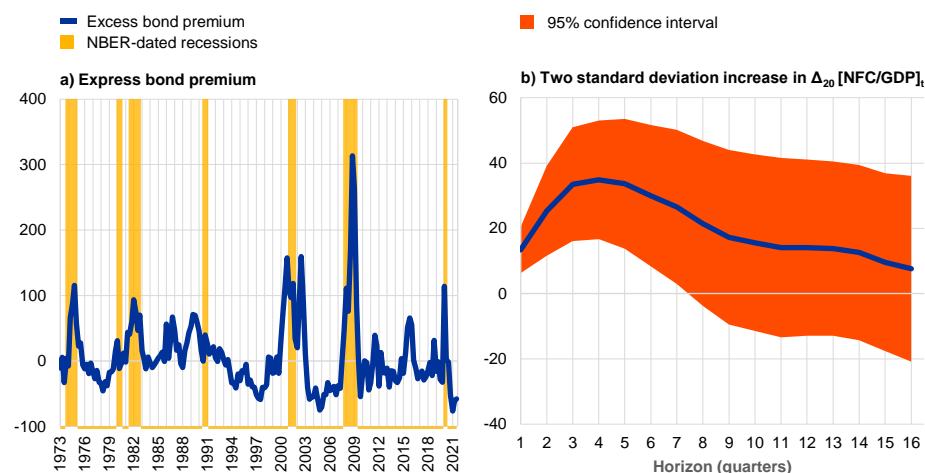
⁵ Though it shares certain similarities, this “behavioural” view of credit cycles is logically distinct from the canonical financial frictions view of business cycle fluctuations, which features fully rational economic agents (Bernanke and Gertler 1989; Kiyotaki and Moore 1997; Geanakoplos 2009). While in the latter class of models, a downturn is triggered by an exogenous shock, which is amplified by a highly leveraged economy, the former approach emphasises the endogenous unwinding of over-optimistic beliefs, which causes a tightening of credit conditions and plunges the economy into a recession; see López-Salido et al. (2017) for an extensive discussion.

⁶ Krishnamurthy and Muir (2017) and Kirti (2018) find considerable empirical support that the interaction between credit aggregates and the mispricing of credit risk provides a much more complete accounting of how a credit-driven downturn gets triggered.

Chart 3

Credit market sentiment and corporate debt build-ups

(in basis points)



Sources: BIS; Board of Governors of the Federal Reserve System; author's calculations.

In this exercise, I regress the EBP at various future horizons on the five-year (i.e., 20-quarter) change in the nonfinancial-credit-to-GDP ratio – the same measure of a corporate debt build-up as that used by Moritz – and a standard set of contemporaneous macro controls.⁷ The resulting local projections impulse response of the EBP to a corporate debt build-up of two standard deviations is shown in the right-hand panel of Chart 3. As shown, corporate debt booms are strongly associated with a subsequent deterioration in credit market sentiment. The increase in the EBP following a sustained increase in the nonfinancial-credit-to-GDP ratio is both economically and statistically significant and quite persistent.

It is this aspect of the credit cycle that is missing from Moritz's analysis of the impact of corporate debt booms on subsequent macroeconomic performance. Whether the interplay between increases in corporate leverage and subsequent reversals in sentiment will turn out to be important for the evolution of the real economy over the next year or so is difficult to say. However, the combination of historically high levels of corporate debt with the exceedingly buoyant credit market sentiment, at least as measured by the EBP, is indicative of a situation that is highly vulnerable to the unexpected changes in both fiscal and monetary policies, as well as to an endogenous unwinding of investors over-optimistic beliefs, as reflected in the significant compression of premia for bearing duration and credit risk.

⁷ The vector of control covariates includes the contemporaneous level of the EBP, the five-year (i.e., 20-quarter) change in the household-credit-to-GDP ratio, four-quarter log-difference in real business fixed investment, four-quarter log-difference in the core PCE deflator and the contemporaneous level of the term spread (i.e., the difference between the 10- and 2-year nominal Treasury yields. To avoid distorting the results by the pandemic, I end the estimation in Q4 2019.

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The future of inflation

By Charles Goodhart

Abstract

We no longer have a generally accepted theory of inflation. This vacuum has been partially filled by reliance on inflationary expectations, but this is a weak reed. Instead, my view is that the main determinants of the structural trend in inflation has been the longer-term shifts in the availability of labour.

1 We lack a general theory of inflation

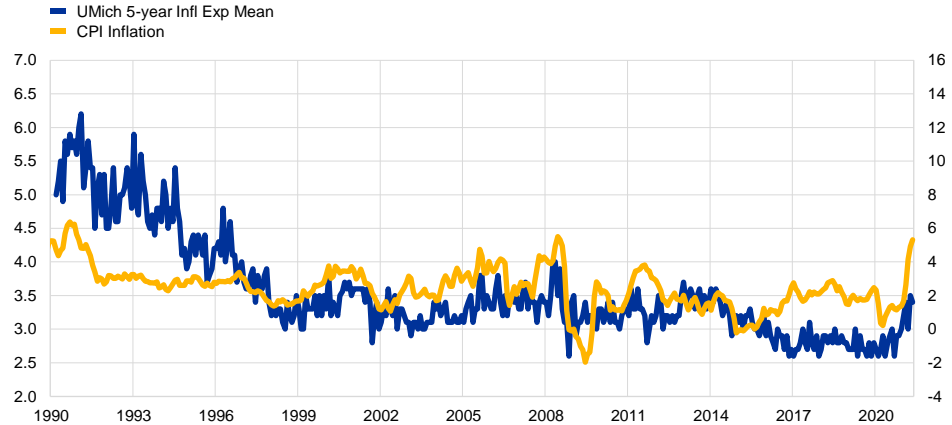
It is a great pleasure to be here. At the moment we are in rather an extraordinary state, because we have no general theory of inflation. We used to have two interconnected theories. One of these was the Friedman monetary theory, whereby inflation is always and everywhere a function of too much money chasing too few goods. Currently that theory has become so discredited that central banks as a general matter refrain from mentioning monetary aggregates at all and almost seem embarrassed by any mention of money. Then, of course, there is the, somewhat interconnected, Philips curve giving a relationship between the level of unemployment and the rate of inflation; that has also been behaving rather oddly recently. This theoretical vacuum has become partially filled with what I like to term 'the bootstrap theory of inflation'; this is that as long as inflation expectations are well anchored, inflation will also remain stable; in other words, inflation depends on its own prior expectations.

Unfortunately, this is a very weak reed. It is a very weak reed because inflation expectations are actually much more closely associated as you can see from this chart, with what has happened in the past.

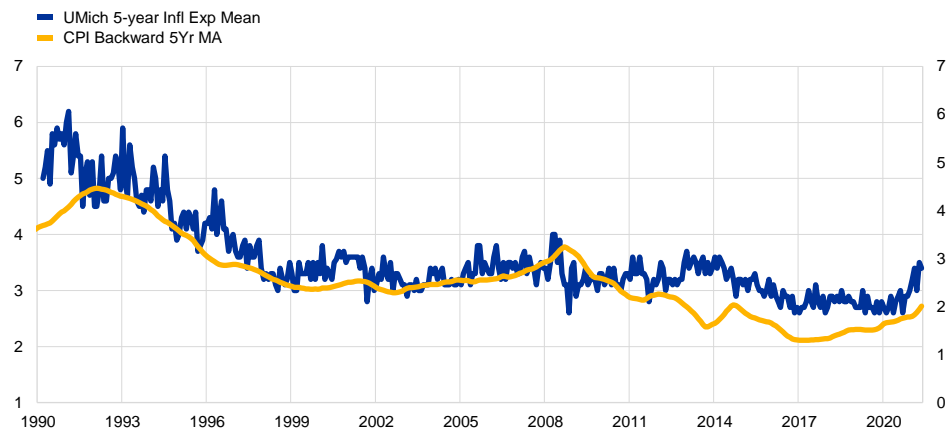
Chart 1

Inflation expectations and CPI

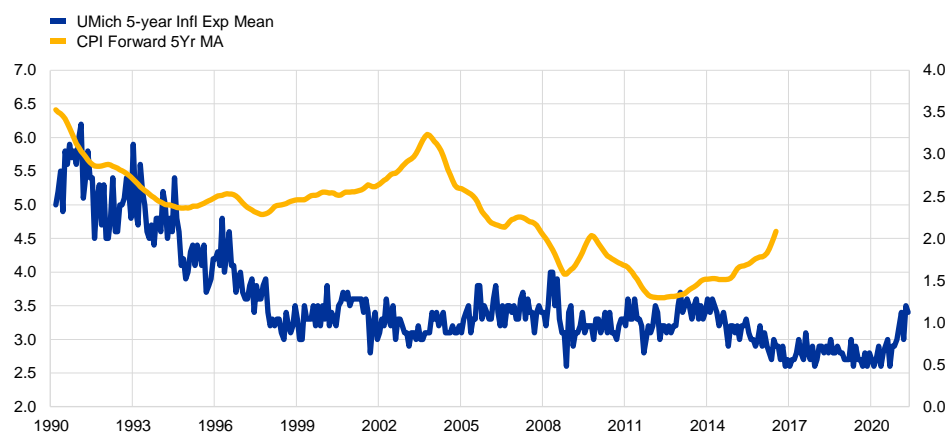
a) Michigan 5Yr inflation expectation vs CPI



b) Michigan 5-yr inflation expectation vs Backward 5Yr-MA CPI



c) Michigan 5Yr inflation expectation vs Forward 5Yr-MA CPI



Source: University of Michigan inflation expectations survey

People are much more likely to extrapolate the recent past than to predict what is likely to happen in future. You can see this by comparing the left-hand diagram on this chart, which is the relationship between the Michigan five year inflation expectations and the backward five year moving average of expectation, and compare this with the right

hand diagram which shows the relationship between the same Michigan expectations and what actually did occur in the subsequent five years. Inflationary expectations are not very useful at indicating what is likely to happen in future, as they are essentially adaptive and backwards looking.

You may not take my arguments that seriously, but there has been a recent (September 2021) and important, though rather controversial, paper by Jeremy Rudd of the Federal Reserve Board. If there is anything in my presentation which I hope that you will take away, it is a need to read that paper; its title is 'Why Do We Think That Inflation Expectations Matter for Inflation? (And Should We?); and I shall give you an indication of how controversial it may be by reading one short paragraph,

'it is far more useful to ensure that inflation remains off of people's radar screens than it would be to attempt to 're-anchor' expected inflation at some level that policy makers viewed as being more consistent with their stated inflation goal. In particular, a policy of engineering a rate of price inflation that is high relative to recent experience in order to effect an increase in trend inflation would seem to run the risk of being both dangerous and counterproductive in as much as it might increase the probability that people would start to pay more attention to inflation and – if successful – would lead to a period where trend inflation once again began to respond to changes in economic conditions.'

More generally, what both Rudd and I tend to think has been most important has been the changes in stochastic trend inflation movements. I attribute this, though he does not sign up to it, to the fact that over the last three decades there has been the greatest ever surge in the availability of labour, particularly in the case of those employers who could move production from high to low wage economies. But this huge surge in the availability of labour is about to end. Indeed, it is currently reversing very sharply.

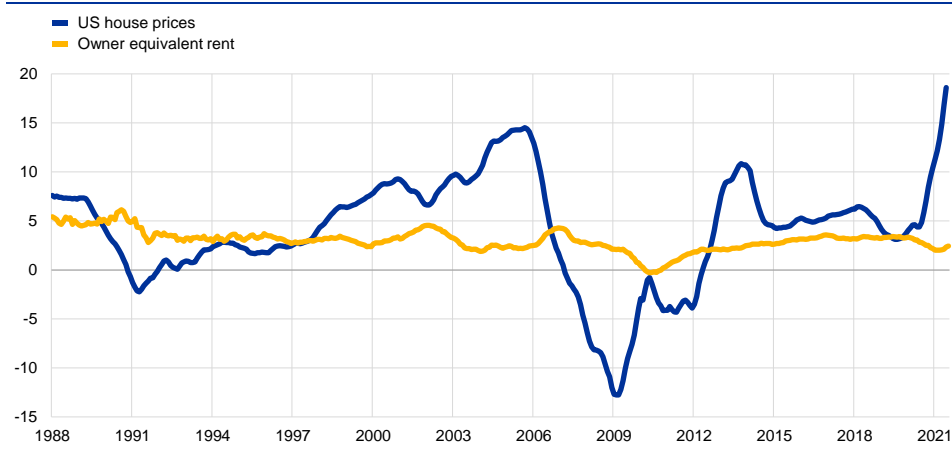
In the absence of any general theory of inflation, what we heard from the earlier presentation by President Lagarde (Lagarde, 2021) has been what you might describe as a menu of different bits and pieces of inflation, inflation in certain commodities, in bits of services, with certain shortages of goods, in shipping costs, etc., etc. It is what you might describe as a 'bits and pieces approach'. In my view, instead, the key factor is supply-side shifts in labour availability. In particular I noticed that in President Lagarde's discussion, as far as I can recall and I tried to listen closely, there was no discussion whatsoever of the fact that in many of the main continental countries the growth in the working age population is not only slowing, it is actually going to decline. So, the factors that led to an increase in labour supply and to a reduction in labour bargaining power, plus the decline in trades unions, etc., all look as if they will now reverse. We are beginning to see this already, and much quicker than I ever expected. There are now quite marked shortages of labour in many sectors, and this is now expected to continue, even perhaps to accelerate to some degree, even after the temporary anti-Covid policy measures, like furloughs, and so on, have gone away.

2 The treatment of housing prices in consumer price indices

I would like to turn now briefly to housing prices.

Chart 2

House Prices and owner equivalent rent



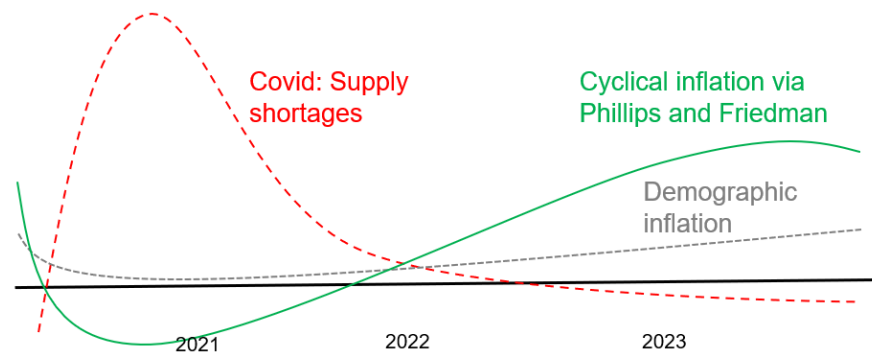
Source: FRED, Federal Reserve Bank of St. Louis database

I very much welcome and I applaud the ECB for planning to include owner-occupied housing on a net acquisitions basis into the harmonised index of consumer pricing, (HICP). I should warn you, however, that this is going to introduce a significantly more volatile element into the index. As you can see from the blue line in the diagram, housing prices are much more volatile than the rental element. The data in this chart come from the United States. The rental element there will soon start to rise, maintaining the increase in their measured inflation. In some of the comments earlier today, it was suggested that there is no sign of instability in the housing market, of housing booms and busts. While actually there is; there has never been such a world-wide coordination of sharp housing price increases, as is currently in process; and there is no reason to believe that this world-wide coordination of sharply rising housing prices is going to go away any time soon. So, if it had been possible to include a net acquisition basis for owner-occupied housing into the present ECB harmonised index, you would have found that such an index would have been quite considerably higher than it is at present. If, instead, you take the US statistical position where it is the rental element that matters, it is likely that such rents will start rising to reduce the margin between new house prices and rentals, and that will lead to some considerable persistence from here on in inflation.

3 The three main elements of inflation

Finally, I want to show a stylistic chart of the three main elements of inflation, temporary supply shortages, cyclical pressures and the underlying structural trend.

Chart 3
The Various Sources of Inflation



Some of the present supply shortages will over time decline, though perhaps even more slowly than here suggested in this particular chart. But offsetting that will be the longer-term trend toward increasing labour shortages, as the working population declines in many countries, and slows more or less everywhere elsewhere in the developed world. Meanwhile the ratio of workers to the aged, the dependency ratio, worsens continuously. Moreover, it is still the intention that monetary policy should remain strongly accommodative, so we are going to get continuing declines in unemployment, and that is going to imply that cyclical inflation will rise in the next year or two, so offsetting the easing of supply blockages.

To conclude, the availability of labour has more than doubled in the last thirty years, and finding workers is going to change from it becoming totally easy to becoming hard to find. Employers will have to bid up wages in order to deal with the continuing shortage of workers. That is neither temporary nor transitory; it is here for the long-run.

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Panel Remarks on The Future of Inflation

By Gita Gopinath¹

Abstract

Under our baseline we expect inflation to remain elevated for some more quarters and then revert to more normal ranges by the end of next year. At the same time, we remain concerned about upside risks to inflation given the unique nature of this recovery and the persistent demand-supply mismatches. The stance of fiscal and monetary policy has important implications for the evolution of inflation and therefore policy makers have the tools to rein in inflation. Central banks should be prepared to move quickly if there are tangible signs of inflation de-anchoring.

1 Panel Remarks

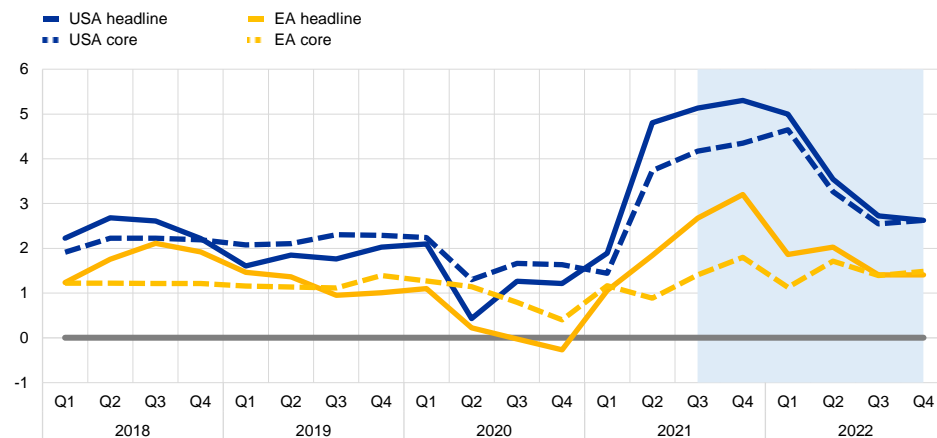
It is a real pleasure to join this panel and speak on this highly topical and important issue. Since we are talking about the future of inflation, let me start with our current projections for inflation. Chart 1 shows our projections for headline and core inflation in the U.S. and in the euro area. As we all are abundantly aware, inflation is running high. Both headline and core are elevated, especially in the US, but the expectation is that this will moderate in 2022 and by the end of 2022 we expect inflation to come down to levels more in the normal ranges. For the euro area, we expect inflation to be below the ECB's two percent symmetric target at the end of 2022.

¹ Economic Counsellor and Director of Research Department, International Monetary Fund.

Chart 1 Elevated inflation

US and Euro area: Headline and core inflation

(2018Q1-2022Q4, percent)



Sources: IMF, World Economic Outlook database

Our projections are guided by the following observations. Some of the rapid rise in inflation is a consequence of so-called base effects, such as the reversal of Germany's VAT rate cut from last year. Similarly, commodity prices have rebounded by over 60% this year after collapsing to historic lows last year. It is highly unlikely that we will have multiple years of sharp increases in commodity prices.

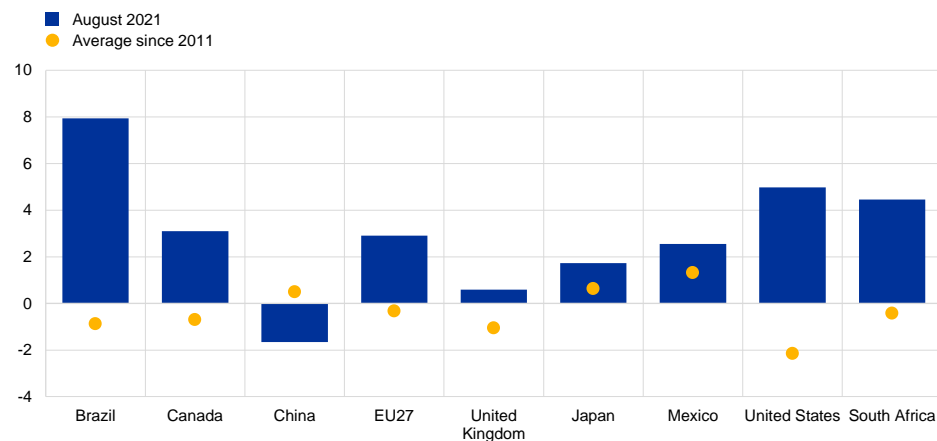
A novel feature of inflation this time round is it has been driven by goods price inflation as opposed to services inflation. This is depicted in Chart 2 for several countries. This anomaly reflects the unusual nature of recovery in a pandemic where consumption is tilted towards goods consumption and away from services consumption, as health risks abound and people work from home. The strong demand for goods has created stress in supply chains in addition to pandemic related supply disruptions in factories and ports. These supply-demand mismatches and shortages, including in the labour market, have persisted longer than many of us expected at the start of this year. Nevertheless, the expectation is that such imbalances should correct over time as the pandemic recedes. The timing of when this will happen is of course subject to considerable uncertainty.

Chart 2

Goods price inflation as the main driver

Excess of goods over services inflation

(economy, percent)



Sources: Haver Analytics and IMF staff calculations

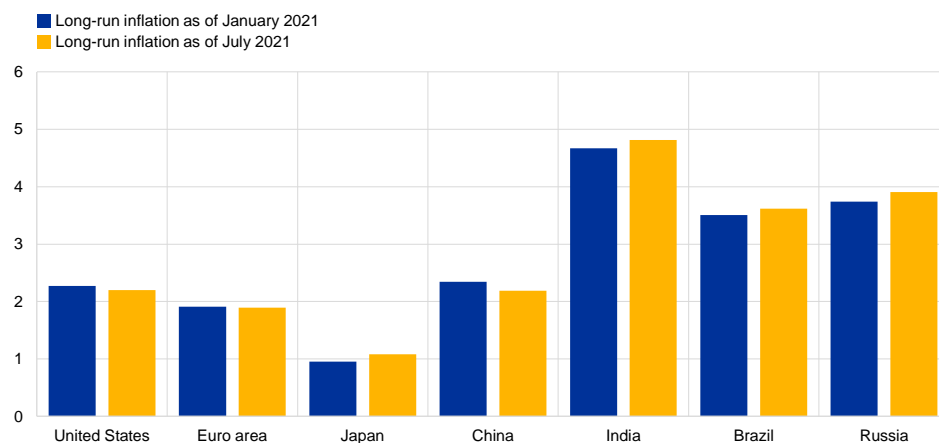
Note: For Japan, average since 2016

Chart 3

Long-run inflation expectations remained anchored

Long-run inflation expectations

(January and July 2021, percent)



Sources: Consensus forecasts

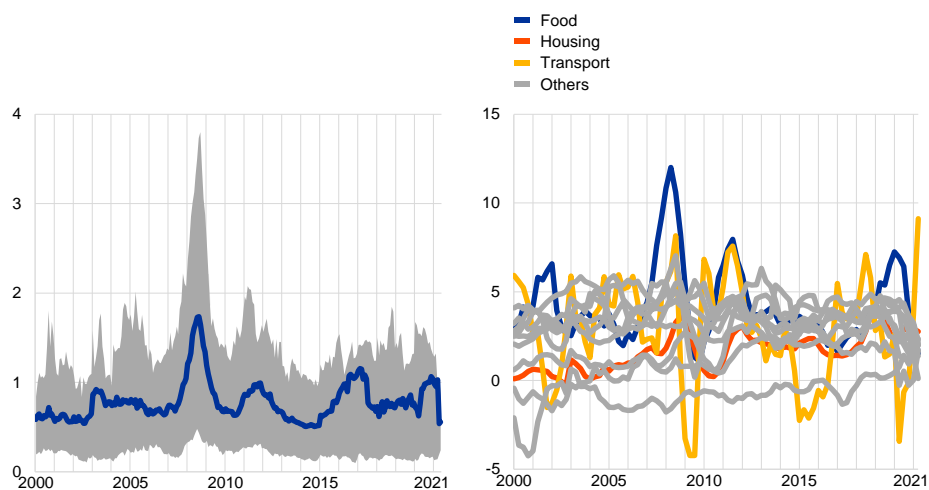
Sectoral inflation dispersion also remains well within historical ranges as shown in Chart 4. Although we have seen some very big prints in terms of inflation for certain sectors, dispersion is not high historically, and especially compared to the period of the Global Financial Crisis. This is a consequence of smaller and less persistent swings in food, fuel, and housing prices, as detailed in the “Inflation Scares” chapter in the [October World Economic Outlook](#).

Chart 4

Sectoral inflation dispersion within historical ranges

Sectoral inflation

(2000-2021, percent)



Sources: Haver Analytics, IMF CPI database, and IMF staff calculations

While sectoral price movements can have transitory effects on inflation, the durability of inflation depends on the level of aggregate demand relative to supply, and price and wage setting mechanisms. The latter in turn depends, among other things, on inflation expectations.

The level of aggregate demand depends on the stance of monetary and fiscal policy and therefore inflation outcomes depend on policy choices. Over the last two decades various forces such as globalization, rising firm profitability and growing automation have flattened the price Philip's curve. In addition, forces such as rising inequality and large demand for safe assets lowered the Wicksellian real interest rate below zero. Because of these forces monetary policy was constrained by the zero lower bound and therefore in its ability to stimulate the economy and raise inflation.

Some of these forces have increased with the pandemic. The trend towards automation has most likely accelerated, and with small businesses being the biggest casualties of this pandemic market power and profitability have likely increased. On the other hand, there is some risk that globalization may reverse. Some propose that ageing demographics will shrink the labour force and lead to inflationary pressures, but at the same time demand is also negatively impacted as the population ages, so the net effect could well be deflationary.

Even if it were the case that the pandemic and ageing have triggered forces that reverse deflationary pressures monetary policy is unconstrained in raising rates to the levels needed to bring down inflation. This asymmetry in the capacity of monetary policy to tame inflation that is too high, as opposed to too low, also gives it the credibility to keep inflation expectations anchored.

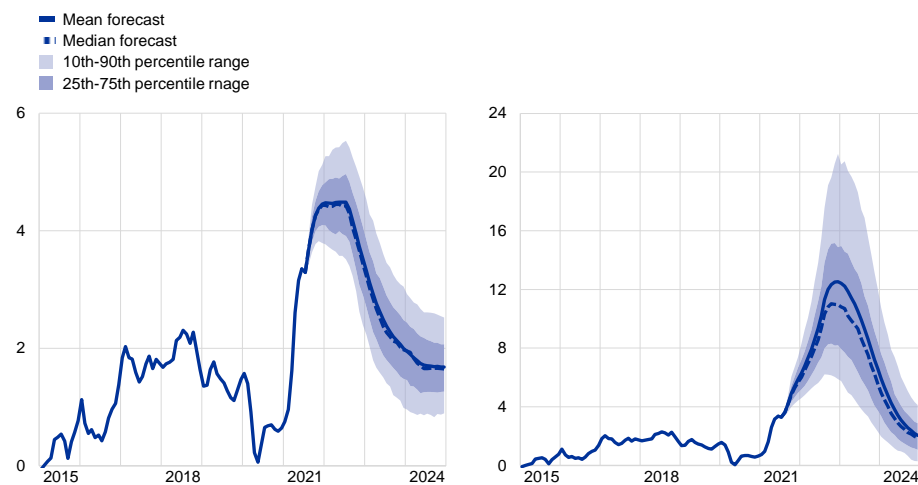
More generally, inflation dynamics depend on inflation expectations. So far long-run inflation expectations remain well anchored (Chart 3) and there are few signs of wage-price spirals

While our baseline projection for inflation is for it to return to normal ranges by the end of next year in most countries, we live in unusual times and uncertainty around inflation is elevated. In Chapter 2 of the October 2021 World Economic Outlook, we consider scenarios where inflation rises well above the baseline. In the first scenario (Chart 5, left), adverse sectoral and commodity price shocks are assumed to be longer lasting. This scenario is rare and is likely to occur with a probability of 0.01 percent based on historical distributions. In this scenario, inflation rises sharply and takes longer to return to target ranges. In the second scenario (Chart 5, right), we have a perfect storm. In addition to the sectoral and commodity price shocks, there is a shock to the expectations formation process that makes it more adaptive. In this case, the median and mean forecasts reach around 8 to 12 percent. Let me emphasize again that this is a tail risk for inflation.

Chart 5
Significant inflation risks

Adverse sectoral, commodity price shocks and Adverse sectoral, commodity price shocks and adaptive expectation shocks

(2015-2025, percent)



Sources: Consensus Economics; Haver Analytics; IMF, CPI database; and IMF staff calculations

To conclude, under our baseline we expect inflation to remain elevated for some more quarters and then revert to more normal ranges by the end of next year. At the same time, we remain concerned about upside risks to inflation given the unique nature of this recovery and the persistent demand-supply mismatches. The stance of fiscal and monetary policy has important implications for the evolution of inflation and therefore policy makers have the tools to rein in inflation. Central banks should be prepared to move quickly if there are tangible signs of inflation anchoring.

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IMF (2021), World Economic Outlook

On the future of inflation

By Francesco Lippi¹

Abstract

The first 20 years of ECB policy delivered low and stable inflation despite turbulent times. This successful experience will continue if policies and institutions maintain their credibility and adhere to a clear price-stability mandate. Monetary credibility was a hard-earned goal for many countries, grounded in rigorous monetary and fiscal policy. The risk of future inflation does not lie in supply bottlenecks, energy shocks or demographic trends. The risk lies in forgetting the recent lessons of history.

1 Introduction

History provides us with one main lesson about monetary economics: that the behaviour of monetary authorities, current and perspective, is the main determinant of inflation. Large monetary expansions, sustained for prolonged periods of time, inevitably lead to excessive inflation. In several cases such episodes are accompanied by fiscal imbalances. We have seen instances of this proposition at least since the French Revolution, during the hyperinflations that hit Europe after WWI (Sargent, 1982), and in Latin America in the second half of the 20th century (Kehoe and Nicolini, 2021). We see them today in several emerging economies. But perhaps the most important lesson for European monetary policy came from the different inflation experiences of Germany and the rest of the European countries in the 1980s.

While several questions remain open about the transmission mechanism of monetary policy, concerning the specific links from policy actions to prices and real variables, we must not forget the lessons that were learned. Controlling inflation over the medium run requires controlling the markets' inflation expectations, something that is inherently related to the expectations about the *future* of monetary policy. At the risk of appearing simplistic, I will argue that the future of monetary policy, and hence of inflation, remains under the control of the central bank. The structural changes that have affected and will continue to affect the world economy, such as globalisation, digitalisation, the emergence of new economic actors, the green-trends, have had an impact on inflation dynamics but have not fundamentally altered the workings of monetary policy. My view, based on classic ideas about money supply, money demand, and the rational choices of optimizing agents, is grounded in its success to explain the big inflations of the past, and is justified by the lack of a superior alternative (see Lucas, 1980, 1996). The biggest risk for the future of inflation is to forget the cause of the low inflation Europe enjoyed over the past decades: a credible monetary policy aimed at maintaining price stability.

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2 Lessons from the past

The first 20 years of ECB policy witnessed unprecedented stable and low inflation throughout the euro area, despite large energy shocks and deep financial crises. A credible monetary policy was able to bring inflation under control in countries where inflation had been high for two decades. Since the beginning of the millennium France, Italy, Spain, Portugal, and even Germany, enjoyed a low and stable inflation that was unprecedented. If anything, inflation has been “too low” relative to target, significantly below the 2% target and occasionally close to zero. Sizeable fluctuations have been recorded, with inflation close to 4% in 2008 and close to zero in 2010, 2015 and again in 2020. Such fluctuations are in part the inevitable consequence of the temporary shocks that affect the components of the aggregate price index: energy prices, supply or demand shortages, base-effects due to VAT adjustments, changes in import prices due to increased trade openness, IT innovations, and many more. While further improvements in monetary outcomes are both desirable and feasible, such as a reduced inflation volatility and a safeguard against near-zero inflation, the main observation about the first 20 years of ECB policy is that it has been a success.

A key risk to be avoided is to confound shocks to relative prices, which recurrently impact the dynamics of aggregate prices, with a systematic change in the dynamics of the slow-moving inflation components. Temporary inflation fluctuations are difficult to eliminate, given the unforeseen nature of the shocks that affect commodity prices, demand and supply patterns. For instance, demographic changes might gradually affect future wages. Yet it would be wrong to confuse such a real shock (e.g., higher real wages) with a permanent shock to inflation. It is a main goal of monetary policy to prevent temporary, possibly persistent, shocks from being embedded into expectations of future price increases, triggering nominal wage changes and even more price increases. Anchoring expectations is essential to avoid such inflationary spirals and to ensure that inflation remains under control. Such a phenomenon, that in many countries takes the form of price-wage spirals, was widespread in the past. To this end the credibility of monetary policy is essential, which in turn requires that fiscal policy is sound.

During the 1970s inflation expectations lost their anchor. It was a sign that central banks were losing control of inflation, a fact that has recently been documented by Reis (2021), who shows that the oil shocks of the 1970s triggered a de-anchoring of inflation expectations in the US. Concerning the present, Reis notes that professional forecasters have only slightly raised their inflation expectations for the United States, while market expectations have moved significantly higher this year and so have household expectations. Inspecting the ECB’s recent survey of market analysts shows no signs of expectations de-anchoring. It is a reassuring sign, one that must be kept under strict surveillance to ensure that markets do not lose faith in the monetary institutions and their mandate. Several questions remain open about the successful stabilization of long-term expectations: Corsello, Neri and Tagliabracci (2021) show that long-term inflation forecasts by SPF have become sensitive to negative short-term surprises to inflation after the 2013-14 disinflation. Likewise, the multiplicity of sources about inflation expectations, their differential information content and their

overall role is one of the challenges that policy makers face, as highlighted by e.g., Coibion et al. (2020).

The fascinating lesson of monetary economics in the 20th century is that things can go bad if the general public expects them to go bad. A high inflation will very likely occur if the private sector gets convinced that high inflation will occur and embeds such expectations in their wage contracts / prices. High inflation expectations make it very costly for the central bank to implement a low inflation policy, thus increasing the likelihood that the monetary authorities will have to accommodate such beliefs. Fellow economists are aware of the “expectations traps” I am describing (see Chari, Christiano, Eichenbaum, 1998). The main lesson from these ideas is to highlight the possibility of losing control of inflation if we lose control of inflation-expectations. Credibility is the *deus-ex-machina* that economists invoke on such occasions. Policy must be such that agents believe the central bank announcements about the fact inflation is and will be the priority, whatever it takes to achieve it. How this is done in practice is difficult to say, but robust institutions and a low inflation history increase the credibility of such announcements.

3 A basic framework

A simple two-equation model helps to illustrate basic notions about monetary policy, as well as a common misconception. The model is naïve in many ways, yet I find it preferable to argue with a precisely defined scheme than to present a series of colourful statements that could be easily misinterpreted. Consider an economy where the money supply, m_t^s , is given by (all variables in logs)

$$m_t^s = m_{t-1}^s + n_t + \varepsilon_t^s$$

where ε_t^s is an iid innovation beyond the control of the central bank and n_t denotes the central bank money supply in each period t . Let us consider a static demand for money by private agents given by

$$m_t^d = p_t + \varepsilon_t^d$$

where p_t is the aggregate price level and ε_t^d denotes an iid shock to the money demand, e.g. a sudden increase in the demand for liquidity. Let $\mu_t = n_t + \varepsilon_t^s$ denote total money supply growth and assume that shocks are observed with a one period lag, so that contemporaneous shocks are not known. It is straightforward to see that inflation, $\pi_t = p_t - p_{t-1}$, is

$$\pi_t = \mu_t + \varepsilon_{t-1}^d - \varepsilon_t^d$$

and inflation expectations are given by

$$\pi_t^e = n_t + \varepsilon_{t-1}^d$$

The first simple lesson from such a stylized model is to illustrate how inflation expectations are pinned down by monetary actions. While inflation forecast errors are to be expected, due to unforeseen money demand and supply shocks, the average value of inflation is pinned down. A richer model would allow for a forward-looking

money demand and would be useful to highlight that it is in fact *the whole sequence of current and future money supply* that is key to pin down the growth rate of prices, a fact that is important to understand the role of central bank announcements and of its credibility (see Sargent, 2013).

The fact that expectations are tied to monetary actions is often overlooked by models that focus on local fluctuations around a steady state. While it is certainly possible, and often convenient, to write models where the policy maker controls an intermediate target variable such as a short-term interest rate or inflation expectations, the limits of such models should be kept in mind, especially during critical times where the economy faces the risk of moving to a new equilibrium (a different steady state). Indeed, the widespread use of quantitative policies that characterized the past decade showcases the limitations of such frameworks.

I would like to illustrate a common fallacy about the money – inflation nexus: a weak empirical link between money and inflation is by no means a proof that there is no structural relation between the two. Rather. Let us consider a regression of inflation on money growth using the simple model described above. The following regression coefficient is obtained

$$\hat{\beta} \equiv \frac{\text{cov}(\pi, \mu)}{\text{var}(\mu)} = \frac{\sigma_n^2 + \sigma_s^2}{\sigma_n^2 + \sigma_s^2} = 1$$

where σ_j^2 denotes the variance of variable j . The equation illustrates the well-known correlation between inflation and money growth, and suggests that when money supply is the dominant force the observations about money and inflation align on a 45 degree line, an empirical regularity that is easily documented in all the high inflation experiences of the past and the present. But, more interestingly, the same logic highlights that the correlation between money and inflation depends on the policy that is implemented, and that it will be more difficult to spot it in the data when monetary policy is targeted at controlling inflation! Suppose that monetary policy aims at minimizing the variance of inflation. In this model the rule that best serves such purpose is $n_t = -\varepsilon_{t-1}^d$, namely one where monetary policy offsets the demand shocks from the previous period, the only ones that are observable. Under this policy, the regression coefficient linking inflation to money growth becomes $\hat{\beta} \equiv \frac{\text{cov}(\pi, \mu)}{\text{var}(\mu)} = \frac{\sigma_s^2}{\sigma_s^2 + \sigma_d^2}$, a coefficient that gets close to zero as money supply disturbance are small relative to money demand shocks.

The model casts light on the claim that the world has changed and that while money growth created inflation in the past, as crystallized by Friedman’s famous proposition, things are different today. The above analysis suggests that the link between money and inflation depends on the monetary policy that is implemented. It is not expected to be visible in an economy where monetary policy is systematically geared at targeting inflation volatility. A richer version of this argument was developed by Sargent and Surico (2011) and Fitzgerald and Nicolini (2014) to explain the apparent failure of a “Phillips curve” type correlation in the US data, and more recently by McLeay and Tenreyro (2020). These models describe monetary policy in terms of a more realistic interest rate rule, accounting for the interactions between the real

economy and money markets. These papers provide clear applications that warn against interpreting reduced form correlations (the disappearing money-inflation link) without a structural model in mind.

While theory and data are a useful compass to gauge the workings of monetary policy, I would also like to stress that several elements that are important for policy remain difficult to understand. This means that more work is needed to further strengthen the institutions and the principles that inform monetary policy. The exact nature of expectations formation, across a variety of private market agents, the structural determinants of the demand for liquidity, the interaction between the real and nominal side of the economy. Despite the ubiquitous presence of digitalisation, and the modernization of the exchange process, the past decade has seen an *increase* in demand for liquid assets, including currency, in most developed countries. I feel no shame in stating that the resilience of cash is one of the things that we do not fully comprehend. Understanding such trends is important to improve monetary policy in future. I am glad that many of these topics are being investigated, both at central banks as well as by academics, and I am confident that if research will be grounded on a rigorous scientific method, as occurred in the past decades, progress will follow.

4 Structural issues

An important question about monetary policy concerns the interactions of nominal shocks (wage increases, oil and other and commodity price shocks, VAT adjustments, changes of the money supply) with the real economy. The speed at which nominal shocks get transmitted to the general price level is important to quantify their business cycle effect and the ability of monetary policy to stabilize output fluctuations.

The past two decades witnessed a revolution in the way scholars look at this classic question. On the one hand, the emergence of new granular micro datasets on price setting behaviour by firms provided the profession with a wealth of data that has an enormous information content. On the other hand, new models were developed, considering several empirical dimensions of firms' heterogeneity previously undocumented and attempting to match the cross-sectional empirical patterns, bridging a wide gap between monetary theory and the data of actual economies.

Theoretical models about the propagation of nominal shocks highlight several microeconomic determinants of the ultimate real effects: a robust prediction of sticky price models stresses the importance of the frequency of price changes, an observable characteristic that exhibits significant cross-sectional variability. Several researchers in academia and central banks are active in monitoring these fundamental patterns to gauge what are the likely future developments of the monetary transmission. For instance, a generalized increase of the frequency of price changes across sectors, as documented for the US by Cavallo (2018) using a sample of online-scraped data, may suggest that monetary policy will become less effective in stabilizing the business cycle. Interestingly, recent evidence for the euro area, collected in Gautier et al. (2021), displays a remarkable stability of the frequency of price setting across time and countries, as measured in the data that underly the

consumer price index measures. Understanding the different trends in the US and the Euro area is one important issue for future research.

Recent results have cast additional lights on the structural determinants of shocks. In Alvarez, Le Bihan and Lippi (2016) and in Alvarez, Lippi and Paciello (2016) we have shown that, in addition to the frequency of price changes, the kurtosis of the cross-sectional price changes is also informative about the propagation of monetary shocks in a large class of sticky price models. The idea is that when there are both price increases and price decreases following a shock, then individual price changes tend to cancel each other, slowing down the propagation of nominal shocks. This effect is encoded in a high value of kurtosis. A recent empirical investigation by Alvarez et al. (2021), based on granular French data for several industries and CPI categories, provides extensive support for the theory.

Much remains to be done both in terms of the models that are used to understand these phenomena and in terms of the measurement to inform and validate such theories. Progress on both fronts will yield a more precise understanding of the future of inflation and monetary policy.

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Productivity and business dynamics through the lens of COVID-19: the shock, risks and opportunities

By Chiara Criscuolo¹

Abstract

Relying, wherever possible, on timely data, the paper provides evidence on four channels through which the COVID-19 crisis has affected productivity and business dynamics across euro area countries: i) cross-sectoral reallocation, ii) creative destruction and within sector reallocation, iii) adoption of digital technologies and iv) teleworking. The results highlight that sectoral reallocation is sizeable and towards high-productivity sectors. The processes of creative destruction and within-sector job reallocation have slowed down but have not been distortive. Entry has recovered more quickly than in the Global Financial Crisis. Firms have also accelerated the ongoing digital transformation process and have adopted remote working. However, not all firms went “digital and remote” to the same extent. Firms that were already more digital before the crisis adopted more and more advanced technologies with implications for productivity dispersion and business dynamics in the aftermath of the crisis.

1 Introduction

The COVID-19 crisis has led to what can be considered the most dramatic global recession since World War II. It created an economic shock that has affected both demand and supply, and curtailed large areas of activity intermittently over months, as measures on the part of both governments and individual actors were implemented to limit the spread of the virus. The pandemic has also caused a significant increase in uncertainty for an extended period, which exacerbated the decline in corporate investment and durable goods consumption spurred by lower demand and disruptions in value chains. With new variants of the virus still causing new infections in many

¹ OECD. This document, as well as any data and any map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. The opinions expressed and arguments employed herein are those of the author and do not necessarily reflect the official views of the OECD or of the governments of its member countries. For their invaluable inputs, I am indebted to colleagues and co-authors from the OECD Productivity, Innovation and Entrepreneurship Division: Sara Calligaris, Flavio Calvino, Márcio Carvalho, Antoine Dechezlepretre, Isabelle Desnoyers-James, Milenko Fadic, Andrea Greppi, Peter Horvát, Francesco Manaresi, Gianpiero Mattera, and Rudy Verlhac and from the Global Forum on Productivity and the Economics Department: Dan Andrews, Filippo Cavassini, Peter N. Gal, Francesco Losma, and Natja Mosiashvili. I am grateful to John Van Reenen, Catherine Mann, Fergal Shortall, Alana Baker and an anonymous referee for useful comments and suggestions. Responsibility for any errors in the article remains my own. E-mail: chiara.criscuolo@oecd.org.

countries, the end is still not in sight in many parts of the globe, keeping the fate of the recovery path highly uncertain.

The pandemic has affected virtually every firm, in every sector and country in the world. The impacts have been both direct, from the pandemic itself, and indirect, from factors such as the repercussions of economic recession; decrease in travel; changes in consumption behaviour and production modes; impaired movement of individuals; and disruptions to global value chains (GVCs). Some sectors have been more affected than others, depending on their ability to work or sell remotely and on how social distancing measures affected their operations. They were either left almost unaffected, had an opportunity to grow (if considered “essential” or if they were providing new services) or halted almost completely (if they relied on face-to-face interactions and the physical presence of customers and a public).

The aim of this paper is to provide new cross-country evidence on euro area (EA) countries to inform policy in the aftermath of the COVID-19 crisis. The focus will be on the channels through which the COVID-19 crisis has affected productivity and business dynamics in the short term, and potentially in the long term, zooming in on four main mechanisms: cross-sectoral reallocation, the process of creative destruction and within-sector reallocation, the adoption of digital technologies and remote modes of working.

We complement the new cross-country evidence with results from the extant literature to provide additional insights on specific issues. Indeed, one of the biggest challenges faced when preparing the paper has been the availability of timely granular data that covered the ongoing COVID-19 crisis, with a clear trade-off between completeness of the data, cross-country comparability and timeliness of the information. Often, choices had to be made, and the evidence presented in the paper is the result of these compromises.

It is too early to say whether many of the changes described in this paper will outlast the crisis or not. We are still most likely in the cyclical phase of this crisis, which is characterised by a high degree of uncertainty (because of the role of new variants and the efficacy of vaccines against them), and it’s not yet clear what the longer-term effects will be. Some changes might be temporary, because of ongoing restrictions or depressed demand. We do not yet have a sense of whether the landscape has changed permanently or not, as some of the restrictions are still in place.

For example, cross-sectoral reallocation may be, to a certain extent, the result of low-productivity sectors being effectively “closed”, with the relevant labour at home rather than working in other sectors. The resulting increase in measured productivity during the pandemic could be just a temporary batting-average effect, and some of the effects of the cross-sectoral reallocation in the medium to long run might be contained if the re-opening is managed properly in short term.

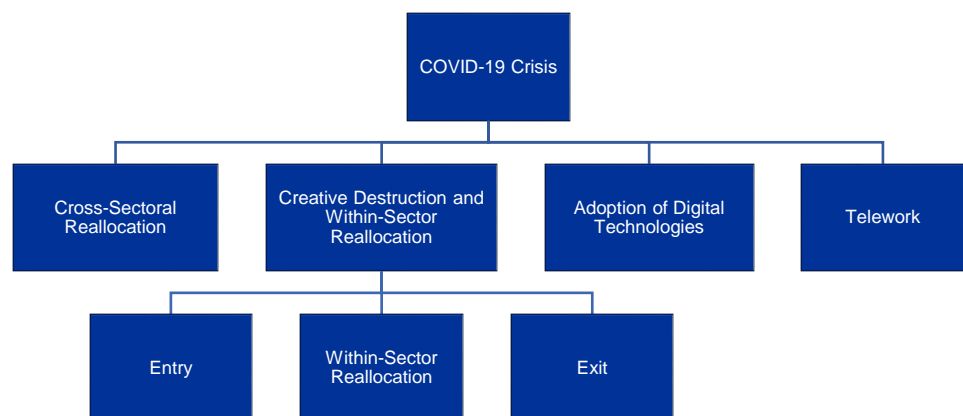
However, some of the reallocation might be more permanent. For example, the growth of online retail, versus brick and mortar shops, seems to have come with a growth in entry of new businesses and some changes in household consumption. The horizon of other shifts might also be heterogeneous. It seems likely that increased teleworking

may be a permanent change – with knock-on effects on the location of economic activity in some industries – while there may be no permanent changes in household behaviour in term of travel or consumption as a result of the pandemic itself, once the restrictions are fully lifted.

To what extent any of these changes will continue beyond the cycle and will affect productivity in the medium to long run is an open question. This blurry boundary between what is cyclical and what is structural makes it tricky to have a sense of long-term prospect with much certainty. Additional scarring effects, such as those on human capital due to schools closures for extended periods during the pandemic, will also weigh in.

The paper will try to draw longer-term policy conclusions on the basis of what we have seen so far, and where available, on expectations of managers and workers from survey evidence. Figure 1 provides an overview of the different ways in which the COVID-19 pandemic may have affected productivity and business dynamics, as considered in this paper.

Figure 1
How the COVID-19 pandemic affects productivity and business dynamics



Across nearly all sectors throughout 2020, the crisis brought a large drop in revenues for many firms who still had to respect payment commitments to suppliers and workers. This caused a liquidity shortfall which may have resulted in a liquidity crisis and the potential default of businesses – including those that were profitable before the onset of the crisis – and consequent job losses, had it not been for the sizeable fiscal intervention by governments through different support measures. These measures include direct financing of wage bills via job retention schemes (e.g. short-term work and wage subsidy), support to laid-off workers (e.g. extension of the coverage and increase in the replacement rate of unemployment benefits), tax deferrals, debt moratoria and extensions.² In some euro area countries (e.g. Finland, France, Greece, Italy, Lithuania, Slovak Republic and Spain),³ these measures were

² For example, Demmou et al. (2021) suggest that, without any policy intervention, up to 38% of firms would face liquidity shortfalls after 10 months since the implementation of confinement measures.

³ See [OECD Covid 19 Employment and Social Policy Responses by Country](#).

also accompanied by changes in dismissal regulations, such as layoff bans. A major part of support policies ensured that companies maintained access to credit, via loans provided or guaranteed by the government,⁴ and/or through the relaxation of macroprudential buffers.⁵ This significant effort in preventing a drop in credit supply to firms has likely contributed to support productivity, as there is significant evidence that negative credit shocks reduce firm investments in productivity-enhancing activities (Manaresi and Pierri 2019, Duval, Hong, and Timmer 2020, Lenzu, Rivers, and Tielens 2020). The support measures went hand-in-hand with large-scale monetary policy measures by central banks, which have also facilitated the expansive use of fiscal policy during the crisis.

The evidence presented suggests that labour productivity in the EA business sector increased in the first few months following the tight social distancing measures implemented in many countries to limit the spread of the virus. This increase reflects a short-term response to the crisis whereby hours worked dropped much faster than output. Indeed, thanks to the large support measures put in place to ensure the protection of job relationships and business survival, the drop in output was not accompanied by a similar size drop in employment. However, hours worked dropped even more than output, with a consequent increase in labour productivity measured as output per hour worked. During the second half of 2020, hours worked recovered in line with output to result in a small drop in labour productivity.

During 2020, average sectoral labour productivity, measured as real value added per hour worked, saw in fact a 1.5% increase, while aggregate output in real terms declined by 6.3% across the EA. The aggregate figure is the result of heterogeneous productivity performance and reallocation across sectors. Low-productivity services that require face-to-face contact with customers – such as hotels, restaurants and entertainment – were the most affected. They experienced drops in terms of value added and hours worked, especially during the first half of the year, because of social distancing regulations. Most other sectors were often affected indirectly, for example through a drop in demand in downstream sectors and/or by consumers or through disruptions in the value chain (e.g. food, aeronautics, etc.) and experienced a smaller decrease in both output and hours worked. Information and Communication even saw an increase in value added. The relative shrinking of the lower productivity sectors in terms of labour input, and their subsequent decreased weight in the economy, contributed to higher aggregate labour productivity. At the same time the large drop in their value added contributed to the decline in real output.

However, it is still too early to be sure that this productivity-enhancing between-sectors reallocation effect is going to be long lasting, as it will depend on changes in consumer behaviour, government support and regulatory measures. The implications for growth in the recovery in turn will depend on the costs and frictions characterising the reallocation of resources across sectors in different countries. The higher the frictions and costs, the more difficult the reallocation and slower the growth.

⁴ Similar schemes have also been implemented at the supranational level, for example the European Investment Bank managed the Pan-European Guarantee Fund. See Falagiarda, Prapiestis and Rancoita (2020) for a more detailed analysis of uptake of these schemes across euro area countries.

⁵ See, for example, [here](#).

The reallocation observed during the crisis is the result of mobility of resources across existing businesses, and of creative destruction with firms entering and exiting the market. This process of creative destruction is a key driver of aggregate productivity growth, so understanding to what extent COVID-19 has affected the magnitude and nature of this process is particularly important.

Cross-country evidence shows that, contrary to the 2008 Global Financial Crisis (GFC), business entry in several EA countries has held up during the COVID-19 crisis. In fact some sectors, such as online retail,⁶ have seen a significant increase. Indeed, the COVID-19 crisis has provided new opportunities for start-ups and innovation. Venture capital has flown to investments in sectors related to remote working, automation, e-payments and health but also in areas related to the green transition. If start-ups can grow and develop on a level playing field, with the necessary financing sources and regulatory environment, current trends of declining business dynamism and rising concentration might also be halted. However, if successful start-ups cannot enter or grow because of regulatory barriers or a lack of financial resources, or if they become targets of M&As by large players, then pre-COVID-19 trends in concentration will likely continue in the recovery period. This will likely have consequences for productivity growth, inequality and innovation, as will be discussed in Section 5 of the paper.

Exit has declined during the COVID-19 crisis relative to 2019, suggesting a slowing down of the creative destruction process. If lower exit levels reflect productive firms remaining afloat and productive jobs matching being protected from the shock, then lower exit might be beneficial for aggregate productivity growth (Guerrieri et al., 2020). However, if lower levels of exit allow non-productive firms to remain in business, resulting in a slowing down the cleansing process of reallocation, this will contribute negatively to aggregate productivity growth. Evidence from single country studies suggests that, although subdued, exit during the COVID-19 crisis has not been distortive, because less productive firms were more likely to exit during the crisis. Similarly, reallocation of resources amongst incumbents has been positively related to size and productivity.

These changes point to a potentially positive outlook for productivity growth after the crisis. The speed of the recovery will also depend on the extent to which policy will allow for a swift reallocation of resources across sectors, and whether the process of exit – which has been largely put to a halt by governments – gradually returns to levels that are more “normal”.

The COVID-19 crisis has also spurred significant changes within firms. Indeed, the crisis has shifted the modus operandi of firms and individuals, and potentially altered behaviour and preferences in the long run. In particular, through the required sudden and far-reaching changes “imposed” on businesses to continue operating, the COVID-19 crisis has been a catalyst for an unexpected acceleration in the adoption of digital technologies and of telework practices. This is likely to have long-run consequences on firms’ productivity growth, productivity distribution and market

⁶ See for example for the Netherlands (Fareed and Overvest, 2021) and for US (US Census, 2021).

power, and, through the latter, indirectly on economic growth, inequality and innovation.

The sudden and fast adoption of digital technologies, teleworking and e-selling might allow firm-level productivity to increase across the board. This, in turn, would improve aggregate productivity. Firms lagging behind, such as SMEs, might experience rapid productivity improvements thanks to the increased adoption, and therefore might be able to close the gap with firms at the frontier of the productivity distribution. In this scenario, aggregate productivity would increase and productivity dispersion would decrease because of faster catch-up of “laggard” firms. Wage inequality, which is closely related to productivity dispersion, might also decrease.⁷

However, if the adoption of digital technologies is heterogeneous across firms, and if both the adoption and the productivity returns to it depend on firms having complementary intangible assets (e.g. good management⁸), then the COVID-19 crisis might lead to an exacerbation of ongoing trends of productivity divergence and [wage] inequality. Before the crisis, SMEs and liquidity-constrained and lagging firms were already adopting fewer – or more basic – digital technologies than firms that were larger, liquidity-unconstrained and more productive. Such firms were adopting more, and more advanced, digital technologies at a faster rate. If adoption of digital technologies during the COVID-19 crisis follows a similar pattern, existing productivity gaps might endure. They might even be further magnified at the aggregate level, since the cross-sectoral changes induced by the COVID-19 crisis have tilted resources towards digital services where productivity divergence was already more pronounced.

Some early evidence, presented in Section 4, suggests indeed that, while the adoption of digital technologies and remote work has become widespread, it is asymmetric across firms. Larger, more productive and more digital-intensive firms have been leading. Thus, there might be a risk for an even larger digital divide in the post-pandemic era. Therefore, policies that ensure a more inclusive digital transformation, from the provision to lagging firms of digital skills and complementary intangible assets, to the wide availability of digital infrastructure, will become very important.

Indeed, the risk that the pandemic accelerates trends not only of productivity dispersion but also of rising concentration and market power more generally, is topical. The evidence for now is scant, mainly due to the lack of available data, but also because of methodological and measurement challenges. Evidence reported in the paper suggests that concentration may indeed increase, especially in digital intensive sectors, given the larger number of sizeable M&A deals by the largest players in these sectors. Concentration might also increase if the wave of business

⁷ Criscuolo et al. (2020) use new harmonised cross-country linked employer-employee dataset for 14 OECD countries to find that, on average across countries, about half of the changes in overall wage inequality can be explained by changes in the dispersion of average wages between firms. Two thirds of these changes in between-firm wage inequality are accounted for by changes in productivity-related premia that firms pay their workers above common market wages. The remaining third can be attributed to changes in workforce composition, including the sorting of high-skilled workers into high-paying firms. These results are in line with previous cross-country evidence showing a strong correlation between productivity dispersion and wage inequality (Berlingieri, Blanchenay and Criscuolo, 2017) and with evidence from single country studies (for references, see Criscuolo et al., 2020).

⁸ See, for example, Bloom, Sadun and Van Reenen, 2012.

exits and bankruptcies – which have been frozen during the crisis mainly due to the massive support provided by government – finally materialise. Maintaining a level playing field for businesses during and after the pandemic, especially in sectors that have already high levels of concentration, should therefore remain a priority for governments.

These results have important implications for policy, which will be discussed in Section 7. The main message is that while some of the changes observed during the crisis have the potential to increase potential output, structural policies will play an important role for minimising adjustment costs of reallocation and thus minimise the risk for unemployment, inflationary pressures and rising inequality. Support measures will have to be gradually lifted and adapted to the evolving economic conditions to avoid stifling the reallocation process. Policies that foster digital diffusion, such as skills and worker mobility, will be particularly important, given the nature of the reallocation and the increased digitalisation of firms – especially if combined with policies that improve digital infrastructure. Policies that foster creative destruction, enable smooth entry and exit, and support experimentation, and ensure a level playing field (such as competition policy and enforcement), will be important components of the toolkit that would ensure a resilient and inclusive recovery.

The paper is organised as follows. Section 2 provides an overview of the heterogeneous impact of the crisis on output, investment, employment and hours worked. The section also analyses its heterogeneity across sectors and its implications for aggregate productivity, though it remains agnostic on whether these changes are cyclical or structural. Section 3 focuses on the process of creative destruction, providing new evidence on trends of entry, exit and bankruptcy during the COVID-19 crisis. This section also discusses productivity implications of the reallocation observed across and within-sectors during the crisis, focusing on the potential distortive role of government support given the generosity of many such measures.

Section 4 focuses on two significant changes observed during the pandemic within firms: the sudden and widespread adoption of digital technologies during the crisis, and the use of remote working arrangements to overcome social distancing measures. Implications for organisations, productivity and its distribution, and inequality across workers, firms and regions are likely to outlast the crisis. The section provides new evidence on telework adoption within countries and highlights differences in adoption within sectors, across firms of different size, and in different locations, as well as the role of digital infrastructure.

Section 5 looks at market power before and during the COVID-19 crisis, by looking at markups and concentration trends over time and across sectors, as well as at M&A dynamics during the COVID-19 pandemic. It links these trends to structural factors, such as the digital transformation and the rising importance of intangible assets in production.

Section 7 concludes by providing an overview of policy implications.

2 The heterogeneous impact of the crisis

2.1 The asymmetric response of employment and hours worked

The COVID-19 crisis was significant in its impact on demand and supply across countries. Sizeable was also the policy response of many developed economies. Estimations suggest that the announced support measures across euro zone countries amounted up to 4 to 11% of GDP (French National Productivity Board, 2021). A support measure widely used by governments has been job retention schemes that help maintain employment by firms and supported companies' cash flow and was accompanied in many countries by regulations banning layoffs. These measures allowed avoiding mass-layoffs and safeguarding job relationships. It also allowed steering clear of a liquidity crisis despite the sudden drop in sales. Moreover, the safeguard of job matches likely contributed to a swift recovery of activities.

Indeed, as shown in Chart 1, business sector⁹ output declined substantially in the second quarter of 2020, as a response to the restrictions in place to contain the COVID-19 pandemic and to the drop in demand. Despite the gravity of the crisis, in euro area (EA) countries, total employment, expressed as persons employed, saw an average contraction compared to the second quarter of 2019 that is a fifth of the output drop (3.8% relative to 17.9% contraction). This is likely thanks to government supported job retention schemes. Thus, GDP per person employed dropped significantly.

The adjustment took place on hours worked rather than employment. Hours per person employed saw a much larger drop, by more than 20% in the EA, reflecting temporary closures or curtailed operations by firms, as well as demand constraints and potential effects of increased uncertainty. This allowed productive job matches to be maintained and employment to recover smoothly in the last two quarters of 2020. This seems indeed very different from what happened in the 2008 GFC when hours worked and employment as well as investment took a much long time to recover (See Chart 2).¹⁰

For most euro area countries, labour productivity, measured as value added per hours worked, increased between 2019 and 2020. Over the course of 2020, hours worked adjusted much faster than output resulting in an inverted V shape productivity trend in 2020.

Chart 1 also highlights that investment dropped significantly in 2020 and remained at lower level relative to the pre-crisis period. Low investments may have long term effects, e.g. on potential output. Thus, in the Appendix we distinguish between investment in tangible and intangible assets (Chart A1 and Chart A2). As it had been

⁹ Figure 1 considers non-agriculture business sector excluding real estate (ISIC Rev. 4 Divisions 05 to 66 and 69 to 82).

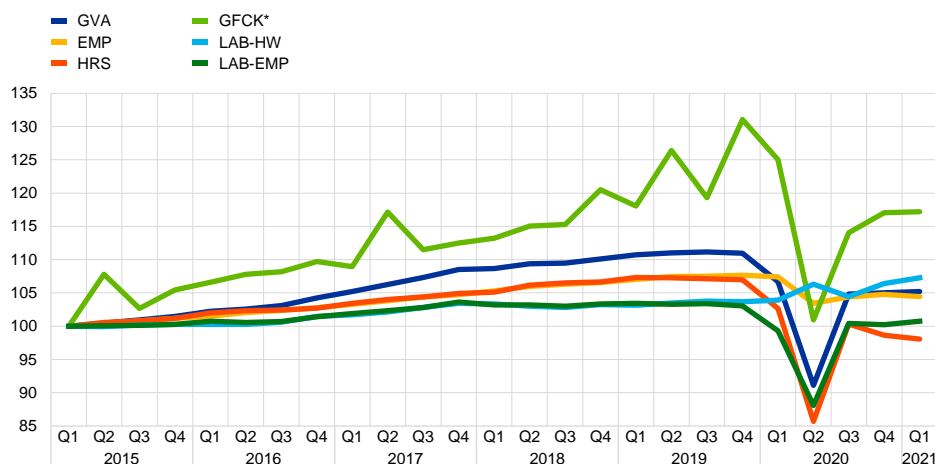
¹⁰ Trends for the UK and the US in both the current COVID-19 crisis and the 2008 Great Financial Crisis are shown in Chart A3 and Chart A4 in the Appendix, respectively.

the case in the Global Financial Crisis, investment in intangible assets show stronger resilience to the shock.

Chart 1

Real Gross value added, number of employees hours worked, Gross fixed formation and labour productivity in Non-agriculture business sector excluding real estate

(2015-21, euro area)



Source: Calculations based on Eurostat's National Accounts database.

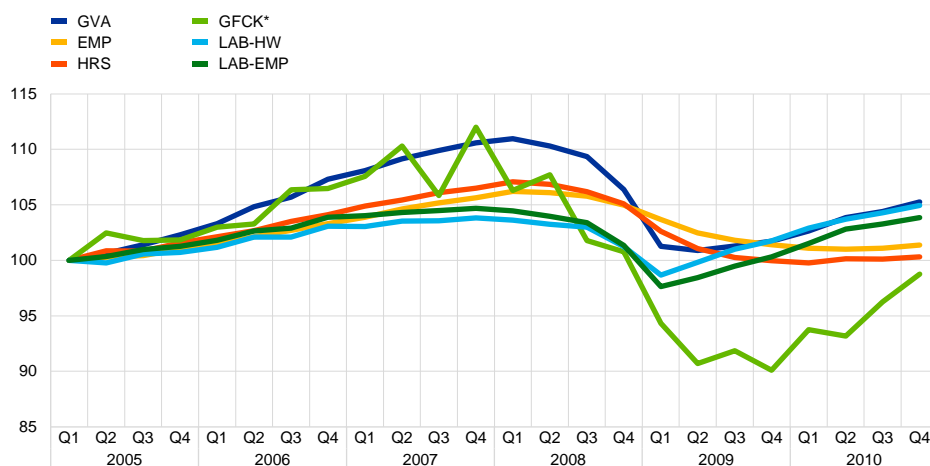
Note 1: Non-agriculture business sector excluding real estate (ISIC Rev. 4 divisions 05 to 66 and 69 to 82) corresponds to the total economy excluding agriculture, real estate, public and other services.

Note 2: GVA in the chart corresponds to real value added, EMP to total employment in persons, HRS to hours worked, LAB-HW labour productivity with hours worked in denominator, LAB-EMP- labour productivity with employment in denominator and GFCK* gross fixed capital formation for all industries, as this variable is not available by industry in quarterly estimates.

Chart 2

Real Gross value added, number of employees hours worked, Gross fixed formation and labour productivity in Non-agriculture business sector excluding real estate

(2005-10, euro area)



Source: Calculations based on Eurostat's National Accounts database.

Note 1: Non-agriculture business sector excluding real estate (ISIC Rev. 4 divisions 05 to 66 and 69 to 82) corresponds to the total economy excluding agriculture, real estate, public and other services.

Note 2: GVA in the chart corresponds to real value added, EMP to total employment in persons, HRS to hours worked, LAB-HW labour productivity with hours worked in denominator, LAB-EMP- labour productivity with employment in denominator and GFCK* gross fixed capital formation for all industries, as this variable is not available by industry in quarterly estimates.

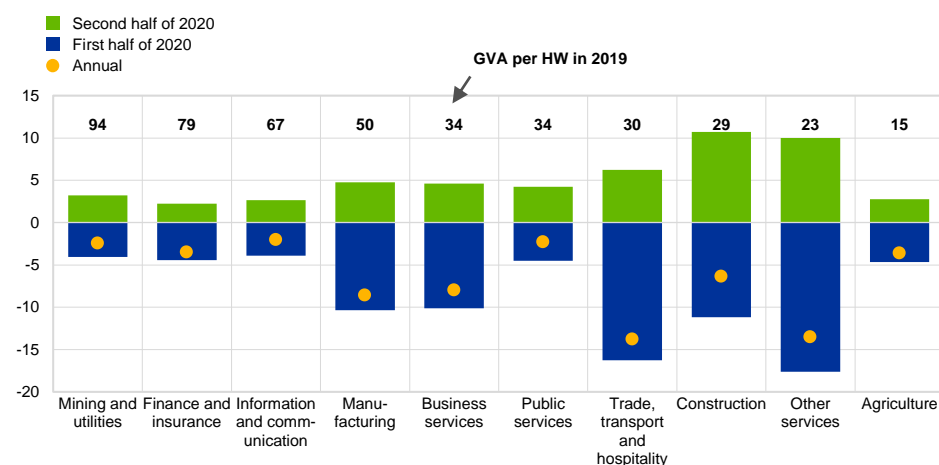
2.2 Heterogeneous impact of the crisis across sectors

While the effects of the pandemic have been felt globally, they have been far from uniform across sectors. Indeed, the pandemic and the stringent measures, taken by governments and private actors, limiting mobility and interactions have affected some sectors more than others. In particular air travel, tourism, brick and mortar retail, and entertainment, have seen their revenues plunge. Indeed, when looking at EU countries, the majority of job losses are attributed to the sectors belonging to wholesale, retail, transport, hotels and restaurants. Of these, retail (e.g. of food) and transport services, considered as “essential services”, were probably less affected than hotels and restaurants, whose operations were hit hardest by the restrictions introduced to limit the virus’s spread. Most of these sectors involve significant social contact in consumption (e.g. travel, hospitality, arts and entertainment, personal services, and airlines) or strongly depend on these sectors (e.g. transport).

Other industries, such as telecommunication services, finance and insurance, online retail, and essential industries were less negatively affected by the recession. These are also amongst the non-agricultural industries with relatively higher productivity as shown in Chart 3.

Chart 3
Low productivity sectors cut hours relatively more, 2019-20, euro area

(change in hours worked relative to previous half year by major sectors of economic activity)



Source: Calculations based on Eurostat’s National Accounts database.

Note: euro area corresponds to weighted average of 19 EA member countries. Variables in 2015 prices.

The inter-industry reallocation process observed during the COVID-19 pandemic with low productivity sectors disproportionately affected and high productivity sectors, such as Information and communication services, showing stronger resilience, contributes positively to productivity growth. Relatively less productive sectors also observed significantly higher drop in Value added, as shown in Chart A6.

The first half of 2020 saw an increase in labour productivity across most industries, with the exception of Manufacturing; Entertainment; Mining and utilities; likely reflecting the stronger adjustment in hours worked relative to the drop in output, in response of the tight lockdown measures during the first wave of the epidemic. During the second half of 2020, most sectors saw a decrease in productivity, with the exception of manufacturing and mining and utilities. The only sector that shows a major decrease in productivity throughout 2020 is the arts and entertainment, which sees a cumulative drop in labour productivity of 3%, more than 15 folds of the other sectors. By the end of the year, the increase in aggregate productivity is also the result of reallocation from low-productivity sectors to high-productivity.¹¹

When comparing which sectors have been most affected by the COVID-19 crisis with those mostly hit during the 2008 GFC strong differences are evident: for example, the sectors that saw the largest drop in 2008-2009 were manufacturing and construction. These two sectors were not strongly affected by the COVID-19 pandemic, with construction growing in the first half of 2020 and manufacturing rebounding quickly in the second half of the year achieving a positive annual growth in 2020.

Bloom et al. (2020a) estimate inter-industry reallocation to have contributed 8.5% to labour productivity growth in the UK in the second quarter of 2020, with the effect declining over the course of 2020 to account for less than 1% of labour productivity in the first quarter of 2021. This suggests that the importance of inter-sectoral reallocation for aggregate productivity growth will have less weight in the medium and long run. In addition, as noted by Bloom et al. (2020c), if the cross-sectoral reallocation results from the shrinking of low productivity sectors without the corresponding growth in high productivity sectors, the crisis may result in lower economic output with negative implications for aggregate growth and welfare.

The next section will provide more details on the Schumpeterian process of creative destruction. Because of data limitations, we will look at the extensive margins of entry and exit using timely data and refer to existing evidence from single countries that investigates whether the process of creative destruction observed during the crisis is productivity enhancing or whether exit indiscriminately hit productive and non-productive firms.

¹¹ In sum, in the first semester of 2020, the stronger drop in hours worked relative to value added has shaped the aggregate trends in labour productivity. This effect was, however, short lived and bounced back in almost all sectors by the end of the 2020 resulting in mitigated changes in labour productivity relative to 2019 at the sectoral level (Chart A7).

3 Process of creative destruction during the COVID-19 pandemic

As discussed in Section 2, reallocation is key for productivity growth. The process of Schumpeterian creative destruction through business entry and exit is central to reallocation and for ensuring growth and innovation (see for example Acemoglu et al., 2018).¹²

Whether the restructuring following a recession is productivity enhancing and can be considered a silver lining is still an open question, both from a theoretical and an empirical standpoint. While a crisis might result in a cleansing of low productivity firms and thus an increase in productivity growth (e.g., Caballero and Hammour, 1996; Osotimehin and Pappadà, 2017; Foster, Grim, and Haltiwanger, 2016) recessions can be sullyng (Caballero and Hammour, 2005; Kehrig, 2015) depending on their nature and the potential increased role of distortions during downturns.

Indeed, Foster, Grim, and Haltiwanger (2016) find that reallocation following the GFC was not as cleansing as in previous recessions and Bartelsman, Lopez-Garcia and Presidente (2019), for nine European countries, find that the link between reallocation and productivity broke during the GFC and attribute this to the trade collapse observed during the GFC. Additional evidence finds that the lack of entry following the 2008 GFC amplified the effects of the financial crisis and caused a missing generation of firms (Messer, Siemer and Gourio, 2016) with negative implications for job creation, productivity growth and innovation.

The question therefore arises on the magnitude and productivity-enhancing nature of the reallocation linked to the COVID-19 crisis. Given data limitations, we are able to provide cross-country evidence on the extensive margins of reallocation, business entry and exit, and not on the intensive margin and cannot explore the cleansing nature of the crisis. Thus, we rely on single country level studies to provide evidence on this issue, e.g. in the euro area: France (Cros, Epaulard and Martin, 2021); Portugal (Kozeniauskas, Moreira and Santos, 2020); Italy (Lamorgese, et al., 2021) and the Netherlands (Fareed and Overvest, 2021). Evidence is also available for the UK (Bloom, et al., 2020a and Andrews, Charlton and Moore, 2021) and the US (Barrero et al., 2021; Wang et al., 2020; Bartik et al., 2020).

3.1 Entry, exit and bankruptcy during the crisis

The drop in demand, the increased uncertainty but also the strict social distancing measures and governments' support instruments have significantly affected both entry and exit during the COVID-19 pandemic with an ex-ante ambiguous effect on aggregate productivity.

¹² See Foster, Haltiwanger and Krizan (2006) for evidence on the US; Bartelsman, Haltiwanger and Scarpetta (2013) for cross-country evidence and Disney, Haskel and Heden (2003) for evidence on the UK.

Firm entry, including of high productivity and innovative start-ups, might have dropped because of the demand shock, the lack of liquidity and increased uncertainty especially in the sectors most affected by the crisis. However, entry might have increased as crises also generate new opportunities for new ventures and new business models. Moreover, even if entry has declined, because of selection at entry, firms that start during the crisis might be on average more productive.

The fate of firms' exits and bankruptcies during the crisis might be twofold. On the one hand, crises may increase the probability of exit at the bottom end of the productivity distribution, thus tightening the process of market selection and therefore result in improved aggregate productivity. On the other hand, the liquidity shock arising from the exogenous social distancing constraints during the COVID-19 pandemic may have forced even productive firms to exit especially in the most affected sectors and in countries where support measures may have not provided prompt and sufficient support to households to sustain demand and to firms to contain liquidity constraints. In countries where governments put in place fiscal support measures, exit, including of low productivity firms, may be subdued as a result of such measures and regulations that delay bankruptcies (see also Caballero and Hammour, 1996). In either case the exit process would be less productivity enhancing during the crisis. In the first case because of the break in the link between productivity and exit and in the second case because support would prevent the cleansing effect of exit and the reallocation of resources from low- to high-productivity firms. This is more likely to be the case if the most productive firms rely less on government support.

Chart 4 shows the change in the number of monthly (quarterly) entry and cumulative entry in 2021 and 2020, relative to 2019 levels in the same month (or quarter) across eight euro area (Belgium; Finland; France; Germany; Italy; Netherlands; Portugal and Spain); UK and US.

In most countries, entry at the beginning of 2021 has recovered or exceeded 2019 levels for the same period (with the noticeable exceptions of Italy and Portugal). Some countries have even experienced a surge in entry compared to 2019.

This is reassuring as the fall in firm entry during crises may amplify the drop in output and reduce the speed of recovery (Clementi and Palazzo, 2016) and potentially leave long-lasting scars to the economy (Sedláček, 2020; Messer, Siemer and Gourio, 2016). The data reported in Chart 4 shows that entry declined substantially in the first months of the COVID-19 pandemic, when the global economy was hit by a sudden and deep economic contraction (OECD, 2020). At its trough (which for most countries corresponded to April 2020), the number of entrants per month was between 20 and 60% lower than the corresponding figure in 2019. The recovery in entry evident for most countries from June 2020 was characterised by a high degree of cross-country heterogeneity: the United Kingdom and the United States experienced a V-type recovery. Other countries (including Italy, Portugal and Spain), continue to struggle with a U-type recovery with the total number of entrants in 2020, and to some extent in 2021, remaining significantly below the 2019 level. Other countries for which data are available (Belgium, Finland, France, Germany and Netherlands) fared in between these two groups in 2020, with some signs of acceleration of business registrations in 2021 in France.

The overall drop in business registrations observed so far in some euro area countries (especially in Southern Europe: Italy and Portugal) may exacerbate secular trends of declining dynamism that have been observed across many OECD countries over the last two decades (Calvino, Criscuolo and Verlhac, 2020) and have persistent negative consequences for employment and productivity growth during the recovery.

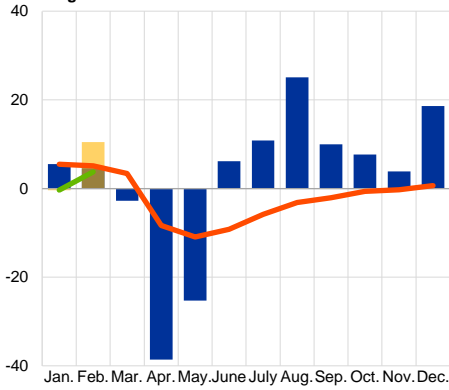
Chart 4

Change in entry, 2021 and 2020 vs 2019

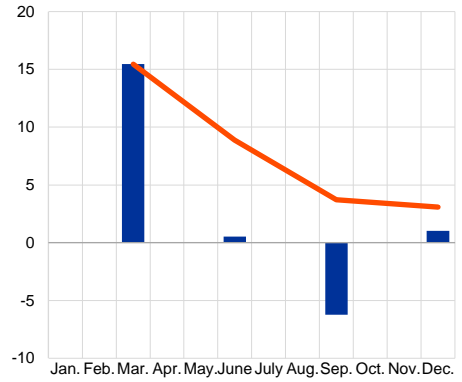
(percentage)

- Difference entry 2020 vs 2019
- Difference cumul. entry 2020 vs 2019
- Difference entry 2021 vs 2019
- Difference cumul. entry 2021 vs 2019

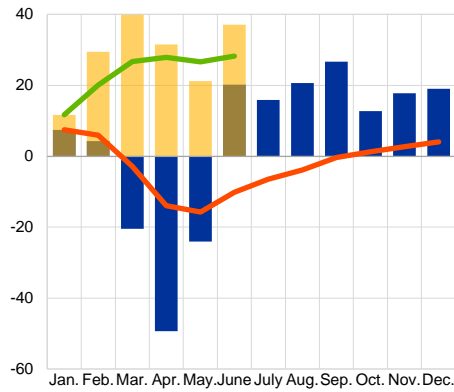
Belgium



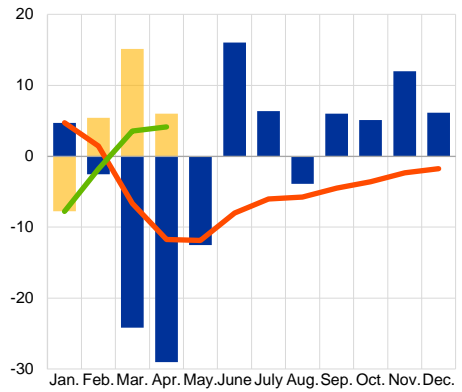
Finland



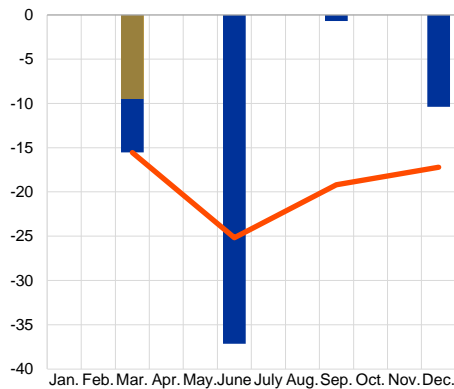
France



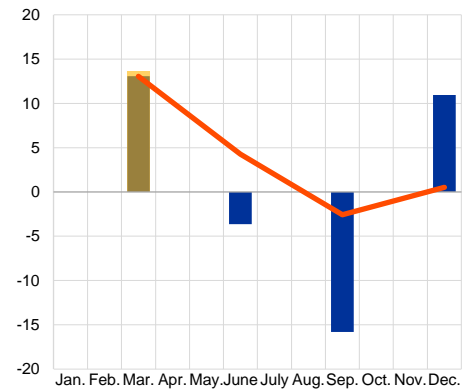
Germany

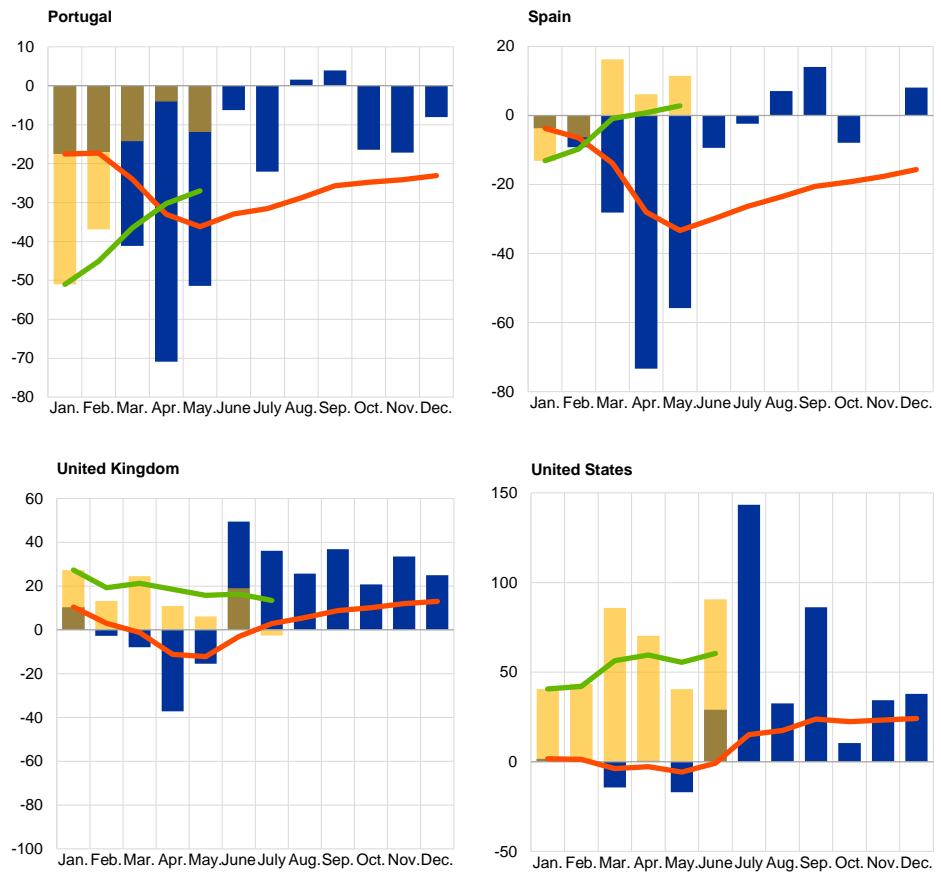


Italy



Netherlands





Note: Bars represent the percentage difference in entry in 2021 (2020) relative to the same month (quarter) of 2019. Lines represent the percentage difference in cumulative business openings from January to each month considered in 2021 (2020) and cumulative business openings over the same period in 2019.

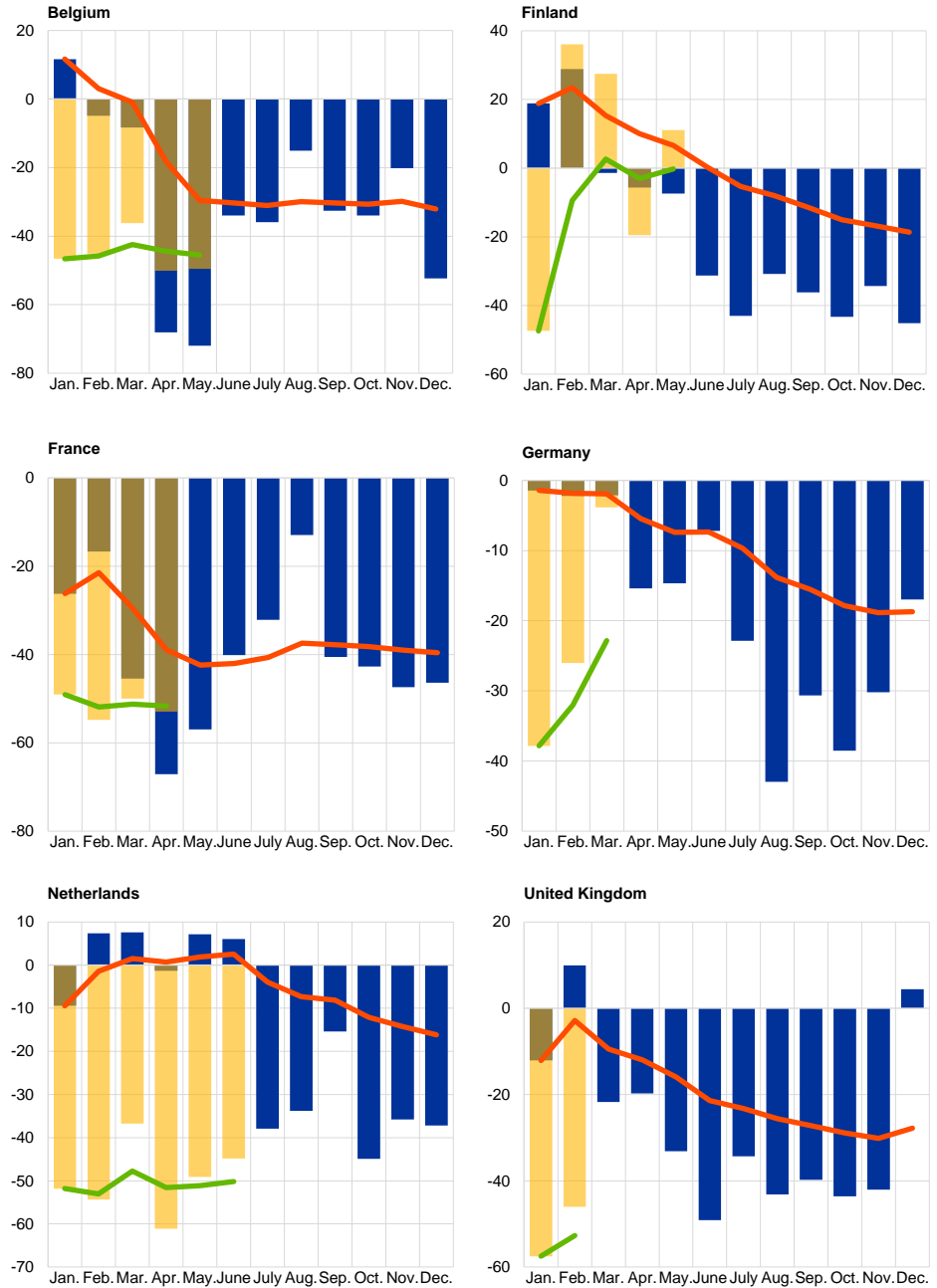
Chart 5 shows the change in the number of monthly bankruptcies and cumulative bankruptcies in 2021 and 2020, relative to 2019 levels in the same month (or quarter). According to the latest available data, total cumulated bankruptcies in 2020 and 2021, since January of each year, were down relative to the corresponding period of 2019. Both regulatory interventions on insolvency procedures and financial support to firms' liquidity may have played an important role in reducing bankruptcies, the former particularly in the early stages of the pandemic, when most countries were implementing such regulations.

Chart 5

Change in bankruptcies, 2021 and 2020 vs 2019

(percentage)

- Difference bankruptcies 2020 vs 2019
- Difference cumul. bankruptcies 2020 vs 2019
- Difference bankruptcies 2021 vs 2019
- Difference cumul. bankruptcies 2021 vs 2019



Note: Bars represent the percentage difference in bankruptcies in 2021 (2020) relative to the same month (quarter) of 2019. Lines represent the percentage difference in the cumulative number of bankruptcies from January to each month considered in 2021 (2020) and cumulative bankruptcies over the same period in 2019.

Chart 6 shows the number of bankruptcies together with a linear time trend estimated for the period 2014-2019. Although some countries display downward trends in

bankruptcies also prior to the crisis, most countries have experienced a significant decline in bankruptcies relative to the trend.

While the slowdown in bankruptcies may have supported viable firms and reduced firing and hiring costs and limit the loss of potential output, the longer support policies are in place the higher the risk that they may actually negatively affect aggregate productivity growth by slowing down the productivity enhancing reallocation process across firms and sectors. If the persistent decline in bankruptcies is a reflection of unproductive firms, the so-called zombie firms, being kept in business, capital and labour might not be reallocated to new business opportunities and to more productive firms.

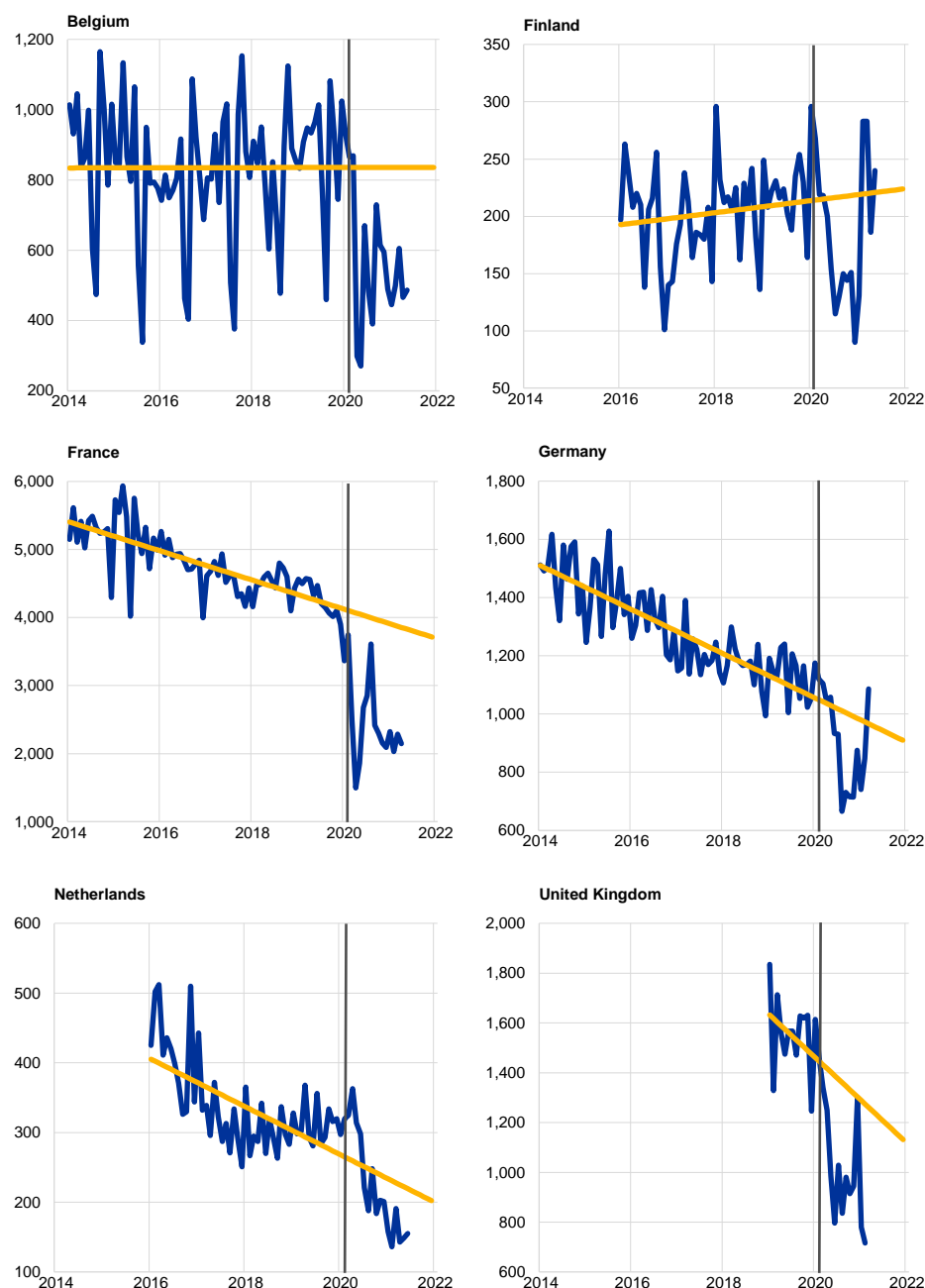
In addition, if the financial support provided through subsidised credit and loan guarantees translates into more firms being in a vulnerable financial position, a new wave of bankruptcies might have just been postponed until the emergency support measures are lifted. This may pose significant systemic risks.

Chart 6

Number of bankruptcies and linear time trend

(number)

— Bankruptcies
— Pre-crisis linear time trend



Note: The chart plots the number of bankruptcies and a country specific linear time trend estimated over the pre-crisis period (2014-19, depending on data availability). The red line indicates February 2020.

Business dynamics during the COVID-19 crisis seem very different from the dynamics observed during the global financial crisis of 2008, presented in Box 1. In particular, entry has picked up much more quickly in some of the euro area countries relative to 2008. While during the GFC, exits went up rapidly across the euro area, exits and bankruptcies were “frozen” during the pandemic and at the end of 2020 were still at

lower levels relative to the same quarter in 2019. This is possibly the result of both fiscal and regulatory support measures.

Box 1

Entry and exit during the 2008 crisis

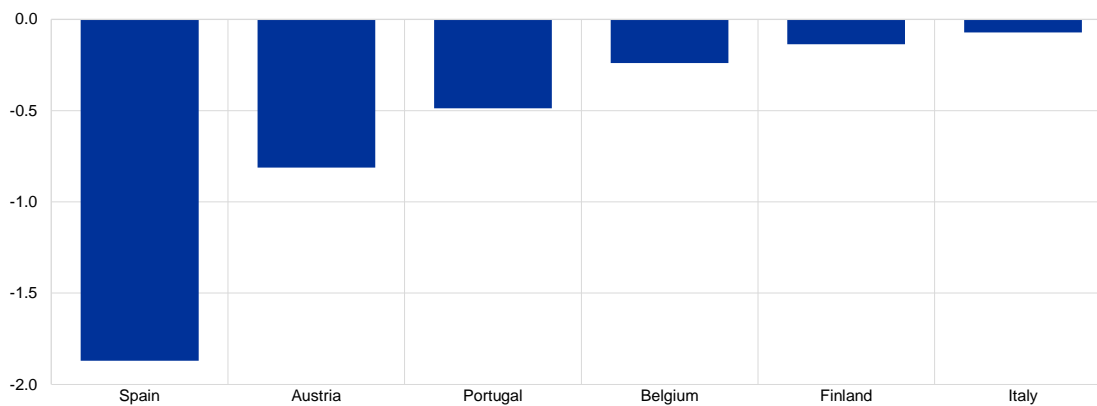
Firm entry, and to some extent firm exit, may exhibit cyclical patterns over the business cycle (see for instance Tian, 2018), reflected also in lower entry and higher exit during recession periods.

Using data for manufacturing and non-financial market services for selected EA countries from the DynEmp v3 database, Chart A shows changes in average entry rates during the GFC relative to the pre-crisis period across countries. It reveals that countries have generally experienced significant declines in entry rates during the financial crisis.

Chart A

Change in entry rates during the 2008-09 crisis

(percentage points)



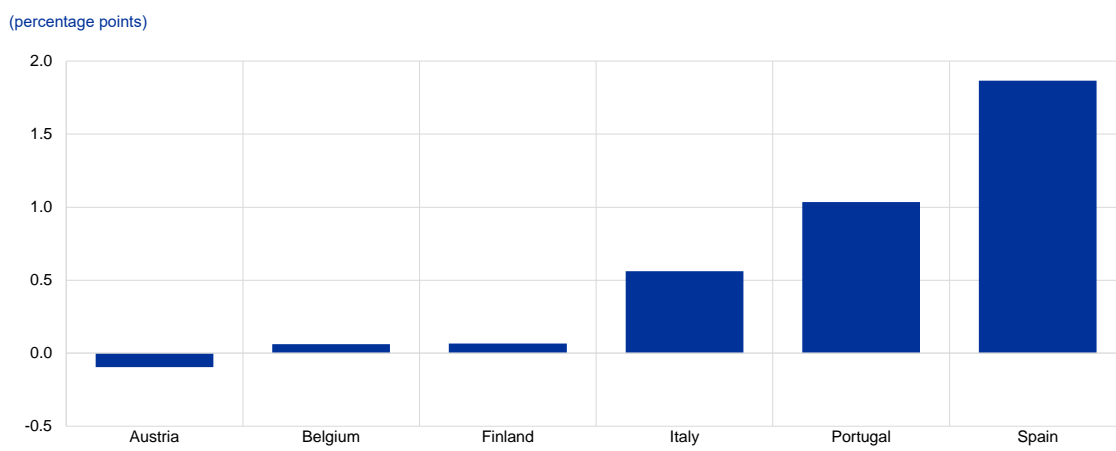
Source: OECD DynEmp v3 database.

Note: The chart plots the difference, in percentage points, between average entry rates in 2008-09 and average entry rates over the 2005-07 period. Data cover manufacturing and non-financial market services and focus on employer units (i.e. excluding firms with one or less person engaged). Owing to methodological differences, figures may deviate from officially published national statistics.

Chart B shows instead changes in exit rates during the GFC relative to the pre-crisis period, across countries, and suggests that most countries have also experienced a rise in exit rates during the financial crisis. In addition to large drops in demand affecting firms' incentives and revenues, the GFC was also characterised by tightening financial condition affecting firm's access to funding. This may have further amplified the cyclical changes in business dynamics, with possible long-lasting consequences for output, productivity and employment (Clementi and Palazzo, 2016; Gourio, Messer and Siemer, 2016; Sedláček, 2020).

Chart B

Change in exit rates during the 2008-09 crisis



Source: OECD DynEmp v3 database.

Note: The chart plots the difference, in percentage points, between average exit rates in 2008-09 and average exit rates over the 2005-07 period. Data cover manufacturing and non-financial market services and focus on employer units (i.e. excluding firms with one or less person engaged). Owing to methodological differences, figures may deviate from officially published national statistics.

3.2 Employment effects of changes in entry

Young firms play a crucial role for job creation and output growth, and the ability of entry rates to recover swiftly from the COVID-19 shock may have significant implications in the medium term for the aggregate economy, and in particular for employment.

To show this, we simulate the employment effects of the average change in the number of entering firms across countries, using data from the OECD DynEmp3 database. Methodological details of the simulation are given in Box 2.

Focusing on the change in the total number of entrants in 2020 relative to 2019 (see Chart 4) we can distinguish three groups of countries:

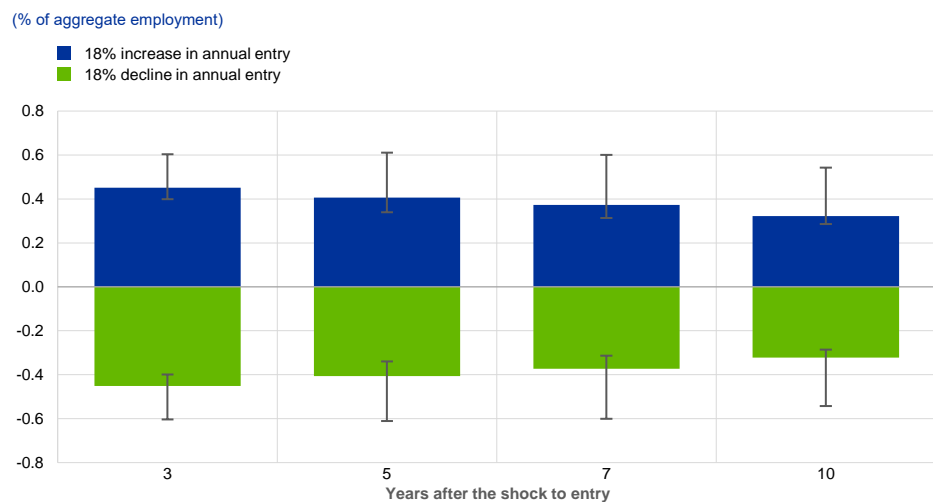
- Countries that have experienced a missing generation of new firms in 2020, with an average decline in annual entry of 18.7%. This group includes Italy, Portugal and Spain. In these countries, the fall in monthly entry in early 2020 has been followed by a slower recovery, resulting in a significantly lower cumulative number of entrants by the end of the year compared to 2019.
- Countries that have experienced a stronger recovery in monthly entry after the initial fall, resulting in comparable or slightly higher levels of entry by the end of 2020. In this group of countries, including Belgium, Finland, France, Germany and the Netherlands, annual entry was on average 1.3% percent higher in 2020 than in 2019 (ranging from -1.7% to 4%).
- Countries that have experienced a significant rise in entry in 2020, with a cumulative number of business creation largely exceeding 2019 levels, by 18.6% on average. This includes the United Kingdom and the United States.

The simulation therefore estimates the effect of a 18% decline in entry (scenario of a missing generation of new firms), and a 18% increase in entry (rise in dynamism), assuming that other margins (i.e. post-entry growth, average size at entry, and survival rates) remain unchanged.¹³

Chart 7 shows that the decline in entry experienced by the first group of countries may lead to a decline in aggregate employment between 0.4% and 0.6% after 3 years and between 0.3% and 0.5% after 10 years. Symmetrically, the significant rise in dynamism observed in the third group of countries could lead to significant and persistent employment gains, between 0.4% and 0.6% after 3 years, and between 0.3% and 0.5% after 10 years.

Entry has remained low at the beginning of 2021 compared to 2019 in Italy and Portugal, reinforcing the potential losses associated with the start-up deficit. On the contrary, other countries, such as France and the United States, and to a some extent the UK, have seen high levels of entry in early 2021 compared to 2019, which could further increase the employment gains during the recovery and beyond.

Chart 7
Employment effects of changes in entry



Source: based on the OECD DynEmp v3 database.

Note: The chart shows the employment losses or gains associated with a 15% decline, a 3% increase and a 20% increase in the number of entrants, relative to aggregate employment in the initial year, on average across countries and cohorts of entrants in 1995, 1998, 2001, 2004, 2007, 2010, and 2012. The bands represent low and high values of the effects of the shocks, representing respectively the 25th and 75th percentiles. The simulation is based on the decomposition proposed by Calvino, Criscuolo and Menon (2015), focusing on A38 industries in manufacturing and non-financial market services. Countries included are Austria, Belgium, Finland, Italy, the Netherlands, Portugal, and Spain.

¹³ These margins may be affected by the COVID-19 shock, though the direction of this effect is not ex-ante clear. The literature has found that financial recessions generate tighter selection at entry: firms that enter are fewer but better (Ates and Saffie, 2021) and adopt more profitable production technologies (Gonzales-Torres, Manaresi and Scoccianti, 2020). Conversely, for non-financial recessions, evidence show that selection at entry is less relevant and low demand at entry persistently reduces growth throughout the new firm's life-cycle (Moreira, 2017). The effect of the COVID-19 shock on startup selection will ultimately depend on the relative weights of supply and demand channels.

Box 2

Methodological details of the simulation

The simulation starts from a decomposition of the net job contribution of surviving entrants to aggregate employment presented by Calvino, Criscuolo and Menon (2015).

The contribution is captured through the normalized net job variation by surviving (Surv) entrants (Ent) in country c , at time t :

$$NJV_{ct}^{Ent} = \frac{EMP_{ct}^{Surv\ Ent}(t+j)}{EMP_{ct}(t)}$$

The numerator of normalized net job creation, $EMP_{ct,t}^{Surv\ Entrant}(t+j)$, identifies employment at time $t+j$ of units entering at time t and that survive between time t and $t+j$. Parentheses indicate that employment is reported at time $t+j$. The denominator $Emp_{ct}(t)$ identifies employment at time t of all active units at time t (including incumbents and new firms).

Calvino, Criscuolo and Menon (2015) find that the net job creation of surviving entrants represent between 1 and 8% of aggregate employment depending on countries. This normalized net job variation by surviving entrants can further be decomposed as follows:

$$\frac{EMP_{ct}^{Surv\ Ent}(t+j)}{EMP_{ct}(t)} = \frac{EMP_{ct}^{Surv\ Ent}(t+j)}{EMP_{ct}^{Surv\ Ent}(t)} \times \frac{EMP_{ct}^{Surv\ Ent}(t)}{NrUnits_{ct}^{Surv\ Ent}(t)} \times \frac{NrUnits_{ct}^{Surv\ Ent}(t+j)}{NrUnits_{ct}^{Ent}(t)} \times \frac{NrUnits_{ct}^{Ent}(t)}{EMP_{ct}(t)}$$

where $NrUnits_{ct}^{Surv\ Ent}(t)$ identifies the number of entrants in country c surviving between time t and $t+j$ and $NrUnits_{ct}^{Ent}(t)$ identifies the total number of entrants in country c , at time t .

The first term on the right hand side corresponds to average post-entry growth rate of surviving entrants:

$$PEG_{ct}^{Surv\ Entr}(t+j) = \frac{EMP_{ct}^{Surv\ Ent}(t+j)}{EMP_{ct}^{Surv\ Ent}(t)}$$

The second term corresponds to the average size at entry of surviving entrants:

$$Avg_{sz_{ct}} = \frac{EMP_{ct}^{Surv\ Ent}(t)}{NrUnits_{ct}^{Surv\ Ent}(t)}$$

The third term corresponds to the survival share of entrants, between t and $t+j$:

$$Surv_{rate_{ct}}(t+j) = \frac{NrUnits_{ct}^{Surv\ Ent}(t+j)}{NrUnits_{ct}^{Ent}(t)}$$

The fourth term corresponds to the start-up rate (total number of entering units over total employment):

$$Start_{rate_{ct}} = \frac{NrUnits_{ct}^{Ent}(t)}{EMP_{ct}(t)}$$

To simulate the employment effects of a change in the number of entrants, $NrUnits_{ct}^{Ent}(t)$, we compute the aforementioned quantities using the DynEmp database and a counterfactual when the number of entrants $NrUnits_{ct}^{Ent}(t)$ changes, i.e. when $NrUnits_{ct}^{Ent}(t)^{Shock} = NrUnits_{ct}^{Ent}(t) \times (1 + shock/100)$ where shock takes the values of the percentage change in entry in 2020 relative to 2019 for different groups of countries (all other quantities are unchanged).

The employment losses or gains associated with a given shock to the number of entering firms are then measured in percentage of aggregate employment, as follows:

$$\frac{Ent^{Shock}_{c,t} - NJV^{Ent}_{c,t}}{EMPC_{c,t}} = \frac{EMP^{SurvEnt}_{c,t}(t+j)^{Shock} - EMP^{SurvEnt}_{c,t}(t+j)}{EMPC_{c,t}(t)} \cdot 100$$

This potential employment effect is computed for different cohorts of entrants, i.e., for $t = 1998, 2001, 2004, 2007, 2010, 2012$ for different time horizons $j = 3, 5, 7, 10, 14$ and for the following countries: Austria, Belgium, Brazil, Canada, Costa Rica, Finland, Hungary, Italy, Japan, Korea, The Netherlands, Norway, Portugal, Spain, Sweden and Turkey.

For each value of the shock, we report the median, 25th and 75th percentiles of the distribution of $NJV^{Ent^{Shock}}_{c,t} - NJV^{Ent}_{c,t}$.

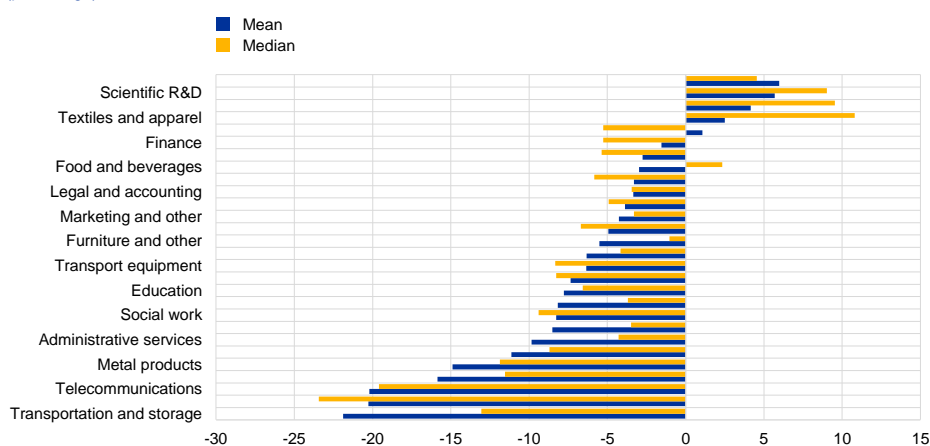
3.3 Sectoral heterogeneity in changes in entry rates during the Crisis

Up until now, we have looked at entry in the business sector, but there is significant heterogeneity across countries regarding the relative effect of the crisis across sectors on business dynamics. For 5 euro area countries (Belgium, Finland, Italy, the Netherlands, and Portugal), data on entry at the sectoral level (28 SNA A38 sectors that altogether represent on average 96% of total entry in non-missing sectors, in 2020)¹⁴ are available allowing a deeper overview and analysis of the changes observed during the COVID-19 crisis.

Chart 8

Average and median change in entry by A38 sectors, 2020 vs 2019

(percentage)



Note: The chart plots the average and median percentage change in entry in 2020 relative to 2019, across countries, by SNA A38 sectors. Countries included are Belgium, Finland, Italy, the Netherlands, and Portugal.

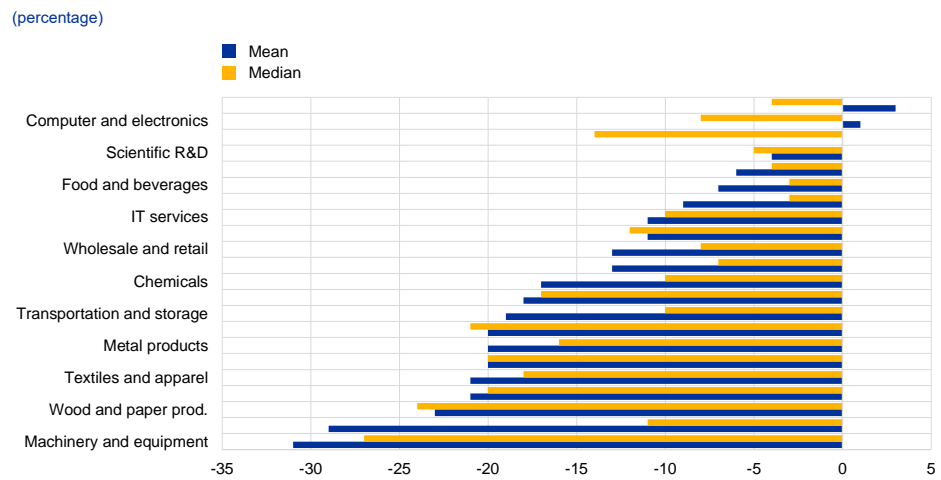
Chart 8 reveals the heterogeneous impact of the crisis on entry across sectors.

¹⁴ In Italy 35% of observations are not classified in any NACE Section and are excluded from the analysis, reducing the coverage to 55% of total entry

On average across countries, “Electrical equipment”; “Scientific R&D”; “Wholesale and retail trade” and “Textile and apparel” stand out as the most resilient sectors, as they have experienced an increase in the total number of entry in 2020 relative to 2019 between 2.5% and 6% on average. Interestingly, evidence from the US (United States Census, 2021) and the Netherlands (Fareed and Overvest, 2021) show that the surge in entries in the retail sector come mainly from new online retail shops rather than new brick and mortar stores. This evidence, together with the National Accounts data discussed in Section 2, shows how the retail sector, which was hit hard by the crisis, was also where new firms have been an important driver of technological change to cope with the pandemic shock. This echoes existing evidence showing that new firms sustained innovation and intangible accumulation during the past recession (Gonzales-Torres, Manaresi, Scoccianti 2020), and drove structural change in the long-term (Dent, Karahan, Pugsley, Sahin 2016).

Conversely, “Transportation and storage”, “Arts and entertainment”; “Telecommunications”, “Hotels and restaurants” and “Metal Products” have been hit harder by the crisis, with an average decline in entry of about 20% and all five countries experiencing a negative change in entry in 2020.

Chart 9
Change in entry during the 2008-09 crisis, by SNA A38 sectors



Source: OECD DynEmp v3 database.
Note: The chart reports the percentage change in the average number of entering units in 2008-09 relative to the average number of entering units in 2006-07 (excluding firms with one person engaged or less). Countries included are Austria, Belgium, Canada, Finland, France, Hungary, Italy, Norway, Portugal, Spain and Sweden.

Chart 9 compares industry patterns in entry during the pandemic with those observed during the 2008 GFC. The comparison highlights the generally stronger negative response of entry during the GFC and marked differences in sectoral heterogeneity, with manufacturing sectors being much more strongly affected during the GFC and services sectors being relatively more affected during the pandemic.

3.3.1 Entry was more resilient in sectors that rely less on face-to-face interactions

Relying on the disaggregated quarterly data on entry available at the SNA A38 industry level¹⁵ for 2019 and 2020, we investigate the (univariate) correlation between the change in entry in 2020 and sectoral characteristics.¹⁶ In particular, the analysis considers characteristics that capture the intensity of face-to-face interactions; potential to telework; as well as the digital intensity of different sectors.¹⁷

We investigate the univariate correlation between year-on-year change in entry and sectoral characteristics by exploiting cross-sectoral variation within a country-quarter, using quarterly data for 2020.¹⁸ The results presented in Table 1 focus on univariate correlations.

Table 1
Change in entry in 2020 and sectoral characteristics, by quarter

	(1) Customer Contact	(2) ICT task content	(3) ICT skill	(4) Telework potential
$\beta^{Q1}(Q1.X_s)$	0.039 (0.102)	-0.143 (0.129)	-10.278* (6.236)	-0.220* (0.115)
$\beta^{Q2}(Q1.X_s)$	-0.383* (0.203)	0.679*** (0.235)	19.499** (9.338)	0.334** (0.165)
$\beta^{Q3}(Q1.X_s)$	-0.000 (0.098)	0.047 (0.160)	8.952 (10.274)	0.157 (0.216)
$\beta^{Q4}(Q1.X_s)$	-0.559* (0.326)	0.193 (0.257)	3.230 (10.5)	-0.063 (0.219)
R2	0.175	0.168	0.162	0.162
Observations	520	520	520	520
Nb Countries	5	5	5	5
Nb A38	25	25	25	25

Note: This table reports the coefficients from a regression of year-on-year percentage change in entry on sectoral characteristics interacted with quarter dummies, and including country-period fixed effects. The regression is based on quarterly data for Belgium, Finland, Italy, the Netherlands and Portugal. Robust standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

¹⁵ The following SNA A38 sectors are excluded from the analysis: Agriculture; Mining; Coke and refined petroleum; Chemicals; Pharmaceuticals; Electricity and gas; Water and sewerage; Public administration; Households; Extraterritorial Organizations.

¹⁶ Data for Belgium, Finland, Italy, and the Netherlands cover business formation including legal and natural persons, while data for Portugal covers only the formation of legal persons (and equivalent)

¹⁷ The share of employment in occupations involving regular face-to-face contact with customers is based on Koren and Petö (2020). The potential to telework is a task-based indicator of telework potential from Espinoza and Reznikova (2020). Digital intensity refers to ICT task intensity, based on Calvino et al., 2018, and Grundke et al., 2017, and to the average ICT skill level based on Cammeraat, Samek and Squicciarini (2021). See additional details in Table B1 in the Appendix.

¹⁸ We estimate the following model: $\Delta^4 E_{csq} = \beta^q.X_s.1_{\{quarter=q\}} + \theta_{cq} + \varepsilon_{csq}$ where $\Delta^4 E_{csq} = (E_{csq}^{2020}/E_{csq}^{2019} - 1) \times 100$ is the percentage change in entry in 2020 relative to the same quarter q of 2019 in a given country c and sector s . X_s are (country invariant) sectoral characteristics, interacted with quarter dummies $1_{\{quarter=q\}}$ equal to 1 for quarter q and 0 otherwise. θ_{cq} are country-quarter fixed effects. This model allows estimating differentiated correlations between the change in entry and sectoral characteristics over the four quarters of 2020. The model includes country-quarter fixed effects controlling for the aggregate impact of the crisis on business formation in each quarter of the year in each country. Standard errors are robust to heteroscedasticity (clustered standard errors at the country-sector level yield consistent results).

Results reported in Column 1 of Table 1 suggest that the declines (increases) in entry in the second quarter of 2020 (with respect to 2019 Q2) and in the fourth quarter of 2020 (with respect to 2019) were more (less) pronounced in sectors with a higher share of employment involving regular face-to-face contact with customers.

Estimated coefficients reported in Column 2 show that the decline in entry in 2020 Q2 was on average less pronounced in sectors with higher ICT task intensity of jobs. In unreported multivariate regression analysis, both ICT task intensity and the share of employment in occupations involving regular face-to-face contact with customers remain jointly significant (in 2020Q2).

Columns 3 and 4 show similar results hold when looking at ICT skills and at the industry's telework potential, respectively.

To summarise, the analysis shows that the change in entry in 2020 Q2 (relative to 2019 Q2) and in 2020 Q4 (relative to 2020Q4) is negatively correlated with the share of employment in occupations involving regular face-to-face contact with customers. The change in entry in 2020 Q2 (relative to 2019 Q2) is positively correlated with ICT task intensity in the sector, as well as the average ICT skills of workers in the sector, and the telework potential of the sector.

Indeed, one of the silver linings to the pandemic might be the opening up of new opportunities because of the needs associated with social distancing, and its impact on every aspect of daily life, from remote work, education and health services and online shopping and entertainment, as well as innovation in drugs, medical equipment and services. This is confirmed from information on venture capital deals¹⁹ in the EA. While Across EA countries the number of deals decreased in 2020 with the exception of Belgium and Estonia, there was an increase in total value of VC deals in 2020 in many EA countries (in particular Estonia, Finland, Ireland, Italy, Austria, Netherlands, and France). Some of the activities that saw an increase in VC financing were indeed related to messaging and communication; online dating; teleconferencing; health; robotics; but also home living; administrative services and online media and entertainment.²⁰

3.4 Is reallocation during the COVID-19 crisis productivity enhancing?

In section 2, we presented evidence that inter-industry reallocation during the COVID-19 pandemic has shrunk low-productivity sectors and thus contributed positively to aggregate productivity growth. At the beginning of this section, we have discussed the importance of reallocation for productivity growth. Evidence on within-industry reallocation across countries during COVID is not yet available. However, evidence from single country studies provides interesting insights.

In particular, existing studies provide evidence on the two mechanisms that may have weakened the cleansing effect of exit. First, whether the negative correlation between

¹⁹ This analysis is based on a database on Venture Capital deal based on information from the CrunchBase and Dealroom databases.

²⁰ Results available upon requests.

exit and productivity has been weakened or broken and second, whether support measures - by helping all firms equally or in some cases less productive firms more than high productivity ones - have made exit less productivity-enhancing than in normal times.

In the euro area, analysis for France (Cros, Epaulard and Martin, 2021);²¹ show that even if depressed, the exit process during the crisis has been productivity enhancing and that government support absorbed some of the sectoral nature of the crisis without distorting the reallocation process. The 2021 report of the “Coœur Committee”²² shows that despite the generosity of the French support measures, amounting to almost 10% of French GDP, few firms have made use of the full suite of measures to which they were entitled to and that Zombie firms have not been disproportionately supported. Rather, support was channelled ex post to firms most impacted by the crisis. Indeed, simulations analysis (Bénassy-Quéré et al., 2021) suggests that the measures may have halved the number of newly insolvent firms, especially in the hospitality sector. These results suggest a tentatively positive evaluation of the French support measures. Evidence for the Netherlands shows that exit during COVID was much more common amongst smaller businesses (Fareed and Overvest, 2021) and thus closely related to size that can be considered a rough proxy for productivity. OECD (2021) confirms that across the OECD smaller firms shrank more than larger ones. Looking at the intensive margin, results also suggest that reallocation has been productivity enhancing: across the euro area, the ECB Survey on the Access to Finance of Enterprises (SAFE) finds that revenue and employment growth recovered much faster across larger firms, while SMEs and micro firms experienced a strong and persistent contraction in turnover and employment. In Italy, Lamorgese et al. (2021) show that better managed firms, defined as those making larger use of structured management practices, saw a smaller decline in sales, probably reflecting a better ability to adapt to the new remote working environment. Evidence for Portugal (Kozeniauskas, Moreira and Santos, 2020) also suggests that higher-productivity firms have been more successful at maintaining employment, but the cleansing effect of exit during the crisis was mitigated by a subdued rise in exit among low-productivity firm, likely reflecting the higher likelihood of low productivity firms benefitting from government support.

For the UK, evidence confirms that the reallocation process has not been distorted during the crisis with the reallocation between industries (low-productivity sectors where affected more) and within-industries (the least productive firms within these industries were affected more) resulting in the productivity-enhancing nature of inter- and intra-industry reallocation. Using a different data source, Andrews et al. (2021) also confirm that job reallocation continued to be positively linked to productivity during

²¹ Cros, Epaulard and Martin (2021) analyse data on bankruptcies of small employing firms in France and find that although subdued the cleansing process of exit is not distorted with low productivity and high debt being key predictors of bankruptcy before and during the pandemic. They also find that the role of government support has been to dampen the COVID shock protecting sectors that had been most affected by the crisis without affecting the cleansing effect of exit. Andrews et al. (2021) also focus mainly on small firms.

²² The Committee on the Monitoring and Evaluation of Financial Support Measures for Companies Confronted with the Covid-19 Epidemic presided by Benoît Coœur focused on four measures: job retention, the Solidarity Fund for smaller companies, state-guaranteed loans, and deferral of social security contributions.

COVID. In addition, recent analysis (Anayi et al., 2021) points to an increase in reallocation²³ relative to the past 15 years, with the within-industry reallocation component accounting for about two thirds of the total.

For the US, a similar increase in reallocation was also found, with both excess jobs and excess sales reallocation rates increasing during the COVID crisis (Anayi et al., 2021; Barrero et al., 2021 and Bartik et al., 2020). On bankruptcies the evidence is more mixed, with bankruptcies for non-home-owners consumers and small businesses dropping significantly despite increased unemployment levels (Chapter 7 filings were at levels 20% below 2019 levels and Chapter 13 filings were up to 65% below 2019 levels in August 2020). On the other hand, Chapter 11 filings by large corporations have increased to reach nearly 200% relative to 2019 (Wang et al., 2020).²⁴

4 Adoption of digital technologies and telework during the COVID-19 crisis

The pandemic brought with it the need for social distancing, working remotely, and producing and providing goods and services at a distance. It has clearly accelerated existing trends towards digitalisation, which holds potential for significant productivity improvements but also risk increasing inequalities if the benefits are not equally distributed across workers, firms and regions within countries.

During the crisis, many firms invested in technological and organisational innovations and automation, which is also in line with existing theories suggesting that crises are a good time for restructuring. There are at least two potential explanations for this. Lower opportunity costs in periods of low demand will lead to the introduction of productivity improving innovations (e.g., Aghion and Saint Paul, 1998; Nickell, Nicolitsas and Patterson, 2001; Barlevy, 2004; Bloom et al., 2021). In addition, increased perceived risk of failure makes efficiency, rather than growth, the priority (Schmidt, 1997). For the US, Hershbein and Kahn (2018) and Jaimovich and Siu (2020) confirm the faster pace of (skill-biased) restructuring during previous crises.

Relative to previous crises, the social distancing restrictions peculiar to the COVID-19 crisis have forced many firms to reorganise much more quickly and much more heavily. This involved a rapid adjustment to remote working and to online delivery of

²³ In the UK, sales reallocation increases more than employment reallocation reflecting the dampening role of furlough schemes on the latter, in the US this difference does not arise reflecting heterogeneity in the two countries' support measures.

²⁴ Evidence from Australia and New Zealand (Andrews, Hambur and Bahar, 2021 and Andrews, Charlton and Moore, 2021) confirm that job reallocation remain productivity enhancing during the pandemic. Although a comparison between Australia and New Zealand points to the importance of support measures generosity and duration to avoid slowing down this process. For Japan, Hong, Kikuchi and Saito (2020) find that the cleansing effect of exit remain stable during the Covid-19 crisis, even though exits have been muted.

their goods and service, which in turn provided an additional unique incentive to digitalise, and to some extent automate, their operations.²⁵

The increased digitalisation and automation - and for some firms faster adoption of artificial intelligence - is likely to lead to an initial drop in output, as reorganizations take time and require heavy adjustments to the operation of businesses, but will ultimately result in an increase in firm productivity (Kopytov, Roussanov and Taschereau-Dumouchel, 2018; Brynjolfsson, Rock and Syverson, 2021).

However, the already more productive and better managed firms can more easily adopt the latest digital technologies and more quickly reap their productivity benefits, since they master the required complementary intangible assets such as proprietary software, organisational capital and intellectual property. To the extent that this is the case, the adoption of digital technologies might result in increased divergence amongst the “best” firms and the “rest”.

Indeed, digital technologies such as software and other intangible assets (e.g. management; branding) are characterised by such features such as scalability, sunkness, synergies, non-rivalry and non-excludability (Haskel and Westlake, 2018). These might reinforce the productivity advantage of the best firms in the sector, especially when intangible assets, such as software, are proprietary (Bessen, 2020). Scalability allows firms to replicate innovations and business models across different locations and allows larger firms to benefit relatively more from digital technologies (see also Brynjolfsson and Hitt, 1998). Intangible assets are also characterised by large sunk costs of development and lack of secondary markets where intangible assets can be resold. In turn, intangibles are characterised by high fixed costs and low marginal costs, which again favours disproportionately the larger, more established players on the market. Moreover, thanks to the synergies between intangibles and with other tangible assets, the best firms have greater efficiencies in digital intensive sectors.

All these features translate in larger, more intangible and digital intensive firms enjoying a larger productivity advantage relative to the rest of the firms, as discussed below, but also larger markups and larger shares of the industry output as discussed in section 5.

In so far as the COVID-19 crisis has been accompanied by an acceleration in the shift to a more digital and intangible economy, this crisis might perpetuate, if not step up, the trend in productivity divergence evident since the early 2000 across the economy (Andrews, Criscuolo and Gal, 2016). As shown in Chart 10, a divergence between firms at the frontier (the “best”) and all others below (the “rest”) - both globally and within the euro area - is evident, even when focusing only on the post- GFC period. This divergence is larger and increasingly more so in digital intensive sectors, defined

²⁵ Chernoff and Warman (2020) characterize the correlations between automation potential and COVID-19 transmission risk; while Caselli, Fracasso and Traverso (2020) confirm that robotisation has facilitated social distancing and lowered the risk of contagion in Italy.

following the taxonomy developed in Calvino et al. (2018).²⁶ In line with the discussion above, firms at the global and euro area frontier are more likely to be a multinational corporation, have more intangible assets, such as patents and trademarks, and conduct higher level of R&D. Thus, they are better placed to take advantage of digital technologies by leveraging the benefits accruing from these complementary tangible and intangible investments, in particular in combination with their larger (global) size.

Interestingly, when focusing on the “rest” in digital intensive sectors of the economy, we see an improvement in the average productivity of these firms in the last ten years, in contrast to the decline that we observe in the other sectors. If COVID-19 has supported the diffusion of digital technologies to the “rest”, both in digital intensive and in less digital intensive sectors, then the average productivity of firms below the frontier might increase across the board, with ultimately positive implications for aggregate productivity. However, this hinges on the capacity of the firms below the frontier to successfully combine digital technologies with the required complementary assets ranging from skills and other types of capital mentioned above.

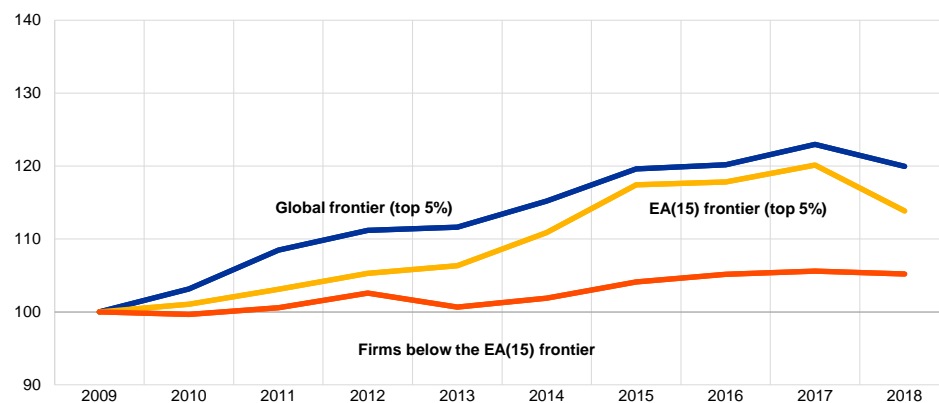
²⁶ This digital intensity taxonomy combines several indicators capturing different technological components of digital intensity (tangible and intangible ICT investment, purchases of intermediate ICT goods and services, robots), the human capital it requires to embed technology in production (ICT specialists intensity and ICT task intensity), and the way digital technologies change the interface of firms with the output market (online sales).

Chart 10

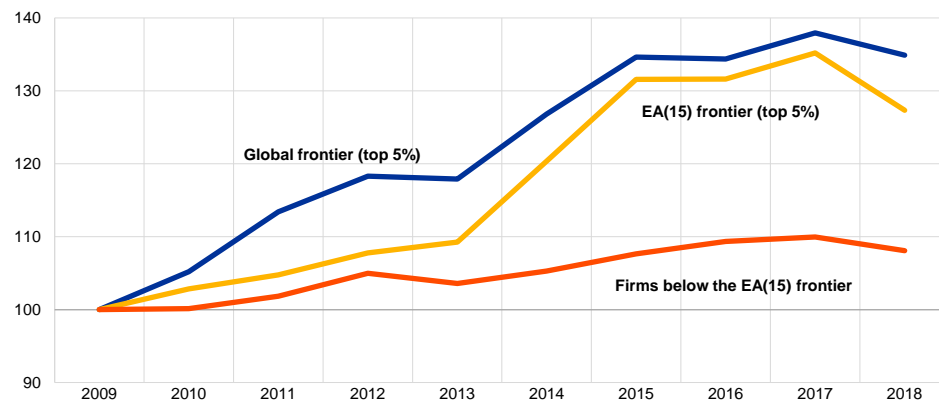
Productivity divergence especially in digital intensive services

(index normalised to 100 in the initial year)

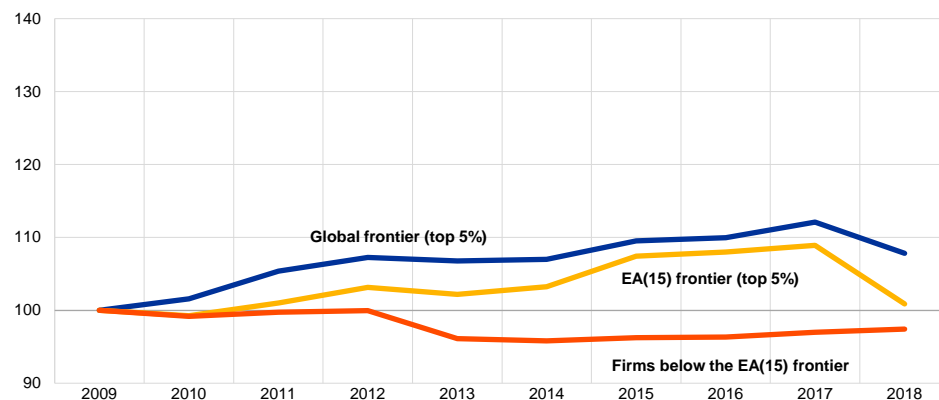
a) Total economy



b) High digital intensity



c) Low digital intensity



Source: Calculations based on ORBIS updating methodology from Andrews, Criscuolo and Gal., 2016 and using the Calvino et al., 2018 taxonomy.

There is further evidence from different data sources pointing to the complementary role of digital and intangible intensity for increasing the productivity gaps between firms. In particular, Corrado, et al. (2021) relying on within-countries micro-aggregated data covering 10 euro area countries²⁷ find that productivity divergence at the bottom,

²⁷ Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands and Portugal.

i.e. between the median firms and the bottom decile of the productivity distribution, in digital intensive sectors is more pronounced in country-sectors that are more intangible-intensive. In addition, results in Berlingieri et al. (2020) find that laggard firms catch-up to the productivity frontier at a lower speed in more digital intensive and more knowledge intensive industries. These findings suggest that an increase in the intangible and digital intensity of the business sector might be particularly challenging for smaller, less productive firms and hamper their productivity catch-up to the frontier.

The next section will collect existing evidence on trends in digital adoption during the crisis, drawing on the limited evidence available in the literature from different studies.

Section 4.2 will then address in detail the rise of telework, a phenomenon that epitomises the sudden changes linked to the use of digital technologies during the COVID-19 crisis, relying on timely data sources including a new data collection effort by the Global Forum on Productivity.

Although it is too early to gauge evidence on the productivity implications of digital adoption and telework during the COVID-19 crisis, the aim of the next two sections is to highlight a significant heterogeneity in the extent and the level of sophistication of digital technology adoption across businesses. This tendency might preserve, if not reinforce, existing trends in productivity divergence as well as concentration and markup distributions, as discussed in Section 5.

4.1 Adoption of digital technologies

While anecdotal evidence on the role of the COVID-19 crisis as a catalyser for digital adoption abounds, evidence from large surveys remains rather limited. Indeed data from National Statistical Offices across European countries covering the use of ICT technologies during 2020 will only become available in December of this year (Eurostat).

However, efforts to document the digital transformation in the EU and the US, the UK and emerging economies have been made by the European Investment Bank (2021a); the CEP at the London School of Economics (Riom and Valero 2020; Bloom et al. 2020a) McKinsey Global Institute (2021), and the World Bank (DeStefano and Timmis, forthcoming; World Bank, 2021). The use of online digital platforms – both by firms and households – has been also found to increase across many segments of the economy, with the rise of mobile payments and online deliveries (OECD, 2021).

The different data sources point to a significant acceleration of digital adoption across firms and countries. However, they also point to significant heterogeneity in the adoption of digital technologies across firms, with larger firms or firms that were already digital before the COVID-19 crisis leading ahead in the adoption of digital technologies during COVID.

Results of the EIB survey show that across both the US and the EU larger firms are more likely to invest in multiple digital technologies.²⁸ The results also confirm that digital firms are more likely to invest in other intangible assets, training and innovation and show higher productivity level and propensity to export, grow faster and pay higher wages.

In the European Union 48% of small and 59% of large digital firms, i.e. firms for which at least one advanced digital technology is implemented in parts of the business, expect digital technologies to gain importance in the coming years, compared with only 32% and 46% of small and large non-digital firms. This, in turn, can potentially lead to an increased gap between digital and non-digital firms in the recovery phase. Similar figures also hold for the United States.

Similarly, the CEP-CBI survey reports that more than 60% of survey respondents have adopted digital technologies (e.g., Enterprise Resource Planning; Customer Relationship management systems; Remote working technologies; Cloud computing; Mobile technology; Automated machinery and AI applications) during the crisis and 38% adopted new digital capabilities (e.g., E-commerce, Advanced analytics and Cyber security). 90 to 95% state that COVID-19 prompted or accelerated the adoption of these technologies and practices. These firms were also more likely to invest in other intangible assets. In line with evidence for EU and US firms, UK medium to large firms showed somewhat higher probability of adopting digital technologies, capabilities and management practices. Also, firms that had previously adopted digital technologies were 30 percent more likely to do so. 90% of UK firms that have adopted digital technologies during COVID expect that they will continue adopting beyond the crisis, pointing to a persistent effect on digital adoption.

The World Bank (2021), using results of an event study by De Stefano and Timmis (2021), focuses on firms in 9 countries, including 4 in the EU (the Czech Republic, Hungary, Poland, the Slovak Republic; and also Brazil, China, India, Mexico and Thailand). The study shows a significant acceleration of adoption of digital technologies, such as e-commerce, online payments, data analytics and advanced data analytics.²⁹ Interestingly, the World Bank study corroborated that during the crisis firms that are larger, multinational, more productive and digital, i.e. with advanced software and cloud in place before the crisis, adopt more advanced digital technologies, (e.g., advanced data analytics), while adoption of more basic digital technologies, such as e-commerce, was more widespread amongst smaller domestic firms.

Taken together, the evidence across different countries seems to point to a clear acceleration in the adoption of digital technologies linked to the peculiarities of the COVID crisis. This has played a critical role for strengthening the resilience of

²⁸ Firms were surveyed about the use of different digital technologies in different sectors. In Manufacturing, technologies considered are (a) 3D printing, (b) robotics (c) internet of things (IoT), and (d) big data/artificial intelligence. In construction (a) 3D printing; (b) drones; (c) IoT; (d) virtual reality. In services: (a) virtual reality; (b) platforms (c) IoT (d) big data/artificial intelligence. In infrastructure (a) 3D printing; (b) platforms; (c) IoT (d) big data/artificial intelligence.

²⁹ Data analytics includes both advanced functions, such as A/B testing, and more basic functions, such as visitor count tracking, feedback forms and error tracking. A/B testing reflects an advanced data analytic technology, where firms randomly show visitors different versions of their website, and track visitors' behaviour (such as purchases) in response, in order to optimize their website design.

businesses and economies to the crisis. Evidence from the US (Pierri and Timmer, 2020) suggests that adoption of digital technologies is linked to a smaller impact of the pandemic on unemployment and the labour market; evidence for Australia, the US and the UK (Andrews, Charlton and Moore, 2021) also seems to suggest that tech savvy firms were more resilient to the crisis.

In addition, according to the responses to the EIB and CEP-CBI surveys, firms expect the adoption of digital technologies and practices to outlast the crisis and to have implications for productivity, profitability and employment. The widespread adoption of even basic digital technologies might represent an important stepping-stone especially for smaller, less productive firms to accelerate their catch-up process.

However, the same evidence also highlights that any pre-existing digital divide across firms, along the size, productivity and the digital use dimensions, plays an important role in explaining the extent, the intensity and the sophistication of digital technology adoption during the pandemic.³⁰ In addition, productivity divergence seems to be larger in sectors providing ICT services (e.g. computer programming, software engineering and data processing) where the increasing potential of digital technologies to create global winner-takes-most dynamics (Brynjolfsson and McAfee, 2011) might have helped frontier firms to increase their performance disproportionately more than laggards. Thus, any existing digital divide will likely persist beyond COVID or even be exacerbated, in the absence of any policy intervention. Firms at the frontier are likely to have not only adopted more and more sophisticated technologies but also been able to benefit more from them in terms of profitability and productivity, thanks to their complementary intangible assets and management capabilities and their larger scale. This has implications for the persistence of productivity growth and dispersion, wage inequality as well as market power as we discuss in Section 5.

4.2 Adoption of telework practices

One of the biggest changes observed by workers and businesses during the COVID-19 pandemic has been the widespread and often sudden reliance on telework (working from home – WFH – or remote work)³¹ as firms were faced with the need to maintain social distances and respect lockdown measures without having to put their activities to a complete halt.

Being able to rely on what Eberly, Haskel and Mizen (2021) called “potential capital”, represented by residential homes and workers’ internet connections, has ensured that a large share of the economy could continue operating despite strict lockdown measures and therefore provided an invaluable source of resilience. Eberly, Haskel and Mizen (2021), estimate that across Japan, the UK, Germany, Spain, France, Italy and the US “potential capital” mobilised through telework contributed roughly 10 percent of GDP on average.

³⁰ This is in line with evidence from the pre-COVID-19 era (see for example Calvino et al., *forthcoming*, for recent evidence on Italy).

³¹ Note that in the paper we use the three terms interchangeably: telework; remote work or working from home.

At the same time, for many firms and workers, tapping into the potential capital of home offices meant having to unexpectedly and suddenly adopt new work and management practices, investing in new digital technologies, tools and capabilities. Taken together, these changes represented a unique opportunity to break the stigma of telework and to learn to work in a digital environment. This shift has helped to find more efficient ways of working with digital technologies. This, in turn, could raise the relative productivity of working with such tools – including working from a distance (Davis, Ghent and Gregory, 2021).

Although the direction and magnitude of the net and long term effects of the surge in remote and hybrid work across countries, sectors, firms and workers remain still unclear, it holds the potential of significantly changing the nature of work, organisations, and cities, with implications for productivity, employment and wages, among other key economic variables.

We will present some recent evidence on these issues. Results on the effect on productivity are still mixed, possibly reflecting the role of other factors, internal and external to the firm, including management, skills, communications infrastructure and an appropriate working environment at home (Bloom, Mizen and Taneja, 2021; Morikawa, 2021 Bloom et al., 2014; Institut Sapiens, 2021).

In addition, recent estimates might reflect short-term effects and might not capture the full longer-term impact. As discussed in OECD (2020) and modelled in a general equilibrium setting in Behrens, Kichko and Thisse (2021) the relationship between telework and productivity is non-monotonic. At lower levels, increased telework is linked to higher productivity because of costs saving for firms, e.g. in term of office space, and higher worker efficiency and satisfaction, due to lower time spent on commuting, better concentration at home, etc. However, at higher levels of telework, productivity can decline as fewer face-to-face interactions in the workplace can lower workers' satisfaction and increase one's sense of solitude; at the firm level this implies fewer opportunities for informal information sharing and learning on the job, impaired communication and coordination, limited managerial oversight and reduced knowledge flows. Moreover, new, innovative ideas and opportunities for collaboration often come out from ad-hoc, informal discussions at the coffee corner, sometimes between members from different teams. In the long run, the lack of such opportunities can have a negative impact on the innovative capacity of the firm.

At a more aggregate level, high level of telework can also translate in lower benefit to workers and firms from agglomeration economies of being located in dense cities and in turn can lower the knowledge spillovers and benefits from agglomeration economies (Behrens, Kichko and Thisse, 2021).

There is therefore an optimal level of telework at intermediate levels of intensity. These have been found to lie between 1 and 3 days of telework a week (Behrens, Kichko and Thisse, 2021; Bloom, Mizen and Taneja, 2021 and OECD, 2021).

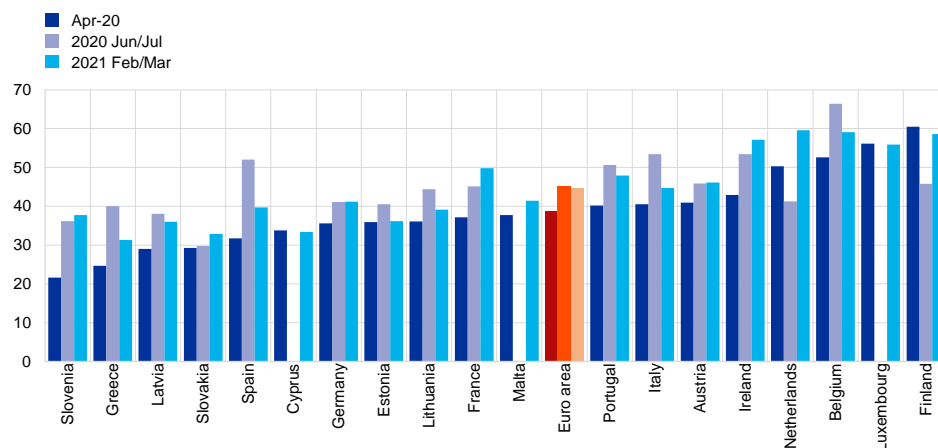
Several surveys have collected evidence on telework practices during COVID.³² Some of these surveys also include questions on expectations about the use of telework practices after COVID e.g., (OECD, 2021; Bloom et al., 2020c and Riom and Valero, 2020). The European Labour Force survey (EU LFS) also contain information on telework and (microaggregated) information for 2020 has become recently available. We will provide some evidence relying on information from Eurofound and preliminary analysis that relies on information on telework from the EU LFS and from the OECD GFP survey.

A clear pattern emerges across countries that wherever possible, given the job tasks, there was a significant and sudden switch from office to home work during COVID-19, making teleworking the customary mode of working for many employees and firms. Eurofound estimates suggest that in Europe the switch meant going from about 1 in 20 workers in 2019 regularly working remotely to more than 1 in 3 working exclusively from home during the first lockdown measures in Europe, corresponding to almost all teleworkable jobs being done from home (see Sostero et al., 2020), with significant differences across countries and sectors. Cross-country differences are significant, ranging in the euro area from 21.6% in Slovenia to 60.5 % in Finland and with cross-country differences reflective of trends in the use of telework pre-pandemic and broadly consistent during the course of the pandemic.

Chart 11
Telework uptake during the COVID crisis was heterogeneous across countries

Share of workers teleworking over the COVID-19 crisis

(percentage)



Source: Authors calculations based on Eurofound.

Although some of the cross-country differences may reflect heterogeneity in industry and occupational structure, most of the differences remain even conditional on them (Sostero et al., 2020).

³² For the EU: Eurofound 2020, 2021, OECD, 2021; Morikawa, 2021; Ozimek, 2020; Taneja, Mizen and Bloom, 2021; OECD, 2021 for the US: Brynjolfsson et al., 2020; Barrero, Bloom and Davis, 2021; Bartik et al., 2020; for the UK: the Decision Maker Panel (Bloom et al. 2020), the CEP-CBI survey (Riom and Valero, 2020).

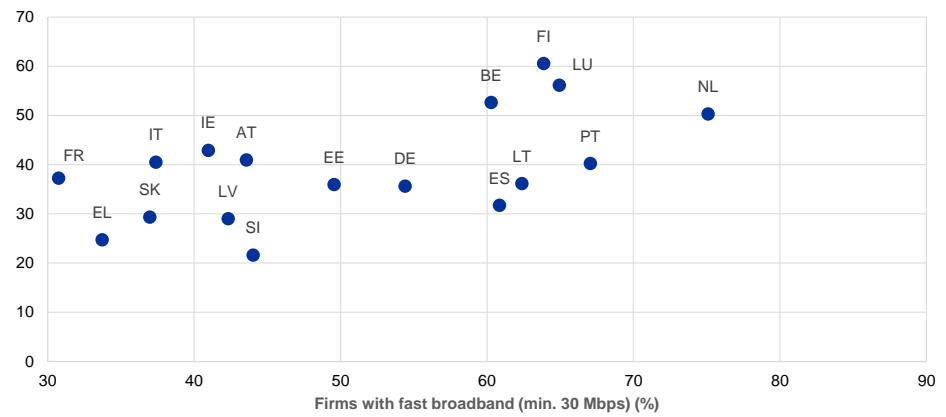
Interestingly, while the pandemic may have removed most of the cultural and social norms that may have hindered the adoption of telework pre-pandemic, the ability to telework remains strongly correlated with both high-quality communications infrastructure for firms (Chart 12) and households (Chart 13), and the digital skills of the workforce (Chart 14). This confirms evidence of similar correlations pre-pandemic (OECD, 2021) and makes skills and ICT infrastructure two key priorities to continue benefitting from telework after the crisis. Results from different surveys also point to the fact that teleworking is also correlated with the level of education of the workforce as well as whether they live in urban areas.

Chart 12

Telework uptake related to firm communication infrastructure

Telework uptake during the COVID pandemic (April 2020) and firm infrastructure for fast broadband speed

(telework uptake (%))



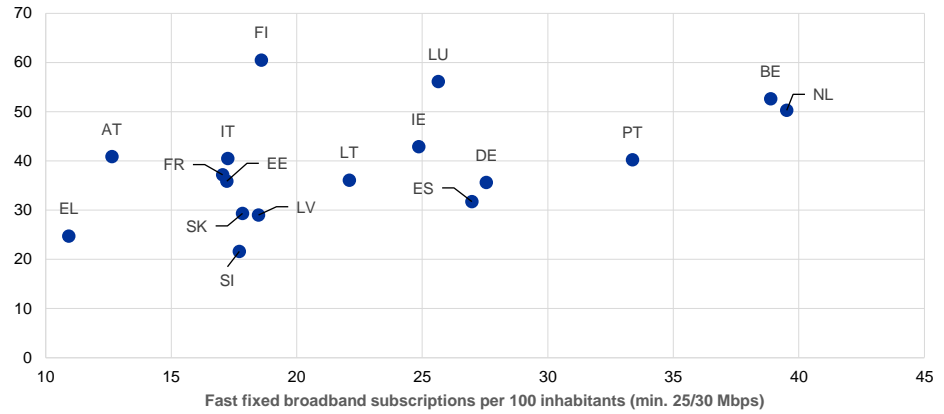
Sources: Author's calculation based on Eurofound (2020) for telework uptake; OECD (2021[1]), "ICT Access and Use by Businesses", OECD Telecommunications and Internet Statistics (database), <https://doi.org/10.1787/9d2cb97b-en> for broadband infrastructure and speed.

Chart 13

Telework uptake related to home communication infrastructure

Telework uptake during the COVID pandemic (April 2020) and home infrastructure for fast broadband speed

(telework uptake (%))



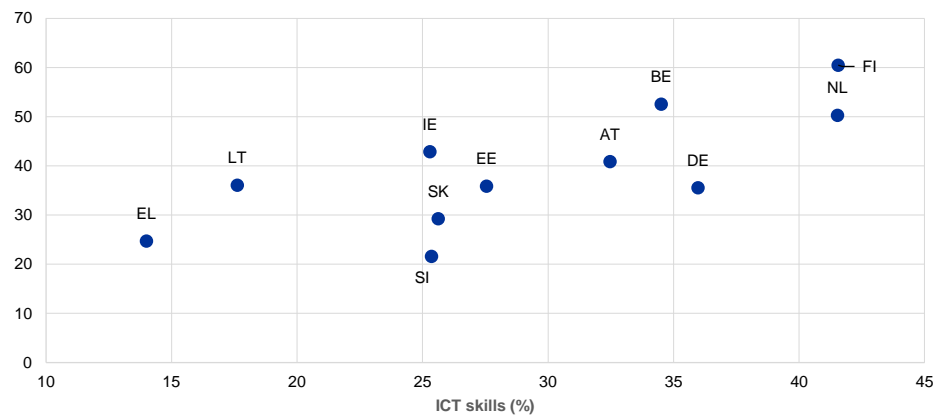
Sources: Author's calculation based on Eurofound (2020) for telework uptake; OECD (2021[1]), "ICT Access and Use by Businesses", OECD Telecommunications and Internet Statistics (database), <https://doi.org/10.1787/9d2cb97b-en> for broadband infrastructure and speed.

Note: Firms with at least 30 Mbps advertised download speed broadband connection, data for 2019. Fast fixed broadband subscriptions per 100 inhabitants (minimum 25/30 Mbps), based on December 2019 speed tiers. Australia: Data reported for December 2018 and onwards is being collected by a new entity using a different methodology. Figures reported from December 2018 comprise a series break and are incomparable with previous data for any broadband measures Australia reports to the OECD. Speed tier data are only for services purchased over the National Broadband Network (NBN), which comprise the majority of fixed broadband services in operation. There is no public data available for the speed of non-NBN services. Mexico and Switzerland: Data are preliminary. New Zealand: Speed tiers are for 2018 instead of 2019.

Chart 14

Telework uptake and ICT skills

(telework uptake (%))



Sources: Author's calculation based on Eurofound (2020); OECD (2019[2]), Skills Matter: Additional Results from the Survey of Adult Skills, for ICT skills.

Note: The ICT skills indicator corresponds to the "proficiency in digital environments". Percentage of adults with high scores in PIAAC's problem solving in technology-rich environments. Problem solving in technology-rich environments is defined as using digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks; it measures both problem-solving and basic computer literacy skills (i.e. the capacity to use ICT tools and applications).

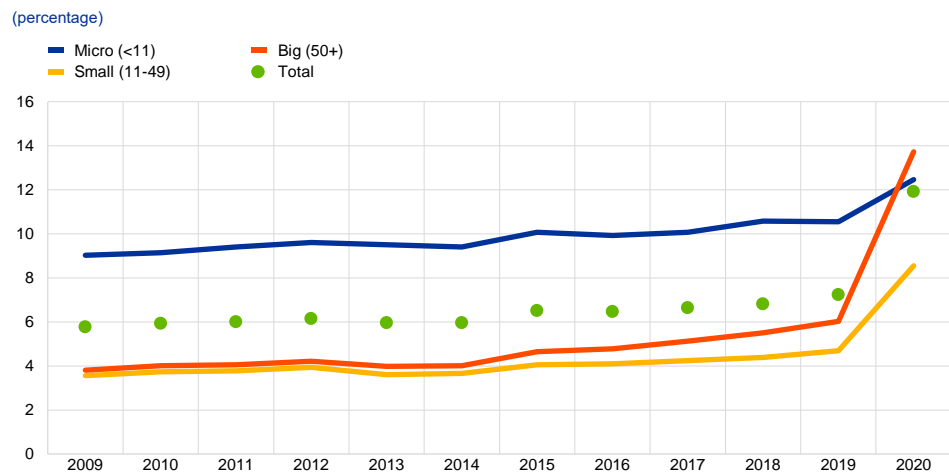
Data for the US point to a telework uptake of similar magnitude as in Europe with results from the Survey by QuestionPro on behalf of Stanford University reporting that about 62 percent of those working in May were doing so from their home (Barrero et al., 2021). Similarly, Brynjolfsson et al. (2020) and Bick, Blandin, and Mertens (2020)

find very close figures (56% and 49%, respectively). In the UK, the ONS also reports a massive shift to the use of telework practices during COVID (ONS, 2020).

Differences exist not only across countries and sectors but also within them. To show this, we rely on granular information on telework use – by firm size, sector and region – from the European Labour Force survey.³³ The evidence reported in Chart 15 and Chart 16 suggests that while there was a general increase in working from home, the uptake was much stronger amongst larger businesses (with more than 50 employees) and in more densely populated areas (i.e. cities), rather than in towns and rural areas.

Chart 15

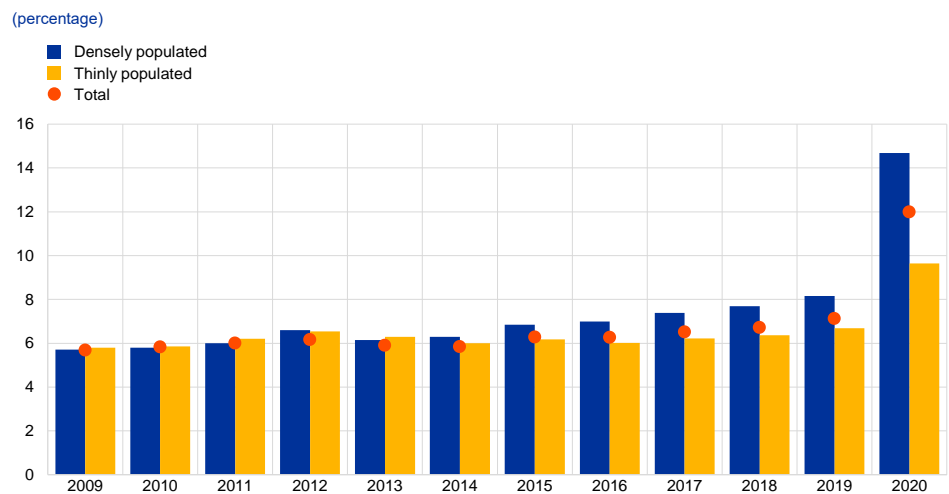
Share of workers usually working from home across firms of different size



Source: Calculations based on EU-LFS.

Chart 16

Share of workers usually working from home in urban (densely populated) and rural (thinly populated) areas



Source: Calculations based on EU-LFS.

³³ The analysis focuses on non-agriculture private business sector firms with at least one employee.

We also conduct an econometric analysis that tries to gauge potential reasons for differences in adoption of telework in 2020 across firms, controlling for unobserved time invariant factors at the country, sector, size-class and region level.

In particular, we focus on the changes observed in 2020 and on factors that may explain differences in the uptake of telework in the last two years. The results are reported in Table 2 and suggest that the share of workers switching to telework was stronger in 2020 than in 2019, and the switch tends to happen more in areas where there is a larger share of households with broadband connection (either fixed or mobile). Even within these areas, broadband connection facilitated switching to telework relatively more for workers in larger firms and those living in cities. These results are robust to including the share of manufacturing activity in the area.³⁴

Table 2
Telework uptake during COVID-19 – Broadband, size and population density

	(1) Home work	(2) Home work	(3) Home work	(4) Home work
Broadband	0.0239 (0.0610)	-0.116 (0.101)	0.531*** (0.184)	0.391* (0.209)
Size class 11-19* broadband		-0.0533 (0.129)		-0.0565 (0.130)
Size class 20-49* broadband		0.272* (0.159)		0.254 (0.162)
Size class 50 or more* broadband		0.325** (0.133)		0.313** (0.132)
Intermediate areas* broadband			-0.400** (0.197)	-0.395** (0.197)
Thinly populated* broadband			-0.652*** (0.190)	-0.640*** (0.191)
2020 dummy	0.0430*** (0.00222)	0.0430*** (0.00223)	0.0429*** (0.00223)	0.0429*** (0.00223)
Observations	10,039	10,039	10,039	10,039
Number of ids	5,406	5,406	5,406	5,406
Adjusted R-squared	0.109	0.111	0.113	0.115

Notes: within-regression (country- area-industry-size class panel) regressions of home work on: year fixed effects and broadband (column 1); year fixed effects and broadband interacted with size class (column 2); year fixed effects and broadband interacted with population density class (column 3); year fixed effects and broadband interacted with both size and population density class (column 4). Baseline categories: size class: 1-10; population density class: densely populated; robust standard errors in parentheses. Broadband is defined as a share of households by country, population density class and year with access to the internet through broadband connection either mobile or fixed.

The large rise in telework during COVID and the relationship between adoption of telework and size are confirmed by additional regression analysis. This additional check uses results for selected euro area countries from a survey designed to describe the implications of the switch to telework during COVID for productivity and expected use of telework after COVID conducted by the Global Forum on Productivity

³⁴ Results available upon request.

(GFP) (OECD, 2021). The GFP survey on telework and productivity reached out to workers and managers from several thousands of companies in 25 countries. It shows that the increase ranges from 20% in manufacturing (from 15 to 35%) to 40%, doubling from less than 40% to almost 80% in knowledge intensive services such as ICT, finance and other professional services.

In addition to firm size, the GFP survey shows that the use of regular telework before and during the pandemic (and its expected persistence after COVID) appear to be strongly related with firms having experience with telework practices before (and/or during the pandemic) (OECD 2021).

The survey results highlight that both managers and to a larger extent workers would like to continue teleworking regularly, at an optimal level of 2 or 3 days per week with coordination of on-site presence as critical for firm performance and therefore suggest that hybrid modes of working might persist beyond the crisis. This is in line with findings from a larger scale survey conducted in the UK by Bloom, Mizen and Taneja (2021). Results from another large scale survey for the US (Barrero et al., 2021) predicts teleworking on 22.2% of working days – equivalent to slightly more than a day per week, which also represents a significant increase relative to pre-pandemic levels.

Against this background, savings in commuting time are estimated to explain half of the estimated productivity increase in the US following COVID, mainly thanks to saved commuting time and higher worker efficiency³⁵ (Barrero et al, 2021). However, these estimates might only capture the positive short term effect of telework on productivity and not the long term relationship that might arise once the economy has fully adjusted to telework (Behrens, Kichko and Thisse, 2021).

The observed trends and the expected persistent use of regular telework may have clear implications for the future of work and organisations, but also of auxiliary business services and real estate in cities, of productivity and innovation.

For the US, Barrero et al. (2021) project that telework will result in a drop in spending of at least 5-10 in cities such as San Francisco or New York relative to pre-COVID-19 levels. This reflects the fact that professionals in well-paid white collars occupations will likely continue to benefit from telework, commute fewer days a week into the office and thus spend less in shops, restaurants, amenities and services near their offices in the city. Althoff et al. (2021) and Ramani and Bloom (2021) find that workers, especially in high income skill service jobs, either moved from more dense to less dense areas both temporarily and permanently which resulted in a drop in residential and commercial rental prices throughout 2020 (Althoff et al., 2021 and Rosenthal, Strange and Urrego, 2021). If these trends persist in the long run, they could lower the pressure on housing markets in densely populated areas (The Economist, 2021).

Even if employees did not leave cities, they worked from their homes and spent significantly less on consumer services in their neighbourhood (Althoff et al., 2021) and virtually not at all on grocery, services and amenities near their office. This could

³⁵ According to their measure of productivity which accounts for commuting time, they estimate that 2.5 percent (earning weighted) productivity increase in the US. This accounts for more than half of the total 4.6 percent increase in productivity, which also reflects higher worker efficiency of telework.

also help explain that low-skilled workers in consumer services were amongst the group most affected by the pandemic, especially in the richest areas of the US (Chetty, Friedman, Hendren, and Stepner, 2020). This suggests that a potential consequence of teleworking is increased inequality between high-skilled professionals and low-skilled workers who cannot benefit from telework or whose livelihood is negatively affected by telework.

5 Market Power before and during the COVID-19 crisis

One concern arising from the asymmetric digitalisation of firms and the differences in their agility in reacting to the COVID crisis is the fact that larger, more productive, better-managed firms may not only become relatively more efficient, but also gain stronger market power in the aftermath of the crisis.

Initial evidence on the performance of capital markets during the pandemic suggests that the largest players have seen the largest gains in market value, with 25 firms accounting for about 40 percent of total gains between February 2020 and February 2021. Most of these companies were digital technology companies and have been amongst the top performing in the last 15 years (Bradley and Stumpner, 2021), suggesting that COVID has strengthened their dominance on the stock market. Their performance on the stock market is one measure of the rising gap between frontier or “superstar” firms and the “rest”. In section 4 we discussed how the last two decades have seen both an increase in digitalisation and knowledge intensity, and a rising gap in productivity. In this section we will focus on a second feature of the last two decades, rising market power, which has also been accompanied by a decline in business dynamism in OECD most countries (see Decker et al., 2014 for evidence for the US, and Calvino, Criscuolo and Verlhac, 2020, across OECD countries).

To do this, we rely on two imperfect proxies of market power: the rise in markups, i.e. the wedge between unit prices and marginal costs, and the rise in industry-level revenue concentration. In addition, and for the last two years, when information on markups or concentration is not available because of lack of data, we focus on M&A dynamics. Both proxies used - markups and revenue concentration - have limitations and are subject to criticisms.

Markups measure the ratio of unit price and marginal cost. If the residual demand curve for the firm is not perfectly elastic, the firm can charge a markup higher than 1 at the firm’s profit-maximizing output level. As both unit prices and marginal costs are often not observed, recent methodologies have been developed to estimate firm-level markups (e.g., De Loecker and Warzynski, 2012; De Loecker, Eeckhout and Unger, 2020). These methodologies have been criticised because of the assumptions needed (e.g. perfectly competitive input markets; no adjustment costs for at least one input; etc.) and challenges in measurement of underlying economic variables from accounting data (Traina, 2018 and Syverson, 2018 for an overview). In addition, from a conceptual point of view, high markups might also not be the results of a non-competitive environment, if high markups reflect the presence of high fixed costs

and low marginal costs, that are features of digital-, intangible- and knowledge intensive production processes (De Ridder, 2019).

Concentration is also not immune to criticisms. The literature has mostly relied on a measure of concentration at industry level, a much broader measure than market concentration.³⁶ Only if the large firms holding the largest share of industry activity are all leading firms in the same market for specific products or services that are close substitutes (see Werden and Froeb, 2018) will industry concentration translate in concentrated product markets. Even in the particular case where industry concentration is a good proxy for market concentration, it might still not be a good indicator of market power in the case of differentiated product or geographic markets, platforms and innovative markets (see Syverson, 2018 for a discussion).

For example, markets can be national, but also local and international. Recent US evidence also highlights how an increase in concentration at the national level could actually lower concentration at the local market level, if the increase in concentration is driven by the expansion of the largest players into new geographical areas where local concentration was high (Rossi-Hansberg, Sarte and Trachter, 2021). However, this result could be mechanical, and is affected by the same criticisms as those of national level measures of concentration (Eeckhout, 2021). Similarly, a domestic increase in industry concentration could be somewhat compensated by increased imports from foreign markets (Gutierrez and Philippon, 2017 and Amiti and Heise, 2021). Thus, an increase in industry concentration will not necessarily imply an increase in market concentration.

Importantly, an increase in industry concentration might reflect an efficient reallocation of resources, rather than the lack of competitive pressure, if the firms with the largest revenue shares are the ones that are able to charge the lowest prices as they are the most innovative, intangible intensive and/or productive at each point in time. Recent studies (e.g. De Loecker, Eeckhout and Unger, 2020 and Autor et al., 2020) find that reallocation of market shares from low to high markup firms accounts for about two thirds of the overall rise of markups. Autor et al. (2020) also find that industries that are becoming more concentrated are those with faster productivity growth and higher innovation, and that larger firms have higher markups. Taken together, this evidence suggests that more productive firms are able to charge lower prices and thus benefit from higher markups. In addition, industries with high concentration may still be very competitive if concentration is the result of production technologies with high fixed costs and/or strong network effects (Crouzet and Eberly, 2018 and 2019), with close rivals still competing aggressively for the market (the so-called “competition for the market”). Finally, technological developments, integration of global markets or sustained innovation could allow the most efficient firms to increase their competitive edge over other firms, thus contributing to welfare gains and productivity growth.

³⁶ For a recent notable exception, see Affeldt et al. (2021). They use a database that identifies over 20,000 product/geographic antitrust markets affected by over 2,000 mergers decisions by the European Commission Directorate General for Competition, over the period 1995-2014. Their measure concentration is a market-specific post-merger Hirsch Herfindahl Index. They find an even steeper increase in concentration than in the extant literature.

However, increases in concentration, or its persistence, could be the reflection of “superstar” firms in dominant position being entrenched thanks to lobbying or anti-competitive behaviour, including the acquisition of potential competitors through “killer acquisitions”, the competition policy environment or anti-competitive regulations.

Therefore, the heterogeneous adoption and implementation of digital technologies discussed above could well increase the observed trends in both markups and concentration, if both are positively correlated with digitalisation, and it could exacerbate them if, in addition, there were an increase in Mergers and Acquisitions activities. In the next sections, we will try to provide evidence on both these questions.

The net implications for prices and consumer welfare are a priori ambiguous and will depend on which process dominates: market power vs. efficient reallocation. On the one hand, technological developments, integration of global markets or sustained innovation allow the most efficient firms to increase their competitive edge over other firms, contributing to welfare gains and productivity growth. On the other hand, when the most efficient firms are in a dominant position, they might enjoy increased market power. This brings negative implications for prices and, hence, consumers (see also De Loecker, Eeckhout and Unger, 2020, who find a negative net effect and discussion in Van Reenen, 2018).³⁷

5.1 Markups

The first proxy of market power we rely on is markups, estimated following the methodology developed by De Loecker and Warzynski (2012) built on the production approach of Hall (1988). This methodology has been widely used in recent years to show an increase in average markups and in their dispersion in the US (De Loecker, Eeckhout and Unger, 2020), across OECD countries (Calligaris, Criscuolo and Marcolin, 2018, and IMF, 2019), and globally (De Loecker and Eeckhout, 2018).

Following closely the methodological choices taken in Calligaris, Criscuolo and Marcolin (2018), we estimate markups across selected euro area countries³⁸ using accounting data from the Moody’s ORBIS database. Calligaris, Criscuolo and Marcolin (2018) show that between 2002 and 2014 markups across 26 countries have increased more in non-financial market services than in manufacturing, and more so in digital-intensive sectors, where they were already high at the beginning of the 2000s. We therefore test whether these results hold within the euro area, as well as in the

³⁷ Measures of concentration and their evolution time may suffer from misreporting and mismeasurement, especially if they are not based on the full population of businesses. In this case, measured changes in concentration may reflect attrition in the sample considered or improvement in data coverage (see for example Ali, Klasa and Yeung, 2009 for a discussion related to Compustat vs Census data in the US and Bajgar et al., 2019 in relation to Orbis in Europe).

³⁸ Euro area countries included are Belgium, Estonia, Finland, France, Germany, Ireland, Italy, Latvia, Netherlands, Portugal, Slovenia and Spain.

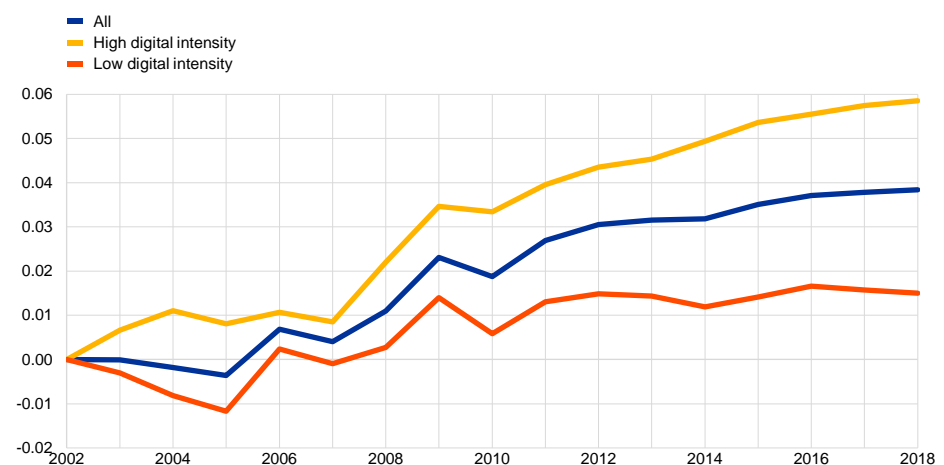
second half of the 2010s. As shown in Chart 17, markups have increased more in digital intensive service sectors, with the gap having steadily increased over time.³⁹

This evidence is in line with evidence from papers focusing on other proxies of market power and showing that digital assets, and in particular proprietary software (Bessen, 2017), might allow firms to increase their efficiency and market power. It is also in line with theoretical models (De Ridder, 2019) suggesting that the reduction of marginal costs and the increase in fixed costs driven by intangibles such as software, gives digital/intangible intensive firms a competitive advantage, deterring entry of new competitors. Calligaris, Criscuolo and Marcolin (2018), show that the rise in markups is positively linked with the increase in software and ICT patents stock, i.e. the intangible part of digital assets.

Chart 17

Average markups have increased especially in digital sectors after the Global Financial Crisis

(index normalised to 0 in the initial year)



Source: Calculations based on Orbis.

Notes: Unconditional averages of firm-level log markups, assuming a Cobb-Douglas production function with 3 inputs (K, L, M) and intermediates as fully flexible input. The countries include BEL, DEU, EST, ESP, FIN, FRA, IRL, ITA, LVA, NLD, PRT, SVN. Included industries cover 2-digit manufacturing and non-financial market services. In the top panel, the graph reports log markups in manufacturing (light blue line), services (green line) and overall (dark blue line), and indexes the 2002 level to 0 (hence the vertical axes represent log-differences from the starting year which, given the magnitudes, approximates well for growth rates). In the central panel, the graph reports log markups in high digital intensive industries (light blue line), low digital intensive industries (green line) and overall (dark blue line), and indexes the 2002 level to 0. In the bottom panel, the graph reports log markups in high digital intensive industries (light blue line), low digital intensive industries (green line) and overall (dark blue line) in the manufacturing (left panel) and market services (right panel), and indexes the 2002 level to 0. The digital intensity of industries is defined using the digital intensity indicator of 2013-15 constructed by Calvino et al. (2018); industries are classified as "high digital" if they are in the top quartile of the industry distribution in terms of digital intensity.

Second, we look at whether the distribution of markups has become more dispersed over time, distinguishing among firms at the bottom, at the median and in the top of the markup distribution in each year. The trends reported in Panel a) of Chart 18 show that firms at the top of the markup distribution are the ones driving the overall increase: since the mid-2000s, they have diverged from the rest and only after the GFC firms with median level of markups have experienced a milder increase in markups. The

³⁹ Chart A10 reports trends in markups distinguishing between non-financial market services and manufacturing. The gap between services and manufacturing has become larger after the GFC of 2008 and has continued to increase since. In addition, the increase in mark-ups in the digital intensive sectors seems to be driven by high-digital intensive services (bottom panel).

trend at the bottom of the markup distribution has instead remained flat for the last 20 years.

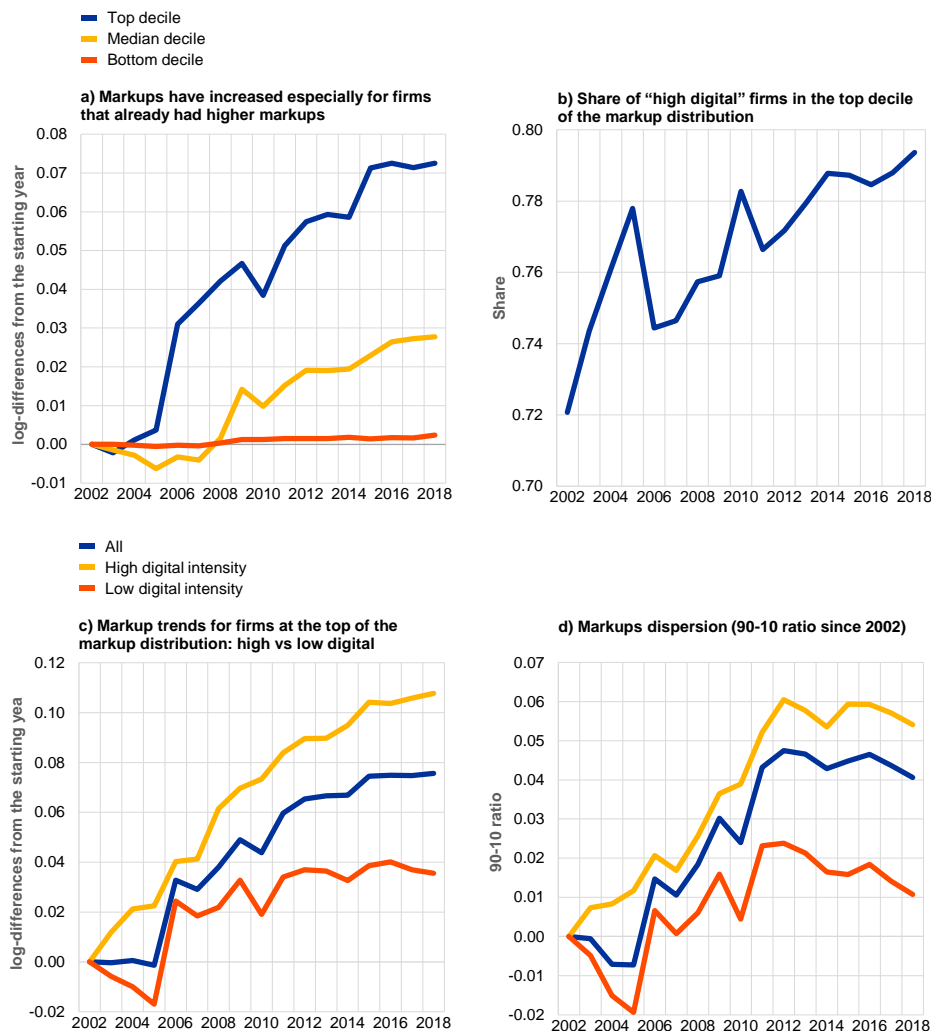
If the increasing role of digital technologies, in particular of intangible digital assets, does play a role in explaining the observed increase in markups, as discussed above, we should observe three trends.

First, the share of “digital intensive” firms amongst the firms with the highest markups should increase over time. Second, they should be the ones observing the largest increase when compared with others at the top of the markup distribution in other sectors. Third, the dispersion in markup should have grown the most in digital intensive sector. Panel b) of Chart 18 confirms the first trend: the share of digital intensive firms amongst the top decile of the overall distribution has increased in the last twenty years. Panel c) of Chart 18 shows that firms in the top decile of the markup distribution in digital intensive sectors have seen the largest increase in markups relative to firms in the top decile in less digital intensive sectors. Finally, Panel d) of Chart 18 confirms that dispersion in digital intensive sectors has increased the most.

Chart 18

The evolution of the markups distribution

(panels a; c; and d: index normalised to 0 in the initial year; panel b:share)



Source: Calculations based on Orbis.

Note: Unconditional averages of firm-level log markups in the chosen part of the distribution of markups, assuming a Cobb-Douglas production function with 3 inputs (K, L, M) and intermediates as fully flexible input. The countries include BEL, DEU, EST, ESP, FIN, FRA, IRL, ITA, LVA, NLD, PRT, SVN. Included industries cover 2-digit manufacturing and non-financial market services.

Panel a): reports log markups ups in the bottom (green line), the median (light blue line) and the top (dark blue line) decile of the markup distribution, and indexes the 2002 level to 0. Hence the vertical axes represent log-differences from the starting year which, given the magnitudes, approximates well for growth rates. Deciles of the distribution are defined relative to the rest of the firms in each 2-digit industry-year.

Panel b): reports unconditional average of the share of firms belonging to high digital intensive sectors in the top decile of the markup distribution defined relative to the rest of the firms in each country-year. The digital intensity of industries is defined using the digital intensity indicator of 2013-15 constructed by Calvino et al. (2018); industries are classified as “high digital” if they are in the top quartile of the industry distribution in terms of digital intensity.

Panel c): reports unconditional averages of firm-level log markups in the top decile of the markup distribution belonging to high digital intensive industries (light blue line), low digital intensive industries (green line) and overall (dark blue line), and indexes the 2002 level to 0. Hence the vertical axes represent log-differences from the starting year which, given the magnitudes, approximates well for growth rates. The top decile of the markup distribution is defined relative to the rest of the firms in each 2-digit industry-year.

Panel d): reports dispersion in markups, measured as the 90-10 ratio of firm-level log markups, belonging to high digital intensive industries (light blue line), low digital intensive industries (green line) and overall (dark blue line), and indexes the 2002 level to 0. Hence the vertical axes represent log-differences from the starting year which, given the magnitudes, approximates well for growth rates. Dispersion of the markup distribution is defined in each 2-digit industry-year.

As discussed in Section 4, the COVID-19 crisis has spurred an increase in digital adoption that has been heterogeneous across firms. The stronger increase in markups for more digital intensive firms suggest that a potential risk of this shift is an increase in markups, especially amongst firms that already had large margins.

5.2 Concentration

Numerous studies have pointed to an increase in industry concentration over recent years in the United States (e.g., Grullon, Larkin and Michaely, 2018; Autor et al., 2020), and similar evidence exists for Japan (Honjo, Doi and Kudo, 2014). More recent studies for Europe also show an increase in concentration, even though to a lesser extent than in the US (Valletti et al., 2017; Bajgar et al., 2018; Bajgar, Criscuolo and Timmis, 2021; Affeldt et al., 2021).⁴⁰

Despite the limitations discussed at the start of the section, carefully documenting trends in industry concentration, together with trends in markups, may provide additional evidence to confirm whether structural and policy factors related to the increase in markups are also linked to increased industry concentration. Also, documenting the increased weight of few firms across industries has implications for upstream sectors (suppliers) and workers which may be faced with monopsony in their local labour market, with implications for wage levels and inequality (Manning, 2003 for a seminal paper, Azar et al., 2018 for evidence on the US; and OECD, forthcoming for cross country evidence). In addition, the systemic risks linked to the large weight of few firms and their potentially stronger lobbying power (Dellis and Sondermann, 2017) may significantly affect the design of policies in ways that might unlevel the playing field.

Based on the methodology presented in Bajgar et al. (2019) and Bajgar, Criscuolo and Timmis (2021), we present trends at the business-group-level in Europe up to 2018 relying on matched Orbis-Zephyr data⁴¹ and the OECD STAN database. Bajgar et al. (2019) and Bajgar, Criscuolo and Timmis (2021) methodology allows taking into account the structure of each business group and apportioning group sales to the countries and industries where it operates, while the OECD STAN data allow obtaining reliable and time consistent 2-digit industry sales denominators for the concentration measures considered in the paper.

The trends reported in Chart 19 confirm the increase in industry concentration in the euro area between 2000 and 2018 of the order of a (cumulated) 8 percent. The largest increases are linked to the GFC and then flatten between 2014 and 2018.⁴² Contrary to the trends in markups shown above, trends in industry sales concentration are mostly similar between high and low-digital intensive sectors. Nonetheless, the digital intensive sectors saw the strongest increase in concentration during the GFC and in its immediate aftermath.

⁴⁰ Earlier studies for Europe (e.g. Gutierrez and Philippon, 2018; Döttling, Gutierrez Gallardo and Philippon, 2017; Valletti, et al., 2017) show that, contrary to trends in the US, concentration in Europe has been stable or decreased.

⁴¹ The business group and subsidiary financial information is primarily sourced from Orbis. The primary source of parent-subsidiary ownership information is Orbis, which is supplemented with data from the Zephyr database of Mergers and Acquisitions (M&As), both provided by Bureau Van Dijk (BvD). Extensive cleaning and a novel apportioning methodology is then applied, as explained in more detail in Bajgar et al. (2019).

⁴² That notwithstanding, recent trends in mergers and acquisition activities point to an increase in the number of acquisition of firms that operate in digital intensive sectors, but, the (revenue based) size of targets is relatively small, so this might explain why this increase does not translate in significant differential changes in the concentration numbers in these sectors.

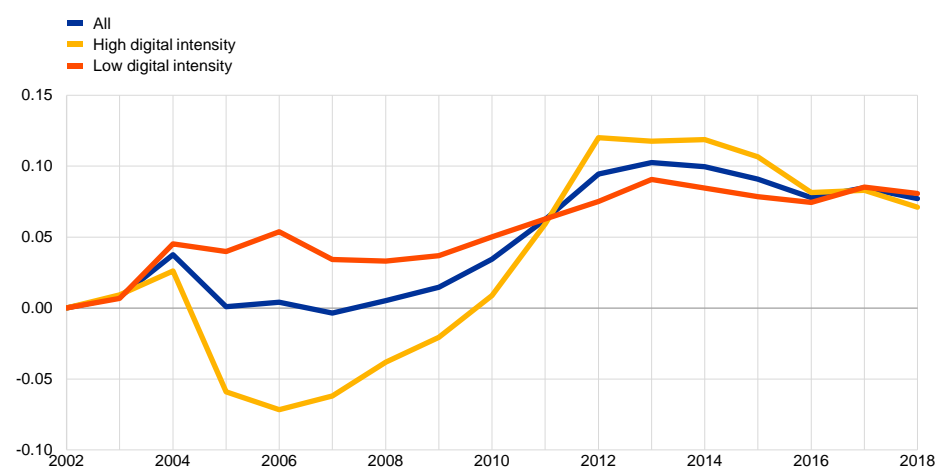
Data is not yet available to investigate trends in concentration during the COVID-19 pandemic directly and to see whether concentration has increased during the COVID-19 crisis and more so in digital intensive sectors. But concentration can increase through several channels: increased exit and lower entry, (organic growth of already large incumbent) and through mergers and acquisitions (M&As). The dynamics of entry and exit during the COVID-19 recession, could not, as of yet, be necessary linked to a strong increase in concentration: exit has been “frozen” and entry has picked up quickly in many EA countries. Reallocation of resources between incumbents, on the other hand, might go in the direction of increased concentration, since resources have been reallocated from small to large firms in the EA, as presented in Section 3. In the next section, we turn to analysing the dynamics of M&As, which could be a channel for increased concentration.

Chart 19

Concentration has increased in the last decade

C8 cumulative change

(change since 2002)



Source: Calculations based on Orbis-Zephyr.

Note: Share of sales accounted for by 8 largest business groups in the available countries of the euro area. The countries include BEL, DEU, EST, ESP, FIN, FRA, IRL, ITA, LVA, NLD, PRT, SVN. Included industries cover 2-digit manufacturing and non-financial market services. In the top panel, the graph reports the cumulative weighted average change in industry concentration in manufacturing (light blue line), services (green line) and overall (dark blue line), with weights given by each industry's share in the total sales across all industries of the region. In the bottom panel, the graph reports the cumulative weighted average change in industry concentration in high digital intensive industries (light blue line), low digital intensive industries (green line) and overall (dark blue line), with weights given by each industry's share in the total sales across all industries of the region. The digital intensity of industries is defined using the digital intensity indicator of 2013-15 constructed by Calvino et al. (2018); industries are classified as “high digital” if they are in the top quartile of the industry distribution in terms of digital intensity.

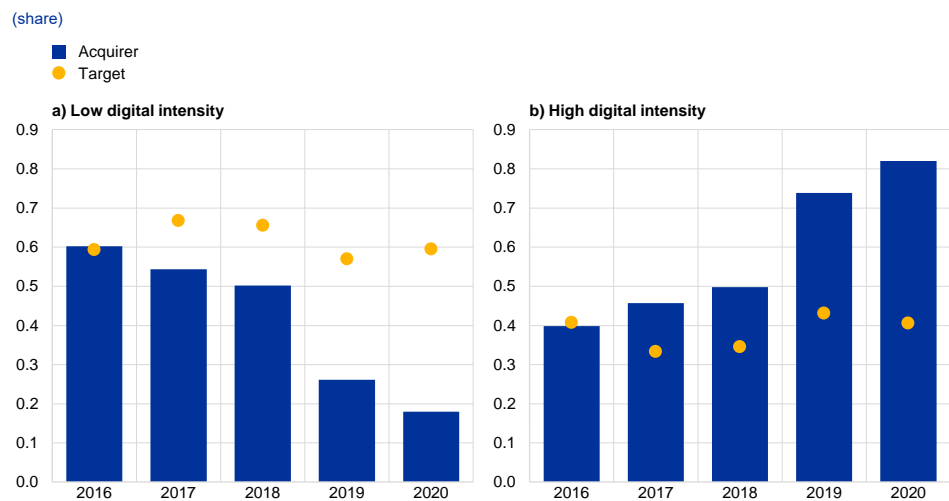
5.3 M&A dynamics during COVID-19

As discussed in the previous section, industry concentration has increased steadily until 2018 just before the COVID-19 crisis. Unfortunately, data on industry concentration during the COVID crisis are not yet available. However, timely data on M&A deals are available for all of 2020. Analysing trends in M&A activities and differences across sectors might give some initial pointers on whether pre-crisis trends might be reinforced.

Chart 20 reports the share of the total value of M&A deals accounted for by deals for which the acquirer (the bars in the chart) – or the target (the diamonds in the chart) – are in high and in low digital intensive sectors over the last five years. The chart shows that the value of M&A deals by acquirer in digital intensive sectors has gone from representing 40% to representing 80% of total deals. The trends for digital targets is much flatter and hovers around 40%.

Chart 20

Trends in share of M&A activity (in values) 2016-20, by industry's digital intensity



Source: Calculations based on Zephyr 2021./

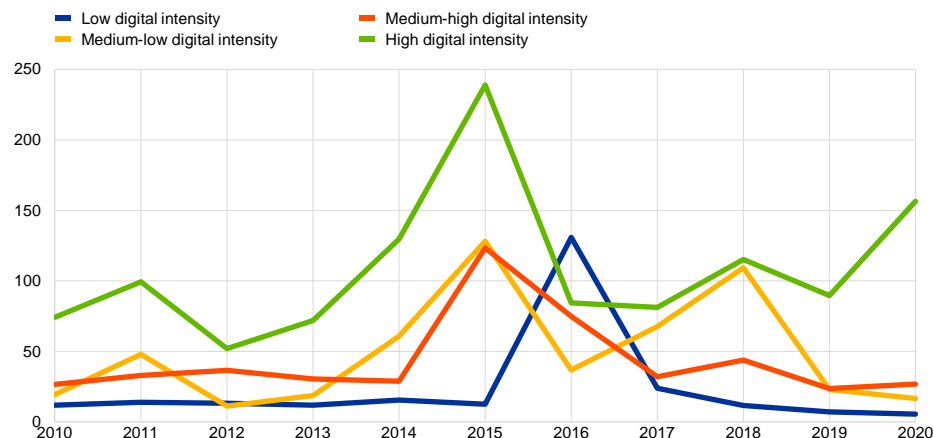
Note: Share of M&A by digital intensity for the available countries of the euro area. The sum of low and high digital intensity bars will sum to 1 in each year. The countries include BEL, DEU, EST, ESP, FIN, FRA, IRL, ITA, LVA, NLD, PRT, SVN. The M&A data reflects the annual total number of acquisitions (i.e., result in a majority stake), purchasing minority stakes and issuing of new share capital from firms active in manufacturing and services sectors (i.e., NACE rev.2 codes 10-33 and 45-83, excluding 19 and 68) and involving target firms in the non-farm, non-financial business sector (i.e., NACE rev.2 codes 10-82, excluding 64-66). M&A value is expressed in 2005 \$ (exchange rates from the World Bank Development Indicators). The digital intensity of sectors is defined using the industry of the target firm and the STAN A38 global digital intensity indicator of 2013-15 constructed by Calvino et al. (2018); industries are classified as "high digital" if they are in the top quartile of the industry distribution in terms of digital intensity.

In fact, when looking at the total value of the deals in billion dollars, as done in Chart 21, the growth over the last two years is even more striking, as the group of deals where the acquirer belongs to high digital intensive sectors is the only one that has observed an increase even during the COVID-19 crisis. The latter increase is mainly driven by an increase of the largest deals (top decile in terms of value) by acquirers in digital intensive firms (Chart 22).

Chart 21

Trends in total values of M&A deals 2010-20, by industry's digital intensity

(USD billion)



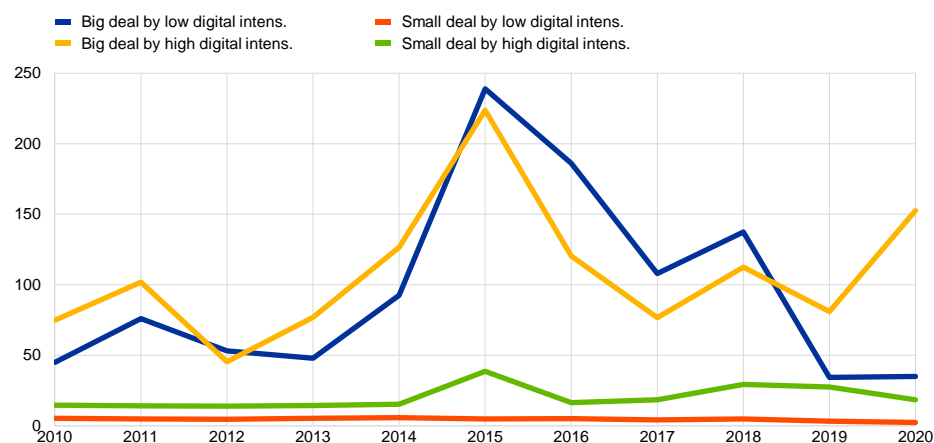
Source: Calculations based on Zephyr 2021.

Note: Total value of deals by digital intensity of the acquirer firm for the available countries of the euro area. The countries include BEL, DEU, EST, ESP, FIN, FRA, IRL, ITA, LVA, NLD, PRT, SVN. The M&A data reflects the annual total number of acquisitions (i.e., result in a majority stake), purchasing minority stakes and issuing of new share capital from firms active in manufacturing and services sectors (i.e., NACE rev.2 codes 10-33 and 45-83, excluding 19 and 68) and involving target firms in the non-farm, non-financial business sector (i.e., NACE rev.2 codes 10-82, excluding 64-66). M&A value is expressed in 2005 \$ (exchange rates from the World Bank Development Indicators). The digital intensity of sectors is defined using the industry of the target firm and the STAN A38 global digital intensity indicator of 2013-15 constructed by Calvino et al. (2018).

Chart 22

M&A values 2010-20: big vs small deals by industry's digital intensity

(USD billion)



Source: Calculations based on Zephyr 2021.

Note: Total value of big (overall top decile of the M&A value distribution) vs small (the rest) deals by digital intensity of the target firm for the available countries of the euro area. The countries include BEL, DEU, EST, ESP, FIN, FRA, IRL, ITA, LVA, NLD, PRT, SVN. The M&A data reflects the annual total number of acquisitions (i.e., result in a majority stake), purchasing minority stakes and issuing of new share capital from firms active in manufacturing and services sectors (i.e., NACE rev.2 codes 10-33 and 45-83, excluding 19 and 68) and involving target firms in the non-farm, non-financial business sector (i.e., NACE rev.2 codes 10-82, excluding 64-66). M&A value is expressed in 2005 \$ (exchange rates from the World Bank Development Indicators). The digital intensity of sectors is defined using the industry of the target firm and the STAN A38 global digital intensity indicator of 2013-15 constructed by Calvino et al. (2018); industries are classified as "high digital" if they are in the top quartile of the industry distribution in terms of digital intensity.

This descriptive evidence suggests that M&A activity related to large deals in high digital intensive sectors has increased even during the COVID-19 crisis.

To provide some additional evidence on whether this could result in increased concentration, we investigate whether the volume of M&A deals, in value and number,

is higher when the acquirer operates in industries that were already concentrated. Estimates reported in columns 1 and 4 of Table 3 suggest that both the total value and number of deals are indeed higher the more concentrated is the industry of the acquirer. The results suggest that this positive relationship is partly explained by the acquisitions by the largest eight firms in the industry (columns 2 and 5). Moreover, the gap in the size and the number of deals between those done by the largest eight firms and the rest is even higher in digital intensive industries (columns 3 and 6).

Taken as a whole these results suggest that the trends in M&A dynamics observed during the COVID-19 crisis might increase concentration especially in digital intensive sectors. This might reinforce any competitive advantage that large firms may have had pre-pandemic, with consequences for competition and innovation.

Table 3
Number and Value of M&As are higher in more concentrated industries

	Log Value of M&A deals			Log Number of M&A Deals		
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged concentration	0.122*** (0.043)	0.081** (0.040)	0.081** (0.040)	0.021* (0.012)	0.011 (0.011)	0.011 (0.011)
Top 8		1.949*** (0.102)	1.740*** (0.120)		0.493*** (0.041)	0.415*** (0.041)
Top 8 x Digital			0.447*** (0.175)			0.167** (0.078)
Observations	28145	28145	28145	28145	28145	28145
Pseudo R-Square	0.122	0.155	0.156	0.046	0.062	0.062
Country and Sector and Year FE	YES	YES	YES	YES	YES	YES
Num. Countries	12	12	12	12	12	12

Notes: This table reports the coefficients of an OLS regression based on M&A activities of acquirers from BEL, DEU, EST, ESP, FIN, FRA, IRL, ITA, LVA, NLD, PRT, SVN. The dependent variables considered are (log of) value and number of acquisitions (i.e., result in a majority stake), purchasing minority stakes and issuing of new share capital from firms active in manufacturing and services sectors (i.e., NACE rev.2 codes 10-33 and 45-83, excluding 19 and 68) in the period 2004-2020. M&A value is expressed in 2005 \$ (exchange rates from the World Bank Development Indicators). The explanatory variables included are: the concentration measure in the country-industry of the acquirers two years before the M&A event (Lagged concentration), a dummy for whether the acquirer was within the biggest 8 firms (in term of gross output) in any country-sector of our sample two years before the M&A event (Top 8), and the interaction of this latter variable with a dummy that classifies industries based on the digital intensity, using the indicator constructed by Calvino et al. (2018); industries are classified as "Digital" if they are in the top quartile of the industry distribution in terms of digital intensity. All regressions control for country, sector and year fixed effects. Standard errors clustered at the country-sector level are reported in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

6 Conclusions and policy implications

The COVID-19 crisis has been one of the largest shocks to the global economy in the last century.

Although the current outlook remains uncertain, the success of vaccination campaigns in many euro area countries has increased confidence in a better economic outlook. However, governments still face significant challenges and risks during the recovery phase.

In addition to the immediate response of businesses to the shock, and the short-term risks faced by countries and economies, medium- to long-term consequences for productivity and business dynamics are likely to come from changes in consumer'

behaviour and from the massive and rapid increase in adoption of digital technologies and telework. These developments have opened new opportunities, but also come with potential risks.

The paper has described these changes – relying on timely data whenever possible, or resorting to evidence from the extant literature – and discussed the channels through which they can affect productivity and business dynamics.

Monetary and fiscal policies have been key for safeguarding productive job matches, avoiding a liquidity crisis and supporting demand. Thanks to the massive support in place, the recovery has been smoother and the resilience stronger than expected at the beginning of the crisis. However, structural policies will be the strategic ally to ensure – in the short run – low adjustment costs, and – in the medium to long run – higher potential output, low inflationary pressure and more equal and inclusive economies.

I will focus in particular on three areas of structural policy that in the aftermath of the COVID-19 crisis will be particularly important: i) fostering digital diffusion and sectoral reallocation, ii) enabling entry, exit and the growth of innovative firms and, iii) maintaining a competitive environment for innovation.

6.1 Fostering digital diffusion and sectoral reallocation

The evidence shows that this crisis has been characterised by significant sectoral reallocation. It is probably too early to classify this reallocation as cyclical or structural. However, if the observed reallocation in favour of higher productivity activities is structural, then it may support the growth of potential output and reduce inflationary pressures in the long run. In the short to medium run, however, this sectoral reallocation may be characterised by high adjustment costs and result in slower growth, a high level of skill mismatch, frictional unemployment and temporarily higher inflationary pressure.

These short- and medium-term costs and the risk of a slower recovery may be attenuated by policies that facilitate labour mobility and provide workers with the skills needed to move from the shrinking to the expanding sectors. Digital skills are particularly key to adapt to the increasingly digital business environment.

COVID-19 has been a game changer for accelerating digital adoption. During lockdowns, digital technologies have been the key for preserving economic activity and ensuring resilience. In the medium to long run, digital technologies, especially if coupled with complementary investment in intangible assets, will boost productivity – ultimately supporting the growth of potential output – and have the potential to compress the productivity distribution by helping laggard firms catch-up.

However, digital adoption during the pandemic has not been homogenous. Large, more productive and better-managed firms have adopted more and better technologies, resulting in an increase to their lead relative to the rest. This might cause productivity dispersion, exacerbated divides in productivity and wages, as well as

lowered innovation and long-run growth. Laggard firms that are now left further behind, as well as potential entrants, might feel discouraged to compete with more efficient frontier firms, and therefore would not have the incentive to invest in innovation, which has negative implications for potential output in the long run. For this new wave of digitalisation to benefit a large number of firms and households, managers and workers – particularly in mSMEs – need higher levels of digital skills.

Use of telework, probably one of the most striking shifts observed during the pandemic, has also been very heterogeneous. This is not only because of the suitability of tasks for remote work differing across occupations and industries, but also because of differences in the level of digital skills of workers and the quality of the digital infrastructure available to them.

The implications of telework for productivity and innovation are ambiguous. In the short term, telework may result in higher growth due to lower commuting costs and higher worker efficiency. In the long run, however, high levels of telework might result in lower levels of innovation within firms, and diffusion across firms, leading to negative consequences for potential output. A permanent increase in the use of telework also has the potential to change the geographical distribution of income and spending, with implications for the future of urban and rural areas, business supporting activities, and real estate prices in cities and business districts. If firms decide to save on office rental costs, and workers decide to live further away from the office and regularly work from home, congestion and housing costs would be reduced, real estate supply pressure alleviated and real estate prices in urban areas lowered. However telework would also result in higher inequality if only a fraction of workers (generally high-skilled, high income services workers) can benefit from telework, and if lower in-person presence in the office results in lower consumption of amenities in urban areas and decreased needs of auxiliary services (e.g., office cleaning and maintenance).

Telework seems to be here to stay. It is, therefore, important that policies are put in place so that telework does not become an opportunity for the few. For the benefits to be widespread amongst workers in both urban and rural areas, governments will need to invest in upgrading high-speed internet infrastructures, offering education and training in skills for the digital transformation, and improving management practices. Increased adoption of telework might also benefit from targeted support for both firms and workers to upgrade equipment, connections and digital security, and from adapting legal and regulatory frameworks.

Policies that support digital diffusion will therefore be crucial to reduce divides across workers, firms and regions. A combination of measures could be used for this purpose. In addition to improving competencies of workers (especially those who are low-skilled) and managers, and ensuring their mobility, measures that increase technology awareness and boost absorptive capacity and address potential financial constraints are going to play an important role.

6.2 Enabling firms' entry and exit, and the growth of innovative firms

To ensure that new firms can leverage the new opportunities arising from the pandemic, and to reduce the gap in entry rates observed in some EA countries (e.g. Italy, Portugal and Spain), policies should foster entrepreneurship by reducing red tape and regulatory uncertainty and levelling the playing field. Policies should also support the development of an ecosystem in which new ventures can experiment and grow, thanks to easy access to financial resources (e.g. venture capital financing and/or new alternative funding sources), knowledge, talent and technology (e.g. through training, mentoring and university-business collaboration).

Policies that support firms' solvency over the short term and improve the efficiency of liquidation procedures and of judicial systems over the medium to long term will also be important for exiting the crisis and supporting sustained productivity growth. It is likely that a wave of bankruptcies has merely been delayed by governments' measures designed to safeguard productive job matches and ensure a smooth recovery. According to the evidence from several countries reported in the paper, such measures have slowed down exit but have not distorted the productivity enhancing nature of the reallocation process. To avoid them becoming an obstacle to reallocation and growth, it is important that support measures are gradually lifted or adapted as countries come out of the crisis. This is likely to be a balancing act. Too early an exit could jeopardise the survival of viable firms in temporary distress and the recovery of firm entry perpetuating a long-term decline in business dynamism. Too late an exit could "zombify" the business sector and slow down reallocation with negative implications for aggregate productivity, and result in an unnecessary increase in public debt. During this phasing-out, it will be crucial to improve the efficiency of insolvency procedures, to allow for speedy entry and exit of firms. This would support reallocation and strengthen the resilience of the economies.

Digital technology adoption goes hand in hand with investment in intangible assets and, thus, is positively related to the growing intangibility of gross fixed capital formation. National Accounts data show how intangible capital formation has remained largely, unaltered during the COVID-19 pandemic, while tangible investments plummeted (and, as of the first quarter of 2021, had not recovered to their pre-crisis levels). This is consistent with the complementarity between intangible investment and digital transformation. While the resilience of intangible investment over the pandemic will likely help mitigate scarring, recent research suggests that growing intangibility of capital may subdue the transmission of monetary policy to the real economy (Döttling and Ratnovski, 2021) and contribute to the flattening of the Phillips curve (Lall and Zeng, 2020).

Moreover, ensuring that all firms – especially those that are young and small – have the resources to invest in intangibles will be key to boost digitalisation among start-ups and micro, small and medium sized firms (mSMEs). This remains challenging because of the difficulty in raising external finance to support intangible investments, information asymmetries, sunkness and higher uncertainty related to this type of asset. Indeed, as banks tend to rely on collateralised lending, access to credit is more difficult for intangible intensive firms. At the same time, levels of venture capital and

equity financing, which are more suitable to finance intangible-investment for young intangible-intensive firms, are still relatively low in many EA countries relative to others (e.g. the United States, Israel or Canada).

Co-investment funds and funds-of-funds could support the development of a stronger, European-level venture capital (VC) market. This could help because a VC market that effectively crosses country boundaries for investment in innovative start-ups and mSMEs is crucial to foster economic growth in the euro area. However, as VC is not easily scalable and focuses on specific industries, the credit market should also be reformed to support intangible investments (e.g. through IP-backed debt finance). The increasing intangibility of firm assets likely poses important challenges to macroprudential policies. For example, intellectual property assets do not generally meet the Basel III eligibility criteria for use as collateral. Thus, further reforms in macroprudential regulations may be needed to cope with changing production technologies among borrowing firms.

6.3 Maintaining a competitive environment for innovation

Policies that support an inclusive digital transformation, together with measures aimed at fostering business dynamism, might also help counteract any potential increase in concentration arising from the growing importance of intangible and digital capital, and maintain markets that foster competition around innovation. Indeed, industry concentration was already rising before the COVID-19 crisis, having seen an acceleration during the GFC especially in digital-intensive industries. Existing structural trends might have been amplified during the COVID-19 crisis as large firms, with larger cash holding and higher level of digital adoption were better prepared and more resilient in the face of the crisis. Mergers and acquisitions dynamics may reinforce this: large players in digital intensive sectors have entered in more and larger M&A deals.

Ensuring a level playing field and open markets will also be important to maximise the returns on investment in digital technologies. In the EU, overcoming the fragmentation of European markets, for example for digital services, will likely allow firms to grow and benefit from economies of scale at the European level.

If increases in industry concentration are paralleled by similar trends at the labour market level, this would result in a downward pressure on wage levels and in an increased wage inequality.

In addition to industry concentration, markups have steadily increased in the last two decades. This increase has been particularly strong in digital-intensive services, a sector that is likely to grow even more after the pandemic. Increasingly, firms belonging to digital-intensive sectors have been those charging the highest markups. Thus, the increase in the adoption of advanced digital technologies and the use of digital modes of buying and working during COVID-19 might accelerate current upward trends in markups and markups dispersion.

The immediate implications for prices, productivity and innovation are a priori ambiguous. If the increase in concentration and markups can be explained, for example, by an efficient reallocation of resources towards the most efficient firms or/and by the nature of a production process increasingly based on intangible assets with high sunk costs and low marginal costs, concentration or increasing markups will not necessarily reflect increased market power. However, in the long run, large high-markup firms might entrench their market power, creating barriers to entry or buying up their competitors; a trend that has already seemed apparent during the COVID-19 crisis. This, in turn, could have negative impacts on innovation over the medium to long term.

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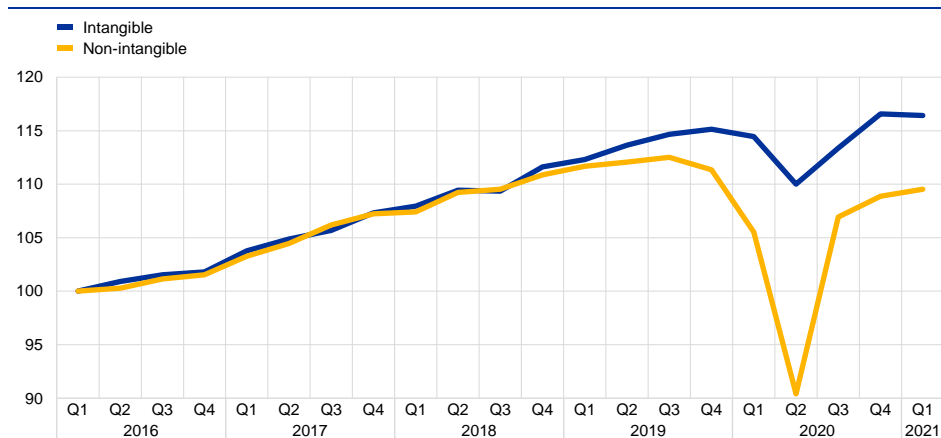
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Appendices

Appendix A

Chart A1

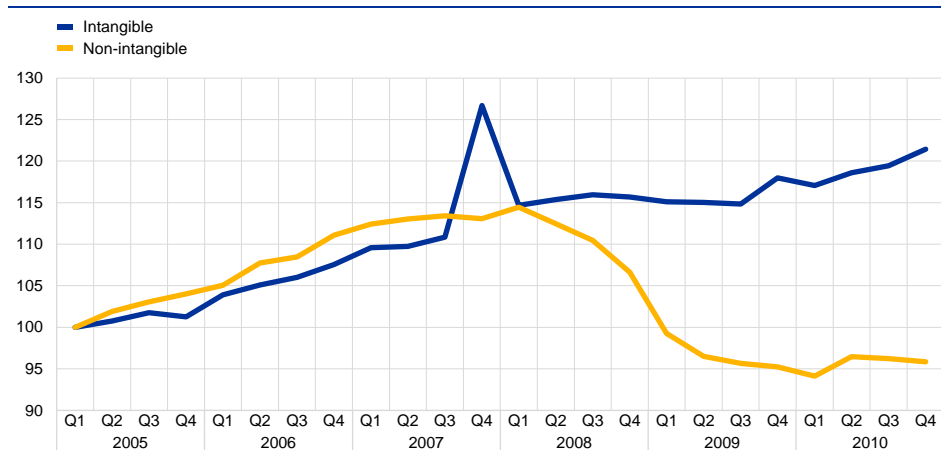
Change in quarterly gross fixed capital formation by tangibility of assets, 2015-21



Source: Calculations based on Eurostat's National Accounts database.
 Note: Euro area corresponds to weighted average of 17 EA member countries (Ireland is excluded because of data consistency, Belgium because of data availability).

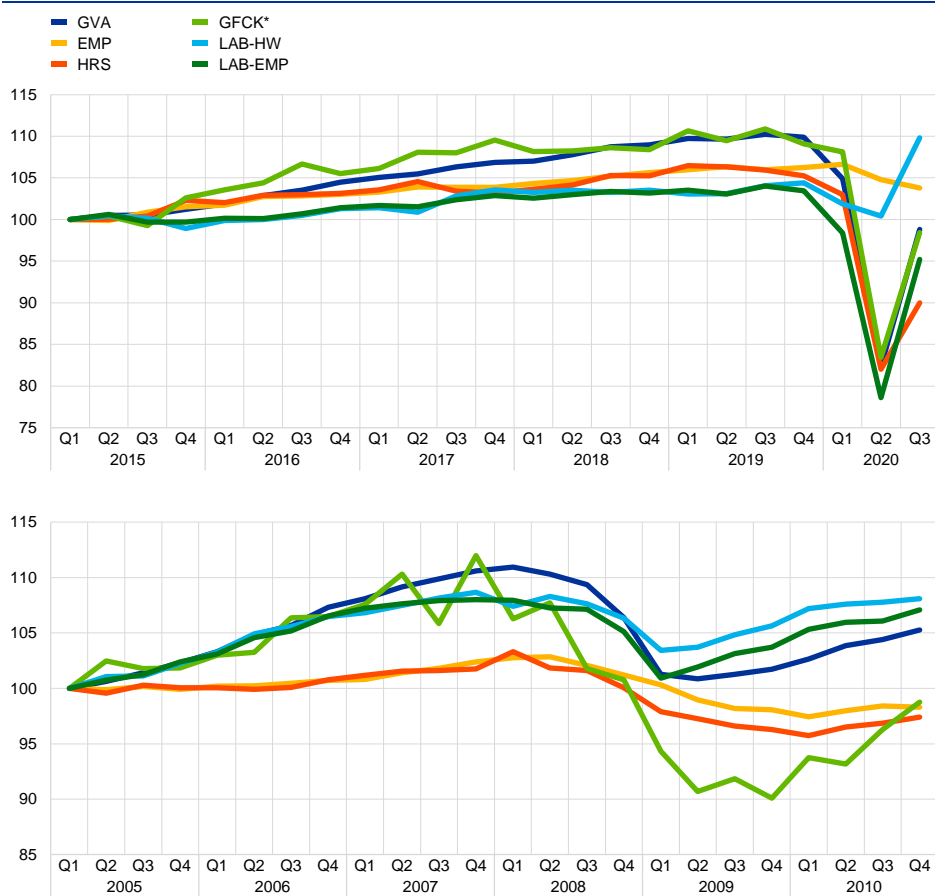
Chart A2

Quarterly gross fixed capital formation by tangibility of assets during the Great Financial Crisis, 2005-10



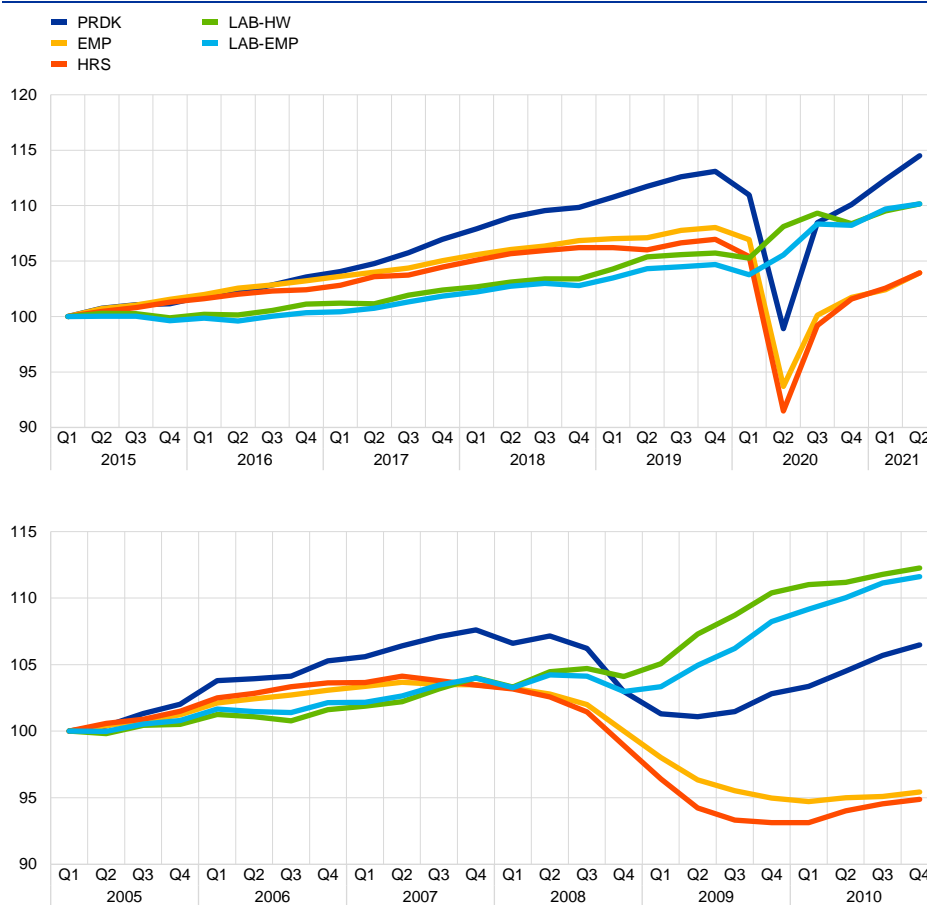
Source: Calculations based on Eurostat's National Accounts database.
 Note: Euro area corresponds to weighted average of 19 EA member countries.

Chart A3
United Kingdom



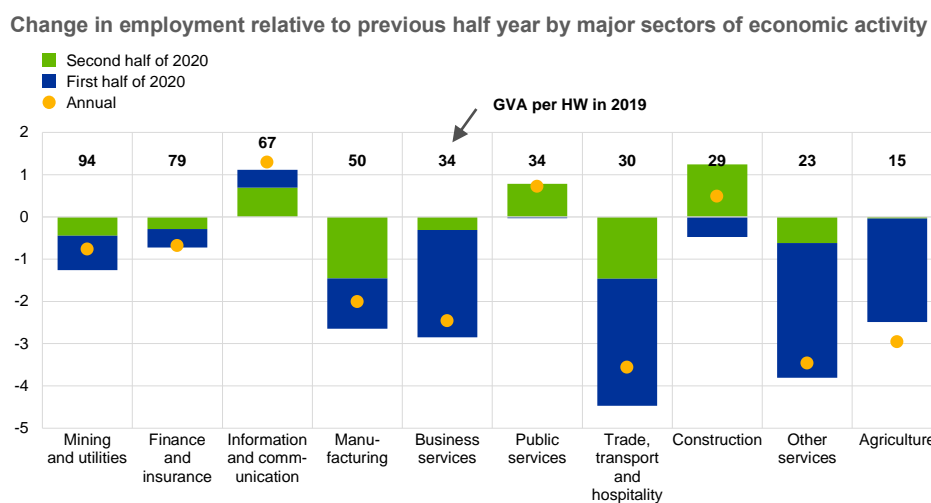
Source: Calculations based on Eurostat's National Accounts database.
 Note 1: Non-agriculture business sector excluding real estate (ISIC Rev. 4 divisions 05 to 66 and 69 to 82) corresponds to the total economy excluding agriculture, real estate, public and other services.
 Note 2: GVA is real value added, EMP total employment in persons, HRS hours worked, LAB-HW labour productivity with hours worked in denominator, LAB-EMP- labour productivity with employment in denominator and GFCK* gross fixed capital formation for all industries, as this/ is variable is not available by industry.

Chart A4
United States



Source: Calculations based on BLS Major Sector Productivity and Costs database.
 Note 1: Measure is based on non-farm business sector, which contains real estate but not housing imputations.
 Note 2: Output is measured in terms of real Output, not Gross value added.

Chart A5
Low productivity sectors recorded stronger job losses, 2019-20, euro area

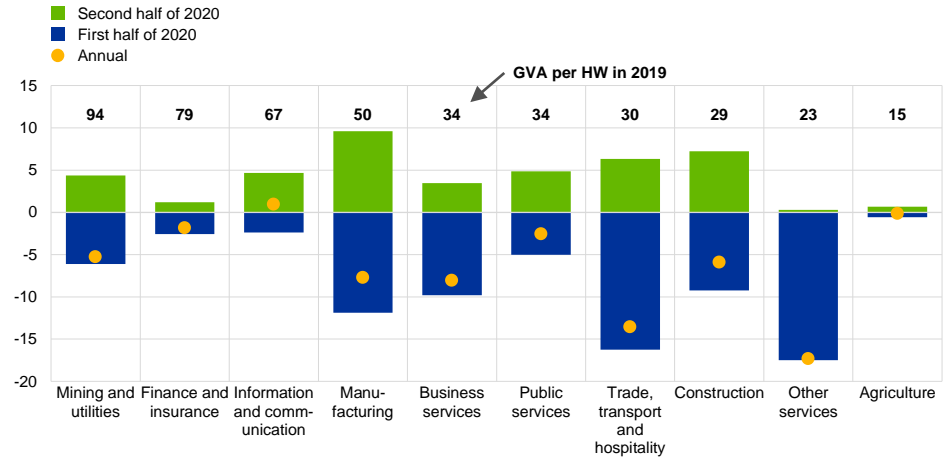


Source: Calculations based on Eurostat's National Accounts database.
 Note: euro area corresponds to weighted average of 19 EA member countries.

Chart A6

Low productivity sectors recorded largest drop in value added, 2019-20 euro area

Change in value added relative to previous half year by major sectors of economic activity

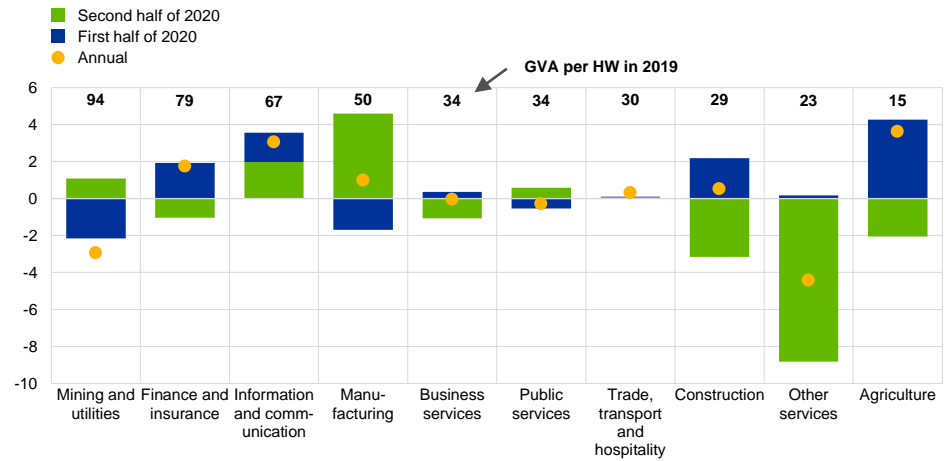


Source: Calculations based on Eurostat's National Accounts database.
 Note: euro area corresponds to weighted average of 19 EA member countries.

Chart A7

Labour productivity during the pandemic, 2019-20

Change in labour productivity relative to previous half year by major sectors of economic activity

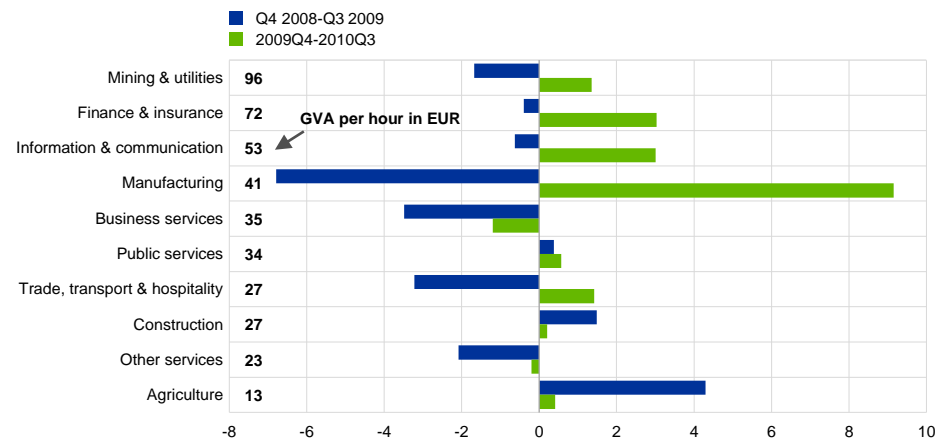


Source: Calculations based on Eurostat's National Accounts database.
 Note: euro area corresponds to weighted average of 19 EA member countries.

Chart A8

Labour Productivity during and in the immediate aftermath of the 2008 Great Financial Crisis

Labour productivity during financial crisis, euro area

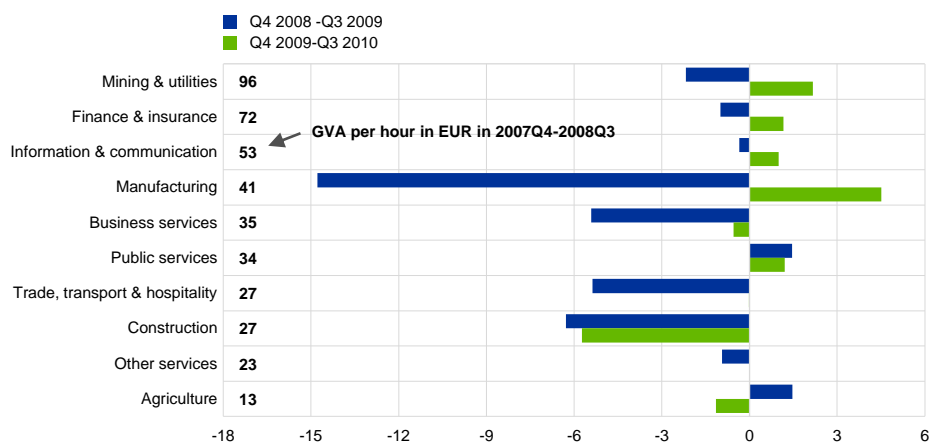


Source: Calculations based on Eurostat's National Accounts database.
Note: euro area corresponds to weighted average of 19 EA member countries.

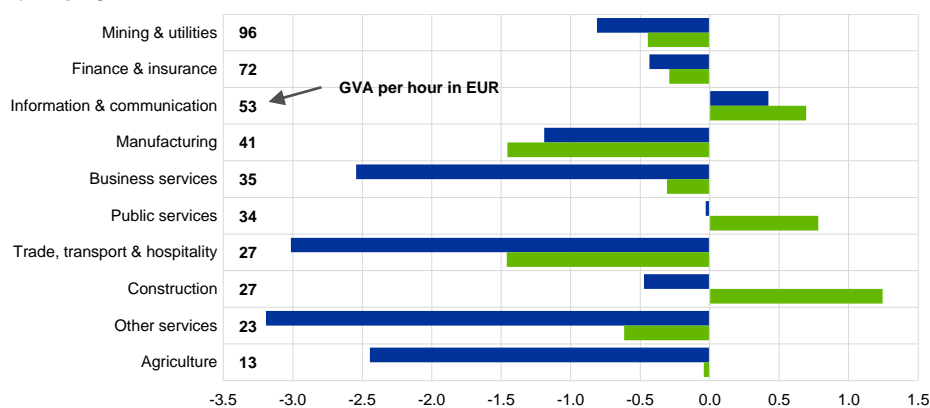
Chart A9

Value added, Employment and Hours worked during and in the immediate aftermath of the 2008 Great Financial Crisis

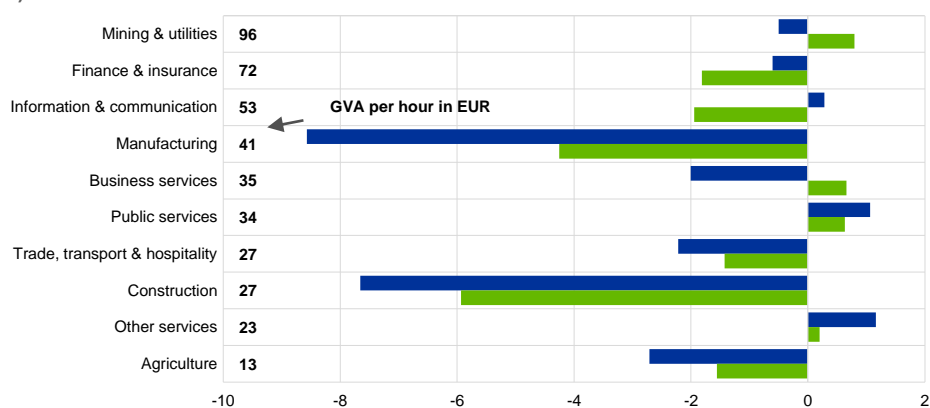
a) Real value added



b) Employment



c) Hours worked

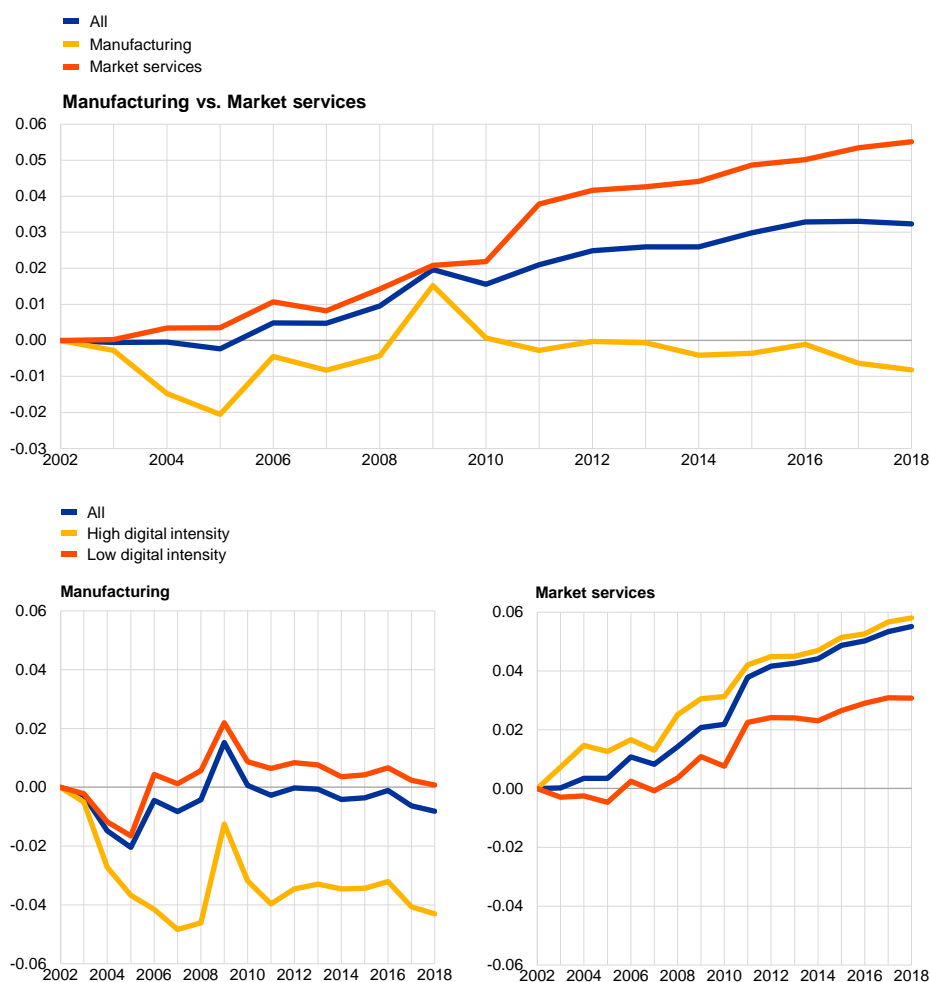


Source: Calculations based on Eurostat's National Accounts database.
 Note: Euro area corresponds to weighted average of 19 EA member countries.

Chart A10

Average markups have increased especially in services and digital sectors after the Global Financial Crisis

(index normalised to 0 in the initial year)



Source: Calculations based on Orbis.

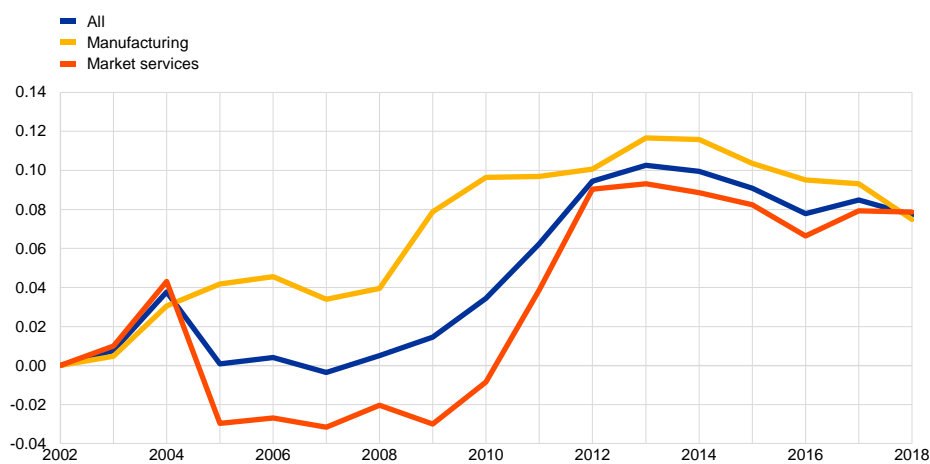
Notes: Unconditional averages of firm-level log markups, assuming a Cobb-Douglas production function with 3 inputs (K, L, M) and intermediates as fully flexible input. The countries include BEL, DEU, EST, ESP, FIN, FRA, IRL, ITA, LVA, NLD, PRT, SVN. Included industries cover 2-digit manufacturing and non-financial market services. In the top panel, the graph reports log markups in manufacturing (light blue line), services (green line) and overall (dark blue line), and indexes the 2002 level to 0 (hence the vertical axes represent log-differences from the starting year which, given the magnitudes, approximates well for growth rates). In the bottom panel, the graph reports log markups in high digital intensive industries (light blue line), low digital intensive industries (green line) and overall (dark blue line) in the manufacturing (left panel) and market services (right panel), and indexes the 2002 level to 0. The digital intensity of industries is defined using the digital intensity indicator of 2013-15 constructed by Calvino et al. (2018); industries are classified as "high digital" if they are in the top quartile of the industry distribution in terms of digital intensity.

Chart A11

Concentration has increased in the last decade in both manufacturing and market services

C8 cumulative change

(change since 2002)



Source: Calculations based on Orbis-Zephyr.

Note: Share of sales accounted for by 8 largest business groups in the available countries of the euro area. The countries include BEL, DEU, EST, ESP, FIN, FRA, IRL, ITA, LVA, NLD, PRT, SVN. Included industries cover 2-digit manufacturing and non-financial market services. The graph reports the cumulative weighted average change in industry concentration in manufacturing (light blue line), services (green line) and overall (dark blue line), with weights given by each industry's share in the total sales across all industries of the region.

Appendix B

Table B1

Sectoral characteristics by SNA A38 sectors

SNA A38 industry	Customer contact	ICT task content	ICT skill	Telework potential
Agriculture	excl.	excl.	excl.	excl.
Mining	excl.	excl.	excl.	excl.
Food and beverages	8.0	39.6	40.5	17.4
Textiles and apparel	6.0	45.2	38.4	17.0
Wood and paper prod.	6.7	53.2	44.7	19.4
Coke & ref. petroleum	excl.	excl.	excl.	excl.
Chemicals	excl.	excl.	excl.	excl.
Pharmaceuticals	excl.	excl.	excl.	excl.
Rubber and plastics	5.0	48.9	44.2	19.8
Metal products	5.0	45.4	44.2	20.6
Computer&electronics	7.0	64.0	61.1	48.2
Electrical equipment	6.0	54.7	50.7	35.4
Machinery&equipment	6.0	56.0	52.3	29.0
Transport equipment	3.0	51.3	49.7	27.0
Furniture and other	n/a	50.5	n/a	n/a
Electricity and gas	excl.	excl.	excl.	excl.
Water and sewerage	excl.	excl.	excl.	excl.
Construction	7.6	41.4	40.7	15.8
Wholesale and retail	53.1	49.4	49.1	23.4
Transport. & storage	9.8	44.9	43.3	21.6
Hotels and restaurants	49.8	37.3	38.1	8.6
Media	26.7	53.2	67.5	62.7
Telecommunications	18.0	55.1	69.5	60.1
IT	19.5	76.5	77.1	76.9
Finance	34.0	70.3	71.0	75.7
Real estate	31.0	64.3	62.5	55.5
Legal and accounting	24.0	56.8	70.1	71.6
Scientific R&D	n/a	56.8	72.7	60.5
Marketing and other	n/a	56.8	n/a	n/a
Admin. services	28.6	56.8	45.4	25.7
Public administration	excl.	excl.	excl.	excl.
Education	35.0	61.3	59.3	44.9
Health	68.4	51.4	55.1	28.4
Social work	30.0	51.4	46.1	19.4
Arts and entertainment	41.9	52.0	52.7	26.6
Other services	33.0	52.0	47.1	25.5

SNA A38 industry	Customer contact	ICT task content	ICT skill	Telework potential
Households	excl.	excl.	excl.	excl.
Extraterr.organizations	excl.	excl.	excl.	excl.

Note: excl. are industries excluded from the analysis. n/a: not available.

Customer contact: measure based on Koren and Petó (2020). Share of jobs in each industry that involve face-to-face contact with customers. A job is defined as involving face-to-face contact if job tasks include tasks such as dealing with external customers, assisting and caring for others, or providing consultation and advice to others, and face-to-face communication occurs at least several times a week. Indicators constructed by matching the tasks associated with different occupations in O*NET, then matching these to the occupation structure of NAICS17 three-digit industries using the US Bureau of Labour Statistics industry-occupation matrix for February 2020. Koren and Petó's three-digit industry-level measures have been aggregated to SNA A38 industries. Three A38 industries could not be matched to the three-digit NAICS information: Pharmaceuticals, Scientific R&D, Public administration and defence.

ICT task content: measure from Grundke et al. (2017), based on the Programme for the International Assessment of Adult Competencies (PIAAC) dataset. Frequency with which surveyed individuals carry out tasks which are related to the use of ICT on the job. This frequency is measured at the individual level. The retrieved frequency is a weighted average of the individual's answers to different questions. The weights used correspond to the sampling weights reported for each individual in PIAAC.

ICT Skill: measure from Cammeraat, Samek and Squicciarini (2021). ICT skill levels are scaled to range from a minimum of 0 to a maximum of 100. The ICT skills indicator consists of a number of different self-reported tasks carried out on the job in a sample of workers in each industry: frequencies of excel use, programming language use, transactions through internet (banking, selling/buying), email use, simple internet use, word use, real-time discussions through ICT computers, reading/writing letters, emails or memos, level of computer use required for the job, and frequency of working physically over long periods.

Telework potential: based on Espinoza and Reznikova (2020) task-based measure of potential telework, aggregated to A38 industries. This measure classifies an individual job as teleworkable if the worker reports that their job organisation is highly flexible (six questions on flexibility in organising and planning their own activities), involves daily use of ICT (five questions on specific tasks including e-mail, use of word processors and spreadsheet software), and seldom or never involves long periods of physical work. Jobs are classified as telework compatible if they have at least one indicator within each of the three domains which is compatible with teleworking.

Discussion of “Productivity and business dynamics through the lens of COVID-19” by Chiara Criscuolo

By John Van Reenen¹

1 Introduction

It was a real delight to read this paper by Chiara Criscuolo which brings together almost everything economists know about the impact of the COVID Pandemic on productivity in the euro area. I highly recommend reading the paper to students, academics and policymakers.

There are a huge number of fascinating empirical nuggets in the paper. For example, in the first half of 2020 the Pandemic hit hard and there were necessary policy responses such as lockdowns. It will surprise many readers that aggregate productivity actually rose! Two proximate factors were behind this. First, across most industries, reported output fell less than the number of hours worked. Hence, labour productivity (output per hour) increased. Second, there was a big reduction of activity away from low measured productivity sectors (such as retail) due to social distancing, whereas manufacturing which has higher productivity was much less affected. This between sector reallocation increased measured productivity.

A second set of facts looks at creative destruction firms within industries. Although business start-up rates fell during the Pandemic, they fell by a lot less than during the 2008-9 Global Financial Crisis. Furthermore, entry seemed to be greater in the more productive sectors (at least compared to the 2008-9 period). So although reallocation might have slowed compared to the pre-Pandemic era, it was not as bad as the last big, bad downturn.

A third set of results relates to diffusion. There was a speed-up of adoption of digital technologies and of teleworking. It is likely that such changes will be beneficial for productivity. An interesting fact seems to be emerging, however, that this accelerated adoption primarily occurred in firms who were already heavy investors in ICT and who already used working from home to some degree. Hence, this is likely to make the dispersion between firms even greater than before. This growing inequality between firms has been pointed out by Criscuolo’s OECD team (e.g. Andrews, Criscuolo and Gal, 2015) and is something that appears to be a common feature across the world (e.g. de Loecker, Obermeier and Van Reenen, 2021).

¹ Ronald Coase School Professor, London School of Economics and MIT Digital Fellow, Director of Programme On Innovation and Diffusion. This was a discussion of the paper at the Sintra conference, not the final version.

Finally, there is a section of the paper looking at pre-pandemic trends in market power. This shows that there are some concerning changes: concentration has been rising and markups seem to be getting larger. Although I agree with this part of the paper and the need for anti-trust vigilance, I have written a lot about this elsewhere (e.g. Van Reenen, 2018), so will focus more on the COVID related analysis in what follows.

The job of the discussant is to offer some constructive criticisms, not just praise, so I am forced to raise a few issues. These are generally discussed in parts of the paper, but they are areas I would want to see highlighted a little more. They relate to the paper's analytical framework, measurement, reallocation and adoption. The next section sketches the size of the challenge we face, then Section 3 details the four issues. Section 4 then emphasises what we need to do: in short we need a new Plan for Growth.

2 The challenge

The magnitude of the Pandemic's shock to the Eurozone is huge. Quarterly real GDP growth rates fell as much as 6% in the depths of the Global Financial Crisis – the period we thought was a once in a lifetime “Black Swan” event. But the fall in output in 2020Q2 was over twice as big at 16%. At the time of writing, the recovery looks swifter than 2008-09, but it is still unclear whether vaccines have made COVID more like a bad seasonal flu, or whether new variants will cause future lockdowns.

It should be remembered, however, that OECD countries were in long-term trouble prior to the Pandemic. Total Factor Productivity growth (TFP) had slowed to a crawl. It was about a third of a percentage point per year in the main Euro countries 2005-2019, and only an annualized 0.76 percentage points in the US (Teichgraeber and Van Reenen, 2021). Slow productivity growth implies slow real wage growth, and these stagnating living standards are, in my view, a major cause of the anger that has given rise to the dangerous populist movements we have witnessed around the world.

COVID has hurt our people and economies, but in some ways it simply revealed more starkly the political and economic problems that already existed.

3 Some issues

3.1 Analytical framework

Figure 2 in Criscuolo's paper gives a simple theoretical framework for the paper, focusing on: (i) between sector reallocation, (ii) within sector reallocation and (iii) adoption of technological and organizational practices. This is a useful framing, but it leaves at least one important mechanism: there is no conceptualisation of the effects of the Pandemic on frontier innovation. Diffusion and reducing misallocation are ways of improving productivity without frontier innovation – they are ways of moving closer

to the technological possibility set. But there are many reasons why a severe downturn could affect investments in R&D and other activities aimed at finding products and processes that are new to the world.

For example, the incentive of firms to invest in R&D may have fallen because the COVID shock reduces market size via lower and more uncertain demand. Furthermore, the ability of firms to innovate might fall due to (i) financial constraints and (ii) distraction of scarce managerial time.

Although there could be countervailing effects, such as the lower opportunity costs of investing into activities that cost time but save money (training, organizational change, etc.). Furthermore, the fact that several COVID vaccines were developed so quickly after a huge public and private R&D effort, shows our collective ability to generate radical innovation when necessary.

Overall, though the empirical evidence does seem to suggest some cutbacks in R&D and frontier innovation activity (e.g. Riom and Valero, 2021).

3.2 Measurement

Productivity is always hard to measure. And it is especially difficult to do so in real time, during a crisis and particularly a crisis where there has been huge government intervention. The numerator of productivity (GDP) is affected by lags and revisions to data, dealing with inventories and getting the price deflator right. The denominator of productivity (worker-hours) is relatively easier to measure in normal times, but times are not normal. With so many people working from home, how do we accurately gauge the number of true hours worked? And measuring TFP is particularly hopeless right now. Getting at effective capital inputs is near-impossible.

So we are likely measuring productivity extremely badly at this moment. But even if we could measure it perfectly, I am not sure how useful it would be. So much has been determined by government policy, the real issue is what happens to productivity when these policies are scaled back.

3.3 Reallocation

Economists, myself included, love to talk up the virtues of the reallocation of resources from inefficient to efficient firms is generally to be welcomed. COVID has certainly increased the need to reallocate resources in a number of dimensions such as towards online from offline; towards occupations where you can work from home compared to those where you cannot, and towards “staycation” tourism and from industries such as aviation as business and leisure travel scales down.

But “reallocation” is a loaded term. The decline of units, be they industries firms or establishments, which are low productivity is not much use if the high productivity units do not sufficiently expand. The risk is that that there will unemployment and under-employment, scrapped assets and underutilised physical and human capital.

Without sufficient expansion of the new, we can have “bad” productivity growth accompanied by a loss of social welfare.

This is why, in the short run, policymakers need to balance protection against reallocation. An important lesson from the Global Financial Crisis was that many countries moved far too quickly to bring in fiscal austerity to reduce government deficits. This prolonged the dip in output. In the UK, for example, the cuts in public investment had a prolonged effect on keeping productivity abysmally low.

3.4 Adoption

The paper rightly points to much evidence of high levels of adoption of digital technologies and teleworking as a result of the Pandemic. Despite the quality of many of these surveys they are still relatively small scale and skewed heavily towards larger firms. More representative data will be available at the end of 2021 from Eurostat.

Even if we take it as given that digital adoption has increased, is this to be wholeheartedly welcomed? Implicitly, there is the argument that there was socially suboptimal adoption of digital technologies prior to the Pandemic. This could be true for various reasons. First, there may be positive spillovers from such technologies as there is for R&D (the evidence here is pretty weak though – e.g. Draca, Sadun and Van Reenen, 2007). Second, there may be a co-ordination failure – e.g. there is less use for Zoom if hardly anyone else uses it. Thirdly, firms may have been making mistakes and it took a shock to push them into doing what was already in their self-interest.

There is also a less optimistic story. Say firms were doing a socially appropriate level of investment in digital pre-crisis, but what the Pandemic has done is forced them to spend inefficiently large amounts on digital platforms – it has just added an extra burden to firms which, when public support is withdrawn will just force a further company shakeout.

It would also be good to think of adoption more widely, as not all technology is digital. Ultimately, we care about overall diffusion/productivity growth not of specific technologies. It is possible that COVID has changed the direction of technical change (e.g. towards specific kinds of digital), but overall diffusion and productivity growth has fallen.

Indeed, the paper does not have much analysis of firm level changes in productivity. We know that in the within firm productivity growth makes up a large share (typically at least half) of aggregate productivity growth. Hence, there is some value to see what is happening to firm-level growth and many of the datasets used to document adoption also have productivity measures (e.g. the Bank of England’s Decision Makers’ Panel used in Bloom et al, 2021).

4 Towards a growth plan

The long-run effect of the Pandemic will depend on how it affects (or does not affect) growth policies. As I noted above, the challenges facing OECD countries are tremendous. We have the immediate challenge of recovering from the Pandemic, but this is in the context of a long-run decline in TFP growth and the need to deal with climate change. To tackle these multiple crises requires ambitious thinking. I believe what we need is a new Growth Plan based around innovation the diffusion of best practice (managerial and technological).

There is now a growing body of credible empirical evidence on what type of policies are most effective at improving innovation and diffusion. These can be evaluated from econometric studies in terms of costs and benefits as well as their likely time horizon, political difficulty and impact on inequality. We summarize policies over management practices in Scur et al (2021) and on innovation policies in Bloom, Van Reenen and Williams (2019).

This approach is quite natural for economists. We imagine a policymaker coming for advice with a budget and a set of preferences and can give guidance based on the evidence. For example, in the Innovation Policy Toolkit (the “Lightbulb Table”) there are a number of policies on taxes, subsidies or human capital expansion. One of the most attractive policies for long-run growth is to reduce some of the barriers to under-represented groups (e.g. kids from low-income families, minorities and women becoming inventors. Bell et al (2019) suggest this could quadruple the rate of innovation.

The principles of putting this together in a coherent growth plan will differ by country. But three principles stand out. First, in the short run the drawing down of business support policies must balance reallocation and protection as discussed above.

Second, there will need to be institutional reform to deliver the policies (for an example, see Besley and Van Reenen, 2013). The kind of long-run policies we need for innovation are vulnerable to political myopia, what I term “policy Attention Deficit Disorder”. Institutions that can put some friction into the constant chopping and changing of policies, needless reversals and rebranding with changes of ministers due to the 24 hour news cycle would be highly valuable. This has been partly achieved in monetary policy through independent Central Banks and competition policy with independent agencies. But we also need similar institutional architectures for other policies (e.g. infrastructure and innovation).

Thirdly, binding a portfolio of growth policies together around important missions is a way to deal with interactions between policies and also to create more political support. The most important mission facing us is dealing with climate change, so a bundle of these policies to deliver the transition to net zero is the best approach.

Will Covid cause a reorientation of policies towards such a Growth Plan? It is sometimes hard to be optimistic in our polarised times, but the experience after the Second World War is instructive. Out of the devastation – which was far worse than COVID – developed countries formed new democracies and new national and

international institutions to foster growth and innovation. A major investment in infrastructure and research, rules based international organisations to cement trade and help with crises and international cooperation that led to what is now the European Union.

With political will and creative ideas, this can be achieved again.

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Climate policies and monetary policies in the euro area

By Warwick McKibbin¹, Maximilian Konradt² and Beatrice Weder di Mauro³

Abstract

This paper presents two types of analysis on the interaction between policies to deal with climate change and monetary policies in the euro area. First, we empirically analyse the historical effects of carbon taxes on inflation in the euro area countries to gauge the impact under the current European monetary regime. Second, we explore two alternative monetary policy rules under a range of simulations in a new European version of the G-Cubed multisector model. We study the economic and inflationary impacts of physical climate change shocks (climate risk) and transitions risks arising from carbon taxation within Europe and globally. We find that under the existing monetary policy framework, the inflationary effects of carbon taxes in Euro area countries have been contained. The only significant increase in the HICP (of about 0.8 index points) is found in the first two years, while the impact on core inflation tended to be negative. Thus, carbon taxes mainly affected relative prices rather than the overall price level, which is in line with previous findings for a broader sample of countries. We also find that producers seem to have absorbed a part of the carbon tax since consumer price inflation was lower than producer price inflation. The results from the simulation model show that the nature of the monetary rule within Europe has a significant effect on the impact of climate shocks and carbon taxation. An entirely forward-looking rule proposed by Hartmann and Smets (2018) may lead to excessively tight monetary policy in the face of climate shocks and climate policy changes within Europe. An alternate modified version of this rule that puts equal weights on current and forward-looking variables leads to a better short-run outcome for Europe. We also find a difference in results for Europe between the impact of climate policy implemented only within the Euro area and climate policy implemented globally. The main difference is the impact of global policies versus Euro area policies on international capital flows and the exchange rate. Overall, the model simulations suggest that physical climate risk as well as transitions risks from carbon pricing have long run output costs but only a transitory impact on inflation. Moreover, the price reaction critically depends on the monetary policy regime, which may result either in inflation or deflation in the short run.

¹ ANU Crawford School of Public Policy, CEPAR, CEPR and The Brookings Institution. We thank Philipp Hartman, Frank Elderson, Anna Breman and staff at the ECB for helpful comments and suggestions. McKibbin also acknowledges the contributions of Peter Wilcoxon and Larry Weifeng Liu to the development of the G-Cubed model and thanks the Australian Research Council Centre of Excellence in Population Ageing Research for additional financial support (CE170100005).

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1 Introduction

The 2021 strategy review of the ECB has surprised observers with the strength of their commitment to incorporate climate change in the monetary policy framework. The ECB board clearly states that the transition to a more sustainable economy will affect the outlook for inflation, output, employment, interest rates, investment, productivity, and financial stability, and the transmission of monetary policy.⁴ Consequently, the ECB announced an ambitious and detailed roadmap on climate-related actions.

One of the key elements of the action plan is strengthening the analytical foundations for gradually incorporating climate change risks in macroeconomic models and monetary policy frameworks. The ECB plans to start immediately to use assumptions on carbon pricing in its regular forecasting. Over the next three years, the ECB plans to integrate climate risks into its workhorse models to assess the impacts on potential growth and monetary policy transmission.⁵

The focus on the effects of climate change on inflation is novel. Most of the current climate-related macro literature has focused on economic growth costs of climate risks. Also, current worries about higher inflation rates have been associated with fears that CO₂ pricing will accelerate price dynamics permanently.⁶

This paper aims to contribute to the ECBs' macroeconomic action plan with two distinct but related analyses for the euro area. The first is an empirical study of the inflationary effects of carbon taxes in countries within the euro area over the past three decades. The second is model simulations using the G-Cubed model exploring the economic impact under different climate shocks, CO₂ taxes, and monetary policy reaction functions.

It is worth briefly discussing differences between the scenarios in this paper with those from the Impact Assessment Models (IAM), which are currently used by the Network for Greening the Financial System (NGFS) to quantify climate risks.

A key difference is in the assumption on the level of carbon tax/price. In the G-Cubed model, we simulate a carbon tax of 50 Euros with a yearly increase of 3 percent, under two assumptions: 1) The tax is only implemented in Europe; 2) and the carbon tax is implemented globally. Whether this is a sufficiently high carbon price to achieve the Paris Agreement goal can be debated, some studies suggest that a carbon price implemented through a market mechanism can induce sufficient substitution in consumption and production to achieve the Paris targets by 2030⁷. We use this price as a baseline since it can be a realistic policy perspective/ambition for a global carbon price.

By contrast, emission prices underlying NGFS scenarios range up to \$100 per ton by 2030 and from 300 to 700 USD/t CO₂ by 2050 (see NGFS 2020b). These higher numbers are because the NGFS uses a different assumption for emission pricing to

⁴ See [2021 ECB Strategy Review](#).

⁵ See [Detailed roadmap of climate change-related actions](#).

⁶ See [here](#).

⁷ See Liu, McKibbin Morris, and Wilcoxon (2020), using the G-Cubed model of this paper.

produce its climate scenarios: emission prices are estimated as the marginal abatement cost necessary to reach a specific temperature increase and thus depend on policy intensity and timing (NGFS 2020b). These can be considered “shadow prices” for the costs of changing technology and capital in critical sectors. For instance, in a “hot house world,” governments do not fight climate change. The price of emissions is zero, and emissions continue to increase and at the globe warms up by more than 3 degrees. In a transition scenario, prices are calculated to be consistent with a pre-defined temperature target (e.g., 67% chance of limiting global warming to 2°C).

For example, the main NGFS orderly transition scenario has emission prices rising quickly to about 100 USD by 2030 and then steadily increasing to 300 USD by 2050.⁸ By contrast, in the NGFS disorderly transition scenario, policy action is delayed, policymakers only wake up in 2030 and by then the necessary emission price path to limit warming to 2 degrees is much steeper and the end price rises to 700 USD.

Simulating a CO2 tax of up to 700 Euro in G-Cubed would not be practical for computational reasons.⁹ More importantly, in practice, climate policies in Europe - and even more so in the US - will not load fully on carbon pricing to achieve the emission goals. Instead, they will rely on a combination of pricing and quantity restrictions, prohibitions, as well as subsidies and technological innovation. The European Green Deal, Fit for 55, explicitly endorses a philosophy for combining CO2 pricing which regulation and standards. An example is transport sector, where an end of the combustion engine for 2035 is combined with carbon pricing through ETS.

There are other differences in the model frameworks of the G-Cubed model and the IAMs.¹⁰ A key difference is the detailed modeling of consumption and production decisions at sectoral levels across countries in the G-Cubed model compared to a simplified model of aggregate GDP in IAMs. There are also differences in the scenarios usually modeled. In addition, there is a difference between market-determined carbon prices or carbon taxes in the G-Cubed model and the shadow prices calculated from the potentially inefficient regulatory policy in IAMs. It is not surprising that our simulations with the G-Cubed model are less extreme than the results of the IAM models.

While the NGFS scenarios illustrate the consequences of delayed policy action (and thus contribute to spur government intervention), our G-Cubed results focus on short- to medium-run macroeconomic dynamics under climate shocks and carbon taxes. This time frame may be more appropriate for the needs and time horizon of monetary policy. Thus, the two sets of analysis are complementary in that they are focused on different time frames and different types of policy interventions.

⁸ Different IAMs underlying the orderly transition scenario deliver a wide range of end prices, with the lowest at about 120 USD.

⁹ Such an extreme scenario could not be computed in G-Cubed.

¹⁰ The G-Cubed model and a range of other models in the climate change literature that are not IAMs regularly participate in the Stanford University, Energy Modeling Forum project coordinated by John Weyant. See Fawcett et al (2018). [EMF is a useful source of model comparisons and policy analysis.](#)

2 Carbon taxes and price dynamics

This section analyses the historical impacts of carbon taxes implemented in countries within the Euro area between 1985 and 2020. We focus on the consequences for CPI inflation under the monetary regime in place when implementing the tax.

2.1 Data

For the empirical analysis, we use data on carbon taxes and economic aggregates. Our data on carbon tax rates and tax bases are from the Carbon Pricing Dashboard of the World Bank. We consider all Euro area countries with available data between 1985 and 2020. In that period, eight Euro area countries implemented carbon taxes at a national level, summarized in Table 1. All tax rates (columns 3-4) are expressed in real 2018 DM/EUR per ton of carbon dioxide equivalent emissions.

The 2020 tax rates might be affected by a countries' efforts to reduce the economic burden during Covid-19. For instance, the French tax dropped from a rate of 45 to 6€/tCO₂e.¹¹ The emission coverage (column 5) indicates the share of a country's total greenhouse gas emissions covered by the carbon tax.

We are interested in the economic effect of carbon taxes. To that end, we look at a range of indicators as dependent variables in our estimations. Our sample consists of 17 Euro area member countries, excluding only Cyprus and Malta due to data limitations. The main variables used for the empirical analysis are summarized in Table 2.

Our data on GDP per capita are from the World Bank and expressed in real DM/EUR using the German GDP deflator. Data on the consumer price index (CPI) and producer price index (PPI) are retrieved from the OECD. We also explore core CPI (excluding energy and food) and the harmonized index of consumer prices (HICP) from Eurostat. All index variables are calculated with the base year 2018.

¹¹ Some countries seem to be using CO₂ pricing anti-cyclically. While this may increase the automatic fiscal stabilizers it counteracts the goal of emission reduction.

Table 1
Carbon taxes in the Euro area

iso	year	initial rate	2020 rate	tax base
Finland	1900	2.01	56.71	0.36
Slovenia	1996	7.56	15.82	0.24
Estonia	2000	0.42	1.83	0.03
Latvia	2004	0.5	8.23	0.15
Ireland	2010	17.13	23.78	0.49
Spain	2014	24.16	13.72	0.03
France	2014	8.46	5.48	0.35
Portugal	2015	5.25	21.6	0.29

Source: Author's calculations based on <https://carbonpricingdashboard.worldbank.org/>, accessed 15.02.2021.
Notes: Table includes carbon taxes used in the empirical analysis. All rates are expressed in 2018 euro per ton of carbon dioxide equivalent (CO₂e) emissions, using the German GDP deflator and exchange rate to convert nominal USD rates from the Carbon Pricing Dashboard of the World Bank. Coverage is the share of total greenhouse gas (GHG) emissions covered by the tax in 2019.

Table 2
Descriptive statistics of the dependent variables

iso	headline CPI			core CPI			HICP			GDP per capita			PPI		
	first	mean	sd	first	mean	sd	first	mean	sd	first	mean	sd	first	mean	sd
Austria	1985	79.73	16.69	1985	80.40	16.35	1996	88.41	11.99	1985	10.40	0.24	2000	93.81	8.81
Belgium	1985	80.59	16.72	1985	81.28	16.16	1996	88.86	12.51	1985	10.34	0.23	1985	84.52	17.23
Estonia	1998	84.60	18.31	1998	87.84	14.44	1996	80.81	20.75	1995	9.21	0.60	1994	83.80	18.38
Finland	1985	81.86	15.26	1985	82.87	15.31	1996	88.45	10.93	1985	10.41	0.22	1985	84.52	12.93
France	1985	83.92	14.10	1985	84.89	13.31	1996	90.53	10.21	1985	10.30	0.17	1985	89.56	9.95
Germany	1985	82.99	14.83	1985	84.10	14.32	1996	90.38	9.97	1985	10.37	0.19	1985	88.55	10.61
Greece	1985	71.26	29.73	1985	73.01	30.02	1996	88.37	14.24	1985	9.66	0.29	1985	73.02	29.16
Ireland	1985	80.39	18.38	1985	79.68	18.94	1996	91.06	11.17	1985	10.37	0.55	1985	83.04	15.31
Italy	1985	77.57	20.09	1985	78.01	19.98	1996	88.23	11.92	1985	10.17	0.17	1991	87.04	13.60
Latvia	1991	70.52	30.67	1995	82.49	20.46	1996	80.51	21.92	1995	8.95	0.62	1995	81.60	20.72
Lithuania	1991	74.89	29.74	1995	87.98	14.95	1996	85.18	16.89	1995	8.97	0.64	1998	92.00	14.95
Luxembourg	1985	79.30	16.85	1985	79.70	16.36	1996	86.62	13.96	1985	11.07	0.39	1985	76.94	20.00
Netherlands	1985	80.17	16.55	1985	79.84	16.61	1996	89.08	11.77	1985	10.44	0.26	1985	82.47	16.84
Portugal	1985	75.48	24.05	1985	74.13	26.13	1996	88.84	12.42	1985	9.55	0.37	1985	81.81	22.35
Slovakia	1991	74.23	26.82	1995	81.34	21.18	1996	83.38	19.95	1990	9.11	0.59	1994	96.07	10.97
Slovenia	1985	62.69	37.72	2000	92.77	10.43	1996	84.05	18.77	1995	9.75	0.24	1994	83.50	18.90
Spain	1985	75.93	21.90	1985	78.33	21.41	1996	87.76	13.63	1985	9.89	0.29	1985	79.63	18.35

Source: Author's calculations.
Notes: Table displays summary statistics for the dependent variables used in the empirical analysis. "First" denotes the first year of observation for a given country. The sample includes all Euro area countries, excluding Cyprus and Malta.

2.2 Estimation

To assess the effect of carbon taxation on the various economic variable, we estimate dynamic impulse responses using the local projections method (Jordà, 2005). Our estimations follow in the spirit of Metcalf and Stock (2020). Specifically, we estimate a sequence of OLS models (depicted here for CPI as a dependent variable):

$$\Delta CPI_{i,t+h} = \alpha_i + \theta_h \tau_{i,t} + \beta(L)\tau_{i,t-1} + \delta(L)\Delta CPI_{i,t-1} + \gamma_t + \epsilon_{i,t}$$

where $\tau_{i,t}$ is the real carbon tax rate in country i in year t . θ_h is the effect of an unexpected change in the carbon tax at year t on CPI, h years ahead. To control for the persistence of the tax rate and CPI, we include the four latest lags of each variable in the regression. A set of fixed effects, α_i and γ_t absorbs unobserved heterogeneity specific to each country or year. $\epsilon_{i,t}$ is an error term.

Dynamic impulse responses are estimated from annual data between 1985 and 2020 for each dependent variable, respectively. The sample is restricted to all Euro area countries with available data. Following Metcalf and Stock (2020), we weight all carbon taxes with their 2019 emission share, postulating that the economic effect of a carbon tax is proportional to its coverage. Standard errors are heteroscedasticity-robust (Plagborg-Møller and Wolf 2021).

Our counterfactual scenario considers a flat €40 carbon tax that applies to 30 percent of GHG emissions, again, in the spirit of Metcalf and Stock (2020). We estimate impulse responses that span the five years after the tax introduction. Throughout, we distinguish between contemporaneous (in year 0), short-term (years 1-2), and medium-term (years 3-5) effects. For more details on the estimation see Konradt and Weder di Mauro (2021).

2.3 Results

The dynamic effects are summarized in Table 3. We begin with the impulse responses for GDP per capita, in panel a. The first row includes only a country fixed effect, the second row adds the ECB's policy rate as a control variable, and the third row includes country and time fixed effects. Impulse responses in the first two rows point to a negative and statistically significant effect on impact that dissipates over time. When adding a time fixed effect (row 3), the dynamic responses switch signs in the five years after the tax implementation. However, only the contemporaneous impact is statistically significant (at the 10% confidence level).

Quantitatively, our findings suggest that a €40 carbon tax applied on 30% of emissions leads to an increase of per capita GDP of 0.18 percentage points (p.p.) contemporaneously, 0.13 p.p. on average in the following two years and an average increase of 0.15 p.p. in the final three years. We illustrate the impulse response function of GDP per capita, including 95% confidence bands, graphically in Chart 1 (panel a). These responses are broadly consistent with Metcalf (2019) and Metcalf and Stock (2020), who find a modest positive response of GDP.

Panel b shows the results for headline CPI. When including country and time fixed effects (row 3), the impulse response is positive and statistically significant at the 1 percent confidence level in the two years following the carbon tax shock. In the medium-term (years 3-5), the response remains positive but does not exceed its standard errors. The estimated effects echo prior results by Konradt and Weder di Mauro (2021), that countries without independent monetary policy seem to experience more inflationary responses after carbon tax enactments.

In quantitative terms, the enactment of a €40 carbon tax with 30% emission coverage is estimated to lead to an increase in headline CPI by 0.26 index points (in the same year), increasing to 1.03 index points (on average) over the next two years and an average increase of 0.28 index points in the following three years. We depict the cumulative impulse response in panel b of Chart 1. Five years removed, the carbon tax enactment leads to an increase of core CPI by four index points, which is, however, not statistically significant.

Next, we turn to core CPI (excluding energy and food) in panel c. The impulse responses are overwhelmingly negative, albeit not statistically significant when including country and time fixed effects. The deflationary response stands in contrast to the results on headline CPI (panel b) but confirms previous results by Konradt and Weder di Mauro (2021). The authors document that while energy prices tend to increase, prices of other goods, primarily non-tradable, tend to fall after a carbon tax implementation.

The estimated impulse responses imply a contemporaneous fall of 0.37 index points, followed by an increase in core CPI of 0.34 index points in each of the next two years and a further decline of 0.32 index points, on average in the final three years following the enactment of a €40 carbon tax with 30% coverage. Once more, we illustrate the cumulative response of core CPI to the carbon tax shock in Chart 1 (panel c).

As a robustness check, we use the harmonized price index (HICP) in panel d. The last row (including country and time fixed effects) highlights that the impulse response is nearly identical to the headline CPI response. That is, we find a positive and statistically significant (at the 1% confidence level) response of HICP in the first two years after a carbon tax enactment.

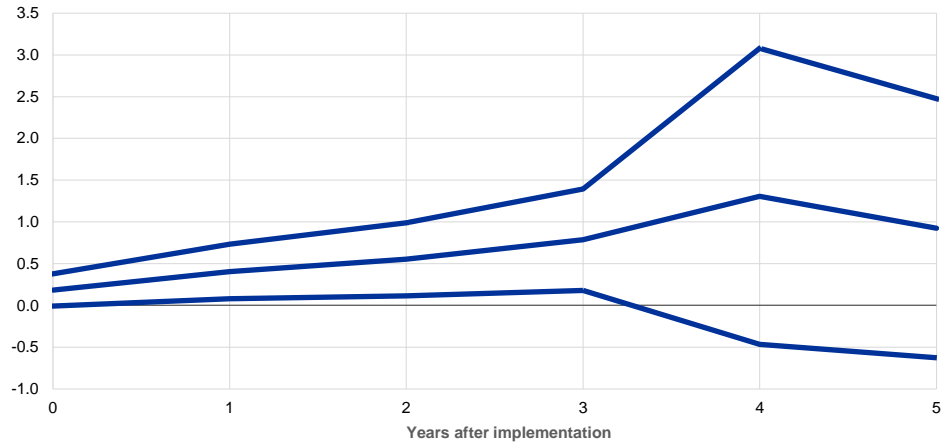
Finally, we test whether producer prices, measured through PPI, react similarly to CPI. The dynamic responses (panel e) show a precisely estimated positive effect on impact and in the two succeeding years after a carbon tax when including country and time fixed effects. The estimated impulse responses are quantitatively large, also in comparison to CPI (panel b). This result could be indicative of producers shouldering most of the burden associated with a carbon tax, rather than passing it on to consumers.

Our reported findings survive a battery of robustness checks. First, the coefficients are of similar size when excluding the period before 2000 and using a sample comprising only of initial member countries. Second, we find similar results when denominating all variables in real USD instead of EUR/DM. Lastly, our findings remain unchanged when using the ECB shadow rate (Wu and Xia 2016) instead of the actual policy rate.

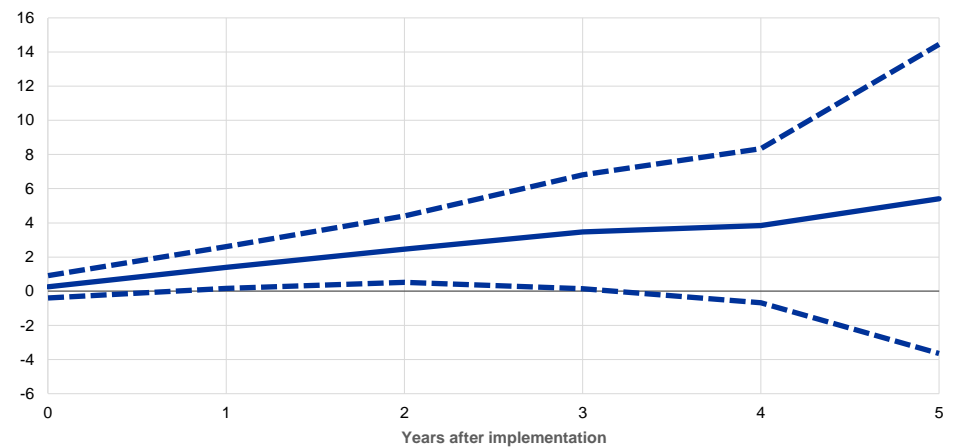
Chart 1

Cumulative impulse responses

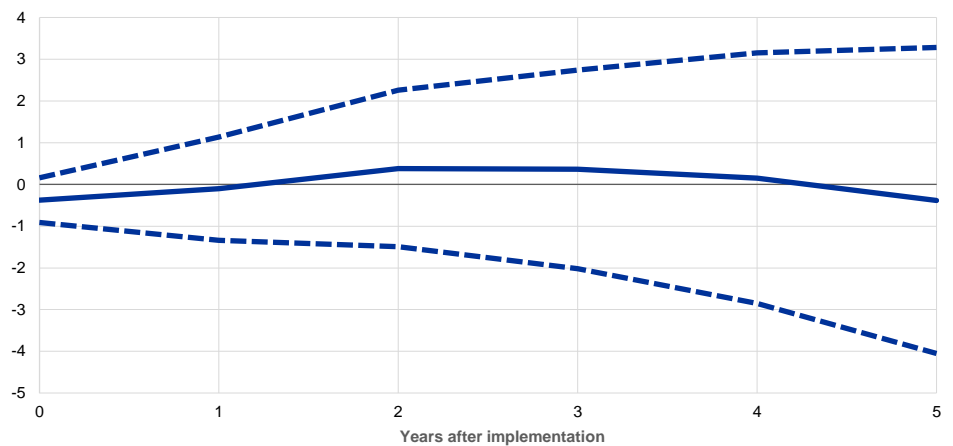
a) Response of GDP



b) Response of headline CPI



c) Response of core CPI



Source: Author's calculations.

Notes: Panels a-c show the cumulative impulse response to a 40-euro carbon tax on 30% of emissions for GDP per capita (in logs), headline CPI and core CPI, respectively. The responses are measured in percentage points (panel a) and index points (panels b and c). The impulse responses are calculated including country and time fixed effects.

Table 3

Dynamic impulse responses to carbon tax shock

Sample	Impact in year			Controls	N	R2
	0	1,2	3,4,5			
GDP	-0.68***	-0.21	0.09	Country FE	497	0.05
	0.23	0.38	0.38			
	-0.75***	-0.21	0.31	Economic	276	0.34
	0.18	0.17	0.56			
	0.18*	0.13	0.15	Country + Time FE	497	0.87
0.10	0.09	0.31				
Headline CPI	-0.06	0.07	-0.89	Country FE	454	0.11
	0.29	0.32	0.56			
	-0.01	0.19	-0.67*	Economic	247	0.40
	0.38	0.32	0.37			
	0.26	1.03***	0.28	Country + Time FE	454	0.52
0.33	0.40	0.64				
Core CPI	-0.53***	-0.16	-0.87***	Country FE	367	0.10
	0.20	0.31	0.26			
	-0.42*	-0.04	-0.29	Economic	246	0.20
	0.24	0.28	0.38			
	-0.37	0.34	-0.32	Country + Time FE	367	0.31
0.27	0.35	0.28				
HICP	-0.06	-0.12	-1.11***	Country FE	333	0.09
	0.25	0.23	0.39			
	0.36	0.37	-0.80**	Economic	276	0.42
	0.35	0.28	0.32			
	0.05	0.85***	0.12	Country + Time FE	333	0.62
0.24	0.23	0.23				
PPI	-0.12	-0.35	-2.48**	Country FE	414	0.11
	0.93	0.63	0.83			
	0.49	-0.45	-2.19**	Economic	245	0.47
	0.97	1.01	1.08			
	0.78**	1.08*	-0.24	Country + Time FE	414	0.72
0.37	0.60	0.83				

Source: Author's calculations.

Notes: Table shows the dynamic impulse responses to a 40-euro carbon tax with a 30% emission coverage. Panel a uses per capita GDP (in logs), panel b headline CPI, panel c uses core CPI, panel d uses the HICP and panel e the PPI as dependent variable. Economic controls include per capita GDP (except in panel a) and the ECB policy rate. The number of observations and R2 represent the average over the six individual OLS regressions, respectively. Standard errors are heteroskedasticity robust. Significance levels are denoted by *** p<0.01, ** p<0.05, * p<0.10.

3**The G-Cubed model**

This section outlines a new European version of the G-Cubed model used to explore the impact of two alternative monetary rules for the ECB under a range of different

climate-related shocks and climate policy changes. These are discussed in detail in the following sections.

3.1 The structure of the model

The G-Cubed model is a global, multisector model, which has been designed to evaluate climate policy and has been used to estimate the impact of environmental shocks (see McKibbin and Wilcoxon 2013 and McKibbin et al. 2018 and 2020, IMF 2020). The model has been modified in this paper in several ways to explore the European setting better. We incorporate a policy rule for the ECB based on Hartmann and Smets (2018) and Orphanides and Wieland (2013) by making the monetary policy reaction function more forward-looking. We have also modified the European version to represent the Euro area rather than all Western Europe which has been the aggregation in previous climate papers using G-Cubed. The Euro area in this new model version is Germany, France, Italy, Spain, Netherlands, Belgium, Luxemburg, Ireland, Greece, Austria, Portugal, Finland, Cyprus, Estonia, Latvia, and Lithuania. The countries removed from the Western Europe aggregation (which included United Kingdom amongst others) have been reallocated to the Rest of the OECD and the rest of the world.

There are ten regions and 20 sectors in the version of the model (version GGG20Nv161) used in this paper. These are contained in Table 4. The sectors in the model are set out in Table 5.

Table 4
Regions in the G-Cubed model

Region Code	Region Description
AUS	Australia
CHN	China
EUR	Euro Area
IND	India
JPN	Japan
OPC	Oil-Exporting developing countries
OEC	Rest of the OECD
ROW	Rest of the World
RUS	Russian Federation
USA	United States

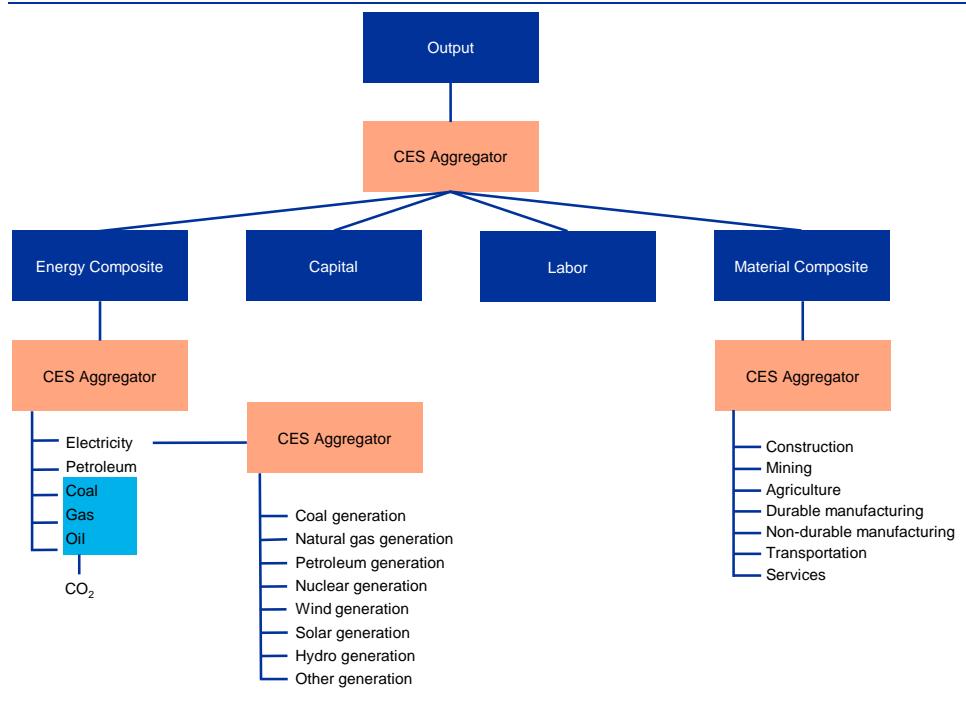
Source: G-Cubed Model (version GGG20N_v161).

Table 5
Sectors in the G-Cubed model

Number	Sector Name	Note
1	Electricity delivery	Energy Sectors Other than Generation
2	Gas extraction and utilities	
3	Petroleum refining	
4	Coal mining	
5	Crude oil extraction	
6	Construction	Goods and Services
7	Other mining	
8	Agriculture and forestry	
9	Durable goods	
10	Nondurable goods	
11	Transportation	
12	Services	
13	Coal generation	Electricity Generation Sectors
14	Natural gas generation	
15	Petroleum generation	
16	Nuclear generation	
17	Wind generation	
18	Solar generation	
19	Hydroelectric generation	
20	Other generation	

Source: G-Cubed Model (version GGG20N_v161).

Figure 1
Production and consumption structure for each sector in the G-Cubed model



Source: Jaumotte et al (2021).

The G-Cubed sectors 1-12 are aggregated from 65 sectors of the GTAP 10 database.¹² The electricity sector is further disaggregated into the electricity delivery sector (sector 1), which purchases inputs from 8 electricity generation sectors (sectors 13-20).

As outlined in Jaumont et al. (2021), there is a production structure for each sector within each country, as shown in Figure 1. CO₂ emissions are measured through the burning of fossil fuels in energy generation.

Note that the elasticities of substitution between capital, labor, energy, and materials and between the sub nests within each sector are estimated using US data.¹³ The parameter for input shares in the CES production function is taken from the latest input-output tables in the GTAP 10 database.

The model completely accounts for stocks and flows of physical and financial assets. For example, budget deficits accumulate into government debt, and current account deficits accumulate into foreign debt. The model imposes an intertemporal budget constraint on all households, firms, governments, and countries. Thus, a long-run stock equilibrium obtains by adjusting asset prices, such as the interest rate for government fiscal positions or the real exchange rates for the balance of payments. However, the adjustment towards the long-run equilibrium of each economy can be slow, occurring over a century.

Households and firms in G-Cubed must use money issued by central banks for all transactions. Thus, central banks in the model set short-term nominal interest rates to target macroeconomic outcomes (such as inflation, unemployment, exchange rates, etc.) based on Henderson-McKibbin-Taylor monetary rules.¹⁴ These monetary rules approximate actual monetary regimes in each country or region in the model. They tie down the long-run inflation rates in each country and allow short-term adjustment of policy to smooth fluctuations in the real economy.

Nominal wages are sticky and adjust over time based on country-specific labor contracting assumptions. Firms hire labor in each sector up to the point that the marginal product of labor equals the real wage defined in terms of the output price level of that sector. Any excess labor enters the unemployed pool of workers. Unemployment or the presence of excess demand for labor causes the nominal wage to adjust to clear the labor market in the long run. In the short run, unemployment can arise due to structural supply shocks or changes in aggregate demand in the economy.

Rigidities prevent the economy from moving quickly from one equilibrium to another. These rigidities include nominal stickiness caused by wage rigidities, lack of complete foresight in the formation of expectations, cost of adjustment in investment by firms with physical capital being sector-specific in the short run. With these rigidities and

¹² See Aguiar et al. (2019).

¹³ These elasticities are assumed to be the same across countries but different across sectors. In other words, the degree of substitution across input in production is a sector are different across sectors but are the same for the same sector in different countries.

¹⁴ See Henderson and McKibbin (1993), Taylor (1993), Orphanides (2003).

monetary and fiscal authorities following particular rules, short-term adjustment to economic shocks can be very different from the long-run equilibrium outcomes. Note that each sector in each country has a capital stock that is based on putty-clay technology. It is costly to move installed physical capital between sectors. This stickiness is an important aspect of the cost of decarbonizing economies, given current energy systems and technologies for using energy.

The model incorporates heterogeneous households and firms. Firms are modeled separately within each sector. The model distinguishes between consumers and firms that base their decisions on forward-looking expectations and those that follow more straightforward rules of thumb, which are optimal in the long run but not necessarily in the short run.

The fiscal rule in the model varies across model versions. In this paper's version of the model, we assumed an endogenous budget deficit with lump-sum taxes on households adjusted gradually over time to cover any incremental interest payments to ensure fiscal sustainability. Thus, the level of government debt can permanently change in the long run with the change in debt to GDP equal to the ratio of the long-run fiscal deficit to the long-run real growth rate of the economy. Based on the extensive literature, including previous studies with the G-Cubed model, we know that the assumption of how carbon tax revenue is used can have significant macroeconomic implications¹⁵. Rather than show a range of assumptions in this paper, we assume that the tax revenue is used to reduce the fiscal deficit across all central bank monetary regimes.

3.2 Optimal monetary policy

There is extensive literature on the optimal rules for monetary policy.¹⁶ Monetary policy rules for interest rates responding to intermediate targets range from money targeting, exchange rate targeting, commodity price targeting, inflation targeting, price level targeting, nominal income targeting, nominal income growth targeting, and rules explicitly embodying trade-offs between variables such as Henderson-McKibbin Taylor Rules. The main insights from this literature relevant for this paper are that most monetary rules handle demand shocks well, but some rules perform poorly in the face of supply shocks and changes in country risk.¹⁷

Since climate shocks and climate policy changes tend to be supply shocks, many of these monetary regimes will not be helpful during a climate transition. While the modeling framework in this paper can simulate each of these monetary rules, the focus in this paper will be on the types of rules likely to be relevant for climate transition scenarios. Other applicable monetary rules which would also be interesting to explore

¹⁵ See McKibbin W. J., Morris, A., Wilcoxon P. J., and Y. Cai (2015) and McKibbin W. J., Morris, A., Wilcoxon P. J. and L. Liu (2018).

¹⁶ See Poole (1970), Taylor (1993), Henderson and McKibbin (1993), Orphanides (2013), Orphanides and Wieland (2013), Hartmann and Smets (2018) and the comprehensive study by Bryant et al. (1993).

¹⁷ Note that as Henderson and McKibbin (1993) and Bryant et al. (1993) point out, a fundamental assumption is the extent of wage and price stickiness in the economy.

further are price-level targeting and nominal income rules. However, due to space limitations, these will be explored in future research.

The subset of monetary rules that we focus on are rules that incorporate output and inflation tradeoffs, such as Henderson McKibbin Taylor Rules. The focus will further narrow down to the Hartmann-Smets (2018) rule, which the authors argued to be a good empirical representation of the ECB policy rule over recent decades. We then focus on the relevance of the tradeoff between current versus future information in that rule.

3.3 Alternative monetary regimes for the ECB

We consider two alternative policy rules for the ECB. The first is the Hartmann-Smets (2018) modification of the Orphanides-Wieland Rule (2013). These are forward-looking versions of the Henderson-McKibbin (1993) and Taylor (1993) rules. This rule is summarized in equation 1. We call this rule in the HS rule in the charts.

$$i_t = i_{t-1} + 0.34 * (\pi_{t,t+1} - \bar{\pi}_{t+1}) + 0.4 * (g_{t,t+1} - \bar{g}_{t+1}) \quad \text{HS} \quad (1)$$

Where i_t is the policy interest rate, $\pi_{t,t+1}$ is the expectation in period t of inflation in period t+1 (rationally expected from the model) and $g_{t,t+1}$ is the growth rate in output in period t+1 expected in period t (the rational forecast from the model).

The second rule (equation 2) is an augmented rule similar to the Hartmann-Smets rule but with a weight on current period variables and a larger weight on one year ahead forecasts of inflation relative to target and output growth relative to the target. We call this rule the modified Hartmann-Smets (MHS)¹⁸ rule in the charts.

$$i_t = i_{t-1} + 0.5 * (0.34 * (\pi_t - \bar{\pi}_t) + 0.4 * (g_t - \bar{g}_t)) + 0.5 * (0.34 * (\pi_{t,t+1} - \bar{\pi}_{t+1}) + 0.4 * (g_{t,t+1} - \bar{g}_{t+1})) \quad \text{MHS} \quad (2)$$

We first solve the model from 2019 to 2100 using exogenous population projections, sectoral productivity growth rates by sector and country, and projections of energy efficiency improvements based on historical experience. The key inputs into the baseline are the initial dynamics from 2018 to 2019 (the evolution of each economy from 2018 to 2019) and subsequent projections from 2019 onwards for productivity growth rates by sector and country. Sectoral output growth from 2019 onwards is driven by labor force growth and labor productivity growth. When solving the model to generate the baseline, we iteratively adjust temporal and intertemporal constants so that the model solution for 2019 replicates the database for 2019 (the latest data we have).

Each central bank scenario will be associated with a slightly different baseline in the initial decade because the monetary rule impacts the projection. We take this into account and present all results relative to the appropriate baseline.

¹⁸ In chapter 4 of Reichlin et al. (2021) we implemented a modified Hartmann-Smets rule with weights of 0.25 on current variables and 0.75 on future variables. It would be an interesting exercise to search over the degree of forward versus current information could minimize a central bank loss function. The values used in the current paper are chosen for illustrative purposes.

4 Climate shocks (physical risk) in the Euro area

We now assess the macroeconomic consequences of climate risk. We follow Fernando, Liu, and McKibbin (2021) to consider a physical risk scenario that incorporates both chronic climate change and extreme climate events. The chronic climate change scenario is based on widely used climate scenarios (Representative Concentration Pathways, or RCP).¹⁹ Given this scenario, we use the results of Fernando, Liu, and McKibbin (2021). The authors calculate damage functions from that scenario RCP 4.5 due to chronic climate. The chronic climate risks considered in that study include sea-level rise, crop yield changes, heat-induced impacts on labor, and increased incidence of diseases.

This scenario is fed into the model through shocks to sectoral productivity and effective labor supplies. We then add to the chronic climate shocks (largely shocks to trends) our estimates of the probabilities of extreme climate events as calculated in Fernando et al. (2021). The authors estimate the future incidents of climate-related extreme events, including droughts, floods, heatwaves, cold waves, storms, and wildfires. These climate shocks are calculated for all countries in the model and will differ across sectors and countries.

Ideally, we would incorporate these extreme event shocks through stochastic simulations of the G-Cubed model to show the mean and variance of the variables of interest and better represent the uncertainty involved in climate shocks. A stochastic simulation approach will be undertaken in future research. For the current paper, we follow Fernando et al. (2021) and implement the mean of the shocks over time.

The response to European variables is explored given the two alternative monetary rules for the ECB.

Physical climate shocks are initially supply shocks. However, because the shocks change relative prices, asset returns, and estimates of capital valuation in different sectors and households' evaluation of human wealth, the shocks also lead to endogenous changes in consumption and investment, which change aggregate and sectoral demand. The simulation assumes that in 2021 households, firms and governments in the model become aware of current and future climate shocks that are not in the baseline. The economic actors understand the RCP 4.5 scenario, expected extreme events, and impact productivity and effective labor supply. These shocks differ across sectors and countries.

Charts 2 to 5 contain results for the climate shocks for a range of macroeconomic and sectoral variables. Without any monetary response, the initial impact of the shock would likely be a fall in output in the most affected sectors (agriculture) and, therefore, a rise in relative prices of the most affected goods. Not surprisingly, agriculture has the most significant direct shock, but durable manufacturing output falls (not shown) because of the fall in investment in Europe. Durable goods feed into the creation of

¹⁹ See van Vuuren, D. P., Edmonds, J., Kainuma, M., Riahi, K., Thomson, A., Hibbard, K., Hurtt, G. C., Kram, T., Krey, V., Lamarque, J. F., Masui, T., Meinshausen, M., Nakicenovic, N., Smith, S. J. & Rose, S. K. (2011).

capital stock across the economy. However, in practice, many variables will change, such as equity prices, interest rates, expected investment returns, etc.

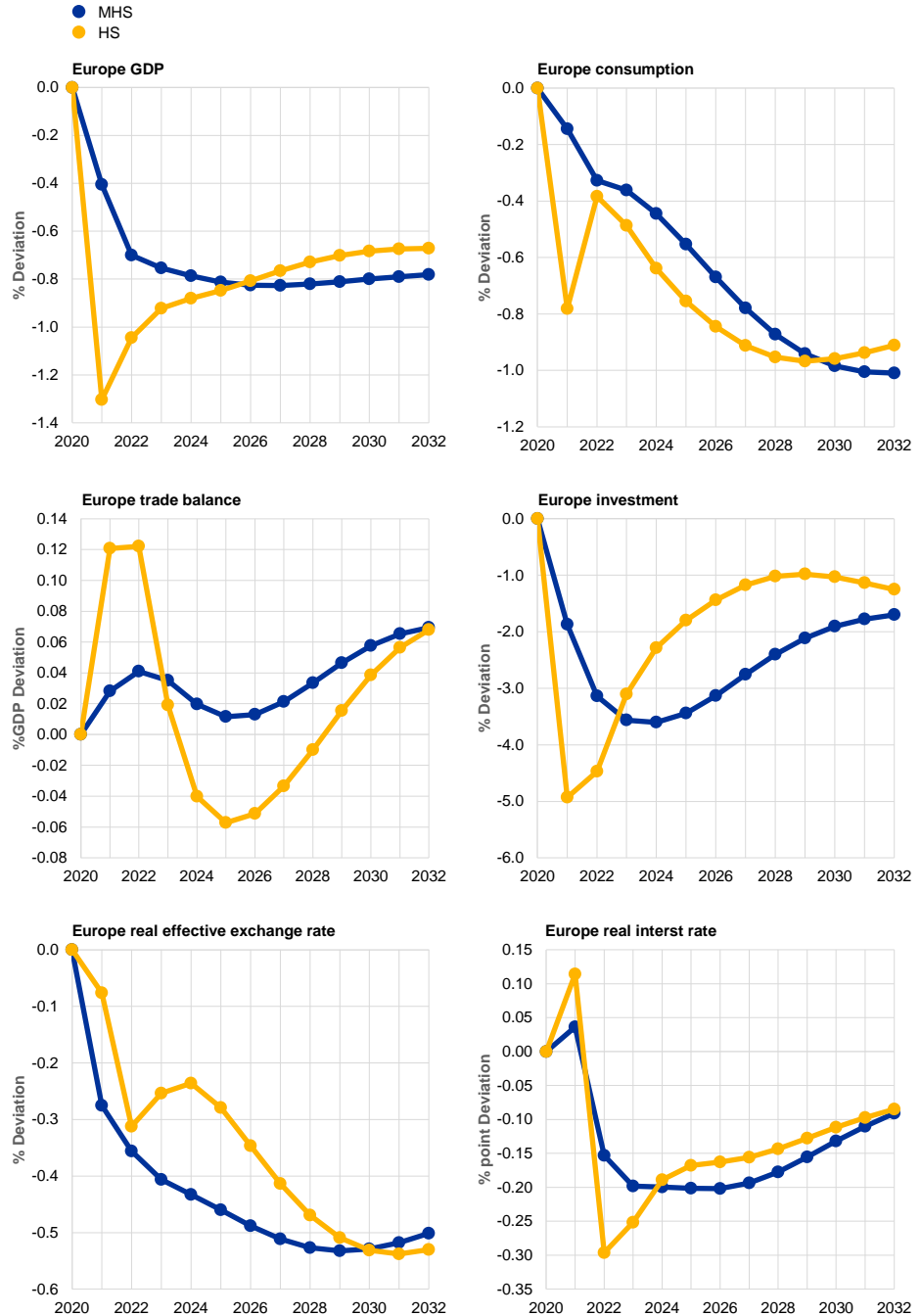
The charts contain two lines for each chart representing the results under the two monetary rules: the HS Rule (yellow line) and the MHS rule (blue line). All results are expressed as either percent deviation, percentage point deviation, or percent of GDP deviation from the baseline. The baseline under each monetary regime is different, so the relevant baseline is used in each case.

Chart 2 shows GDP, consumption, investment, the trade balance, the real effective exchange rate, and the real interest rate. The results indicate that the two alternative monetary rules have very different implications for the outcome of the climate shocks.

Chart 2

Euro area aggregate quantity effects under a global climate shock

(in percent deviation from baseline)



Sources: G-Cubed Model Simulations (version GGG20N_v161).

Monetary policy is initially tightened under the HS rule because output growth is expected to recover in the year after. Thus expected GDP growth rises despite a significant fall in output in 2021. The fall in equity prices causes financial wealth to fall together with a fall in real wages. Consumption therefore falls. Under the HS rule, the rise in the interest rate causes human wealth to fall slightly more than under the MHS rule. The initial excessive monetary contraction exacerbates the climate shock by

slowing the economy more and accentuating the fall in investment consumption. The slowdown also causes a slight improvement in the trade balance due to capital outflow. The MHS rule considers the sharp GDP drop in the current period and therefore does not tighten policy as much. There is still a slight tightening of policy by the ECB because the positive inflationary impact of the shock.

Inflation rises (Chart 3) in the MHS rule because of the relative price shock plus the relatively larger depreciation on the Euro feeds into imported prices for final goods and intermediate imported goods. Inflation falls under the HS rule because the tighter monetary policy reduces domestic prices and leads to an appreciation of the Euro causing import prices to fall. Using contemporaneous inflation in the policy rules leads to a smaller deviation of inflation and GDP from baseline under the MHS rule. The different inflation outcomes clearly show in the deviation of the aggregate price level, which is positive under the MHS rule but permanently negative under the HS rule. Most aggregate real variables are similar under both monetary regimes after several years because the monetary responses have passed through the economy. Note that the Euro/Dollar exchange rate reflects the permanent change in price levels under the two monetary regimes.

Sectoral results are shown in Chart 4. As expected, the permanent fall in aggregate GDP caused by the permanent supply shocks emanating from climate change leads to a decline across the sectors, although there are some interesting differences. Firstly, the most significant shocks occur in agriculture productivity, but the fall in investment across the economy has a disproportionate impact on the durable goods sector since this sector produces the goods that feed into the investment purchases of domestic firms. Durable goods are also important for exports, especially from Germany. Although we don't show the global results, the adverse supply shocks are occurring globally, so there is also a global investment slump and implications for production supply chains globally. The construction sector is also hurt by the investment slowdown across the economy, reducing the demand for construction.

The sectoral results differ across the two monetary regimes. The additional tightening of monetary policy under the HS regime has a more significant negative impact on all sectors. The output loss is slightly more significant on construction and durable goods because these sectors are more sensitive to changes in real interest rates. Durable goods exports are also hurt by the appreciation of the Euro resulting from the tighter monetary policy.

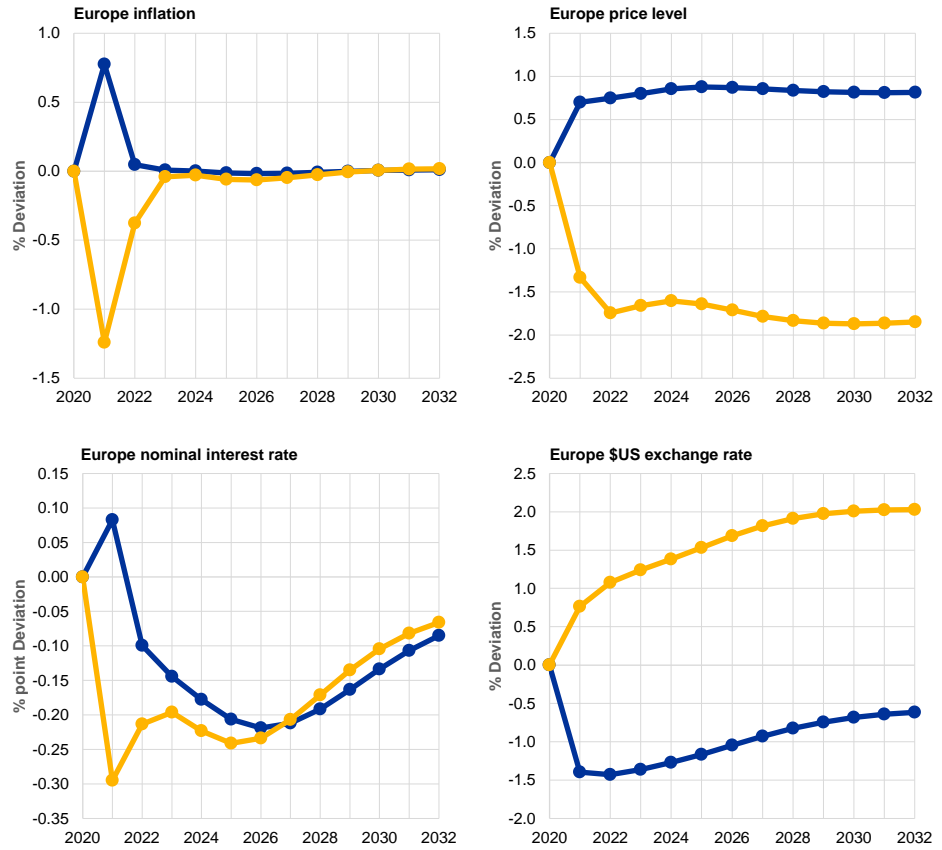
Finally, it is interesting to observe how the monetary regimes change the trade-off between inflation and GDP in the first year of the shock. This trade-off is shown in Chart 5 for the two monetary regimes. The inflation change is on the vertical axis, and the change in GDP is on the horizontal axis. The HS rule has a larger output loss and deflation in response to the supply shock, whereas the MHS rule has a smaller output loss and higher inflation in response to the climate shock.

Chart 3

Euro area inflation, prices, interest rate and exchange rate effects under a global climate shock

(in percent deviation from baseline)

- MHS
- HS

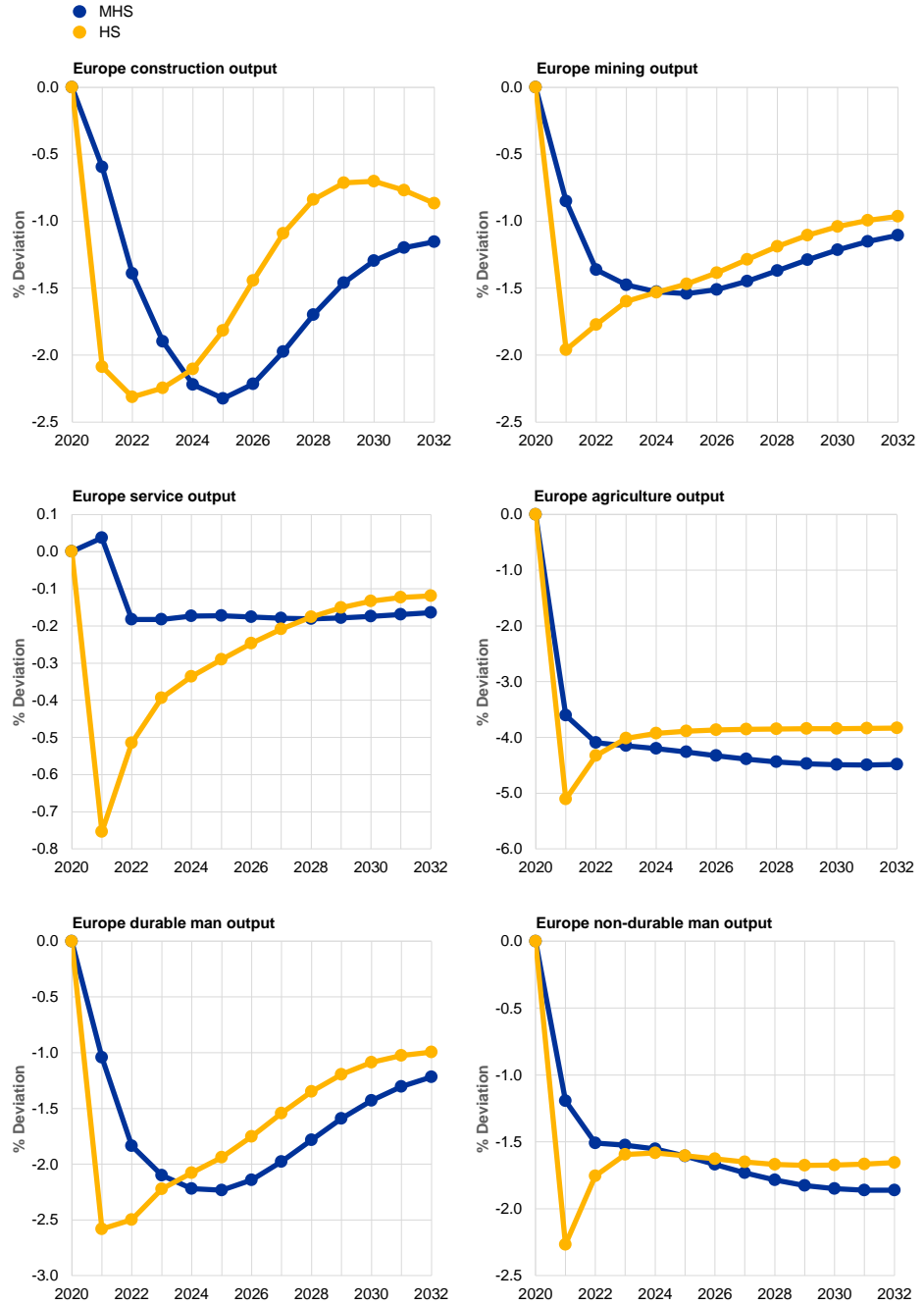


Sources: G-Cubed Model Simulations (version GGG20N_v161).

Chart 4

Euro area sectoral output effects under a global climate shock

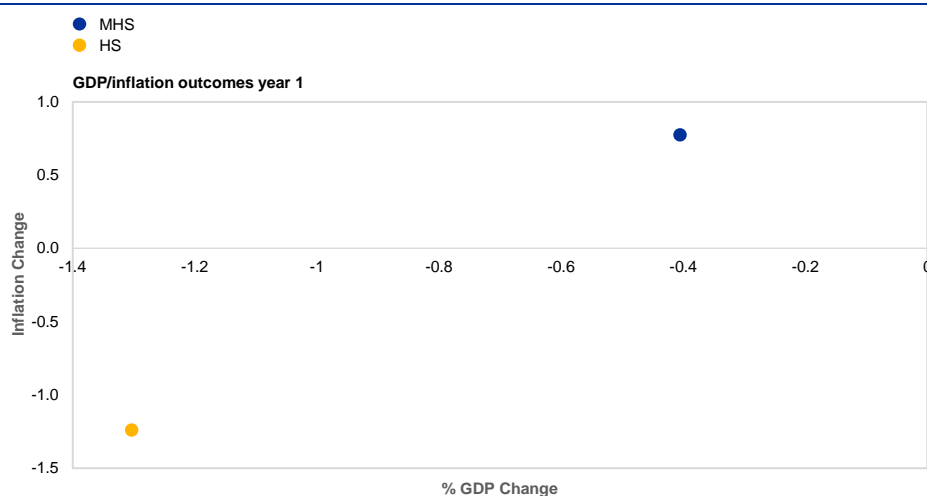
(in percent deviation from baseline)



Source: G-Cubed Model Simulations (version GGG20N_v161).

Chart 5

GDP/inflation trade-off in year 1 under a global climate shock



Source: G-Cubed Model Simulations (version GGG20N_v161).

These results show that the choice of the monetary regime have a transitory impact on the short-term economic outcomes to climate shocks. It also seems important to use both current period information as well as expected future variables in the monetary policy rule.

5 Climate policy (transition risk) in the Euro area

We now focus on transition risk. That is the impact of policies aimed at transitioning economies to a low carbon world. We focus in this section on European only carbon policy. Global carbon policy is explored in the following section.

We first consider the implications of implementing climate policy in the Euro area. We illustrate climate policy using a 50 euro per ton carbon tax rising at 3% per year. The revenue from the tax is used to reduce the Euro area-wide fiscal deficit. This tax is assumed to be understood by forward-looking households and firms as a precommitment by the European governments. As in the case of climate shocks above, we explore the macroeconomic and sectoral outcomes.

Our primary interest is studying how relative prices and inflation respond to the carbon tax under different assumptions about the reaction of the ECB. Given the relatively steep jump and continued increase in carbon costs, it is interesting to see if there might be higher inflation as a result.

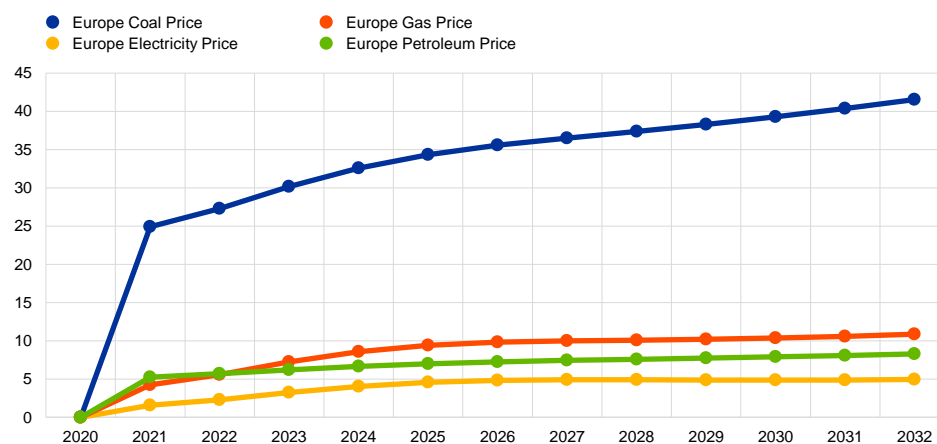
Chart 6 shows the decomposition of prices within the energy and non-energy components for the MHS rule (the results for both monetary rules are very similar). As expected, all energy prices respond to the carbon tax, most notably the price of coal which steadily increases from 25 up to 35 percent relative to baseline. Among sectors, transport prices rise most sharply among the components, while service prices show very little change. Thus, the carbon tax does increase energy prices, shifting relative prices (and expenditures).

Chart 6

Price decomposition (after-tax) under a Euro area carbon tax

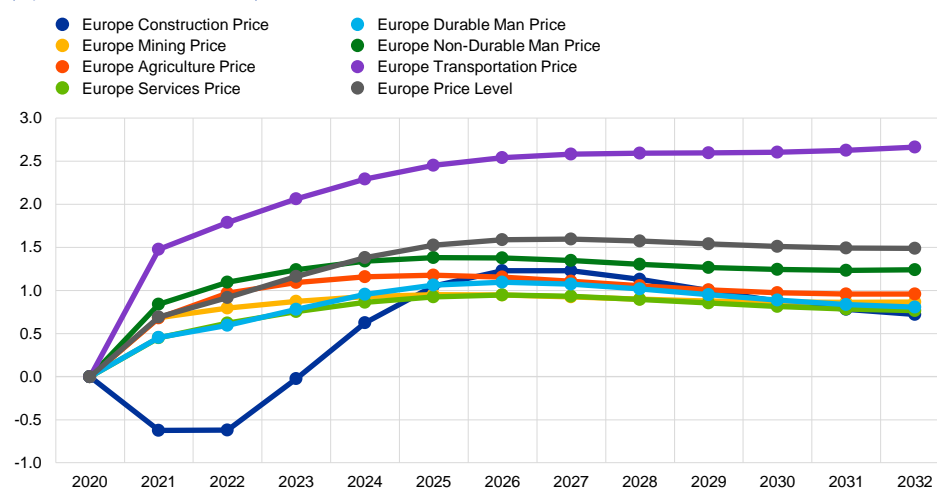
a) Energy price effects of European carbon tax

(in percent deviation from baseline)



b) Non-energy price effects of European carbon tax

(in percent deviation from baseline)



Source: G-Cubed Model Simulations (version GGG20N_v161).

Chart 7 shows the results for CPI inflation, the price level, the interest rate, and the exchange rate as changes relative to baseline. The increase in the carbon tax pushes up input prices. The two monetary rules have very different implications for inflation.

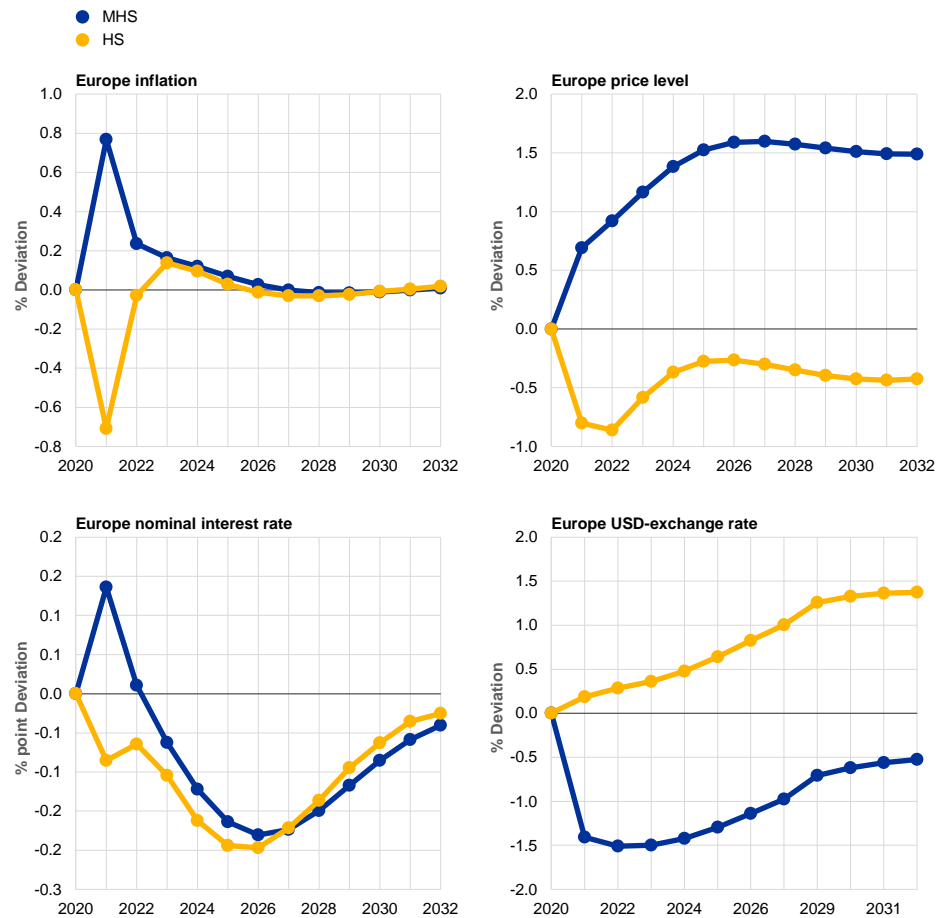
First, focus on the forward-looking HS rule. Following the carbon tax shock, GDP falls sharply in the first year, but in period $t+1$, output recovers with a higher growth rate but with GDP at a lower level (Chart 8). The HS rule balances lower inflation in period $t+1$ against higher growth relative to target in period $t+1$ and contracts monetary policy to offset the coming growth spike. Thus, rather than rising in period t , this type of monetary policy produces deflation in the first period. By mechanically looking through the shock to the period $t+1$, an entirely forward-looking ECB would “miss” the precise nature of the carbon tax shock in the initial period.

By contrast, the MHS rule is only partially forward-looking. It places a weight of 0.5 on first-period variables and 0.5 on period t+1 variables (using the HS relative weights on inflation and output growth in both periods). In this case, inflation would increase sharply in the year of the carbon price shock, as would initial output and consumption (Chart 8). Higher inflation under this monetary rule falls to about 0.1 percent p.a. in 2025 and eventually towards zero by the decade's end.

Chart 7

Euro area inflation, prices, interest rate and exchange rate under a Euro area carbon tax

(in percent deviation from baseline)



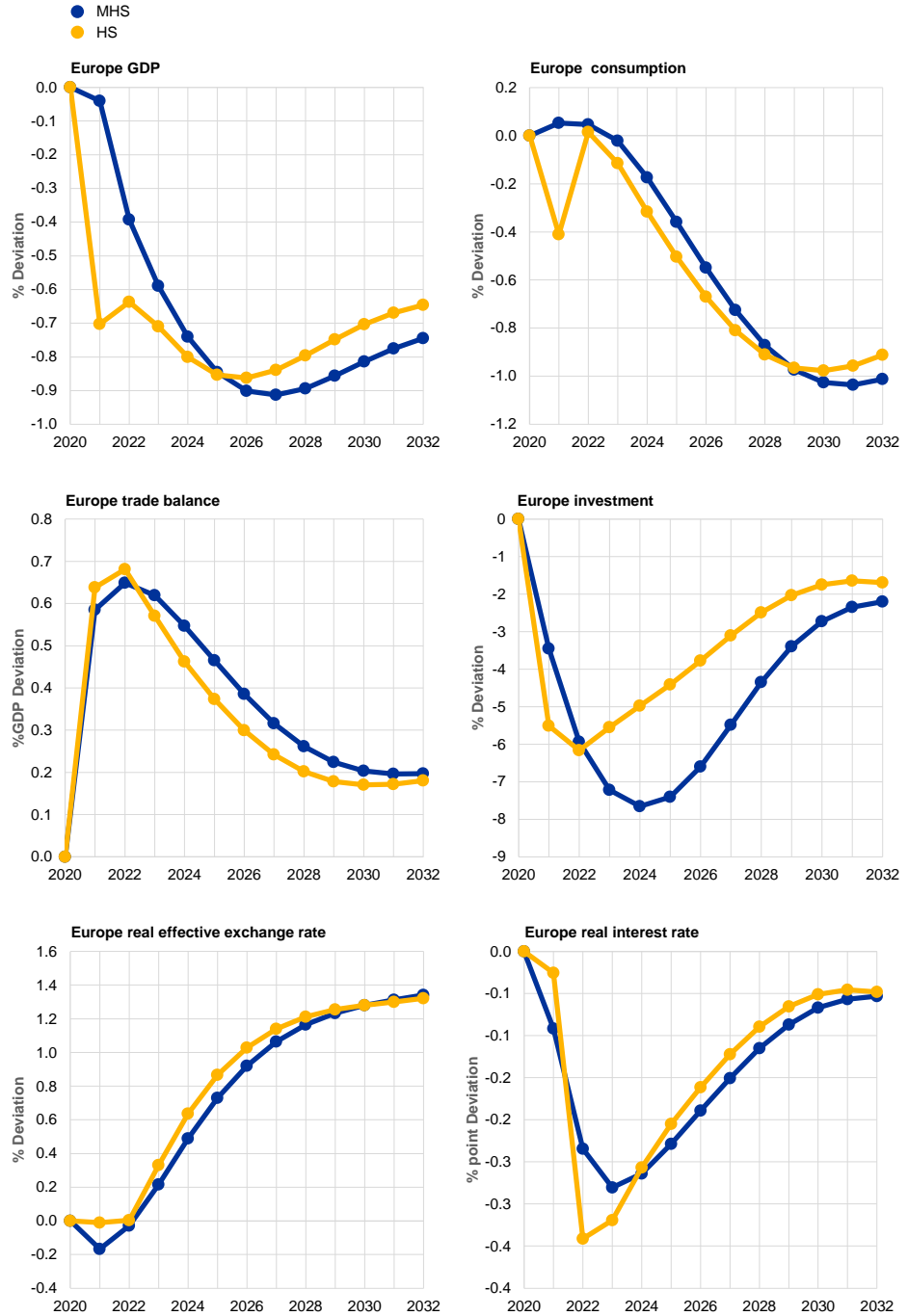
Source: G-Cubed Model Simulations (version GGG20N_v161).

Both monetary rules control inflation within four years but note that the price level is very different under the two monetary rules. Under the MHS rule, the carbon tax will show up in a permanently higher price level. In contrast, the HS rule leads to a permanently lower price level, as prices do not fully recover from the initial deflationary shock.

Chart 8

Euro area aggregate quantity effects under a Euro area carbon tax

(in percent deviation from baseline)



Source: G-Cubed Model Simulations (version GGG20N_v161).

Chart 8 shows the results for Euro area output and its components. As already mentioned, there is a significant difference in the response of GDP under the two different monetary regimes, but this difference disappears quickly. Overall, the difference between the scenarios in terms of output costs after the first year are not

large, especially given that Euro area GDP continues to grow in the baseline and after the tax.

Investment in the Euro area falls sharply in the case of a carbon tax (with the deviation from baseline of between -6 and -10% after 5 years), then recovers and by the end of the decade the cumulative decline is about -5%. Note that investment in non-fossil fuel energy increases but the investment losses from the much larger fossil fuel sectors offsets the expansion in investment in other sectors. The overall decline in investment reflects the lower capital stock and lower output resulting from the tax. As shown in Jaumotte et al (2021) this effect can be more than offset by policies focusing on green infrastructure investment.

Taken together these results suggest that a carbon tax has long run output costs but only a transitory impact on inflation. The monetary policy response is critical to the initial impacts on inflation and output because monetary policy only influences short run economic activity due to wage rigidities but has no impact on long run growth by assumption.

Sectoral Differences: Looking under the hood of macroaggregates there are significant sectorial shifts induced by the carbon tax under both monetary rules (Chart 9). Outside the energy sectors, the most affected sectors are mining and manufacturing of durables. These reflect the lower investment which purchased goods from these sectors. As shown in Jaumotte et. al. (2021) different assumption about the policy mix (such as including green investment) can significantly change this result.

Chart 9

Euro area sectoral output under a Euro area carbon tax

(in percent deviation from baseline)



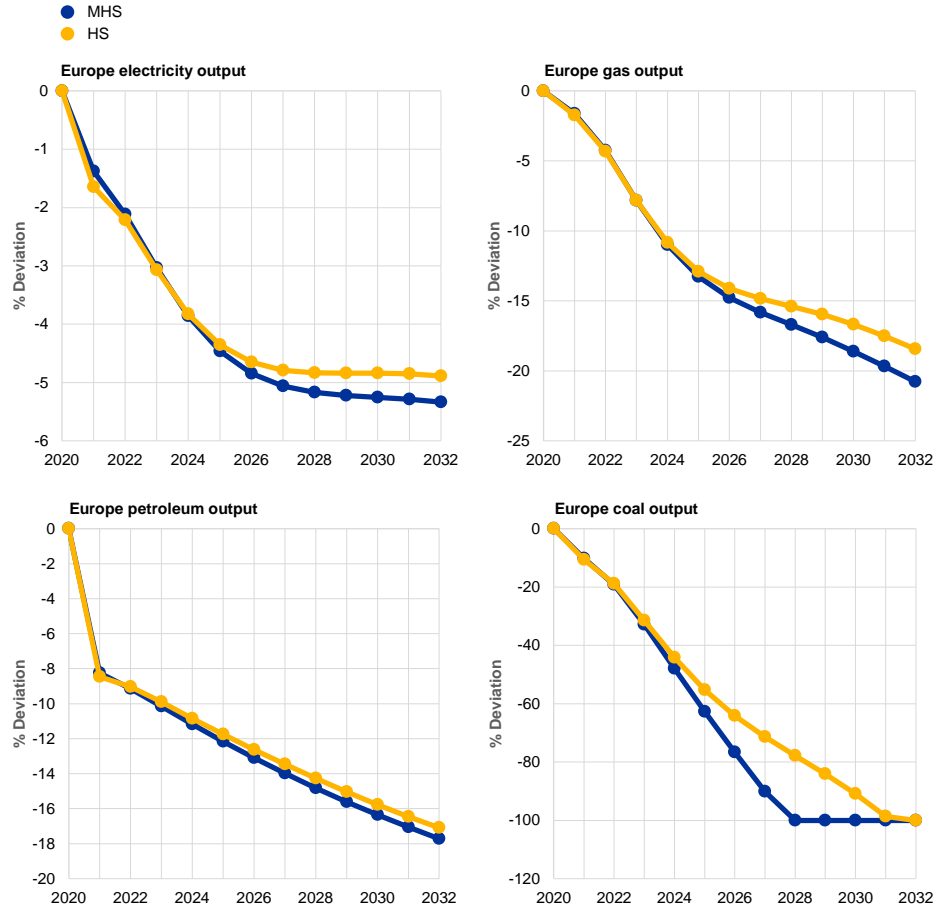
Source: G-Cubed Model Simulations (version GGG20N_v161).

Energy Output: In the energy sector carbon tax effects are most visible (Chart 10). Coal output falls quickly towards zero, oil output about halves. Electricity and Gas output fall by 5 and 15%, respectively, by 2032.

Chart 10

Euro area energy output under a Euro area carbon tax

(in percent deviation from baseline)

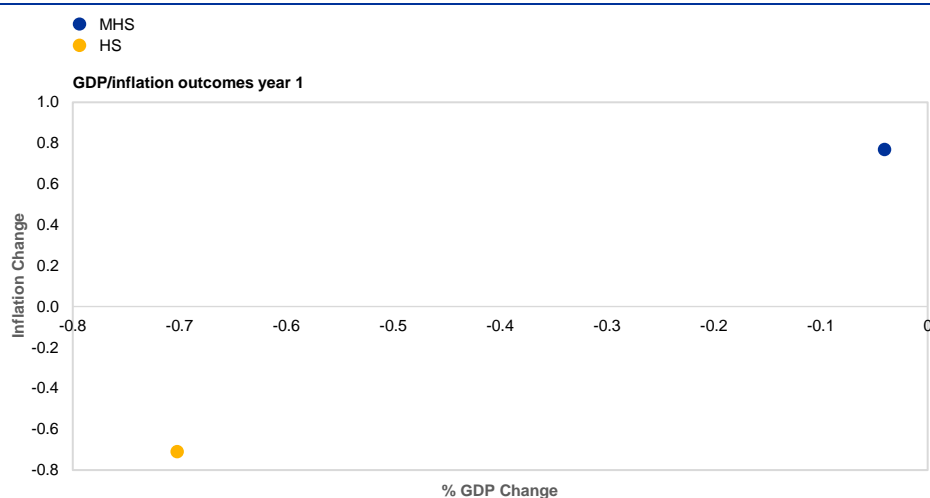


Source: G-Cubed Model Simulations (version GGG20N_v161).

Overall, as for the climate shocks and the climate policy changes, these simulations show that monetary policy rules matter. Depending on the monetary policy reaction, the initial shock would amplify output costs and induce deflation or minimize output costs but allow higher inflation in the short run. Chart 11 illustrates the trade-offs between inflation and GDP growth in the first year following a carbon tax shock under the two monetary rules. Over time these differences disappear quickly in the G-Cubed model. Importantly, the effects on both output and prices remain quite contained, despite the steep large carbon tax impulse of 50 euro per ton and a yearly increase of 3%.

Chart 11

GDP/inflation trade-off in year 1 under a Euro area carbon tax



Source: G-Cubed Model Simulations (version GGG20N_v161).

6 Global versus Euro area climate policy (transition risk)

Finally, we explore the impact of global climate policy versus Euro area climate policy. In this case, we only use the MHS rule, given its superior performance compared to the HS rule.

In the analysis of climate shocks, we used global shocks because climate change is a worldwide issue. It is interesting to compare Euro area climate policy acting alone, as in the last section, with a worldwide response to climate change in the policy simulations.

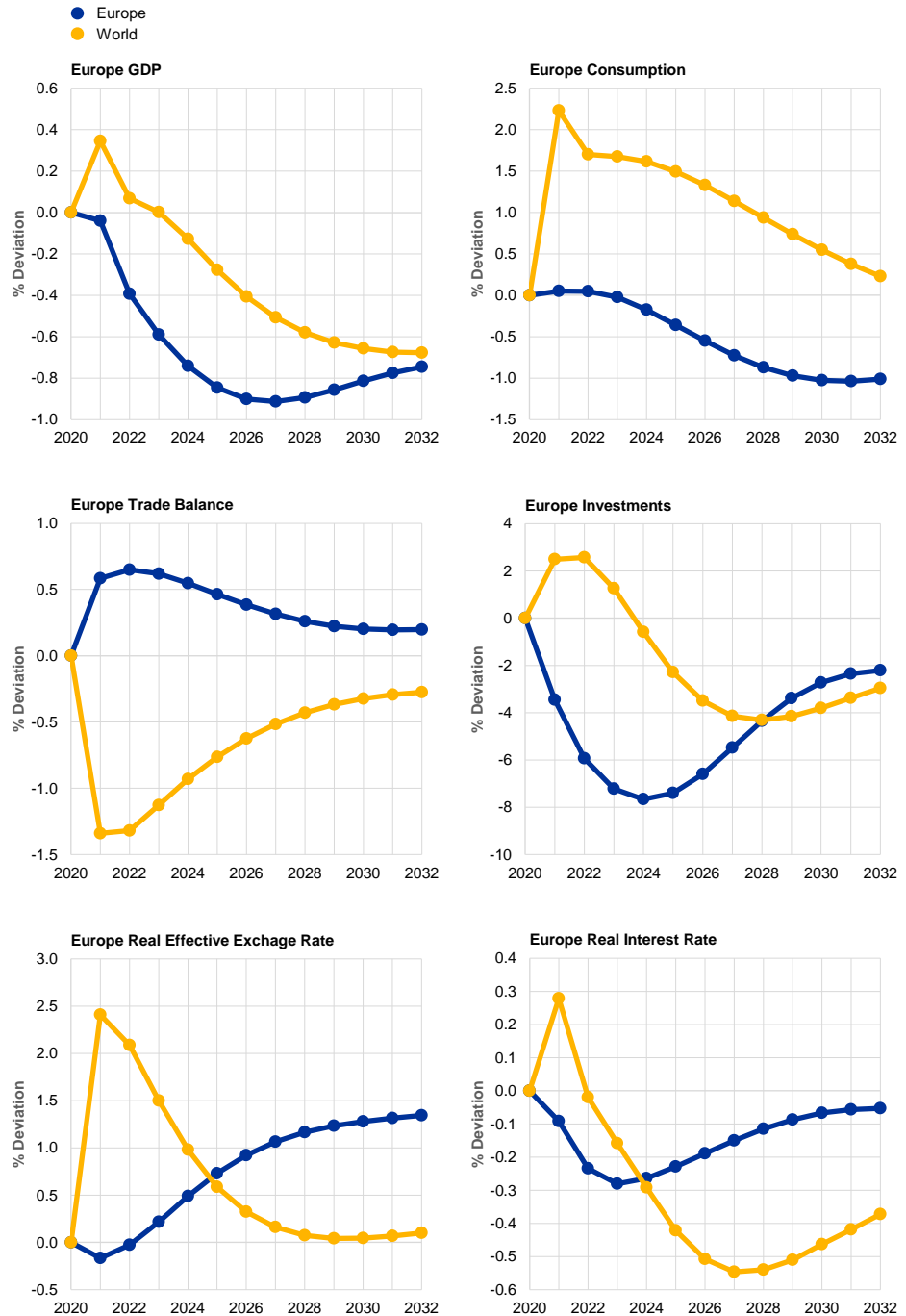
We implement the same climate policy in the Euro area as in section 6, but we now assume the entire world follows the same carbon price path. The exception is for oil-exporting countries because the policy cannot be implemented in these economies without major economic collapse, which has implications for the global results through energy and asset markets. To avoid this problem (and probably realistically), we exclude oil-exporting countries from the carbon price applied internally to these economies. Still, the exports of these economies are taxed when they enter the participating economies.

The results are contained in Charts 12 through 14. We only compare the two climate policies but keep the monetary regime the same across the two climate policy regimes. As expected, many of the sectoral results for the Euro area are the same. This is because the dominant impact of the climate policy on the Euro area is the policy in the Euro area. However, there are some interesting differences. Under the world carbon tax, the effect on countries outside the Euro area is more negative than within the Euro area. This outcome partly reflects the economic structures of the economies and the different energy systems, and different factor endowments. This is explored in detail in Liu et al. (2020).

Chart 12

Euro area aggregate quantity effects under a Euro area versus a global carbon tax

(in percent deviation from baseline)



Source: G-Cubed Model Simulations (version GGG20N_v161).

In contrast to the policy only being implemented in the Euro area, a global carbon tax will cause capital to flow from more highly impacted economies into Europe. This capital flow is reflected in a Euro area trade deficit (Chart 12) rather than a trade surplus resulting from a Euro area-only policy. This capital inflow tends to appreciate the Euro, which puts downward pressure on inflation through lower import prices for

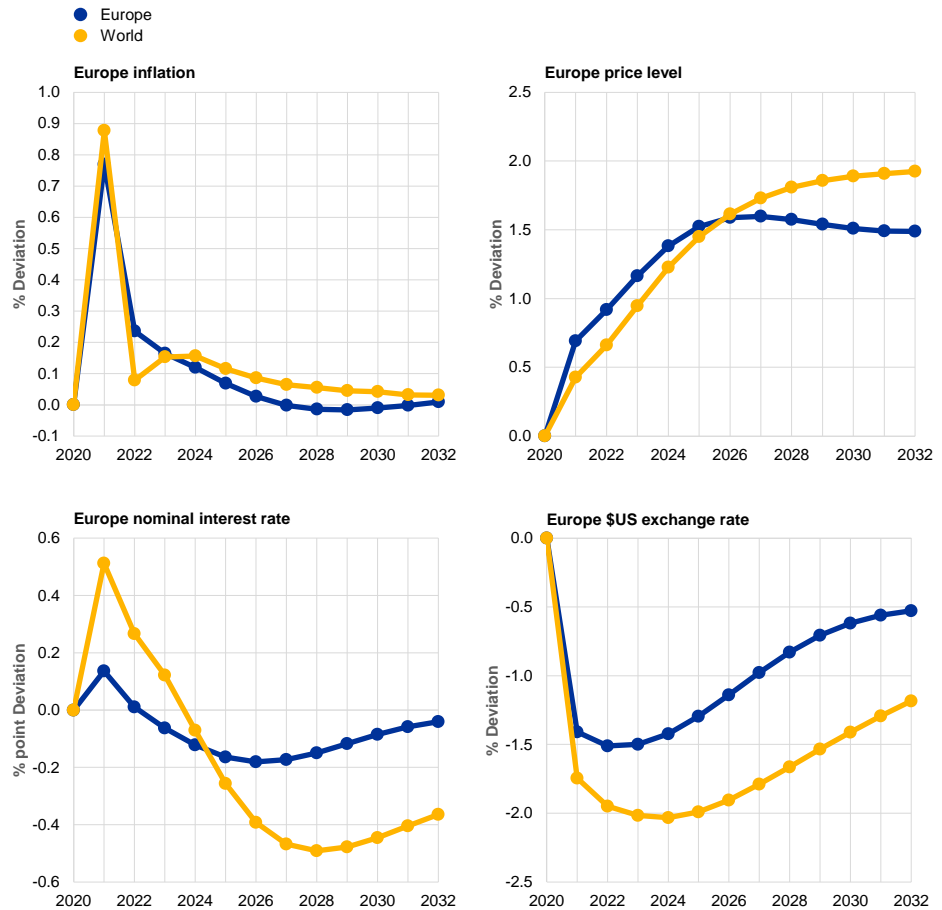
final goods and imported intermediate goods. The European terms of trade improve which raises income. Also, the relative loss of competitiveness of European exports is eliminated by the global policy. Thus, the decline in production at the sector level is reduced. Both consumption and investment in Europe are initially higher under the global policy compared to the Euro area-only policy.

The problem facing the ECB in the two policy scenarios is different. Inflation is slightly higher (Chart 13), but the output is initially higher under the global policy and lower under the Euro area only policy.

Chart 13

Euro area inflation, prices, interest rate and exchange rate effects under a Euro area versus a global carbon tax

(in percent deviation from baseline)



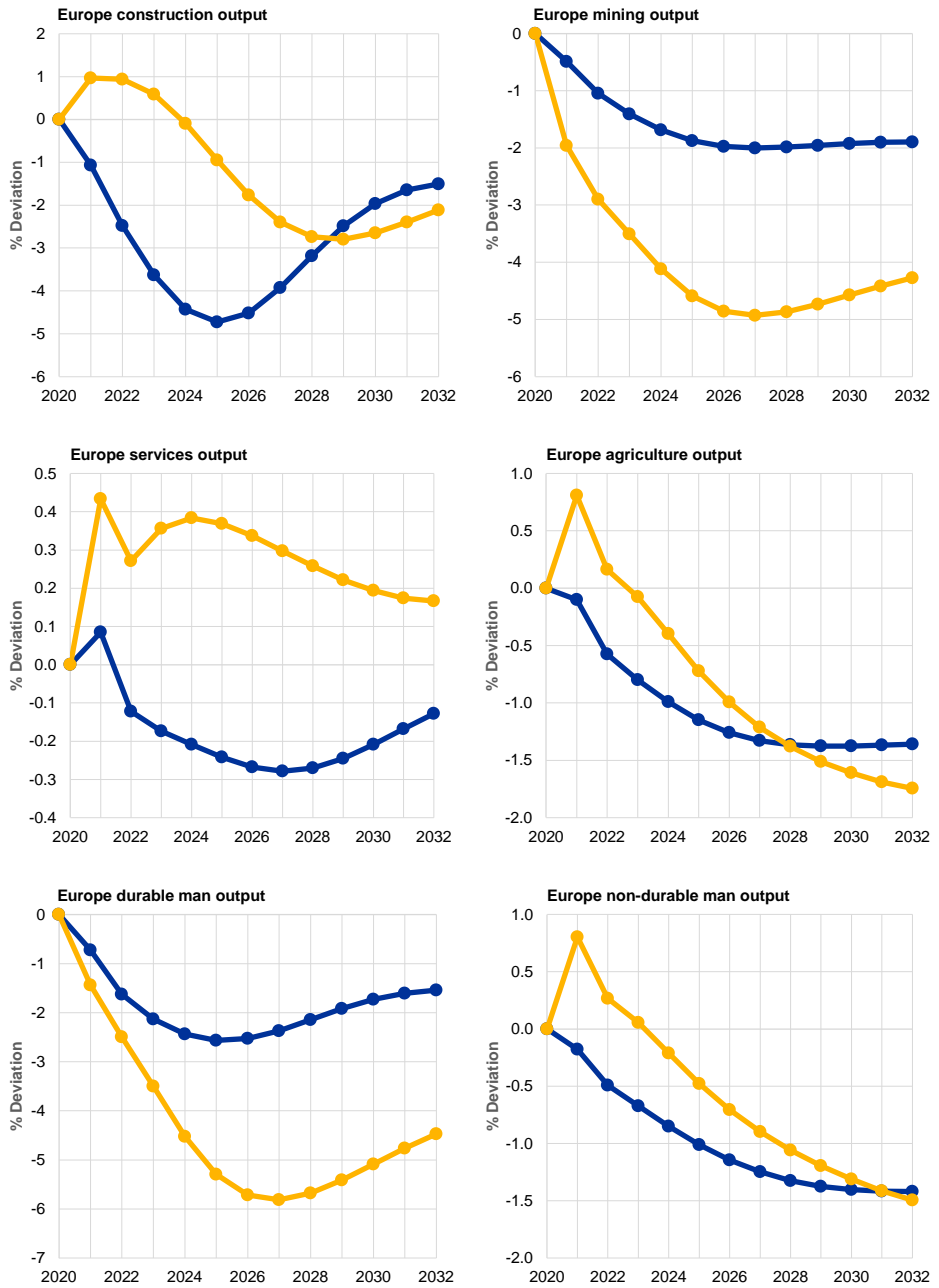
Source: G-Cubed Model Simulations (version GGG20N_v161).

Chart 14

Euro area sectoral output under a Euro area versus a global carbon tax

(in percent deviation from baseline)

- Europe tax
- World tax



Source: G-Cubed Model Simulations (version GGG20N_v161).

7 Summary and Conclusion

This paper explored the economic impact of physical climate risks and transition risks arising from a carbon tax for the Euro area economies.

We started by examining the historical effects of carbon pricing on output and inflation in the Euro area from 1985 to 2020. Compared to previous studies, this analysis considers a larger range of price indices, a longer period, and a narrower sample of countries consisting only of Euro area members. Nevertheless, broadly we find a similar pattern for the Euro area as in previous studies of Metcalf and Stock (2020) and Konradt and Weder di Mauro (2021). The effect of carbon taxation on GDP in the short run tends to be positive but imprecisely estimated. The short run effects on headline inflation are positive in the Euro area (while in larger samples they tend to be negative). Especially in the first two years after a tax introduction, we find that headline CPI and the HICP increased in some specifications by about 1 percent and 0.8 index points, respectively. After 3 years, inflation is contained. The impact on core inflation tended to be negative indicating that carbon taxes operated mostly by changing relative prices rather than affecting the overall price level, for a given monetary policy. Finally, we also find that producers have absorbed a part of the carbon tax since consumer prices increased less than producer prices.

We then proceed to examine the economy-wide and sectoral impacts of climate shocks and climate policies, in a new version of the global G-Cubed model, which focuses on the Euro area. We use this new model to explore physical climate risk (both underlying climate change and extreme climate events), transitional climate risk (through changes in climate policies), and climate policies applied only in the Euro area compared to a global policy response. We also explored the interaction of the climate shocks and the monetary policy regimes for the ECB, focusing on the degree of forward-lookingness of the monetary policy rule.

A first finding of the simulations is that the short run outcome from the various climate shocks depend significantly on the policy rule followed by the ECB. In particular, incorporating current and future information into the policy rule (which we call the modified Hartmann-Smets rule, MHS) leads to better inflation and output outcomes than a purely forward-looking rule. Future work could explore the results across these weights to search for optimal weights on current and future information. The optimal weights will likely vary depending on the nature of the economic shocks and the economy's structure.²⁰

Focusing on the MHS monetary policy rule, Table 6 provides the summary of our simulations across different shocks for a selection of Euro area macro variables (always relative to baseline), for the first year and the cumulative 10-year impact.

²⁰ See McKibbin and Sachs (1988) in the case of optimal simple exchange rate rules.

Table 6

Summary of G-Cubed simulations under the MHS rule, after 1 year and 10 years, relative to baseline

a) Effect after 1 year

Variable	Climate Shock	Euro area carbon tax	Global carbon tax
GDP	-0.41	-0.04	0.35
inflation	0.77	0.77	0.88
price level (CPI)	0.7	-0.69	0.43
trade balance	0.03	0.58	-1.34
real exchange rate	-0.28	-0.17	2.41
durable goods output	-1.04	-0.72	-1.44

b) Cumulative effect after 10 years

Variable	Climate Shock	Euro area carbon tax	Global carbon tax
GDP	-7.45	-6.99	-2.76
inflation	0.78	1.34	1.67
price level (CPI)	8.17	13.49	13.61
trade balance	0.31	4.25	-7.74
real exchange rate	-4.52	6.9	8.2
durable goods output	-18.35	-20.17	-44.94

Source: Own calculations

Notes: Table based on simulations using the MHS policy rule, in response to various shocks considered in chapters 4-6. Panel a shows the effect relative to the baseline scenario after 1 year, panel b shows the cumulative effect after a 10-year period (relative to baseline).

GDP declines in all cases with one notable exemption: in the short run we see a positive impact of a global carbon tax for Euro area output. The reason is that this triggers inflows of capital from highly impacted countries into the Euro area. However, this effect is not persistent: in the ten-year horizon GDP declines (relative to baseline) in the Euro area both for a European and a global carbon tax. Notice that the largest cumulative impact on GDP is found because of physical climate risks, not transition risks from carbon taxation. Thus, the climate shocks and climate policies tend to reduce the level of GDP relative to baseline (although it would still be higher than in 2020) and significantly reduce global investment with negative effects on durable goods manufacturing. Monetary policy can do little about this outcome. However, as shown in Jaumotte et al. (2021), using a slightly different version of the G-Cubed model, this result depends crucially on the assumptions of how carbon tax revenue is used. Recycling through a green infrastructure program may stimulate global investment and reverse this result. Clearly, there is need for greater research on coordinating monetary, climate and fiscal policies nationally and globally to deal with the climate transition at lowest economic cost. However, these findings also caution against “selling” a green transition as a growth program.

Inflation in the Euro area is contained in all shocks and the magnitude of the inflationary response is in line with our finding of the historical responses in the Euro area.

The Euro area trade balance and exchange rate respond very differently to a carbon tax if Europe acts unilaterally, compared with a global carbon tax. For the latter, the

Euro area receives capital inflows (because it is less impacted relative to other countries in a global climate policy package), leading to an appreciation of the exchange rate and a trade deficit. Conversely, in the European carbon tax scenario capital flows out causing a slight exchange rate depreciation and a trade surplus which improves competitiveness despite the rise in the price of carbon on input prices. This is interesting, because it provides a counter argument to the logic of a Carbon Border Adjustment Mechanism (CBAM) as a way to adjust for the competitiveness effects of European carbon policy.

Finally, the cumulative contraction of durable goods manufacturing output is quantitatively large in all scenarios. It is largest on the global carbon policy because there is a global decline in investment in fossil fuel energy use and in carbon intensive industries. This contraction is not offset by an expansion in renewable intensive industries. With global investment weaker, the durable goods industry in the Euro area faces weaker demand from domestic industries and weaker export demand for durable investment goods. With Euro economies (especially Germany) a large exporter of durable goods, this impact is notable. It again highlights the importance of the role of a global infrastructure package to accompany the carbon pricing package as a way to rebalance the sectoral impacts of climate policy.²¹

The new ECB focus on climate change is a welcome and important development. As already argued in the ECB review, this will require developing new and more complex economic models. This paper demonstrates that there is already a research stream that can explore the interaction of monetary policy, fiscal policy and climate change. However, a great deal more research in this area is still needed. As the models developed over coming years will necessarily become more complex because of the complexity of a climate transition, a particularly useful direction would be to support model comparison exercises following the strategies of the Stanford Energy Modeling Forum (Fawcett et al 2018) and the Brookings Model Comparison Project (Bryant et al 1993).

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²¹ See IMF (2020) and Jaumotte et al. (2021) for analysis of this issue.

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Discussion on the paper “Monetary policy and climate policies: implications for Europe” presented by Warwick McKibbin

By Anna Breman¹

Abstract

Within their mandate, central banks need to address the risks that climate change poses to price and financial stability. The paper by McKibbin et al. (2021) concerns risks to price stability. In these comments, I will make three main points. First, the authors advance the literature by showing, in a multi-sector model, some of the monetary policy trade-offs of climate-related shocks. Second, the authors evaluate the effects of both carbon taxes (transition risks) and extreme weather events (physical risks). It is important to disentangle these effects to better understand the policy implications of climate change. Third, future research should evaluate policy instruments other than the policy rate, in particular large-scale asset purchases and targeted lending. Finally, the paper illustrates, in a convincing way, that as the negative effects of climate change increase over time, central banks will need to prepare for difficult monetary policy trade-offs.

1 Introduction

Thank you very much for inviting me here today. And a warm thank you to Professor McKibbin and your co-authors Maximilian Konradt and Professor Beatrice Weder di Mauro for your research on climate change and monetary policy.

Climate change is ultimately a scientific question. To model the economic effects of climate change, we have to start with the physical science. I would therefore like to show you some results from the latest IPCC report. See Figure 1.

Climate scientists distinguish between warming of the “atmosphere, ocean and land” and its complex effects on the climate system (IPCC, 2021, p. 5)².

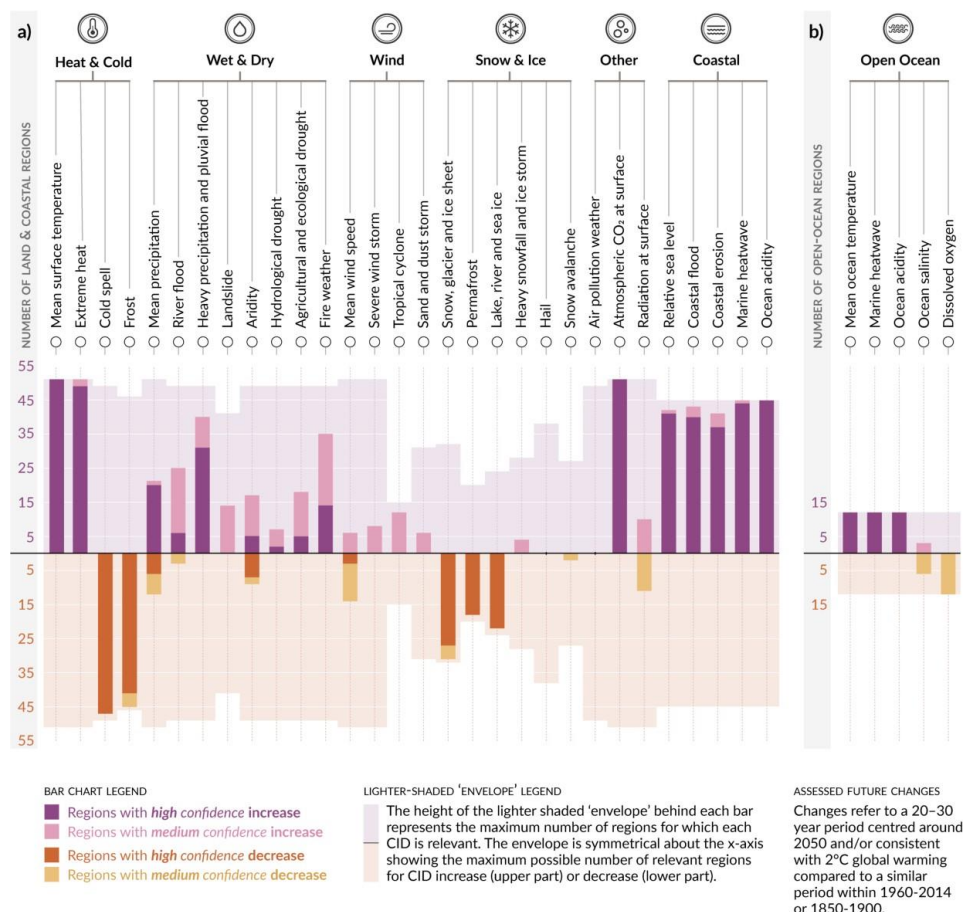
¹ Deputy Governor, Sveriges Riksbank. The author would like to thank Ulf Söderström, Daria Finocchiaro, Magnus Jonsson, Marianne Nessén and Emma Bylund for their comments during the preparation of these remarks.

² The IPCC report states that “It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred”.

In just the past few months, citizens of euro area countries have experienced extreme heat, flooding and fire. Climate scientists call these kinds of events climate impact drivers. In addition to the three events I just mentioned, the IPCC lists another 32 such climate impact drivers in their latest report.

Figure 1
Multiple climatic impact-drivers are projected to change in all regions of the world

Number of land & coastal regions (a) and open-ocean regions (b) where each climatic impact-driver (CID) is projected to increase or decrease with high confidence (dark shade) or medium confidence (light shade)



Sources: IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis, Cambridge University Press, p. 34 fig. 9.

Reading the latest IPCC report, what stands out is the multifaceted linkages between global warming and its impact on the climate. I therefore want to stress the many different channels through which climate change affects households and firms and therefore our economies.³

That is the physical science.

³ Two further results in the IPCC (2021) report that are important to highlight when considering the economic effects are the irreversible nature of the impacts: "many changes due to past and future greenhouse gas emissions are irreversible for centuries to millennia..." (p 28). And, the risk of tipping points: "abrupt responses and tipping points of the climate system ... cannot be ruled out (high confidence)" (p. 35).

The economic perspective on climate change is that it stems from the failure to put a price on a negative externality, the emission of greenhouse gases. The first best policy response is therefore to put a price on carbon, for example a tax, and this price should be global. Economists want climate policies to cause *a change in the relative price between goods and services that emit greenhouse gases and those that do not*.

Now, let us combine the physical science with economics.

2 Modelling the economic effects of climate change

Successful models should combine the complex changes in the climate system, with an economic model to estimate the effects on standard macro variables such as GDP, employment and inflation. The model should also include transition risks from climate policies such as carbon taxes.

Clearly, that is no easy task. But that is what professor McKibbin and co-authors have been asked to do in McKibbin et al. (2021).

Let us look at the research presented today.

The first empirical part of this paper looks at carbon taxes in the euro area. As I have already mentioned, the purpose of carbon taxes is to change relative prices. It is therefore encouraging that the empirical part of the paper finds that carbon taxes in the euro area have done exactly that, i.e., changed relative prices rather than the overall price level.

However, we should be careful in interpreting the results as indicative of future climate policy and its effect on inflation. First, the carbon taxes in this sample are likely low compared to the tax levels necessary to meet the commitments in the Paris agreement.

Second, they are local taxes, which means that consumers can substitute goods produced locally with imports from other countries with lower or no carbon taxes. A global tax on carbon would give less room for substitutions; while at the same time spur more innovation in green technology. The net effects on consumer prices are uncertain.

That is why we need a general equilibrium type of model with multiple sectors and multiple countries. That is the second part of McKibbin et al. (2021).

Let me highlight what I considered the most important contributions. I will do that from the perspective of a policy maker.

First, the model estimates the effects on variables relevant to central banks, in particular inflation, and it compares different monetary policy responses to climate-related shocks. That is novel. There is an urgent need for more research within this field.

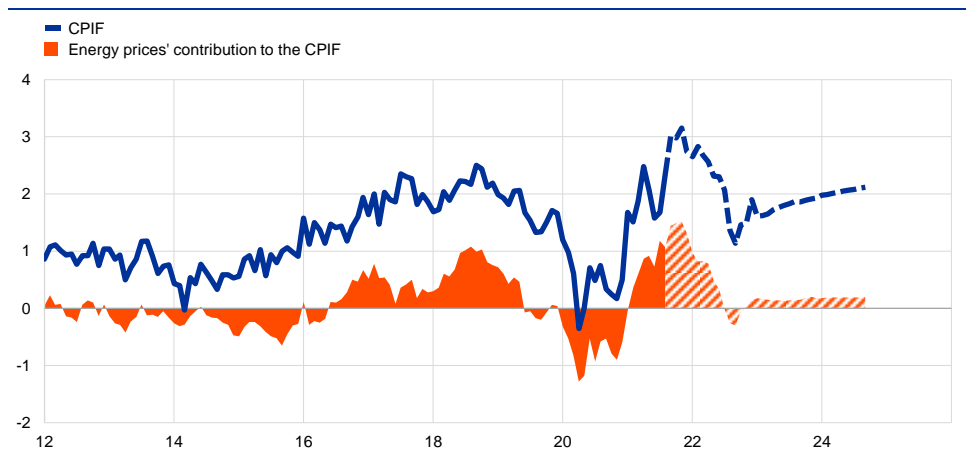
As always, there is room for further research and alternative models. I would like to see models that include policy tools that are currently used by both the ECB and the Riksbank, such as large-scale asset purchases, targeted lending and collateral policies.

Second, another important contribution in this paper is that, in modelling the physical risks, it incorporates both chronic climate risks such as sea-level rise, crop yield changes and extreme weather events. It takes the physical science seriously. Moreover, the model simulates both physical risks and transition risks. This is valuable as it allows us to disentangle the different effects from different types of shocks and compare the magnitude of the effects.

However, transition risks and physical risks are modelled separately. In reality, we face a near future with different climate-related shocks happening simultaneously. In further research, it would therefore be valuable to have models where different shocks interact.⁴

Let me give you an example to illustrate the challenges facing monetary policy makers when multiple shocks happen at the same time. I will use Swedish inflation data. Chart 1 shows the Riksbank’s preferred measure of inflation, the CPIF.

Chart 1
Consumer price inflation in Sweden and contribution of energy prices



Sources: Statistics Sweden and the Riksbank.
Notes: Annual percentage change and percentage points respectively. CPIF is the consumer price index with a fixed interest rate. The broken line and the striped area represent the Riksbank’s forecast from September 2021.

Between 2014 and 2019, we had a clear upward trend. Then the pandemic hit and we faced three shocks at more or less the same time; (1) a demand shocks due to the pandemic, (2) supply shocks also due to the pandemic, and (3) large swings in electricity prices due to a warm, windy and wet winter. We have a lot of hydropower and wind power and electricity prices therefore tend to vary depending on the amount

⁴ Not forgetting the importance of considering the economic impacts of tipping points such as the study by Dietza et al. (2021).

of rainfall and wind. In early 2020, electricity prices fell sharply at the same time as the coronavirus pandemic hit demand.⁵

In 2020 and 2021, inflation therefore first turned down sharply and then rebounded. As a result, in a year and a half, we have had more volatility in inflation than in the six years prior to the crisis. Our current forecast is that inflation will continue to rise and volatility will remain high. As is shown in the chart, the single largest contributing factor to volatility (and to both high and low inflation) has been energy prices. And in the case of Sweden, this is mainly due to weather-related impacts on electricity prices rather than changes in international oil and gas prices. They do impact energy prices, but in this period less so than domestically driven changes in electricity prices.

My main point is that, in real time, it is difficult to distinguish between a relative price change and an overall increase in the price level. As a result, it will be difficult, when we face multiple shocks at the same time, to accurately forecast *the persistence of the shock, its second round effects and its effect on inflation expectations*.

This is important when we consider the type of shocks that we are likely to face from climate change.

3 Climate change and the monetary policy response

Let me come back to the effects of climate change and its impact on price stability and the monetary policy response. I agree with the conclusions in McKibbin et al. (2021). We should not tighten monetary policy if we face transitory shocks from for example carbon prices or extreme weather events. And, we should focus on core measures of prices rather than headline inflation when determining the appropriate monetary policy response to changes in inflation.

However, importantly, we will face difficult trade-offs in setting monetary policy when facing more frequent shocks to inflation as the effects of climate change increase over time.

Here are therefore my final comments on this paper as a policy maker.

The results in McKibbin et al. (2021) point to larger effects from physical risks than from transition risks. Let me give you some more evidence on physical risks, more precisely extreme weather events, and their effect on inflation. There is not much empirical research on this topic, but there are some papers and the results show similar effects.

Empirical research shows that extreme weather events already have significant effects on inflation. The largest effect on inflation comes from increases in food and energy prices. As such, it causes substantial differences between headline and core inflation. Heinen et al (2019), Peersman (2018) as well as the paper by Parker (2018),

⁵ In addition, measurement problems due to the pandemic also exerted downward pressure on inflation in 2020.

find effects in developing countries, while a recent paper by Kim et al (2021) finds significant effects on inflation in the United States.⁶

Just from this example, here are three challenges facing us policy makers.

The first one I have already mentioned. In real time, it is difficult to distinguish between a relative price change and an overall increase in the price level.

Second, high volatility in prices, such as food and energy prices, makes forecasting more difficult and increases the risk of policy mistakes. It extends the time before we can accurately adjust policy to meet an inflationary or deflationary trend. And sometimes, we may act when the best response is to do nothing.

Third, we can face a credibility problem vis-à-vis households and firms. Households and firms tend to form inflation expectations from changes in prices of goods that are salient (see e.g., D'Acunto et al 2021; Mackowiak et al 2009). Food and energy prices are such items. If we see substantial volatility in food and energy prices, but central banks stress core prices, it can cause a large discrepancy between household inflation expectations and central bank communication. That can severely hurt credibility. Inflation expectations risk becoming unanchored.

4 Concluding remarks

Let me conclude. Monetary policy and climate policies: what are the implications for Europe? Should central banks care about climate change?

First, empirical research shows that climate change is already a threat to price stability. Food and energy prices are likely to be the main drivers for the effects on inflation.

Second, we need to model, analyse and prepare for difficult trade-offs in setting monetary policy.

Third, central banks have an obligation to consider the risks that climate change poses to our economies and act in accordance with our individual mandates.

But, exactly how we should do that – and whether we should adjust our policy tools to also combat climate change⁷ - I will leave that for our discussion.

⁶ Parker (2018) finds significant effects from extreme weather events in developing countries but not in advanced economies. The paper by Kim et al. (2021) shows that – in a data sample that cover the past six decades – there are no significant effects from extreme weather on inflation in the United States in the early parts of the sample, but that there is a significant effect in more recent years as extreme weather events have become both more frequent and more severe.

⁷ See e.g., Breman (2020); Elderson (2021), Ceuore (2018), ECB (2021), Drudi et al. (2021), Lagarde (2021), Schnabel (2020a, 2020b).

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Should inequality be a concern for monetary policy?

By Juan J. Dolado¹

Abstract

In contrast to the widespread view that only monetary policy tightening leads to higher inequality, this note argues that softer monetary policy could also widen disparities in labour earnings at business cycle frequencies. In particular, it points out that both capital-skill complementarity in production and asymmetric search and matching frictions among workers with different skills introduce a dynamic demand amplification effect favouring high-skilled workers. In effect, following an unexpected cut in the policy rate, the rise in investment demand for some types of capital goods (like equipment or ICT) increases labour demand for high-skilled workers which in turn makes complementary capital more productive, encouraging a further rise in investment demand and the skill premium. This mechanism gives rise to a multiplier loop which is magnified by asymmetric labour market frictions.

1 Why is there a growing interest on this issue?

Widening inequality in income and wealth has been the subject of extensive academic and public debates over the last decades, mainly pointing to long-term trends driven by technological progress, demographic changes, capital taxation and globalization. Yet, following the uneven recovery from the Great Recession and its subsequent deterioration during the pandemic crisis, questions have been raised about the role of stabilization policies (other than fiscal policy) in generating higher inequality. Specifically, one of the issues that has attracted growing attention is how monetary policy (MP in short), both in its conventional and unconventional formats, affects inequality at higher (business cycle) frequencies.

Research on MP design has not remained passive in the face of these concerns. The growing influence of micro level heterogeneity (HANK, the acronym for Heterogenous Agents in New Keynesian models) and search and matching (SAM) frictions on macro modelling have brought inequality to centre stage. These new modelling strategies, while retaining nominal rigidities, have replaced the prevailing representative-agent assumption by heterogeneous households who face uninsurable earnings risk.² As a result, calibration and simulation of HANK plus SAM models have pointed to inequality

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² See, *inter alia*, Kaplan et al. (2018) and Ravn and Sterk (2021).

in income, wealth, and consumption as key determinants and outcomes in the analysis of how aggregate variables respond to alternative MP actions.³

Two contrasting views prevail on whether inequality should be a concern for MP actions. On the one hand, there are those who interpret distributional issues as *side effects* of central banks' policies aimed at stabilizing the economy (see Bernanke, 2015, and Draghi, 2016). Accordingly, MP should best contribute to social welfare by promoting aggregate stability in terms of inflation and output fluctuations, which in turn would be beneficial from an inequality perspective. On the other hand, in line with the above-mentioned methodological contributions, there are those who argue that taking distributional effects into account in MP implementation not only matters for its optimal design but also because it interacts in relevant ways with the different channels of the MP transmission mechanism. Advocates of this view have often argued that contractionary MP shocks are the only ones that systematically increase inequality, as rising unemployment falls disproportionately on low-income households (see, e.g. Coibion et al., 2017). However, given the complex and uncertain links between MP and inequality, there has been a second stream within this literature stressing that an expansionary MP stance-- like the one adopted by most central banks since the global financial crisis-- could also worsen inequality. The standard argument is that an unexpected cut in the policy rate or quantitative easing raise stock prices and these assets are disproportionately held by the wealthy. However, younger households tend to hold more interest-sensitive liabilities, while older households, typically richer, tend to hold more interest-sensitive assets, so that inequality is likely to drop on this count.

Since the final effect of looser MP on income inequality is ambiguous, my goal in this note is to review other underlying channels which are less debatable. In particular, my discussion will focus on a plausible mechanism that leads to the seemingly paradoxical result that expansionary MP could widen inequality. As argued below, this channel works through the existence of capital-skill complementarity in production and asymmetric search and matching frictions among workers with different skills.

2 Transmission channels of monetary policy to inequality

A useful starting point to discussing these issues is to briefly review the main channels through which softer MP may affect inequality. To do so, let us consider a surprise reduction in the policy rate. Then, the following mechanisms shed light on the distributional effects of systematic differences in households' and firms' exposure to this type of expansionary MP shock.

- **Savings-redistribution channel:** such a shock would benefit debtors and hurt creditors, depending on the maturities of their assets and liabilities. Since borrowers are generally poorer than lenders, this channel often implies that easier MP reduces inequality.

³ For example, the recently released ECB Work Stream Report on Employment (2021) devotes one its main sections to the role of employment heterogeneity for the conduct of MP.

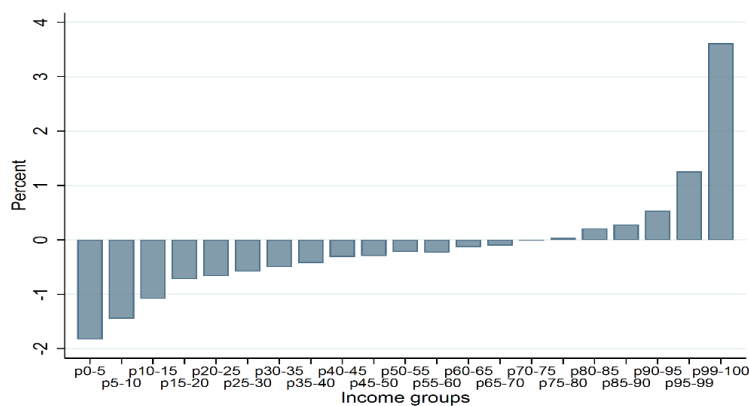
- **Interest-sensitivity channel:** a reduction in the interest rate would lead to an increase in asset prices, which typically favours the richer, as well as to higher inflation, which is likely to hurt the poorer as they rely relatively more on cash in their transactions. As a result, inequality is bound to rise.
- **Household / firms- heterogeneity channel:** an expansionary MP stance favours access to financial markets of liquidity-constrained households and small young firms, as well as benefits holders of flexible mortgages. Thus, according to this channel, inequality is likely to be reduced.
- **Income-composition channel:** the aggregate demand expansion driven by monetary loosening can affect wages, profits and transfers in different ways, depending on how labour and product-markets regulations operate. Therefore, this channel predicts an ambiguous effect of MP on inequality.
- **Labour earnings-heterogeneity channel:** there is heterogeneity in the way that wages and employment rates of workers with different skills and occupations respond to a looser MP stance. The evidence points out that the high-skilled benefit the most, so that labour income inequality is likely to widen.

Estimating the joint effect of all the previous channels linking expansionary MP with changes in income and wealth inequality becomes difficult in the absence of granular information about the different components of households' disposable income. Fortunately, the availability of this type of data in some Nordic countries has made it possible to obtain conclusive empirical evidence on the signs of these different effects. A nice example is the recent study by Andersen et al. (2020) which uses individual tax record and balance sheets covering the entire adult population in Denmark over the period 1987-2014. By exploiting the historical currency peg between the Danish krone and the euro as a source of exogenous variation in MP, these authors are able to compute the gain in disposable income for each household over a two-year horizon in a counterfactual scenario where the policy rate is lowered by one percentage point.

Chart 1 depicts the percentage difference between the counterfactual shares and the actual shares of aggregate disposable income across the ex-ante income percentiles. As can be seen, there is a positive income gradient in the distributional effects: the share of disposable income at the upper tail of the distribution increases by 3.5 %, while the corresponding share at the bottom of the distribution falls by almost 2%. In other words, while disposable income increases for all income groups when MP becomes looser, the gains are much larger for high-income than for low-income households. Hence, this compelling evidence illustrates how the distribution of disposable income becomes more unequal as a result of the differences across income groups in the exposure to the above-mentioned direct and indirect channels of MP, providing some support for the theoretical arguments developed in this note.

Chart 1

Two-year changes in income shares for a 1 pp. cut in interest rates



Sources: Andersen et al. (2021).

Notes: This Figure shows the simulated percentage change in the share of total disposable income for each income group following a one percentage point cut in the policy rate.

Although part of the explanation for the previous findings relies on the heterogeneous effects of softer monetary policy on asset values, through changes in property prices and stock prices (benefiting households with higher incomes), the response of labour incomes of workers with different skills could also be a relevant driver of the observed positive gradient.

3 Inequality in labour earnings: an alternative channel

Regarding changes in labour income, Dolado et al. (2021) provides an alternative channel rationalizing how an unexpected cut in policy rates could disproportionately raise the relative labour income share for high-skilled (HS) workers, who are better off to start with, vis-à-vis less-skilled (LS) workers. This effect is driven by a higher increase in the wages and employment rates of HS-workers than for LS-workers, resulting from the following two mechanisms:

- **Capital-skill complementarity (CSC)** embedded in the production structure. The basic insight is that higher investment, driven by lower interest-rates, increases the stock of capital equipment, which is a *complementary* factor of HS-labour. This means that it increases the marginal product of this kind of workers, pushing their labour incomes above their steady-state values. By contrast, capital equipment becomes a *substitute* factor for LS-workers, slowing therefore the growth of their labour earnings. For instance, replacing the conventional Cobb-Douglas (CD) production function used in the intermediate-goods sectors in New-Keynesian macro models by the KORV production function proposed by Krusell et al. (2000) allows to account for this relevant feature. In effect, CSC is captured by the elasticity of substitution between HS-labour and capital being below unity (making them complements), while it is well above unity between LS-labour and capital (making them substitutes).

- **Asymmetric search and matching frictions (ASAM)** in the labour market. The argument here is that HS-workers are subject to less frictions than LS-workers by exhibiting lower separation rates and higher matching efficiency. The insight is that the latter can only undertake simple tasks while the former can search for both simple and complex vacancies, being therefore more easily matched. Moreover, H-workers are more indispensable to produce output with complementary capital. This translates into higher bargaining power which leads to higher wages when production expands as a result of looser MP.

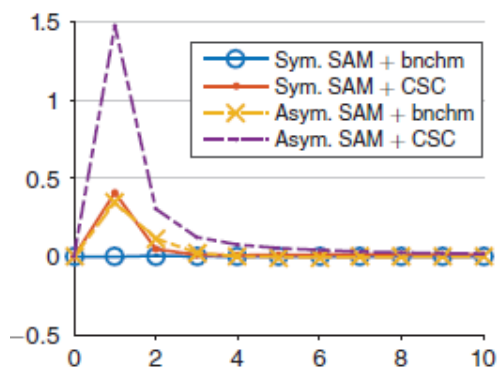
Under these circumstances, the rise in investment and other aggregate demand components following an expansionary MP shock leads to an initial increase in labour demand for more fluid HS-workers, which in turn makes complementary capital equipment more profitable. This encourages a further increase in investment demand which creates additional labour demand pressures for HS-workers, who enjoy higher employment rates and wages, and so on. Thus, CSC creates a *dynamic amplification effect* (i.e. a multiplier loop) which is absent in New-Keynesian models with standard Cobb-Douglas production functions in which this feature is missing. Note that this multiplier loop effect is magnified under ASAM, since the presence of lower frictions for HS-workers provides an additional source of initial imbalance in relative labour demand which interacts with higher aggregate demand pressures.

The main implication of introducing these two features in models with price stickiness is that the interaction of CSC with ASAM leads to a more substantial rise in labour income inequality than the sum of the channels alone. To illustrate this effect, Dolado et al (2021) calibrate the parameters of the model to reproduce pre- Great Recession macroeconomic and labour market averages in the United States for HS workers (those with some college), LS workers (the rest) and entrepreneurs. Then, they proceed to simulate the dynamic response of the relative labour income shares (i.e. the skill premium times the relative employment rates) to an expansionary MP shock (a one percentage cut in the annualized federal-funds rate, FFR).

Chart 2 above plots the impulse response functions (IRFs) of this simulation exercise under four alternative scenarios involving: (i) symmetric SAM and a (benchmark) Cobb-Douglas production function, (ii) only CSC, (iii) only ASAM, and (iv) CSC and ASAM together. As can be inspected, the interaction between both features has a larger combined effect (a rise in relative labour income between of HS and LS of 1.5 percent) under scenario (iv) is larger than the sum of each of the features alone under scenarios (ii) and (iii) (a rise a 0.4 percent each). This simulated effect is arguably modest but not negligible: its contribution to the variance of labour earnings inequality is close to 10 percent at horizons shorter than 3 years.

Chart 2

Effects of CSC and ASAM on relative labour income between high and less-skilled workers after an unexpected 1 pp. cut in the annualized policy rate.



Sources: Dolado et al. (2021).

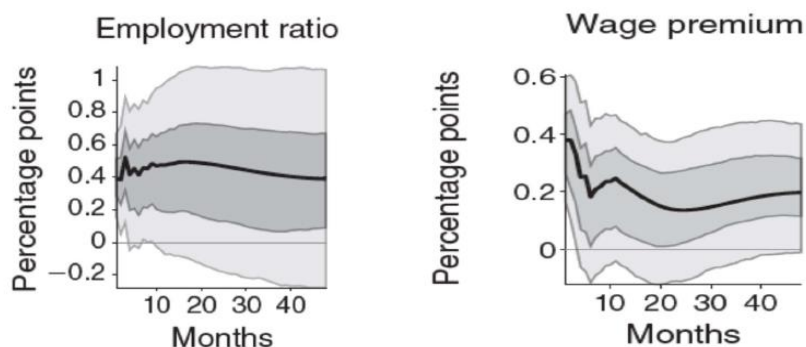
Notes: This Figure shows the IRFs of the relative labour income of high-skilled vs. low-skilled workers following a one percentage point cut in the Federal Funds rate under the four scenarios discussed in the main text. The vertical axis measures percent changes while the horizontal axis represents quarters.

It is interesting to note that the previous findings are not specific to an expansionary MP shock but also apply to other favourable aggregate demand shocks. Yet, softer MP is likely to have larger quantitative effects. This is due to their relatively more favourable impact on capital demand, which plays a key role in the CSC channel, compared to, say, government expenditure or discount factor shocks which, in contrast to MP shocks, tend to crowd out private investment.

Finally, these theoretical results find empirical support in a SVAR model for the U.S. using aggregate and sectoral monthly data over the period 1980-2007, including inflation and unemployment rates, separate employment rates and hourly wages for HS and LS-workers and the FFR. The dynamic effects of an expansionary monetary shock (a surprise cut of one percentage rate in the annualized FFR) on the two components of the relative income shares (skill premium and relative employment rates) are identified via an IV-SVAR approach using the narrative series shocks provided by Wieland and Yang (2020) as an instrument for the true shocks in the FFR. Chart 3 displays the point estimates and percent confidence intervals (68% and 95%) for the two IRFs, showing that, in line with the simulation results, both the skill premium and the relative employment rates between HS and LS-workers increase by about 0.4 percentage points and remain higher for almost three years.

Chart 3

IRFs of the skill premium and relative employment rates to an unexpected 1 pp.cut in the FFR



Sources Dolado et al. (2021).

Notes: This Figure shows the IRFs of the employment ratio between high-skilled vs. low-skilled workers and their wage differential following an unexpected one percentage point cut in the FFR in an IV-SVAR model including seven variables at monthly frequencies (the overall unemployment rate, the log of real wages for high and less-skilled workers, the relative employment rate, CPI inflation, and the FFR). Narrative/ Greenbook shocks as the instrument to identify FFR shocks.

Although, for simplicity, the previous mechanism has been laid out in a setting with only two types of labour, it can be easily extended to many more types. In particular, a similar reasoning applies to the *task-based* models advocated by Acemoglu and Restrepo (2018) to capture the job polarization phenomenon in advanced economies. As it is well known, following the rapid increase in AI and robotics investment, the wages and employment shares of workers exerting routine jobs is rapidly declining while hiring and wages in non-routine and abstract jobs is increasing, leading to new forms of inequality.

Moreover, the fact that the labour market of routine jobs (clerical and plant production occupations) is less *fluid* than the labour market of non-routine and abstract jobs (professionals, managers, and personal services) also has implications for another stylized feature of the euro area labour markets discussed in this panel, namely, the flattening of the price Phillips curve since the mid-2000s. For example, Siena and Zago (2021) show that an increase in the *fluidity* of the labour market (easier relocation across jobs resulting from higher separation and hiring rates) results in a flatter price Phillips Curve, which is consistent with the empirical evidence available on this issue and it implies an important fact for MP strategies, especially in light of rising job polarization.

4 Concluding remarks

Despite benefiting debtors, the unemployed, and homeowners with flexible mortgages, the paths followed by capital and labour earnings in the face of an expansionary MP shock could be quite different. The distribution of gains and losses is crucial for several reasons. Besides mattering for the direct and indirect channels through which MP operates (i.e. different marginal propensities to consume, precautionary saving in the face of uninsurable idiosyncratic risk, etc.), it defines how MP affects inequality. In my previous remarks, I have argued that both the way

technology interacts with the fortunes of workers of different skills, via higher investment in capital equipment and ICT and the existence of different labour-market frictions, could be behind widening labour-earnings inequality in the short run. It leads to an amplification effect that favours HS-workers vs. LS-workers due to the more skill-intensive production structures (CSC) and the lower frictions experienced by the former (ASAM). This translates into higher labour earnings for HS-workers which, added to the high concentration of gains in the form of higher business income and stock market income at the top of the income distribution, may explain a substantial part of the positive income gradient resulting from softer MP which has been documented in the literature.

These arguments should not be necessarily taken as implying that central banks should consider reacting to measures of inequality, which are better dealt with by fiscal and education policies. However, it is worth being aware of the potential distributional consequences of MP actions at business cycle frequencies which could be dampened by medium-term inflation targeting rules aimed at stabilizing demand fluctuations.

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How to measure labor market slack? Worker heterogeneity and monetary policy

By Antonella Trigari¹

Abstract

Measures of labor market underutilization are a key input to monetary policy. We emphasize a new measure of labor market slack that encompasses all margins of unmet demand for labor and weights job seekers by their effective search intensities. The importance of accounting for search intensities is illustrated through a narrative of U.S. versus Euro Area unemployment rates at the onset of the Covid recession. We construct an effective job seekers rate for the Euro Area, along the lines of Abraham, Haltiwanger and Rendell (2020), and emphasize specific institutional aspects of European labor markets. We find that the effective job seekers rate is less volatile than the unemployment rate and, importantly, that it conveys distinct information about cyclical dynamics of labor market slack. We conclude with some tentative considerations regarding the relation between our measures of labor market slack and measures of inequality, and the implications of this relation for the new monetary policy trade-offs that arise in presence of inequality.

1 Introduction

Measures of labor market slack are a key input to monetary policy, for two reasons. First, they constitute an indicator of demand-related inflationary (or deflationary) pressures. For instance, a tight labor market - one in which many jobs are available and few workers are searching for jobs - will put upward pressures on current (and expected) wages and production costs, in turn a crucial determinant of price inflation. Second, measures of slack permit to assess the cyclical position of the economy. In the context of the ECB's medium-term perspective on price stability, this is central to manage the trade-off that arises when adverse supply shocks move inflation and real activity in opposite directions. Indeed, managing this trade-off means assessing whether short-run inflationary pressures are "acceptable" given the state of the labor market and the broader economy.

Historically, policymakers and academics have focused on the unemployment rate as their primary measure of underutilization in labor markets. Yet, the unemployed are not the only group who searches for jobs. The existence of large observed flows from

¹ Bocconi University, IGIER and CEPR. Many thanks to Nicolò Gnoco for superb research assistance and to Davide Debortoli for insightful discussions while preparing these remarks.

both non-participation to employment, and from employment to employment, suggests that many job seekers are actually out of the labor force or are already employed. Put differently, the unemployment rate does not capture all margins of unmet demand for labor.

Also, the pool of job seekers is heterogeneous. For instance, despite wanting a job, some individuals may reduce the intensity of their job search due to discouragement. All else equal, these marginally attached workers have a lower likelihood to find jobs than those who meet the official definition of unemployment (as they have looked for work in the past four weeks). The unemployed themselves are heterogeneous along several dimensions, including history (e.g., by reason of unemployment) or duration of their unemployment spell (with the long-term unemployed having a lower job finding rate than the short-term unemployed).

Existing alternative measures to the unemployment rate do account for additional margins of labor market underutilization. For example, the U4 measure also counts discouraged workers, U5 considers all marginally attached workers, and U6 further adds the involuntary part-time. However, these simple counts of the number of job seekers effectively assign the same weight to all searchers and thus fail to capture their heterogeneous propensities to search for work. Conceptually, an ideal measure of labor market slack should encompass all job seekers, but also account for differences in their effective labor supply. Abraham, Haltiwanger and Rendell (2020) construct one such measure for the US economy.

1.1 A tale of two unemployment rates: US vs. EA during Covid

To demonstrate the importance of accounting for search intensities, we compare the evolution of the unemployment rate in the U.S. and in the Euro Area at the onset of the Covid crisis. The top panel of Chart 1 plots the US official unemployment rate against the Euro Area rate, at quarterly frequency. In the U.S., unemployment rose from 3.5 percent in February 2020 to an unprecedented 14.8 percent in April 2020. Instead, Euro area unemployment only rose by 1.5 percentage points, from 7.1 percent in March 2020 to 8.6 percent in April 2020.

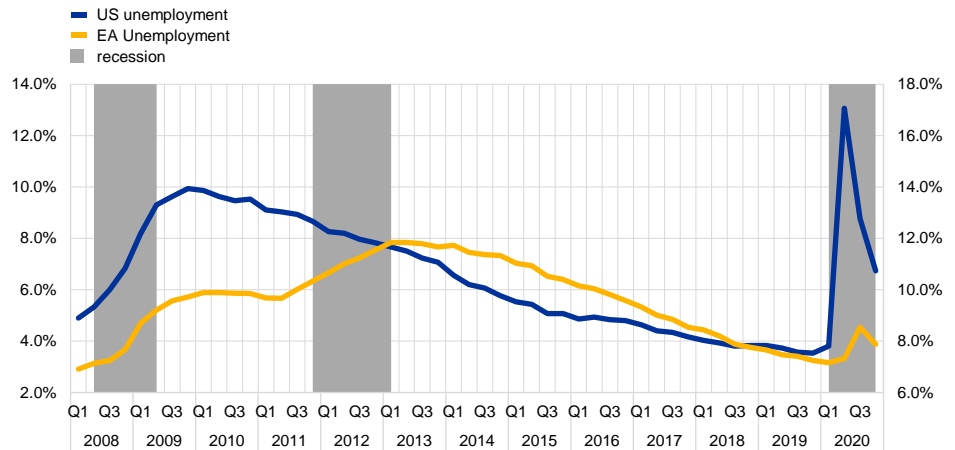
The main reason why the unemployment rate has behaved so differently in the two geographical areas is the distinct way in which official statistics report workers on temporary layoff: as employed, but absent from work in the Euro Area; as unemployed on temporary layoff in the U.S.² Effectively, temporary layoffs are assigned a weight zero in Euro Area unemployment (as if their search intensity were zero) and a weight one in U.S. unemployment (as if their search intensity were equal to that of other “permanently” unemployed, i.e., workers with no option to go back to a previous job).

² Workers in the Euro Area are classified as temporarily laid off if they are absent from work with an assurance of return to work within 3 months, and receiving at least 50 percent of salary. In the U.S., unemployed on temporary layoff are people who have been given a date to return to work or who expect to return to work within 6 months.

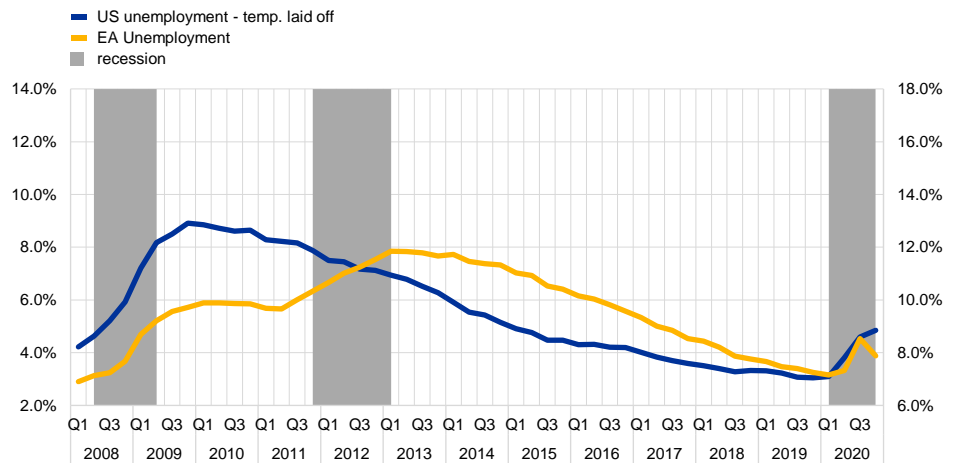
Chart 1 US and EA unemployment rates

a) Officially reported unemployment rates

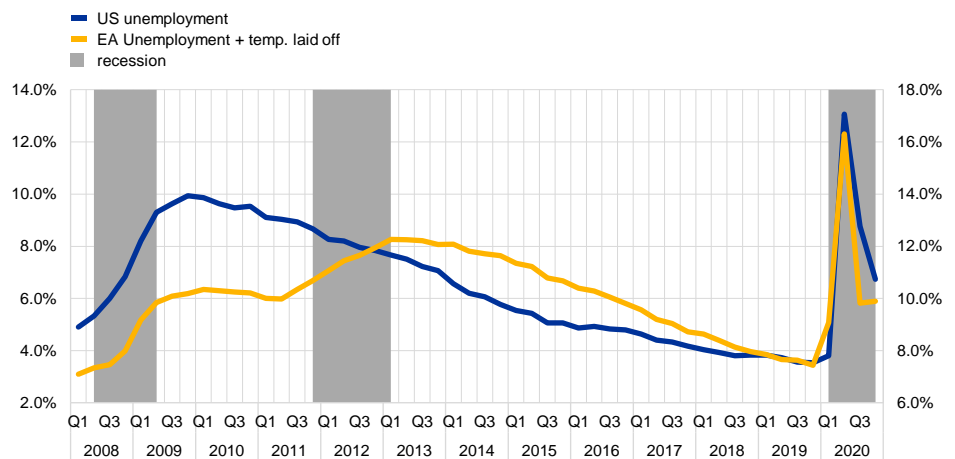
(percentage of the labor force. Left axis: US unemployment; right axis: EA unemployment)



b) Officially reported unemployment rates removing US temporarily laid off unemployed



c) Officially reported unemployment rates adding EA temporarily laid off workers



Sources: Eurostat, BLS, and author's calculations.

The construction of counterfactual unemployment rates that either do not count temporary layoffs (as in the middle panel of Chart 1, where temporary layoffs are subtracted from US unemployment) or that do count them (as in the bottom panel, where temporary layoffs are added to the Euro Area unemployment), makes the increase in the unemployment rate in the two areas remarkably similar. On a quarterly basis, the unemployment rate in both the U.S. and the Euro Area either increases by around 10 percentage points when temporary layoffs are counted in, or by around 1.5 percentage points when they are not.

The key takeaway from this comparison, however, is that neither approach is likely to be appropriate. The proper way to factor in temporary layoffs in a measure of slack should be according to their effective intensity to search for *other* jobs. This search intensity is likely different from zero, but certainly well below that of other unemployed workers who have no option to resume their previous job.³

2 Constructing a measure of effective job seekers rate

Abraham et al. (2020) construct a synthetic measure of effective job seekers for the US economy, as follows:

$$S_t = \sum_i \rho_t^i S_t^i,$$

where S_t^i is the number of job seekers of type i , and ρ_t^i is the search intensity of job seekers of type i .

The major challenge is obtaining a measure of search intensities. While different approaches have been adopted in the literature, Abraham et al. (2020) infer search intensities from ex-post outcomes. Building on Hall and Schulhofer-Wohl (2018), they assume that differences in job finding rates only arise due to differences in search intensities, so that variations in relative job finding rates across different groups of searchers can be interpreted as variations in relative search intensities. They then use CPS data to track flows to employment by initial state, while also controlling for demographic characteristics. Their baseline measure of effective job seekers weights each group of job seekers by its base-period relative transition rate to employment (relative to the group with the highest job finding rate).

Abraham et al. (2020) estimate relative job finding rates for 22 groups: 13 among the unemployed, 7 among the nonparticipants, and 2 among the employed. Their results indicate that there is a wide variation in employment probabilities by initial status. For instance, in 2010 discouraged workers were on average 80 percent less likely to find a job compared to recently temporarily laid off workers, which they take as their benchmark category as they exhibit the highest job finding rate (51.8 percent).⁴

³ Unfortunately, transition rates of temporarily laid off workers to other jobs are not available in the LFS-based data disseminated by Eurostat.

⁴ We note that their measure of the job finding rate for temporary layoffs includes transitions back to their previous job, i.e., recalls.

2.1 A (very rough) measure of effective job seekers in the Euro Area

In the same spirit of Abraham et al. (2020), we construct an (admittedly rough) measure of effective job seekers for the Euro Area, for the period 2006Q1-2021Q1.

From the supplementary indicators to unemployment made available by Eurostat, we take the following indicators of marginally attached individuals, available starting 2006Q1: persons seeking work but not immediately available, and persons available to work but not seeking. We pool other nonparticipants into one residual category. We also distinguish between the long-term and the short-term unemployed, using data on unemployment by duration. Finally, we consider one single group of employed workers.

Importantly, Eurostat makes available LFS-based transition rates that are consistent with the classification of labor market states just described. We use relative transition rates to employment by initial state as weights in the construction of a Euro Area measure of effective job seekers.⁵

Specifically, we compute effective job seekers as follows:

$$S_t = \underbrace{\rho^{ST} U_t^{ST} + \rho^{LT} U_t^{LT}}_{\text{Unemployed, } U_t} + \underbrace{\rho^{SNA} N_t^{SNA} + \rho^{ANS} N_t^{ANS} + \rho^{ONP} N_t^{ONP}}_{\text{Nonparticipants, } N_t} + \underbrace{\rho^E E_t}_{\text{Employed, } E_t},$$

where U^{ST} is the number of short-term unemployed, U^{LT} that of long-term unemployed, N^{SNA} is the number of persons seeking work but not immediately available, N^{ANS} the number of persons available to work but not seeking, N^{ONP} that of other nonparticipants, and E the number of employed workers; and where the corresponding weights are computed to be:

$$\rho^{ST} = 1, \quad \rho^{LT} = 0.41, \quad \rho^{SNA} = 0.38, \quad \rho^{ANS} = 0.27, \quad \rho^{ONP} = 0.11, \quad \rho^E = 0.11,$$

where ρ^{ST} is normalised to 1, being the short-term unemployed the group with the highest job-finding rate in our data.

Finally, we compute a *rate* of effective job seekers by expressing S_t as a share of the working-age population:

$$s_t = \frac{S_t}{U_t + N_t + E_t}$$

Before illustrating the properties of the Euro Area job seekers rate, we briefly discuss a few caveats associated to its construction and in line with refinements we are currently pursuing in ongoing research. First, time aggregation issues need to be addressed when measuring the transition rates. Second, more narrowly defined job seekers groups are needed to capture specific institutional features of European labor markets. This is especially true for the group of employed workers that pools together,

⁵ The transition rates reported by Eurostat are annual averages of quarterly rates. These are available from 2011 onwards, and only for some Euro Area countries, including France and Italy among the largest Euro Area economies, but not Germany. The available countries account for between 50 percent to 95 percent of the Euro Area aggregates, depending on the margin considered. To obtain Euro Area transition rates, we aggregate according to the corresponding margin share in the aggregate. The resulting job finding rates do not display clear trends over time. Hence, we simply take their average over the available sample.

for example, workers with open-ended and fixed-term contracts—who presumably have very diverse propensities to search—as well as workers on short-time work schemes or on temporary layoff—whose search intensity is likely very different from that of other employed workers, as previously discussed. While LFS-based transition rates from Eurostat are not available for these separate margins, accounting for them is potentially important in light of the marked duality of European labor markets and the pervasive use of job retention schemes.

2.1.1 The effective job seekers rate is less volatile than the unemployment rate

Chart 2 plots the effective job seekers rate against the official unemployment rate. The scales are shifted so as to align the mean of the two series and facilitate the comparison. (Note that we do not normalize the series at some specific date, as this would alter their relative volatilities).

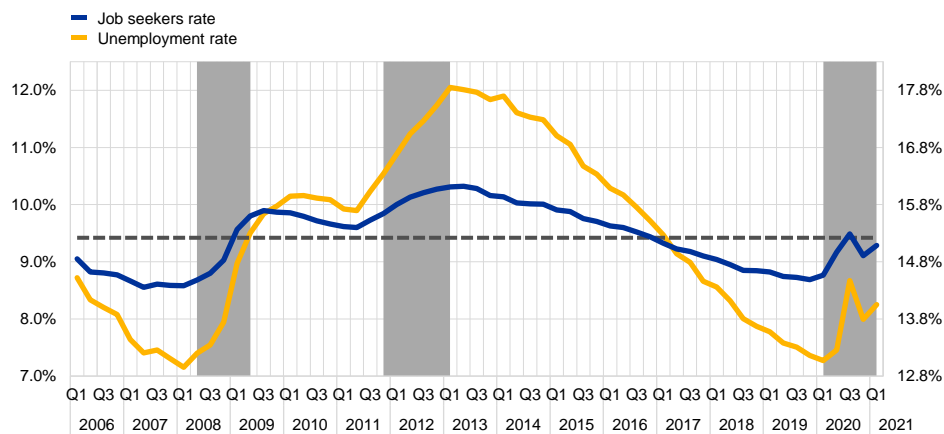
What stands out is that the two series are highly correlated and both countercyclical, but have very different cyclical volatilities. The standard deviation of the rate of effective job seekers is 65 percent smaller than the standard deviation of the unemployment rate. In this respect, it is useful to compare the alternative measures at relevant points in time. For example, the peak value of the unemployment rate recorded at the end of the sovereign debt crisis was 68 percent above its pre-Great Recession level. In contrast, the increase of the job seekers rate over the same time span was only 12 percent. Similarly, the peak value of unemployment during the Covid recession was 19 percent above its pre-crisis level in Q4 of 2019, while the peak value of the job seekers rate was only 6 percent above.

Why is the volatility of the effective job seekers rate dampened relative to that of the unemployment rate? First, there are offsetting changes in the cyclical composition of the pool of effective job seekers: during recessions there are more unemployed workers, but less employed job seekers; vice versa, during expansions, there are more employed workers, but less unemployed job seekers. A second reason is the down-weighting of the long-term unemployed ($\rho^{LT} < 1$), which reduces by construction the contribution to volatility from this component. This effect turns out to be quantitatively important. Moreover, it is further strengthened by the shift of the short-term unemployed to the long-term group, especially so in the aftermath of the Great Recession when the increase in the (initially short-term) unemployment pool was not reabsorbed due to the proximate emergence of the debt crisis.

Chart 2

Effective job seekers rate and unemployment rate

(left scale: percentage of workforce; right scale: percentage of working-age population)



Sources: Eurostat and author's calculations.

2.1.2 The unemployment rate is an imperfect signal of the effective job seekers rate

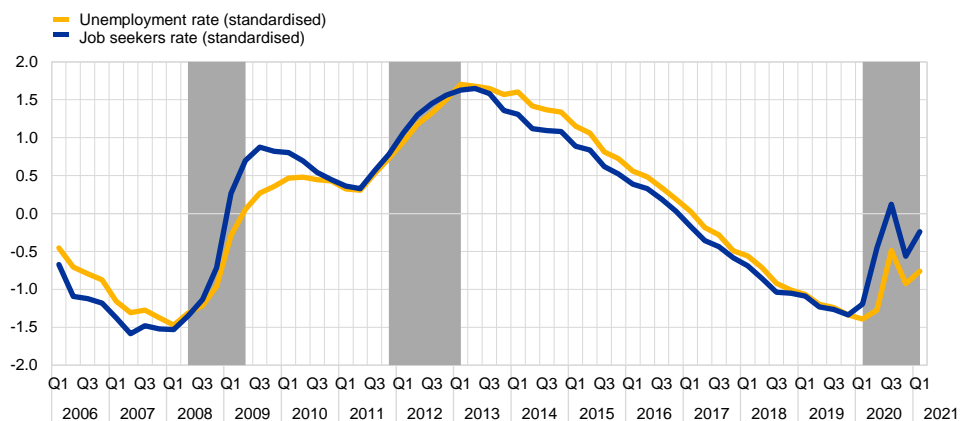
If effective job seekers of each of the different types moved together over time with the unemployed group, though with different volatilities, it would be irrelevant to account for them individually. Indeed, in such instance, the implications of the two measures for wage and price dynamics would be the same and only reflected, all else equal, in different slopes of Phillips curve-type relations. Quantitative trade-offs facing central banks between stabilizing inflation and economic activity would also be unaltered. While perfect correlation cannot happen, as an increase in any one job seekers group implies a decrease in other groups, it could still be the case that the unemployment rate is close to be a perfect signal of the job seekers rate. Preliminary investigation finds it is not.

Specifically, to uncover cyclical differences in the two measures of slack beyond their distinct volatilities, we compare them in standardised terms. The results are reported in Chart 3 and emphasize some interesting patterns.

Chart 3

Effective job seekers rate and unemployment rate (standardized)

(both measures in standard deviations away from mean)



Sources: Eurostat and author's calculations.

Overall, taking the effective job seekers rate as the “true” measure of slack, the plots indicate that the unemployment rate underestimates slack during recessions (and in the immediate aftermath of the Great Recession), and overestimates slack during expansions.

The inspection of the dynamics of the individual components of the job seeker rate reveals that one reason behind the different cyclicity of the two series is the behavior of the long-term unemployed. As the number of long-term unemployed only increases sluggishly in the Great Recession and its aftermath, their down-weighting induces the job seekers rate to rise more promptly than the unemployment rate (after controlling for their relative volatility). Because the sovereign debt crisis sets in very closely in time, the stock of long-term unemployed catches up and the two standardized measures eventually reach a comparable peak. Then, in the recovery phase, the long-term unemployed decrease only slowly, so that the effective job seekers rate moves again more swiftly than the unemployment rate. Throughout the ensuing expansion, the standardized effective job seekers rate remains steadily below the standardized unemployment rate, to then converge to a comparable level just before the Covid crisis. As the pandemic hits, the increase in the standardized effective job seekers rate is once again sharper than that of the unemployment rate. The reason however is different than in the previous recessionary episodes. At the onset of the Covid crisis, we actually observe a decrease in the long-term unemployed and a concomitant increase in the margins of nonparticipation that capture discouragement and immediate unavailability, suggesting some flows between the state of long-term unemployment and nonparticipation. These marginally attached workers slip out of the official unemployment rate, but are accounted for by our effective job seekers measure. Indeed, it is well-known that the standard unemployment rate has failed to capture the extent of labor market slack in the latest recessionary episode, as many workers have exited the labor force for both fears of getting sick and family or child-care related reasons.

It is possible to quantify the extent to which the unemployment rate underestimates the amount of slack during recessions in our sample period. In the Great Recession the maximum difference between the changes in the standardized effective job seekers rate and the standardized unemployment rate is 0.64 standard deviations and occurs in Q2 of 2009. Given a standard deviation of the unemployment rate of around 1.55 percent, this corresponds to a maximum underestimation of slack of about 1 percentage points of unemployment. The same statistics during the Covid crisis is even larger, with a maximum difference of about 0.81 standard deviations in Q2 of 2020, corresponding to an underestimation of slack of about 1.26 percentage points of unemployment.

While a Phillips curve type of analysis is beyond the scope of these remarks, we note that the evidence just discussed suggests that an s -based wage Phillips curve (estimated using the job seekers rate, s) could possibly be flatter during recessions than a u -based wage Phillips curve (estimated using the unemployment rate, u). Indeed, for a given change in wage growth $\Delta\pi^w$ (in absolute percentage point terms) during a recession, we have, in standardised terms, $\Delta s > \Delta u$, hence:

$$\frac{\Delta\pi^w}{\Delta s} < \frac{\Delta\pi^w}{\Delta u}.$$

A major caveat here is that one would need estimates of natural (benchmark) rates for both the effective job seekers rate and the unemployment rate, so as to construct the relevant gaps.

In this respect, micro data on labor market transition rates might be useful not only to construct a measure of effective job seekers, but also to control for longer-term trends in the relevant benchmark rates. See the analysis of Crump et al. (2019) for an application to the unemployment rate within a New Keynesian Phillips curve framework.

To conclude, while the valuableness of the effective job seekers rate in explaining wage and price dynamics requires further investigation, preliminary analysis indicates that the job seekers rate conveys additional information relative to the unemployment rate.

3 Inequality, labor market heterogeneity, and monetary policy trade-offs

We conclude these remarks with some tentative considerations regarding the relation between measures of labor market slack and measures of inequality, and the implications of this relation for monetary policy trade-offs. These considerations arise from the naïve observation that our measure of slack assigns little weight to persons who would most likely get a large weight in measures of cyclical inequality. For example, the long-term unemployed have relatively low job finding rates, but at the same time relatively high vulnerability to aggregate shocks (for a variety of reasons associated to lack of insurance, such as low wealth or low income).

The starting point is the observation that welfare depends not only on the inflation rate and the aggregate level of economic activity, but also on their distributional implications, specifically for consumption inequality.

A recent vintage of heterogeneous agent New Keynesian models studies how the presence of inequality changes optimal monetary policy prescriptions relative to a representative agent framework. See, for example, Acharya, Challe and Dogra (2020). One key mechanism emphasized there is that with countercyclical income risk, a higher level of economic activity will raise inflation, but also mitigate consumption inequality. Hence, the presence of inequality introduces a new monetary policy trade-off. The resulting policy prescription is that in response to a recessionary aggregate shock that increases inequality, the central bank should tolerate higher inflation than in the absence of inequality, so as to mitigate the cyclical increase in inequality.

One important question is then which dimensions of worker heterogeneity will matter for the new trade-off, and how. On one hand, if individuals who lack insurance from financial markets (proxied by high marginal propensities to consume, MPC) also have more cyclical jobs, as documented in Patterson (2021), then the case for tolerating a higher inflation volatility is likely to be stronger.

On the other hand, if the measure of slack that is relevant for inflationary pressures assigns little weight to high MPC individuals (e.g., the long-term unemployed in our effective job seekers rate), the case for tolerating a higher volatility of inflation is likely to be weaker. In this case, in fact, stabilizing wage and price inflation may imply little stabilization of inequality.

New empirical questions then arise, that require new granular cross-sectional data: How does lack of insurance from financial markets correlate in the cross-section with lack of insurance from labor markets? How does risk in financial and labor markets correlate with the role played in wage determination?

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What have we learned from HANK models, thus far?

By Giovanni L. Violante¹

Abstract

Heterogeneous Agent New Keynesian (HANK) models are emerging as leading frameworks to study the impact of monetary and fiscal policy on the macroeconomy. This article highlights four lessons learned, so far, from research on these models: (1) the transmission mechanism of monetary policy is starkly different from its representative agent counterpart; (2) several channels of amplification/dampening of the effects of monetary policy emerge that are linked to the income and wealth distribution; (3) monetary policy redistributes income across households, but it is a blunt instrument to promote income mobility or contrast income disparities; (4) an informed conduct of monetary policy requires rich micro data which can provide a comprehensive and high-frequency pulse of household balance sheets.

1 Introduction

Like all Central Banks, the ECB uses a suite of different models to inform monetary policy decisions. Some of these models are large systems of equations with a “reduced form” flavour that aim at a detailed representation of the complex relations among the many sectors of the economy. Others are lower-dimension Structural Vector Autoregression (SVAR) models where shock identification is often guided by economic theory. Others yet are fully structural dynamic stochastic general equilibrium (DSGE) models, usually estimated via a Bayesian approach.²

Each of these models serves its own purpose. The first two approaches are mostly designed for short-term or medium-term forecasting. While forecasting is a necessary ingredient of the policy decision process, it’s by no means the only one. Central banks need to have a profound understanding of the economics behind the transmission mechanism of monetary policy and of its quantitative effects on the macroeconomy. DSGE models are a key tool in this respect, because they are fully micro-founded and forward-looking, and thus they allow to analyze counterfactual scenarios which provide an essential context to the policy choice.

¹ Princeton University, CEBI, CEPR, IZA and NBER. I thank Greg Kaplan and Ben Moll for useful comments.

² See the Review of Macroeconomic Modelling in the Eurosystem: Current Practices and Scope for Improvement, one of the background papers prepared by the ECB staff for the monetary policy strategy review.

The typical quantitative DSGE model currently used in central banks, however, features either a representative consumer or very limited heterogeneity on the household side (e.g. spender-saver or borrower-saver structures). Even these models are useful and informative, to some extent. The frontier in academic research, however, has recently shifted toward incorporating heterogeneity and distributional considerations in the household sector to a much fuller degree.

I was especially glad that one of the many excellent background papers prepared for the 2021 monetary policy strategy review advocates to take steps forward in this direction. Namely, the Review of Macroeconomic Modelling in the Eurosystem recommends that (page 14): *given the achievements in the academic HANK literature, central banks should venture into this area of modelling, possibly focusing first on households and labour market heterogeneity (notwithstanding other relevant dimensions) and advancing the empirical validation of those models.*

Heterogeneous Agent New Keynesian (HANK) models are born from the fusion of two workhorses of macroeconomic theory: (i) the New Keynesian approach to the study of business cycles and stabilization policies, and (ii) the incomplete-market approach to the study of the distribution of income and wealth, and of those policies that promote social insurance, income mobility and equality of opportunities and resources.

In this class of models, the production and monetary policy blocks are exactly the same as in the Representative Agent New Keynesian (RANK) model and, as in that framework, they are summarized by three aggregate equations: (i) the Phillips curve which specifies a relation between inflation and output dynamics; (ii) the Taylor rule which summarizes how the monetary authority operates its main instrument, the nominal interest rate; (iii) and the Fisher equation which links the real interest rate, the policy rate, and expected inflation.³

The crucial innovation lies in replacing the representative consumer, and hence the aggregate Euler equation (or the IS curve), with the modern theory of consumption and saving. The starting point of this theory is that households are heterogeneous ex-ante and ex-post and, because of financial market imperfections, these differences transmit to consumption, saving and welfare. Namely, consumers are subject to uninsurable idiosyncratic labor income risk (e.g., unemployment spells, demotions and promotions, job to job transitions, occupational and sectoral swings in demand, health and disability shocks, etc.) which they can smooth only by saving in a non-state contingent asset (e.g., a risk-free bond) and by borrowing up to a maximum credit limit. In equilibrium, the lack of perfect risk-sharing yields a non-degenerate cross-sectional distribution of income, consumption and wealth, as well as individual mobility dynamics across the distribution, both of whom resemble their data counterpart.⁴

At the cost of oversimplifying, one might say that there are three groups of households in this economy, each one important in its own way for monetary policy analysis. The

³ See Clarida, Gali, and Gertler (1999) for a classical survey article on the New-Keynesian perspective on monetary policy.

⁴ See Carroll (2001) for a comprehensive review article on consumption behavior in the so called 'buffer stock' model, and Heathcote, Storesletten and Violante (2009) for a review article on the heterogeneous agent incomplete markets approach to quantitative macroeconomics.

first group is composed by those who have very low liquidity and, therefore, high marginal propensities to consume (MPC) which are called 'hand-to-mouth' households in this literature. They derive their income from wages and government transfers. The second group could be thought of as comprising a 'middle class' of households which have a strong precautionary saving motive (i.e., 'saving for the rainy day') determined by their desire to stay away from the borrowing constraint. The bulk of their income comes from labor. The third group contains high net worth individuals, sufficiently rich that the precautionary saving motive is trivial for them. These are households with low MPC, like the consumer in representative agent models. Because they hold the bulk of the wealth in the economy, a substantial share of their income comes from capital, and they are especially exposed to capital gains and losses from fluctuations in asset prices or private equity values.⁵

Over the last few years, this new class of models has proved itself to be a rich framework to investigate the impact of macroeconomic shocks, fiscal and monetary policies on aggregates and on the distribution.

In the rest of this article, I will reflect on four main lessons, especially relevant for Central Banks, which we have learned from this new synthesis, so far.

2 Lesson I: Transmission mechanism of monetary policy

The most important lesson we have learned from HANK models is about the transmission mechanism of monetary policy.

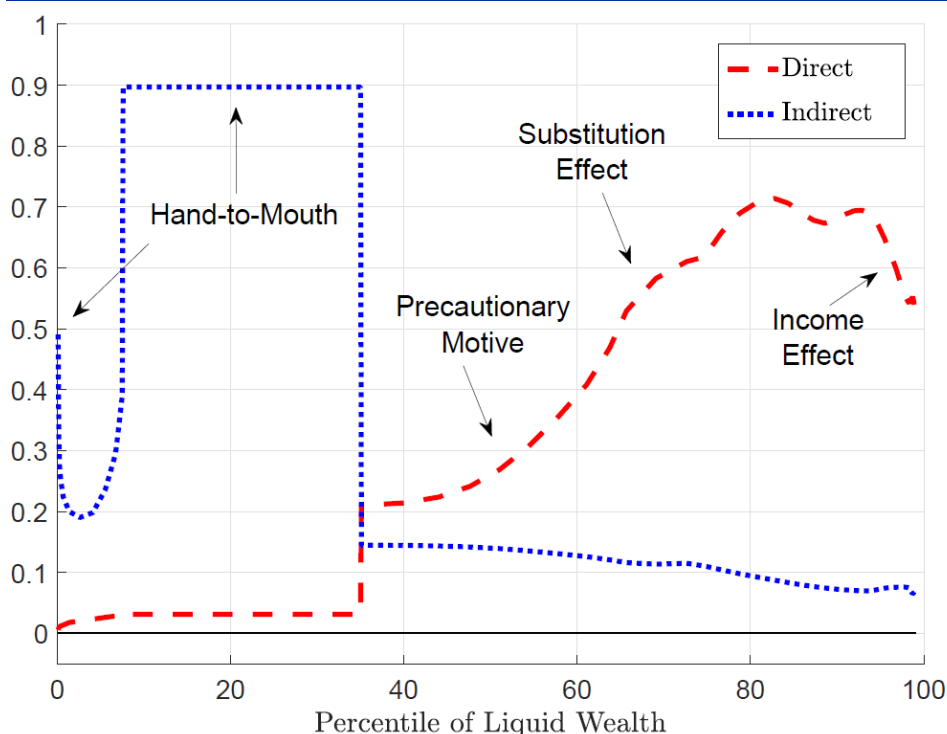
It is useful to start from the canonical representative agent model. There, a cut in the nominal rate induces a rise in consumption expenditures through intertemporal substitution via the aggregate Euler equation. This is the *direct effect* of a monetary policy shock. Such rise in expenditures, in turn, leads to an expansion in the demand for labor and, because of nominal rigidities, to an additional round of increase in expenditures. The size of these *indirect* general equilibrium effects linked to the Keynesian multiplier are proportional to the magnitude of the aggregate marginal propensity to consume which, in RANK models, is tiny (approximately equal to the discount rate). As a result, in the standard RANK model, the transmission of monetary shocks to the real economy occurs almost entirely through direct intertemporal substitution.

Thus, somewhat paradoxically, the channel by which monetary policy affects aggregate output in the standard New Keynesian model differs markedly from the ideas typically associated with John Maynard Keynes (namely, the equilibrium spending multiplier). For these reasons, as suggested by John Cochrane, it would be more appropriate to call this framework the *sticky-price intertemporal-substitution model*.

⁵ One reason why this distinction is somewhat of an oversimplification is that in the data there exist households with almost no liquid wealth, but sizable illiquid net worth (e.g. housing or retirement accounts). These so called *wealthy hand-to-mouth* households have a portfolio composition similar to the middle class, but their consumption behaviour is more alike to the poor hand-to-mouth. See Kaplan, Violante (2014) and Kaplan, Violante and Weidner (2014).

Chart 1

The consumption response to a monetary policy shock across the wealth distribution



Notes: Reproduced from Kaplan and Violante (2018).

In HANK models, the channels of transmission of monetary policy are more complex, and vary across the income and wealth distribution. But, most importantly, the *indirect general equilibrium effects* become at least as important quantitatively as intertemporal substitution. The key reason is that in this class of models, in line with the empirical evidence, the aggregate MPC is at least 20 times larger: 15-20% over the first quarter, instead of 0.5-1%.

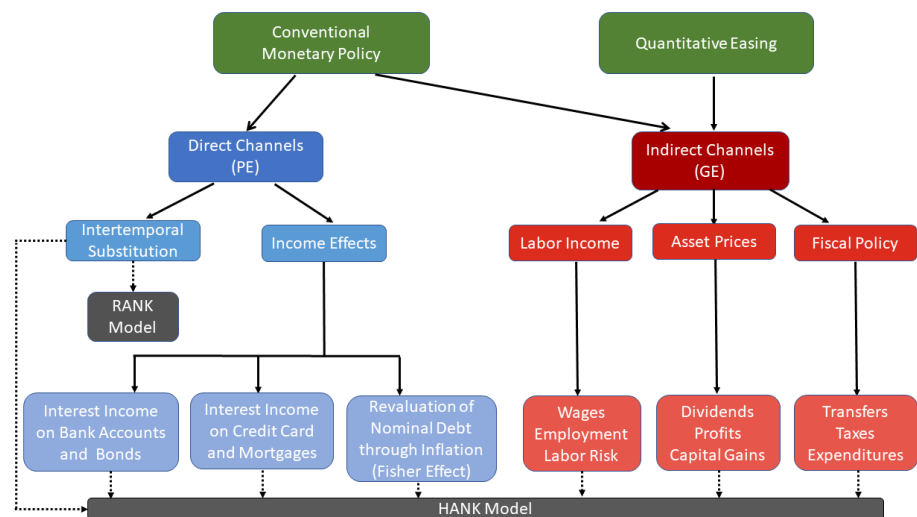
Chart 1 summarizes the transmission mechanism of a monetary policy easing in the HANK model of Kaplan, Moll, and Violante (2018). It plots the change in consumption at various percentiles of the distribution of liquid wealth, split between direct and indirect effects. Different forces play out at different points of the distribution. At the bottom, indirect effects operating through the rise in employment and wages, paired with a strong MPC, explain the strong consumption response of poor and wealthy hand-to-mouth households. Indirect effects fade away quickly, as we climb along the wealth distribution. The intertemporal substitution channel starts mattering, but around median liquid wealth the precautionary saving motive stifles this channel: households fear to receive negative income shocks that will put them against the credit limit and, as a result, they increase expenditures only moderately. For richer households the substitution channel dominates, but for the richest ones the lower interest rate induces a negative income effect.

This version of the model abstracts from a number of additional channels that are being incorporated in more recent work, such as nominal long-term debt and asset prices. Figure 1, a re-elaboration of Moll (2020), gives a more comprehensive list of all

possible channels of transmission of shocks in this class of models. It also highlights how quantitative easing (i.e., asset purchase programs) affects aggregate consumption entirely through indirect channels.⁶

Figure 1

The transmission mechanism of conventional and unconventional monetary policy



Notes: A re-elaboration of Moll (2020).

In the last few years, a number of authors have leveraged micro data on consumption, income and household portfolios for various countries to estimate the size of these direct and indirect channels and how they vary across the cross-sectional distribution.⁷

What are the implications of these new findings that have emerged from HANK models for the conduct of monetary policy? Seen through the eyes of the representative agent model, the job of a central banker is relatively straightforward. In order to understand the impact of a change in the policy rate on aggregate consumption, all that is needed are two ingredients: expected inflation to convert the nominal rate under control into the real one, and the aggregate intertemporal elasticity of substitution which measures the sensitivity of aggregate consumption to the real rate.

From the perspective of HANK models, instead, central banks face a much more complex task. First of all, the informational requirements about the household side of the economy are more exacting. To estimate the aggregate consumption response, one needs a full picture of the joint distribution of marginal propensities to consume, income composition, and the various elements of household balance sheets. We will return on this point in Section 5. Second, the importance of indirect equilibrium channels means that the transmission of monetary policy is crucially mediated by all those mechanisms that contribute to price formation in goods, inputs, credit, housing and financial markets. It is then essential for a central bank to have a deep

⁶ In frictionless representative agent models where “Wallace neutrality” holds, quantitative easing has no real effects. See Cui and Sterk (2020) for an analysis of QE in HANK.

⁷ See Cloyne and Surico (2020) for evidence on the US and the UK, Holm, Paul and Tischbirek (2021) for evidence on Norway, and Andersen et al. (2021) for evidence on Denmark, for example.

comprehension of market structure, market frictions as well as of those institutions and actors that play major roles in these settings (i.e., local governments, unions, regulatory bodies, etc.).

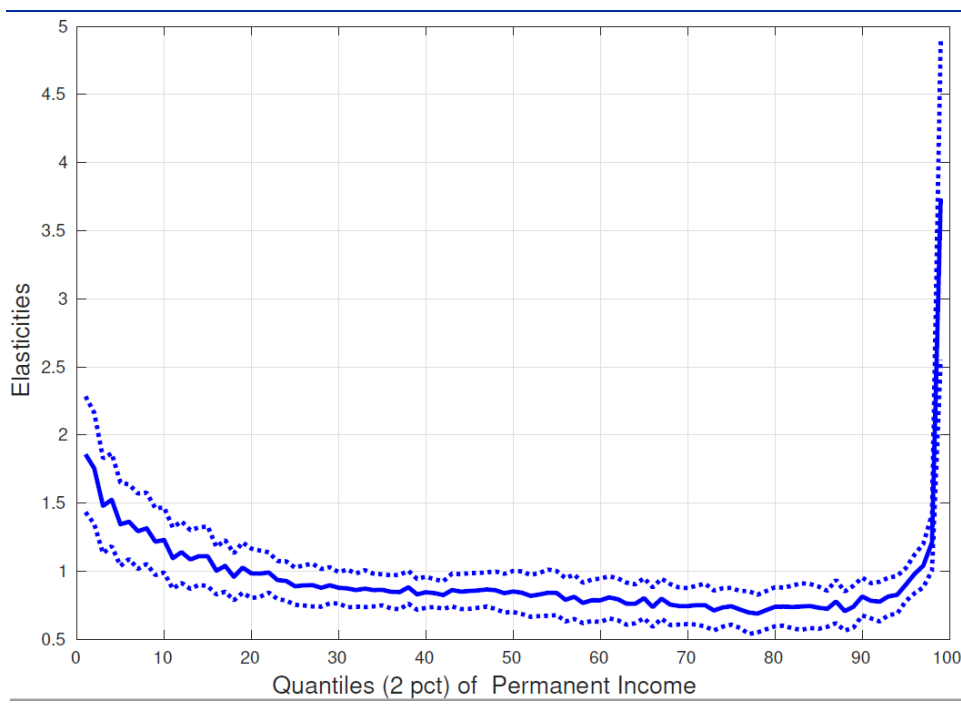
Overall, from the perspective of HANK models, it is much harder for monetary authorities to fine-tune policy interventions because so many elements of the transmission mechanism are entirely outside their control and depend on the complex dynamics of many different markets.

3 Lesson II: Economic forces leading to amplification and dampening

Besides modifying the transmission mechanism of shocks, household heterogeneity and market incompleteness also alter the strength of their propagation through the macroeconomy. There exist at least three separate sources of amplification/dampening relative to the representative agent counterpart.

The first source is the *redistribution channel*. Chart 2 reproduced from Guvenen et al. (2017) plots the elasticity of earnings to aggregate GDP across the distribution of (permanent) labor income. Exposure to aggregate fluctuations is highest at the extremes of the distribution. At the bottom, the reason is that those households are more likely to become unemployed during a recession (or to find employment along an expansion). At the top, instead, labor compensation is largely based on performance, and thus linked to the aggregate state of the economy.

Chart 2
The elasticity of earnings to GDP across the distribution



Source: Guvenen et al. (2017).

The bottom line is that, in general, households are unequally exposed to aggregate shocks. In HANK models, this heterogeneous sensitivity is a source of amplification of shocks to the extent that income is redistributed from low MPC to high MPC households (Auclert 2019; Bilbiie 2020, Patterson 2021, Slacalek, Tristani and Violante 2020). A new literature that emphasizes the role of heterogeneity in risk-taking among households, points out that amplification occurs also when income is redistributed from households who have a low marginal propensity to take risk to those with a high such propensity because aggregate investment would increase and, as a result, aggregate demand would expand as well (see, in particular, Kekre and Lenel, 2020).

When assessing this channel, it is important to keep in mind that the main sources of income vary across the distribution: at the very bottom, households mostly live off government transfers; labor income is paramount for the middle class, whereas for the very wealthy, business and entrepreneurial income are dominant. This *uneven income composition* means that it is crucial to understand how these different sources of income respond to aggregate shocks in order to estimate the magnitude of amplification or dampening (see, for example, Alves et al. 2020; Broer et al. 2020).

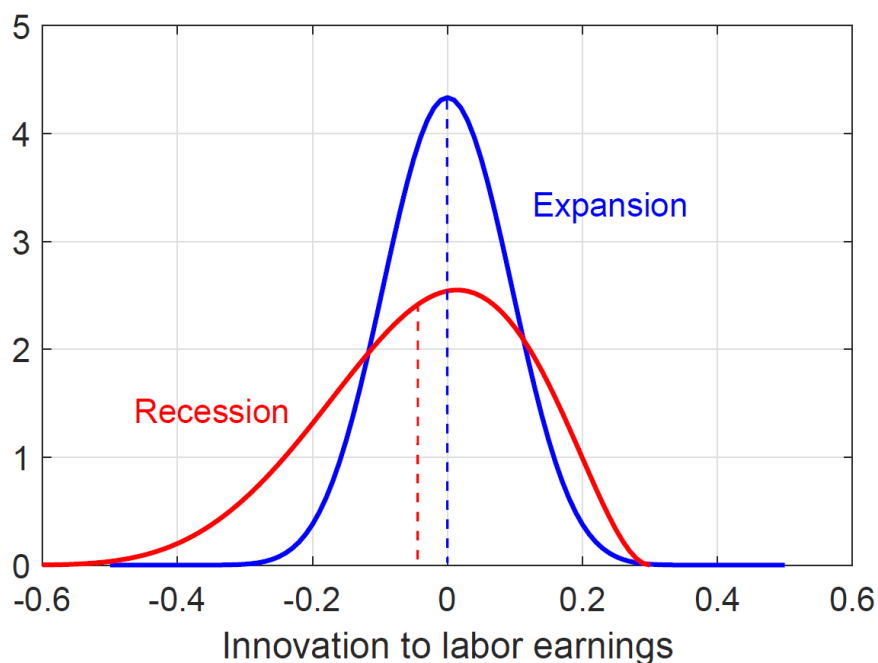
The second source of amplification is related to the cyclical nature of the precautionary saving motive. Chart 3 illustrates the cyclical shift in the distribution of earnings growth: left-skewness is countercyclical because unemployment risk rises in recessions. In response to this surge in risk, households become more cautious and start saving more in order to build a buffer in case their employment status worsens.

In HANK models, this *precautionary saving channel* amplifies the negative aggregate shock because the cut in expenditures to build the additional buffer stock of saving piles up onto the initial reduction of aggregate demand (see Acharya and Dogra 2020).

It should be emphasized that, in versions of the HANK model with capital, in equilibrium these extra savings would show up in investment, i.e. they would be redirected into a different component of demand, without much net effect. In reality, though, households who 'save for the rainy day', want to compress their exposure to risk and strengthen their liquidity, and thus do not save in risky or illiquid assets, but rather into cash, bank accounts or government bonds. Only a two-asset version of HANK with liquid bonds and illiquid risky capital has predictions consistent with the data (see Bayer et al. 2019, and Kaplan, Moll and Violante 2018).

Chart 3

The countercyclicality of idiosyncratic labor market risk

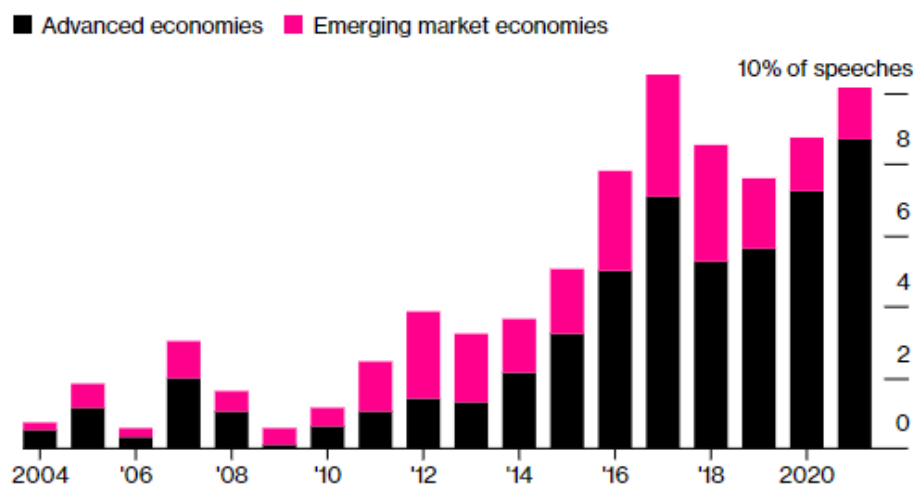


The third main source of amplification is the *fiscal policy channel*. When the monetary authority cuts the interest rate, borrowers gain. Governments are net borrowers and, as a result, they have extra resources in their budget. The extent of this inflow depends largely on the maturity structure of debt and on how rates at other horizons respond to a change in the short rate (Auclert, Rognlie and Straub, 2020).

When the government uses these resources to increase transfers or reduce individual taxes, additional income flows to households. Similarly, if government expenditures rise, the ensuing rise in labor demand would further favour households. In all these cases, fiscal policy amplifies the initial monetary impulse. The magnitude of this effect depends, once again, on the cross-sectional covariance between the change in income and the marginal propensity to consume.

Chart 4

Central bankers' speeches mentioning inequality



Source: Bank of International Settlements

Note: Speeches of central bankers mentioning the keywords "inequality" and "distributional consequences/impact of monetary policy" expressed as a share of all central bankers' speeches in the BIS database.

4 Lesson III: Monetary policy as a redistributive policy

Questions on the distributional effects of monetary policy have traditionally been considered of minor importance compared to the analysis of its impact on the aggregate economy. Recently, though, there has been a significant shift. Chart 4, which shows the fraction of central bankers' speeches which contain a discussion of the relation between inequality and monetary policy, clearly illustrates this transformation.⁸ Two main reasons are behind this trend. The first one is that, in many countries, the distribution of income and wealth has become ever more concentrated at the top. The fundamental reasons behind the secular rise in inequality are related to structural shifts in technology and globalization. Discussions around inequality dominate the press and have become common among the general public. Thus, even though inequality is not a monetary phenomenon in the long run, this subject has become hard to ignore for central banks.⁹

The second reason is more germane to central banks. In the aftermath of the Great Recessions, monetary authorities started adopting unconventional policy measures, some of which have the objective of supporting asset prices to strengthen the asset side of financial institutions and promote lending to households and firms in distress. As a by-product, however, these policies have generated capital gains mostly accruing to the wealthy and, as a consequence, central banks have been accused of contributing to the rise in inequality. In reality, these policies have also sustained aggregate demand and therefore provided support for the most vulnerable groups. As

⁸ In particular, several recent speeches by top monetary policymakers focused on this issue, e.g., Borio (2021), Draghi (2015), Haldane (2014), Kuroda (2017), Mersch (2014), and Yellen (2015).

⁹ Dolado, Motyovski and Pappa (2021) offer a different perspective where, by lowering interest rates and favouring investment in technologies which replace unskilled labor, expansionary monetary policy can have long-run effects on inequality.

put it by Bernanke (2015), monetary policy is a blunt tool which certainly affects the distribution of income and wealth, although whether its net effect is to increase or reduce inequality is not clear.

In this context, what can we learn from HANK models that can be useful for this debate?

The first lesson is that, in this class of models, every stabilization policy is redistributive to some extent, and every redistributive policy can either stabilize the economy or amplify the initial shock. It is, in essence, impossible to fully disentangle the two margins. As explained in Section 3, it is precisely because a shock or a policy intervention redistributes in a certain way that we see amplification or dampening. HANK models are useful because they offer a structure to shed light on the interplay between stabilization and redistribution.

From the normative perspective of optimal monetary policy, what is the balance of stabilization and redistribution that should be achieved according to HANK models? When plausibly calibrated, in these models the size of uninsurable individual labor market risk is at least an order of magnitude larger than aggregate risk, i.e. the risk of recessions.¹⁰ In addition, the standard objective function of the monetary authority is typically assumed to be an equal-weight utilitarian welfare function that mechanically values redistribution toward the poor (i.e., those with high marginal utility of consumption). As a result, the social insurance and redistributive motives tend to dominate the price stabilization component of the welfare function.¹¹

As an example, consider the optimal policy response to a positive mark-up shock. The analysis follows Bhandari et al. (2021). The standard RANK model prescribes to “lean against the wind”, i.e. a rise in the nominal rate to cut aggregate demand and tame inflation. In the presence of heterogeneous households and imperfect insurance, instead, an increase in mark-ups reduces the labor share in favour of the owners of capital. A rise in the policy rate which stifles aggregate demand would further hurt workers. In HANK, in fact, this latter force pushes optimal policy in the opposite direction, i.e. toward a cut in the nominal rate in order to foster the aggregate demand for labor and redistribute income back to workers. Unsurprisingly, in light of our previous discussion on the social welfare function, this channel quantitatively dominates in the numerical experiments. This is a stark example in which the optimal monetary policy prescription in HANK models is the opposite than in its representative agent counterpart.

It is immediately obvious from this result that the optimal design of monetary policy depends on the fiscal response to the aggregate shock already in place. If the fiscal authority intervenes in a timely manner by providing welfare-improving social insurance, then the monetary authority can focus on price and output stabilization. In general, fiscal policy is in a much better position to offer the desired degree of

¹⁰ As explained in Section 3, idiosyncratic and aggregate risk are not disconnected. In particular unemployment risk increases in recessions.

¹¹ The normative implications of the HANK approach to monetary policy are studied, e.g., by Acharya, Challe and Dogra (2019), Bhandari et al. (2021), Bilbiie, Monacelli and Perotti (2020), Gornemann, Kuester and Nakajima (2021), and Legrand, Martin-Baillon, and Ragot (2020).

redistribution, because it can be tailored and carved much more finely toward the groups most in need of financial relief. This advantage of fiscal policy emerges very clearly in the numerical simulations of HANK models.¹²

In practice, though, fiscal authorities act with much delay relative to the aggregate shock because of the unavoidable political negotiations that precede the bill's vote in the legislative process. Moreover, the final product is often ---for the same reasons--- a compromise that fails to be efficiently directed toward the hardest hit groups of the population. Consider the last downturn in the US. The recession and the lockdown started in mid-March, but it took at least another month before the first round of extra fiscal transfers (UI top-up and untargeted economic impact payments) were made to households. In this first month, the role of the Fed in "holding water" was essential. The ECB played a similar crucial stop-gap role in the Eurozone over that period.

Even when fiscal policy is ineffective, should central banks be concerned with inequality and redistribution? Opinions vary even among top policymakers, as witnessed by the different approach of the ECB and the Fed. The Fed has embraced many of these concerns explicitly aiming for "inclusive recoveries", whereas the ECB in his strategy review has remained focused on the narrower mission of price stabilization.

There are clear advantages to more narrowly defined institutional missions. Policy goals are more credible and transparent and communication is easier. The fact that the goal (e.g. price stabilization) is unique to the central bank reinforces its independence. At the same time, a central bank that appears to be completely oblivious to the defining issue of the new century --rising inequality-- can become the target of political attacks from special interest groups which might undermine its own independence. At the very least, it is then important that central banks use all the available empirical and theoretical tools to competently evaluate the impact of their policies on the distribution of income and wealth, in order to achieve a full understanding and, possibly, clearly communicate and disseminate the findings.

HANK models are a key tool in this sense. In particular, this framework can be used to choose the right policy instrument among the variety of tools currently available. Price stability can be achieved in many alternative ways, and the central bank can, for example, choose to meet this goal in the most equitable way possible.

5 Lesson IV: New data requirements

In Section 2 we argued that, in HANK models, changes in the policy rate transmit to aggregate consumption through the household sector in a variety of different ways. According to the theory, every element of the household budget constraint can be, in principle, affected: labor income through a GE change in labor demand, capital income through the direct change in the interest rate, the value of asset holdings (e.g., bonds stocks and housing) through the effect of monetary shocks on asset prices, the

¹² For an example related to the COVID-19 recession in the US, see Fu, Kaplan, Moll and Violante (2020).

real value of nominal liabilities through the change in inflation or refinancing, taxes net of transfers through the response of the fiscal authority to the monetary shock.

In order to assess the importance of all these channels empirically, it is therefore paramount that central banks have access to the right data. In the last two decades, central banks have made enormous progress in gathering rich micro data. Their research and policy units make excellent use of these databases to analyse the current state of the economy and inform the policy decision process.

Most of the efforts, however, have been directed to collecting granular administrative data on the financial system (e.g., bank balance sheets, lending to households and firms, etc.), and understandably so since many central banks also have an explicit regulatory role, and are deeply concerned about financial stability. Sufficiently rich data collection on the household sector has, however, lagged somewhat behind. The Household Finance and Consumption Survey (HFCS), a collective effort of central banks and statistical institutes of the Eurozone coordinated by the ECB, was an important first step in this direction. This repeated cross-section (in its third wave now) collects household level data on demographics, employment status, income and consumption expenditures, and households' balance sheets (assets and liabilities).¹³

Its main strength is that it contains a large number of harmonized variables for representative samples for each country in the Euro area. It is also a flexible survey and new questions can be added in every wave to study issues that are particularly relevant in the current macroeconomic conditions.

At the same time, this dataset, in its present form, has a number of shortcomings. First, its sample size is relatively small (usually observations are in the tens of thousands) which prevents analysing the data at the level of granularity that many of these models require. Second, the dataset lacks a longitudinal dimension. If one wanted, for example, measure the effect of monetary policy shocks across the wealth distribution, the panel dimension is essential to keep track of changes in employment status, income, wealth and consumption at the household level. Third, the HFCS, like most household surveys of this type, suffers from the inability to properly sample from the very top of the wealth distribution (e.g., the top 10%).¹⁴ As explained earlier, these households are important for assessing the transmission mechanism of monetary policy because they hold most of the financial wealth in the economy and account for a sizable share of consumption expenditures. Fourth, the survey is currently triannual and the data are released only with a lag of two years after the survey date, which prevents a timely and high-frequency monitoring of the health status of household balance sheets.

State of the art empirical analysis in economics is quickly shifting away from this type of data. The frontier is *administrative data* that are, originally, collected for some purpose other than research. For example, government agencies (e.g., social security or tax authorities) collect these data to keep a record of payments made or received. For private companies (e.g. financial firms, or payroll processing firms), these

¹³ See https://www.ecb.europa.eu/stats/ecb_surveys/hfcs/html/index.en.html.

¹⁴ A notable exception is the US Survey of Consumer Finances which oversamples the rich.

proprietary data are the essential input to provide their core services. Over the last decade, researchers have gained access to this type of data (often by teaming up with someone inside the institution) more and more frequently.¹⁵

Because of their administrative nature, measurement error—a primary concern in surveys—is minimized in this type of data. Their sample size is often 100 or even 1,000 times larger than surveys. As a result, they allow to analyze finely selected sub-groups of the population stratified by age, education, gender, race, income and wealth, as well as geographical location. In addition, they often contain a panel dimension which allows to keep track of individuals over time. Because of their administrative nature, the individual identifier in these datasets is the social security number which permits to link different sources of data together. Finally, many of these datasets record information at a relatively high frequency.

It is useful to briefly describe two examples of state-of-the-art datasets with features that would be extremely helpful to central banks, one public and one proprietary.

The first one is a government dataset for Denmark recently used by Andersen et al. (2021). The main data source is individual-level records for the entire population in Danish tax registry. The data contain detailed information about income and balance sheets for roughly 70 million individual-year observations. The tax records contain all major items of households' disposable income (e.g., wages, dividends and interest expenses). Information on the main balance sheet components (e.g., housing, stocks and debt) is reported by third parties such as financial institutions and matched through personal identifiers. These data can also be matched to records on car purchases from the auto registry.

The second one is the proprietary database of the JP Morgan Chase Institute, the think-tank of the homonymous private financial institution. It contains the daily balances, inflows (e.g., direct deposits), and outflows (e.g., debit card transactions) of Chase personal checking and credit card accounts, nearly 30 million accounts. Administrative banking data provide a high-frequency lens into consumer finances, with transaction-level measures of income and expenditures. The bank has the ability to categorize transactions, and thus to identify inflows of labor income, capital income and government transfers (e.g. UI payments and economic impact payments). Similarly, it is able to separate outflows between spending and debt payments.¹⁶

Compared to the registry data from Denmark, this database has the advantage of the higher frequency and the direct observability of expenditures. The main disadvantages are two. First, the sample is not representative of the population along a number of dimensions. Second, the data originate from one financial institution only,

¹⁵ See Vavra (2021) for an overview of how these data have been used in the context of the last US recession.

¹⁶ See Cox et al. (2020) for a recent example of the use of these data to assess the efficacy of fiscal support to households during the COVID-19 recession in the United States.

while many households have financial activity in more than one bank or credit card company and thus, as a result, the data can underestimate assets and liabilities.¹⁷

To sum up, ideally the ECB and other central banks should have access to a variety of individual level datasets containing joint information on expenditures, income, assets and liabilities with the following characteristics: (i) *large*, to allow for granularity in the empirical analysis and ability to capture the top of the distribution; (ii) *longitudinal*, to follow the same individuals over time; (iii) *administrative*, to minimize reporting errors; (iv) *high frequency*, in order to uncover and track sudden changes in the economy, and warrant fast policy reactions. Only a dataset with these characteristics can provide a comprehensive and timely pulse of household finances in the Eurozone.

These considerations do not imply that the ECB should abandon the HFCS survey, quite the opposite. Surveys and administrative data are complementary. In particular, the survey design makes it representative of the broader population and this is essential in order to be able to benchmark proprietary administrative data –which, as explained, can suffer from serious selection problems—to the universe. Without this careful benchmarking, the information in proprietary data is not of much practical use for policymakers.

6 Conclusions

New theoretical and quantitative models trickle down from academia to policy makers with some lags. This is natural, and also efficient because only few among the newly proposed models end up surpassing the test of times. HANK models are in a phase of development where our understanding about their mechanics is already deep enough to make them useful to policy makers.

It is critical however that, alongside the investment in the model infrastructure (i.e., theory and computation), an effort be also made in collecting rich micro data that permit to draw a tight mapping from the many components of the model into their empirical counterparts.

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¹⁷ Another example of administrative data originated from financial accounts is data made available by financial aggregators, like mint.com in the US, i.e. companies that offer financial planning services to their clients. These data have the advantage of combining all accounts at the individual level, but typically the sample is not representative of the universe.

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