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## Challenges for monetary policy in a rapidly changing world

Globotics and macroeconomics:  
Globalisation and automation of the service sector

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EUROPEAN CENTRAL BANK  
EUROSYSTEM

# Globotics and macroeconomics: Globalisation and automation of the service sector

By Richard Baldwin<sup>1</sup>

## Abstract

*Globalisation affects the functioning of the euro area macroeconomy. The macroeconomy's functioning, in turn, conditions the conduct and impact of monetary policy. This is why globalisation matters for central banks. It is also why central bankers should pay attention to the evolution of globalisation. And evolve it has. This paper argues that the future of trade is in services – especially trade in intermediate services. Barriers are radically higher and falling radically faster for services versus goods, and, unlike farm and factory goods, there is no capacity constraint when it comes to intermediate services exports from emerging markets. The paper argues that undertaking the sort of analysis for services trade that was done in the 2000s on globalisation's impact on, say, HICP inflation will require a substantial upgrading of the data available.*

## 1 Introduction

This paper argues that our economies are at the start of a third great transformation that will have macro implications for euro area economies and ECB policymaking. Having gotten your attention, I hasten to add that there is nothing revolutionary here. The argument splices together trends that have been in evidence for years into a string of logic that leads to novel implications. Even those may not be so new.

In a nutshell, digital technology (digitech) is rapidly exposing services that were previously non-tradeable to the opportunities and challenges of globalisation. One name for this new form of globalisation is “telemigration”, which refers to workers who sit in one nation but regularly work in offices and remote teams in another nation. Simultaneously, digitech is introducing automation to services that were previously non-automatable. “White-collar robots” is one name for the automating algorithms – things like Robotic Process Automation (RPA), virtual assistants, chatbots, and sophisticated AI packages like IBM's Watson. These robots are automating service-sectors tasks at digitech's eruptive pace – driven by machine-learning on one hand, and, on the other hand, by the falling cost of gathering,

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transmitting, storing, and processing the massive datasets needed to train the algorithms.

To stress that both the globalisation and robotisation of service jobs are happening at the same time – and are driven by the same technologies – I created the ugly, but hopefully memorable word ‘globotics’ in my 2019 book on the subject. In my view, globotics will improve lives in the long run but the transition could be rough. That is why the word ‘upheaval’ follows globotics in my book’s title.

Firms embracing white-collar robots and telemigrants will do so to save money by replacing office and professional workers. The mismatch in speeds of digitech (displacing jobs) and human ingenuity (creating jobs) may produce ructions in euro area labour markets in the medium term. As was true for the manufacturing sector over the past quarter century, automation and globalisation in services will create new opportunities for European firms and citizens who are globally competitive but more competition for those who are not. The effect is likely to be akin to the China Shock’s impact on goods-producing sectors, but potentially much larger since services account for a much larger share of the euro area employment and GDP.

## Globotics and central banking

What does any of this have to do with running a central bank? Policy choices depend critically upon how the macroeconomy works – especially the economic mechanisms that determine prices, wages, employment, and growth. Globotics will create and displace jobs, will raise productivity and quality, will lower costs, and is likely to quicken growth-enhancing innovation. Globotics will buffer the links between local labour market conditions and wage formation by creating better substitutes for local labour. These changes may affect what the equilibrium rate of unemployment. Or it may create a new form of unemployment as steady jobs are replaced by precarious work arrangements rather than overt joblessness. It could further flatten and globalise the Philip’s Curve. In this exploratory paper, I will focus on the impact of globotics on the prices of goods and services in the HICP.

Plainly, there is little novelty in these assertions. Former ECB President Jean-Claude Trichet pointed out much of this in his 2008 speech in Barcelona (Trichet 2008), and ECB researchers have elaborated many of the themes in the 2021 ECB Strategy Review.<sup>2</sup> The conversation we need is about speeds and magnitudes, and the fact that the future automation and globalisation of service sector will not be identical to automation and globalisation of goods sectors in the past.

I believe a whole new research work programme is needed to think ahead on how this looming service-sector transformation will impact the functioning of euro area macroeconomies. Indeed, one way to read my paper is as a sales pitch for such a work programme. To kick off the sales pitch, I frame my conjectures about

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<sup>2</sup> See ECB (2020) and ECB (201a, b, c)..

globalisation's future as a response to the classic question that journalists frequently pose to international economists across the planet.

## 2 Has globalisation peaked?

The answer to this question is twofold: for trade in goods and the phase of globalisation that has driven it since 1990, the answer is probably yes; for trade in services the answer is surely no.

### 2.1 False peaks in trade in goods

Chart 2.1 shows the standard case for 'peak globalisation'. The left panel shows the ratio of world trade in goods to world GDP from the 1960s to 2020 (most recent data). The 'lazy narrative' asserts that trade in goods was globalising gradually until the ICT revolution launched globalisation's "offshoring expansion" phase around 1990, but the Global Crisis killed globalisation around 2008.

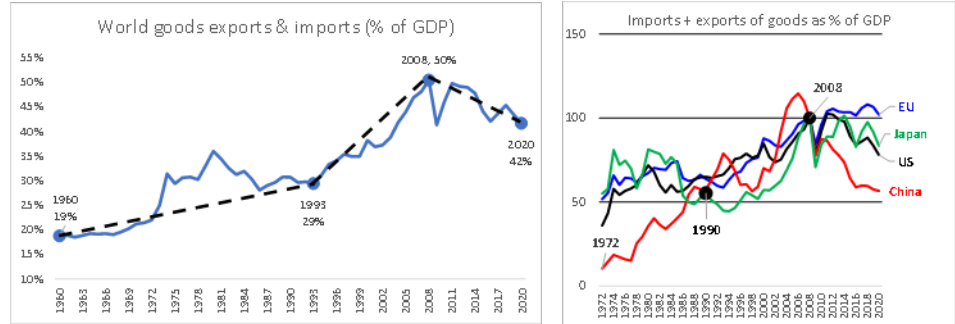
I call this the lazy narrative since the 2008 world peak is false. As the right panel shows, the world's largest exporter, China, peaked well before (in 2006), and the world's second and fourth largest, the US and Japan, peaked after 2008 (in 2011 and 2014 respectively). Taken together, the EU has not really peaked so much as stagnated. In other words, the peak in the left panel is false – a happenstance of adding together disparate trends. This is definitely not a situation where one explanation fits all (hence the 'lazy' moniker).

Nevertheless, it is clear that globalisation of markets for goods is no longer rising as it had been rising between the 1990s and the mid-2000s. 'Slobalisation' is the term used by some to describe this. Particularly striking is the shift in China's trade to GDP figures (right panel of Chart 1). For deeper analysis and empirical investigation, see Antras (2021), and discussion by Susan Lund.

### Chart 1

The peak globalisation 'lazy narrative': the ICT revolution launched globalisation's offshoring-expansion phase in 1993 then GFC killed globalisation in 2008.

(goods trade as % of GDP; for world, left panel; for right panel, indices 2008 = 100 for respective nations)



Sources: Author's calculations based on WTO data, downloaded from stats.wto.org  
 Notes: Trade in goods, and GDP figures measured in current price US dollars. Many authors present the ratio of all international commerce (goods and services) to GDP; here I focus only on the imports and exports of goods.

What's going on with China? India's and China's rapid industrialisation, which started with the globalisation's offshoring-expansion phase in the 1990s, was unusually fast by historical standards. Before the 1990s, many nations – including all the G7 nations apart from the UK – industrialised the old-fashioned way. They built up their industrial base behind high tariff walls. China and India, by contrast, did it by lowering tariffs, welcoming offshored stages of production, and thus receiving massive inflows of manufacturing knowhow from G7 firms. By the 2000s, however, the easy fruits of offshoring had been harvested by manufacturing firms, and the Indian and Chinese industrial bases achieved 'escape velocity'. For them, industrialisation led to a substitution of imported parts for locally made parts and a stronger focus on domestic customers.

### Chart 2

China and India are converging to normal, mega-economy openness ratios

(shares)

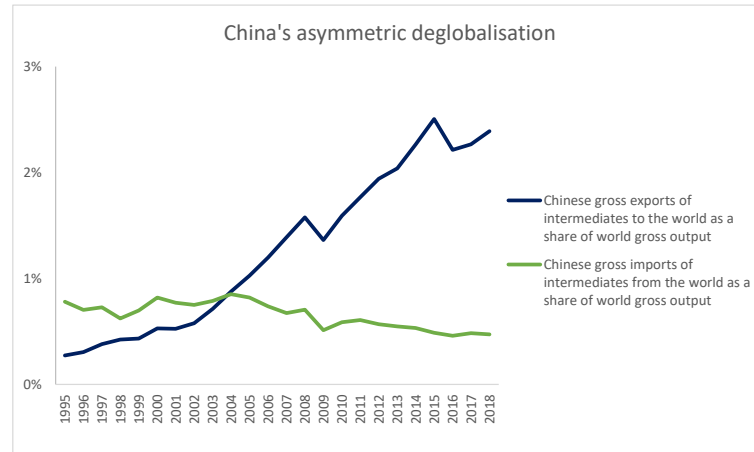


Sources: Author's calculations based on WTO data, downloaded from stats.wto.org  
 Notes: Trade in goods, and GDP figures measured in current price US dollars.

### Chart 3

China continues to expand its engagement with global supply chains on the selling side but is contracting its involvement on the sourcing side.

(shares of world gross output)



Sources: Calculations undertaken by Rebecca Freeman and Angelos Theodorakopoulos using concepts developed in Baldwin, Freeman and Theodorakopoulos (2022).

Note: The gross trade concept is used in both measures so as to match the gross world output which forms the denominator of both measures.

The evidence for China is clearest in Chart 2. Interestingly, China is now losing some stages of production to even lower wage emerging markets such as Vietnam (not shown). Chart 3 shows how the drop in Chinese trade in goods is due to an asymmetric decline in its purchases of imported inputs but a continued expansion of its sales of intermediates to nations around the world.

## 2.2 No peak in trade in services

While the global value of trade in goods has stagnated, trade in services has continued to boom. The pandemic had a peculiar impact on services trade stemming from the 'great lockdown'. In 2020 and 2021, travel and transport services plummeted, but other types of services trade continued to expand sharply.

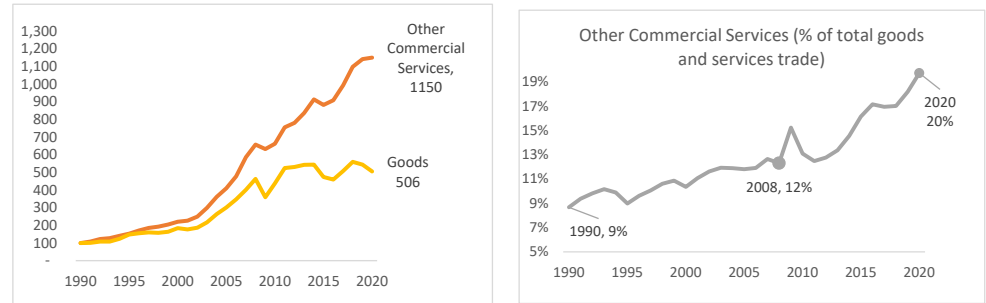
Data on trade in services is not really fit for the purpose of tracking its impact on the global economy. Services trade data is of a much lower level of quality and detail than is available for trade in goods. The services trade data is mostly gathered from balance of payment statistics where the service categories were created to provide slots for allocating international financial transactions that did not come with a customs form. At the most aggregate level, two categories are well measured and easily interpreted – travel (which includes tourism) and transportation – but about 60% of services trade falls into a grab-bag called 'Other Commercial Services' (the 'commercial' is added to indicate the service providers are private as opposed to public).

## Chart 4

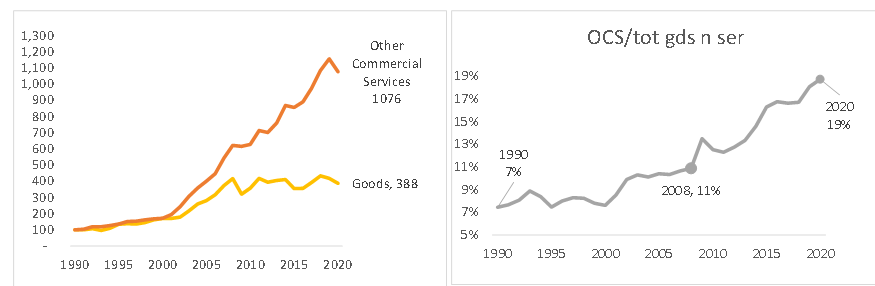
### Trade in services have continued to boom even as goods trade stagnated

#### Trends in world trade in goods and services, 1990-2020

(left panel, 1990=100, right panel, shares)



#### Trends for the euro area economy, 1990-2020



Sources: Data downloaded from [stats.wto.org](https://stats.wto.org).  
Notes: These flows are not normalised by world GDP

Here we focus on Other Commercial Services (OCS) when arguing that globalisation continues apace when it comes to services. Chart 4 shows that worldwide OCS flows have grown faster than trade in goods for decades (left panel), but the divergent paths became more pronounced after the 2008-09 Great Trade Collapse. Since the trade recovery in 2010, trade in goods has generally stagnated, but OCS have continued to grow rapidly. Between 1990 and 2020, goods expanded 5 times while OCS multiplied by 11 times. The right panel shows how this has shifted the importance of services in international commerce. In 1990, OCS accounted for only 9% of all trade in goods and services, but by 2020, that figure had tripled, and its rise shows no sign of abating.

Work in the most recent World Development Report leads to the same conclusion using a purpose-built categorisation of services trade (World Bank 2021). The publication points out that what they call 'data-driven services' have increased from about one-quarter to almost half of total service exports.

The bottom charts show that the same basic features hold for the euro area economy.

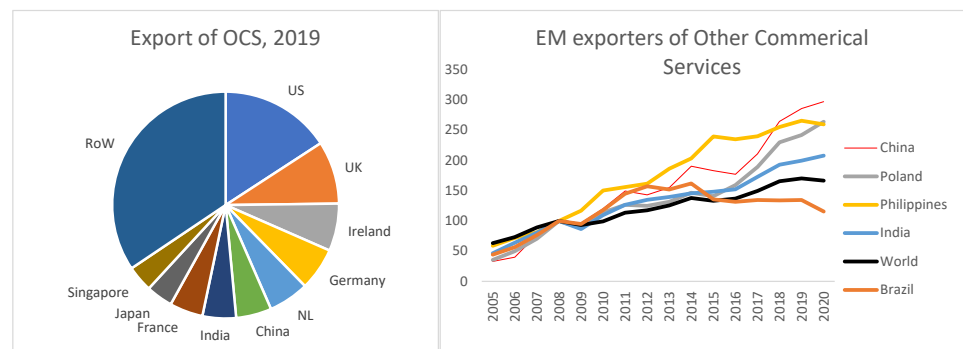
Who are the big players in the trade in services arena? The global shares of the largest OCS exporters are shown in Chart 5 (left panel). The top ten exporting nations account for about two-thirds of all service exports. The US, UK, Ireland, Germany, and the Netherlands alone account for about 40% of world exports. Adding in India and China brings the total to over half. The right panel shows that most of

the large emerging economies are seeing faster than average growth in their service exports. Brazil is an exception. This matters since the wages for their office and professional workers are far lower than they are in the euro area. As digitech makes remote workers less remote and easier to weave into workflows in high-wage nations, emerging markets are likely to offer a large reservoir of attractively priced service sector workers (more on this below).

### Chart 5

#### Top ten exporters of services and emerging market exporter trends

(left panel, shares; right panel, 2008=100,



Sources: Stats.wto.org

Notes: The series is "BOP6 - SOX1 - Other commercial services"

While advanced economies still account for the bulk of service exports worldwide, the role of emerging economies is fast gaining pace. The biggest emerging market exporters of services are China, India (with 5% of the world total each), Korea, Poland, the Philippines, and Brazil. The world export of OCS has risen by 1.7 times since 2005, but the OCS exports from China and India, for instance, have almost tripled.

The International Labour Organisation’s flagship report in 2021, “The role of digital labour platforms in transforming the world of work,” points out that: “a trend has developed towards outsourcing work, both low-skilled and high-skilled, especially as traditional businesses look to digital labour platforms and digital tools to meet their needs for human resources. These platforms host workers from around the world, enabling businesses to complete their tasks at a faster pace and lower price than if the tasks were performed on site. In many instances, the work is outsourced on these platforms by businesses in the global North and performed by workers in the global South.”

### Box 1

#### Primer on (the sad state of) trade in services statistics

This box presents the main categories of services trade, focusing on 2019 (the last year before Covid-19 massively distorted services trade). About 40% of all services trade consists of transportation (17%) and travel (24%, mostly business travel and tourism). The rest is called “Other



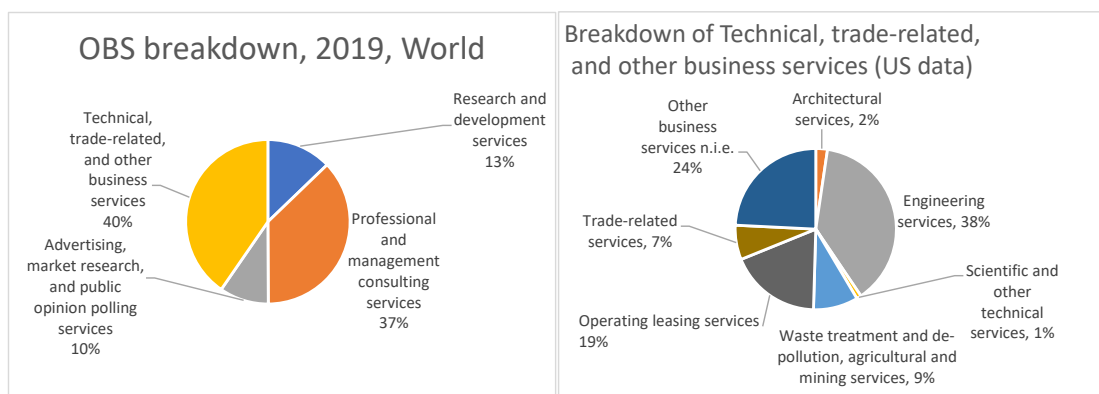
Commercial Services (OCS)". Here the 'commercial' means non-governmental (international provision of services by governments amounts to only 1% of services trade).

The OCS category consists of a few big items and many small items. Some are easily recognisable. Among the bigger categories are Financial Services (9%), and payments for intellectual property rights. The category Telecommunications, Computer, and Information Services accounts for 11% of the total; much of this is made up of computer services related to software, but a large share is tossed into the category 'Other computer services other than cloud computing' (this is typical of the lack of precision in trade statistics). The largest sub-category (23%) is 'Other Business Services'. This includes a broad array of services. Some – like Architectural, Financial, Engineering, R&D, Advertising and Marketing, and Professional and Management Consulting services – are easily associated with sectors and jobs. Others, like Operating Lease Services, and 'Other Business Services, not elsewhere included' are difficult to map into jobs and sectors in the domestic economy.

### Chart A

Breakdown of components of OBS, 2019, World

(shares of world trade by category, left panel; shares of US services imports, right panel)



Peeling off another layer of the onion, Chart A shows the components of OBS. The largest categories are: Professional and management consulting services (37% of OBS), and Technical, trade-related, and other business services not elsewhere included. Disaggregate figures for the 'Technical, trade-related, and other business services not elsewhere' included (TTOBS) category are not available for the whole world, but some nations – like the US – provide more detail. The right pie chart in the figure shows these. It indicates that the big items are: Engineering services, 38% of TTOBS; Leasing services, 19% of TTOBS; Other business services, not included elsewhere, 24% of TTOBS.

## 3 Why did globalisation change?

The charts showed that the boom in goods trade that started around 1990 slowed around the mid-2000s, but the boom in services trade powered throughout the

period. And this was but the latest big change in the nature of globalisation. How should we organise our thinking about these?

This section explains how the ‘globalisation as arbitrage’ perspective can account for the patterns while providing a springboard for conjectures about globalisation’s future. It is based on my early thinking (Baldwin 2006) and refinement in my 2016 book, *The Great Convergence: Information Technology and the New Globalisation* (Baldwin 2016).

## 3.1 Arbitrage and globalisation’s great unbundlings

Arbitrage drives globalisation. Since arbitrage is self-extinguishing, globalisation very naturally follows a “punctuated equilibrium” pattern. The argument is simple.

Putting capital flows aside, globalisation can be defined as all the things that happen when goods, services, investment, expertise, and intellectual property cross international borders. Arbitrage is what drives these cross-border flows. When things are scarce (and thus relatively dear) in one place and abundant (and thus relatively cheap) in another, firms arbitrage the differences by buying/making them in the later and selling them in the former. This is the heart and soul of international commerce.

The arbitrage is constrained by three main types of separation costs: trade costs, communication costs, and face-to-face costs. When these costs are high, arbitrage is difficult, so things remain ‘bundled’ together within economies. Autarky is the forceable bundling of all production and consumption within a nation. Before the 19th century transportation revolution, most production and consumption were bundled together inside nations. Trade was rare.

The history of globalisation is really the history of the progressive relaxing of the constraints on the arbitrage of goods, knowhow, and labour services. It could be called the cascading constraints view of globalisation.

### 3.1.1 Globalisation’s two historical unbundlings

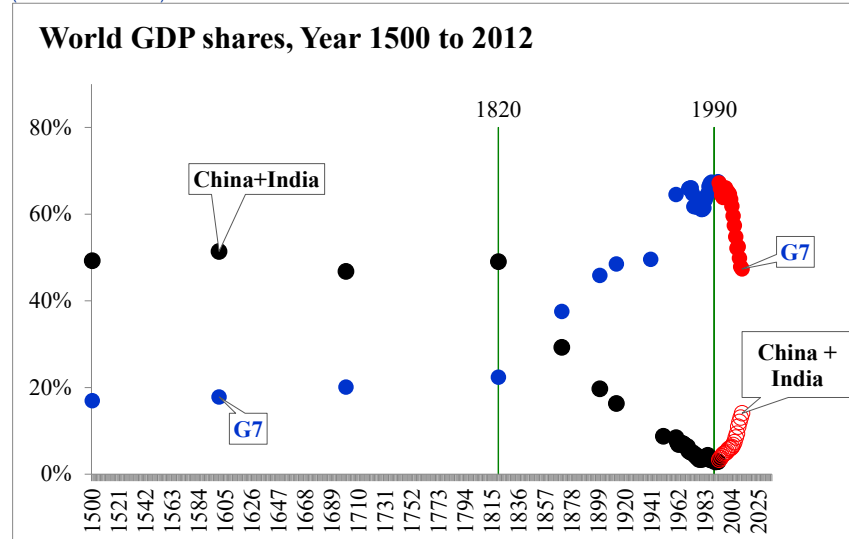
Globalisation’s ‘first unbundling’ happened when steam power and Pax Britannica radically lowered the cost of moving goods but lowered the other separation costs much less. Goods trade boomed – radically so in the long 19<sup>th</sup> century (1820 to 1914) – but it settled into a more routine expansion phase from about 1960 once the low-hanging arbitrage opportunities had been seized.

The trade boom reshaped the world. It set off self-enforcing cycles of agglomeration and innovation that spurred growth in the small club of economies that used to be called the industrialised countries. The rest of the world grew more slowly for 170 years. The result was the ‘Great Divergence’ (Chart 6).

## Chart 6

Globalisation's impact changed radically twice in the past two centuries

(Share of world GDP)



Sources: Author's calculations based on data downloaded from Maddison and WDI.  
Notes: GDP measured in current price dollars.

Globalisation changed dramatically around 1990 when it entered its offshoring-expansion phase, or what I have called the “second unbundling” to contrast it with the first unbundling (Baldwin 2006). This was triggered by the ICT revolution which relaxed the second separation cost – communication and coordination costs. ICT made it feasible for G7 firms to fragment highly complex industrial processes into production stages, and then spatially unbundle some of them to low-wage nations.

Think of this as the offshoring-expansion phase of globalisation where G7 manufacturing firms seized low-hanging opportunities for combining their advanced manufacturing knowhow with foreign low-wage labour in factories set up abroad. As the offshored process had to continue to operate as if it were still bundled, we can think of this as factories crossing borders, not just goods. Trade boomed again.

With factories crossing borders, parts and components often crossed borders multiple times with the natural result that the trade-to-GDP ratio took a step up (Chart 1). As with the arbitrage triggered by the first unbundling, the second unbundling eventually picked all the low-hanging offshoring and the expansion slowed. This, in my view, is where we are today. Additionally, the multiple-border-crossing trade is unwinding since industrial automation is reducing the labour cost-share of manufacturing and with it the profitability of offshoring stages to low-wage nations. Reshoring, in other words, is driven by secular technological changes in addition to any medium-term rise in trade costs and risks (Baldwin and Freeman 2021).

### 3.1.2 Comparative advantage was partly de-nationalised

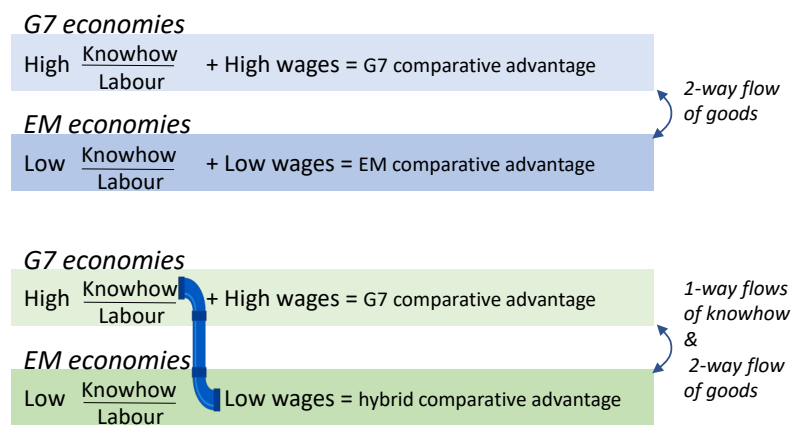
A point that is not sufficiently recognised is how different the economics driving the second unbundling was from that of the first. From 1820 to 1990, the arbitrage

driving the first unbundling could be thought of as following Ricardo's law of comparative advantage. Rich nations had higher knowhow-to-labour ratios (and thus higher wages) but in some sectors their high-tech more than offset their high wage and so they were price competitive. In other sectors, the opposite held and nations with low-tech-low-wage combination were price competitive. Two-way trade resulted.

The second unbundling was driven by arbitrage in manufacturing knowhow, which worked on very non-Ricardian principles. Manufacturing firms in rich nations owned lots of technical, managerial, and marketing knowhow but high communication costs restricted them to applying it only to rich-nation workers. ICT opened previously non-existence arbitrage opportunities that led to a one-way flow of knowhow out of G7 nations. Since the knowhow was the basis of the rich nations' Ricardian comparative advantage, we slipped into a world where the sources of comparative advantage were crossing borders, not just the goods that were the fruits of the comparative advantage.

A schematic diagram helps nail this down (Chart 7). The top two bars show the traditional determinants of Ricardian comparative advantage during the pre-1990 globalisation. Nations that had high knowhow to labour ratios (take the G7 nations to be concrete) had high wages. G7 nations had a comparative advantage in sectors where their high productivity more than outweighed their high wages. The second bar shows the situation of Emerging Markets (EMs) whose low knowhow/labour ratios produced low wages that were, in their comparative advantage sectors, low enough to offset their low productivity.

**Chart 7**  
How and why comparative advantage changed around 1990



Sources: Author's elaboration of ideas in Baldwin (2016).

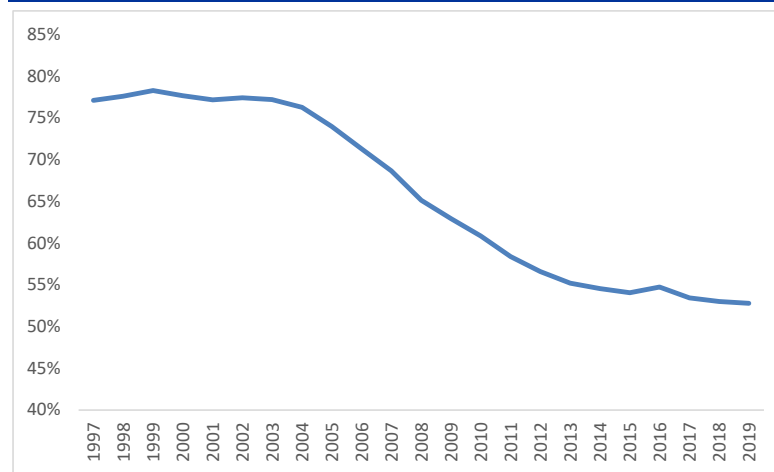
The second set of bars shows how the second unbundling changed comparative advantage. ICT opened a pipeline (i.e., relaxed the second constraint on arbitrage) that allowed G7 firms to combine their high technology with low wage workers abroad. This created a hybrid comparative advantage. For example, when Ford makes auto parts in Mexico, it is using American knowhow and Mexican labour, not Mexican technology and Mexican labour. Before ICT, this was not practical. Comparative advantage was defined at the level of the US and Mexico. After, it was

defined at the level of Ford's internationalised manufacturing process. In manufacturing sectors, the contours of comparative advantage shifted from national boundaries to GVC boundaries.

The resulting high-tech-low-wage combination was globally disruptive. It radically changed the nature and impact of globalisation both across nations and within nations. Most obviously, it fostered a rapid shift of manufacturing away from rich nations (Chart 8). And it reversed the growth gradient. After 1990, many poor nations grew faster than the rich ones. This produced a rapid reversal of global GDP shares from about 1990 (Chart 3.1).

### Chart 8

High-income countries' share of world manufacturing GDP rapidly fell to a lower plateau during globalisation's offshoring-expansion phase (second unbundling)



Sources: Author's calculations based on World Development Indicator data.  
Notes: Manufacturing, value added (current US\$), ratio of World Bank's High Income Country group to world.

In short, the arbitrage unleashed by steam power created a type of globalisation that stressed trade in made-here-sold-there goods. The knowhow arbitrage unleashed by ICT meant that factories were crossing borders, not just goods. According to this reading of history, the transitional buildout of GVCs produced rising trade to GDP ratios from 1990 to the mid-2000s. By then, all the easy arbitrage was completed. The low-hanging fruit had been picked.

This begs the question: Why did services trade behave so differently?

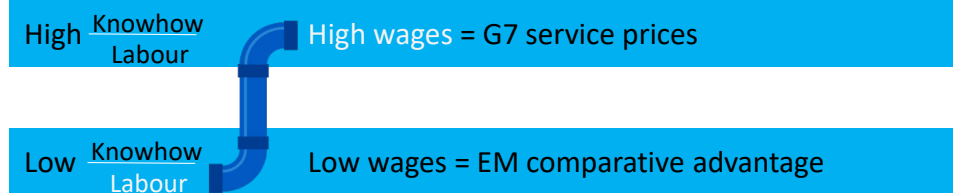
## 3.2 Future globalisation's third unbundling

Today we are seeing a third unbundling. It is driven by the modern version of ICT – namely digital technology. But rather than enable arbitrage in manufacturing knowhow via GVCs, it is enabling the arbitrage of labour service sector via telemigration. Think of it as the spatial unbundling of labour and labourers, or a spatial separation of office workers and their offices.

### Chart 9

Why services trade did not peak in the mid 2000s

#### 3<sup>rd</sup> unbundling comparative advantage



Sources: Author's elaboration of ideas in Baldwin (2016).

Chart 9 schematically illustrates some differences between the third unbundling and the first two. The first unbundling was arbitrage in goods, with knowhow locked inside nations. The second unbundling allowed the source of Ricardian comparative advantage (knowhow) to be arbitrated internationally. The economics of the third unbundling is much more like that of the first.

The arbitrage is between the low service-sector wages in emerging economies and the high service-sector wages in G7 nations with digitech opening the pipeline that allows this export of office work without the office workers migrating. Since the job is not always won by the cheapest, the export of labour services will be two-way. As always, the easier arbitrage will mean more opportunities for a nation's most competitive service workers but more competition for its least competitive service workers.

### 3.2.1 The third unbundling as service-sector wage arbitrage

Note that the arbitrage here is direct wage competition among service sector workers, and wage differences are probably the largest unexploited arbitrage left in today's world. Taking Colombia as an example of a middle-income emerging market, a recent study matched the US's occupation classifications with those of Colombia to compare wage rates (Baldwin, Cardenaz, and Fernandez 2021). Focusing only on the occupations that Dingel and Neiman (2020) have classified as teleworkable in the US, the study found that the wages in the US were on average 1500% higher in the US than in Colombia. Plainly low wages are not the only source of competitiveness in services but with wage gaps being that large, it is likely that the digitech-driven globalisation of the service sector will have an impact on prices in advanced economies.

Some of the arbitrage is done via online freelancing platforms like Upwork, Freelancer, and Zhubajie (these are like eBay but for services). Wage comparisons based on worker-level data scrapped from such online freelancing platforms confirm the presence of enormous wage gaps, although the size varies greatly according to the data selection criteria. Data from a number of the largest freelance platforms reported in ILO (2021) indicate that average hourly earnings paid in a typical week for those engaged in online work is US\$4.9, with the majority of workers (66%)

earning less than the average. While \$4.90 an hour seems like a low wage in Europe, it corresponds to full-time equivalent salary of about \$10,000 per year – a salary which is considered comfortably middle-class in most countries.

An important difference between goods and services barriers arises from the nature of some services. While most goods can be put in a box and shipped, some services require real face-to-face contact. This need will shield some rich-nation service workers from direct wage competition. As the face-to-face need does not line up clearly with high- versus low-skill distinctions (as we found out during the Covid lockdowns), the domestic impact of the third unbundling may be quite different than that of the first and second.

As with the first two, the third unbundling will, in my view, affect the macroeconomy by strengthening the connection between domestic and international prices while weakening the connection between domestic labour supply and demand conditions and the wage formation process. There will be some big differences that are explored in Section 4, but first consider the future of services trade.

### 3.3 The future of globalisation is trade in intermediate services

Digital technology is refashioning the future of trade. Trade in services has grown faster than trade in goods for years. This section presents the argument that this trend will continue for the foreseeable future and may well accelerate.

The argument boils down to a few facts and a deduction. First, barriers to trade in most services are now two or three orders of magnitude higher than the barriers to trade in goods (Benz and Jaax 2022), but many of today's service barriers are technological rather than fiscal or regulatory.

Services are hard to tax at the border, so most barriers arise from domestic regulation (OECD 2020). Much of this regulation, however, concerns "final" services, not "intermediate" services. Regulations, restrictions, and controls typically apply only to transactions between the final service seller and the final service buyer. The service tasks that are inputs to these final services are – by contrast – much less regulated. For example, while there are strict rules for selling accounting services in the US, there are few rules concerning the qualifications of the service workers that do the paperwork behind the provision of such accounting services. A US accountant can employ pretty much anybody to tally up a client's travel expenses and collate them with expense receipts. The quality control burden falls on the sellers of the final service, not government regulators.

In short, since it is hard to tax imported services, the main source of protection is regulation, but since most of the regulation only applies to final services, the main barriers to international arbitrage in intermediate services are the difficulties of coordinating work teams that include faraway workers.

The second fact is that digitech is rapidly lowering the technological barriers to trade in intermediate services. These two facts mean that service-trade barriers are falling

radically faster than goods-trade barriers and likely to continue doing so for the foreseeable future.

The third fact is that export capacity in emerging markets is not as great a limiting factor in services as it is in goods since every nation has a workforce that is already producing intermediate-service tasks. All emerging market economies have bookkeepers, forensic accountants, CV screeners, administrative assistants, online client help staff, graphic designers, copyeditors, personal assistants, travel agents, software engineers, lawyers who can check contracts, financial analysts who can write reports, etc. There is no need to develop whole new sectors, build factories, or develop farms or mines. This fact is the basis of a broad re-evaluation of development pathways for emerging markets – as has been noted by several recent, high-profile reports stressing the role of services trade in development (WTO, 2019; Nayyar, Hallward-Driemeier, and Davies, 2021; ILO, 2021; ADB, 2022).

The fourth fact is that the demand for imported intermediate services is not as great a limiting factor as it was for trade in goods. Businesses in G7 nations spend a great deal on services. Many services, say housing services, are nontraded, but many are potentially tradable. Roughly speaking, if the service could be provided by someone working remotely during the pandemic, then it is a candidate for competition from imported services. Moreover, tradeable intermediate services are inputs into many nontraded final services. For instance, a company that manages rental properties can cut costs by offshoring some back-office services to a low-wage nation.

The deduction is simplicity itself. Barriers are radically higher and falling radically faster for services versus goods, and, unlike farm and factory goods, there is no capacity constraint when it comes to intermediate services. Ergo, the future of trade lies in services.

### 3.3.1 [How important are imported intermediate services to the euro area?](#)

While official trade data does not distinguish between final and intermediate services, the OECD's TiVA database has, via estimation rather than observation, collected the bilateral flows in intermediate services. This database covers only the advanced economies and a few large emerging markets.

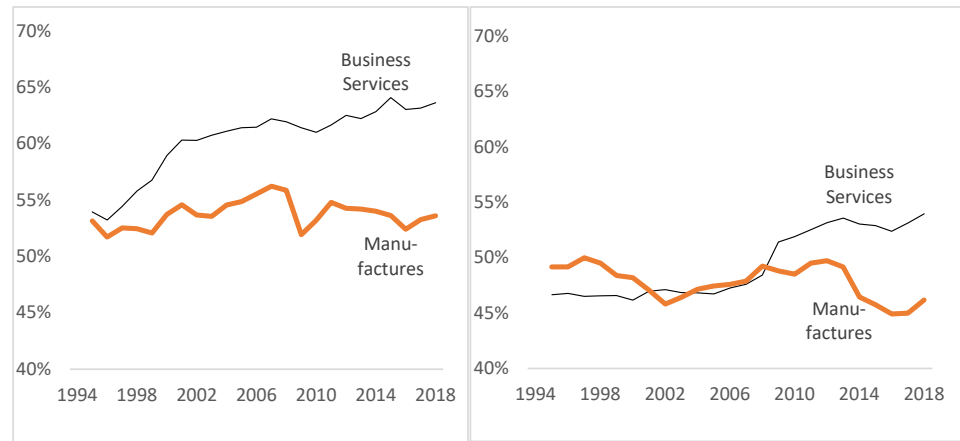


## Chart 10

### Imported services used more as intermediate inputs than are imported manufactures

#### Intermediates as share of imported services and manufactures, 1995-2018, EA19 and UK

(shares of own-sector imports, 1995 - 2018)



Sources: Author's calculations based on OECD TiVa data, downloaded from [stats.oecd.org](https://stats.oecd.org)

Notes: TiVa data is only available for the 1995-2018 period. Imports in the charts are measured on the usual 'gross' basis (not value added basis). Business services encompass all non-governmental services (the TiVa database categories of services do not line up with standard trade in services categories, like OCS).

The left panel of Chart 10 shows the numbers for the euro area as a whole and the figures for the UK in the right panel for comparison. The level for manufacturing, at about  $\frac{1}{2}$ , indicates that the EA19 manufacturing sectors are highly dependent upon imported intermediate inputs. The trend is rising up to the mid 2000s but declining since. This mirrors the trends already been documented. The line for the importance of imported intermediates in services is quite distinct. The level starts out a bit higher for services than goods, but the trend is steadily upwards. For the UK, the facts are similar when it comes to trends, in particular the rising importance of imported intermediates in services.

## 4 Services are important and different

Services are an enormously important part of the euro area (EA) economy and getting more important, as Chart 11 shows (the left panel emphasises levels, the right panel focuses on trends). Twenty years ago, service jobs accounted for about two-thirds of EA jobs. The figure now stands at about three-quarters (left panel). The service sector GDP share rose from 63% to 66% but has stagnated since the Global Crisis (left panel). The divergences in the levels between jobs and GDP shares are due to the well-known fact that labour productivity is, on average, lower in services than it is in other sectors. The divergence in the trends show that the productivity gap has been widening.

Chart 12 shows that the secular rise in the importance of services in consumption expenditure was suddenly and sharply reverse during the period of intense Covid lockdown policies. The future will tell, but the reversal is likely to be reversed going forwards as the lockdowns and restrictions become a thing of the past.

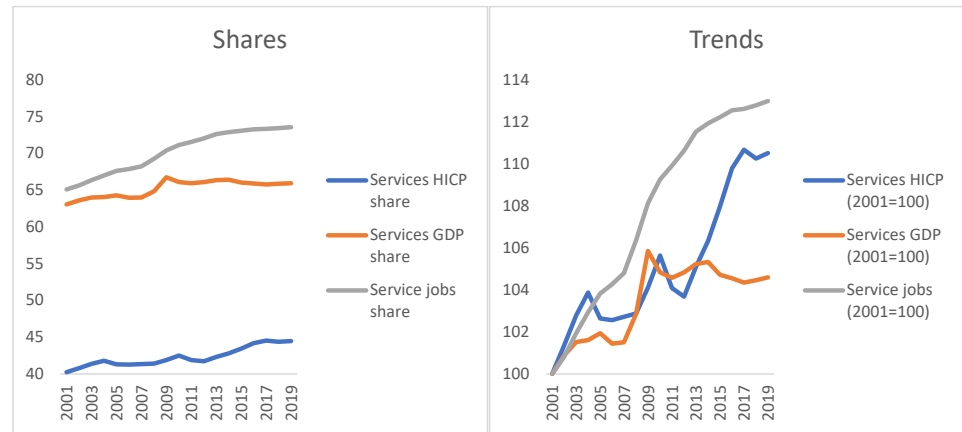
A remarkable feature of these charts is the substantial difference between services' weight in consumer expenditure and their weight in the general economy. Since the EA's net export of services is a small share of GDP (around 1%), the difference must lie in the fact that many services are either sold to other final users (government or investment expenditure) or are used on inputs into the production of goods and services.

**Chart 11**

'Servicification' of the euro area economy, levels and trends

**Service sector jobs and GDP shares and weight of services in HICP, 2001-2019**

(shares of own-sector imports (left panel); indices (right panel, 2001 = 100)



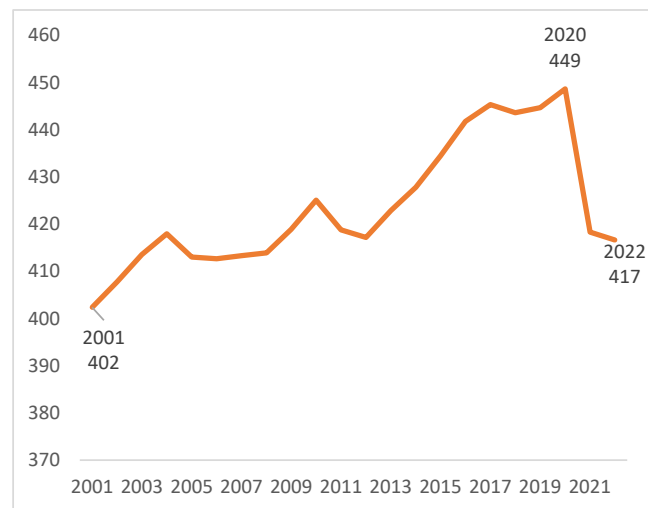
Sources: Authors elaboration of World Bank and Eurostat data

**Chart 12**

The weight of service prices in HICP was rising until C19

**Weight of all services in HIPC**

(weight of all items is 1000)



Sources: Author elaboration on Eurostat online data.

### 4.1.1 Services are three times more important as intermediate inputs into domestic production than manufactures

While the importance of intermediate inputs is widely recognised in goods sectors – that is what GVCs are all about – the focus of most studies has been on intermediate goods (Johnson 2014). This is a missed opportunity since it turns out that services are about three times more important as intermediates than manufactures.

Table 1 – which looks at the French economy as an example – shows that at the level of the whole economy (bottom row), intermediate service inputs account for 30% of the total gross output, while manufactured intermediates account for only 11%. Note that ‘gross output’ is value added (i.e., GDP) plus the use of all intermediates consumed in the production of the final value added.

**Table 1**  
Roles of services vs manufacturing as intermediate inputs, France, 2018

	Service inputs	Manufacturing inputs	Imported service inputs	Imported manufacturing inputs	Sector share of total gross output
Service sector	32%	5%	4%	2%	68%
Manufacturing sector	24%	25%	4%	13%	26%
Primary sector	28%	17%	3%	5%	6%
Total economy	30%	11%	4%	5%	100%

Sources: Author elaboration on Source: Author’s manipulation of calculations produced by Rebecca Freeman and Angelos Theodorakopoulos using the OECD’s inter-country input-output data base. See Baldwin, Freeman, Theodorakopoulos (2022).

The usage of services and manufactures as inputs naturally varies across sectors as the first two columns show. The importance of services, however, is consistently high in primary, secondary, and tertiary sectors while manufacturing usage is concentrated in the manufacturing and primary goods sectors. The outsized importance of service inputs at the economy-wide level is explained by the fact that the French service sector is twice as large as the primary and secondary sectors combined (68% for services and 32% for manufacturing and primary sectors).

When it comes to the role of imported inputs, the pattern is more even. At the economy-wide level, imported service imports account for 4% of gross output while imported manufactured goods account for 5%. The general impression that imported intermediate goods are critical to imported inflation comes from the facts that hold for the manufacturing sector. For manufacturers, imported inputs of manufactured goods amounts to 13%. The modest size of the manufacturing sector in the French economy’s gross output (26%) explains why imported manufactured inputs are much less important at the aggregate level. Looking at the same calculations for the earliest available year, 1995, reveals the growing role of services. In 1995, intermediate services accounted for 25% of France’s gross output while manufactured intermediates accounted for 14% (not shown in table).

## 4.2 Services sector automation

Digital technology is exerting a deflationary pressure on service prices via an entirely separate route – automation. This assertion requires some background on important but insufficiently remarked differences between ICT and digital technology. Today's digitech impulse is radically different than the steam-power impulse that triggered the first automation (called mechanisation, or industrialisation), and the impulse that triggered the second automation (called computerisation). The differences between the digitech breakthrough and ICT, however, are subtler than the differences between steam and ICT.

When computers and integrated circuits started getting useful in the 1970s, automation crossed a 'continental divide' of sorts. There are many ways of characterizing this crossing – a shift from things to thoughts, from hands to heads, from manual to mental, from brawn to brains, and from tangible to intangible. But regardless of how we think of it, computers could do only a highly restricted type of thinking. In fact, they weren't thinking in any real sense, they were just following an explicit set of instructions called a computer program. They were strictly obedient to the computer code.

Digital technology has pushed computing across a second "continental divide." Think of it as the switch from conscious-thought to unconscious-thought. Daniel Kahneman called these 'thinking fast and thinking slow'. Thinking slow is the conscious, explicit reasoning that humans could teach to computers using programming languages. Thinking fast is the unconscious, instantaneous, instinctive thinking that we could not teach computers by writing code. Back then, computers could not do intuitive, unconscious thinking since we didn't understand how humans think intuitively.

A type of AI called "machine learning" allowed computers to jump over this limitation. Since 2016 and 2017, computers are as good or better than humans in some instinctual, unconscious mental tasks—things like recognizing speech, translating languages, and identifying diseases from X-rays.

The upshot is that computers now have cognitive capacities that they never had before 2017 (which was dubbed the "Year of AI" by Fortune magazine). While machine-learning progress was smooth, in 2016 it started producing models that allowed computers to do shocking things, like beat the world's best Go player. This matters for the issue at hand since some of computers' new cognitive skills are useful in the service sector. This is leading to automation of services that had previously been thought to be immune to automation.

Computers' new cognitive skillset is allowing automation of some service sector task, not just factory tasks as in the past. While both the new globalisation and the new automation is likely to affect the workplace at the task level more than the occupation level, it is useful to look at which types of occupations have a high share of tasks that are either vulnerable to globalisation, or to automation, or to both.

### 4.3 Which service jobs are offshorable and automatable?

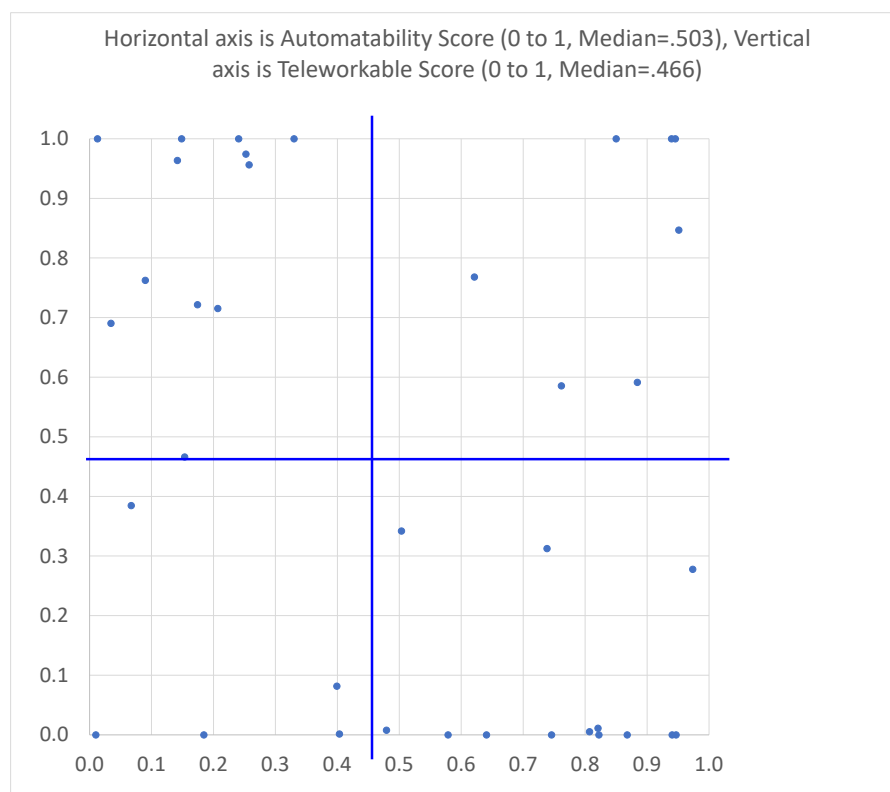
A couple of famous attempts have been made to classify occupations by teleworkability and automatability. Here we use the two most well-known efforts to classify jobs. These were done on US data.

To stress that service jobs and thus service prices are being affected by both globalisation (i.e., offshoring of service tasks, especially intermediate service task) and automation (i.e., application of machine-learning trained models to automate certain service sector tasks), Baldwin and Okubo (2022) plot each occupation in a quadrant diagram, the Globotics Quadrant (Figure 13). To reduce clutter, occupations are aggregates from the original 700+ Bureau of Labour Statistics categories of occupations into Japan's 37 occupations.

**Chart 13**

The globotics quadrant diagram for the US

(units, axis description)



Sources: Baldwin and Okubo (2022), used with permission  
Notes: Automatability score based on Frey and Osborne classification of occupations; Teleworkability classification based on Dingel and Neuman classification of occupations. Blue lines indicate median values of the normalised series.  
The US job categories used by these authors (over 700) are grouped together into the Japan's NIRA categorisation of occupations, weighted by employment levels.  
See Table 4.2 for a list of occupations in each quadrant.

A few salient points are worth highlighting. First, the occupations are fairly evenly spread across all four quadrants. Second, there is no clearly positive or clearly negative correlation between offshorability and automatability. Third, there is a notable clustering of occupations with the lowest possible teleworkable score but a high automatable score, and one with high teleworkability and low automatability.

**Table 2**  
**US occupations by globotics quadrant**

(NE is both automation and globalisation, SW is neither, NW is globalisation with little automation, SE is automation with little globalisation)

NW quad	NE quad	SW quad	SE quad
<b>Accountancy clerks</b>	General clerical workers	Doctors, dentists, veterinarians, and pharmacists	Administrative and managerial workers
<b>Agriculture, forestry and fishery workers</b>	Management, finance and insurance professionals	Medical Technology and Healthcare Professionals	Architects, civil engineers and surveyor
<b>Agriculture, forestry, and fishery engineers</b>	Manager of residential facilities and buildings	Occupational health and hygiene service workers	Artists, designers, photographers, film operators
<b>Carrying, cleaning, packaging, and related workers</b>	Office appliance operators	Professional social welfare workers	Authors, journalists, editors
<b>Construction and mining workers</b>	Outdoor service workers	Public health nurses, midwives, and nurses	Data processing and communication engineers
<b>Food and drink cooking, staff serving customers</b>	Sales clerks	Security workers	Legal Professionals
<b>Manufacturing process workers</b>	Transport and post clerical workers		Management and business consultants
<b>Other service workers</b>			Manufacturing engineers
<b>Production-related clerical workers</b>			Other specialist professionals
<b>Sales workers</b>			Researchers
<b>Transport and machine operation workers</b>			Teachers
<b>Workers in Family Life Support and Care Service</b>			Workers in religion

Sources: Baldwin and Okubo (2022), used with permission  
 Notes:

The occupations in the North-east quadrant are exposed to above average offshorability (taking teleworkability as a rough indicator of offshorability) and to above average automation. These are: General clerical workers, Management, finance and insurance professionals, Managers of residential facilities and buildings, Office appliance operators, Outdoor service workers, Salesclerks, and Transport and post clerical workers. While there are only seven categories in this quadrant, they are occupations with many employees. In total, about 11 million people work in the North-east quadrant occupations, which is over 10% of the 103 million workers in all 37 of the occupations listed here.

## 5 Globotics and HICP developments

Globalisation affects the functioning of the euro area macroeconomy in many, many ways. Here I will focus only on the impact on the HICP. My original intent was to extend – to trade in services – the analyses that had been done for trade in goods. Upon reflection, I believe that is not possible without an entire research work programme. This section explains my reasoning starting with a quick recap of the

classic imported inflation analyses of the 2000s (Auer and Fischer 2010; for a review see Balatti et al 2021). Before that, however, it is worth showing that goods and services in the HICP behave very differently. As we saw, all services taken together count for about 45% of the HICP price basket in 2020. Clearly, any change in the evolution of services prices could have a big impact on HICP inflation.

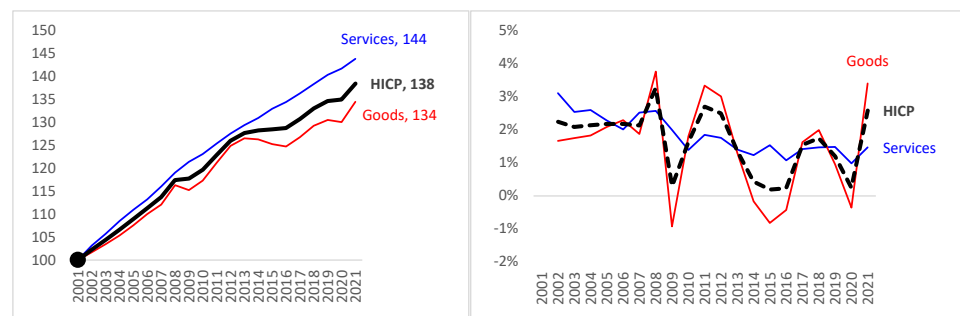
As it turns out, the price of services in the HICP measure have behaved quite differently than those of goods. In a nutshell, service prices have risen faster than goods prices and with notably less annual fluctuation (Chart 14). For the euro area as a whole, the service price sub-index rose by 44 points since 2001, while the goods price sub-index rose by only 34 points (Chart 14, left panel). Disaggregated data (not shown) tells us that this faster service inflation was strongest in the low-income euro area members like Estonia, Latvia, and Lithuania. This is to be expected.

### Chart 14

Euro area HICP index, and the goods and services sub-indices behave very differently.

#### Levels and annual inflation, 2001-2021

(left panel: indices 2001 =100, number are levels in 2021; right panel, annual inflation, %)



Sources: Author elaboration of online data. Note: Services have about 40% weight in the HICP (including house Notes:

The stylized fact that service prices rise faster than goods price is known as the Balassa-Samuelson effect. It is typically thought of as arising due to two other stylised facts, namely that productivity advances faster in goods than services, and services are less traded than goods. According to the Balassa-Samuelson mechanism, ongoing globalisation pulls workers into the most productive (export) sectors with the result that wages rise economy wide. As services are nontraded, labour intensive and enjoy slower labour productivity growth, service prices rise faster than goods prices.

The right panel of the chart displays shows that services have played a stabilising roll in annual inflation rate of the full HICP. For the last 20 years, services prices have been less volatile than goods prices (right panel).

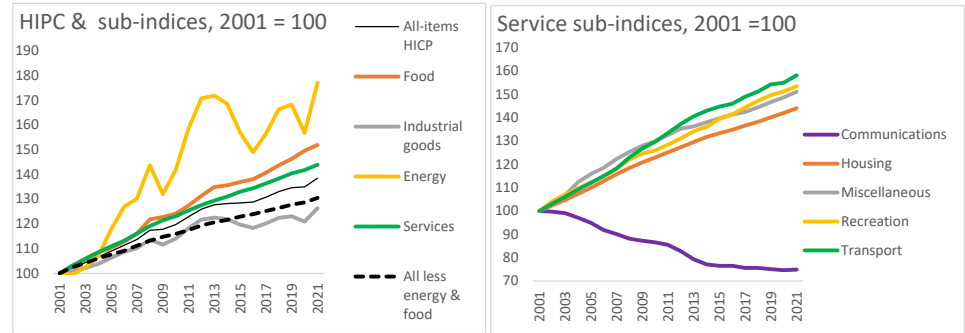
A slightly more detailed decomposition breaks out industrial goods, energy, food, and services (Chart 15). Here we see that both the food and energy prices have risen even faster than service prices, with industrial goods prices rising the least rapidly over the two-decade period. The basic points can be seen more precisely in Table 3.

**Chart 15**

**HICP sub-indices and focus on service sub-indices, 2001-2021**

**Apart from communication services, which was powerfully deflationary, all service sub-indices rose faster than the all-items HICP**

(indices 2001 = 100)



Sources: Author elaboration of online data.

Notes: Food refers to Food including alcohol and tobacco, and Services refers to Services (overall index excluding goods).

**Table 3**

**Services inflation has been higher on average but less volatile, 2001 - 2021**

Category	20 year inflation (to 2021)	Annual inflation standard deviation	2019 HICP weight
All-items HICP	38%	0.9%	1000
Food including alcohol and tobacco	52%	1.0%	190
Industrial goods	26%	1.8%	365
Energy	77%	6.3%	101
Services (overall index excluding goods)	44%	0.6%	445
Overall index excluding energy, food, alcohol and tobacco	31%	0.4%	709
<i>Focus on services</i>			
Services related to communication	-25%	1.2%	26
Services related to housing	44%	0.5%	110
Services - miscellaneous	51%	1.1%	84
Services related to recreation, including repairs and personal care	53%	0.7%	153
Services related to transport	58%	0.8%	72

Sources: Eurostat online HIPC database



## 5.1 The goods-based ‘Globalisation of Inflation Hypothesis’ (GIH)

During the offshoring-expansion phase, say 1990 to 2008, many analysts presented evidence showing that inflation became less sensitive to domestic cyclical conditions and more sensitive to global factors (Borio and Filardo, 2007, White 2008, BIS 2014, 2015, etc). This came to be known as the globalisation of inflation hypothesis (GIH). The received empirical judgement was that competition from imported manufactured goods held down inflation modestly, but the simultaneous commodity supercycle drove up commodity prices leading to imported inflation.

Many of the GIH studies approached the mechanism along Phillips Curve lines, namely the linkages between domestic inflation and global versus domestic demand slack variables (IMF, 2016b, ECB 2021a). Others estimate the total impact of imports from low-wage nations on domestic prices using instrumental variables. Still others take a “decomposition approach” that starts from the role of imported prices in a price index, say the HICP. Here I will focus only on the latter as it is the most direct, most transparent way to demonstrate my key point – that the impact of services trade on inflation dynamics is a matter that requires much more research.

### 5.1.1 An accounting decomposition: goods trade and domestic inflation

To structure the discussion and clarify terms, consider a super-simple price index which aggregates the price of imported goods,  $P_{imp}$ , and domestic goods  $P_{dom}$ , using  $\mu$  as the weight placed on imports (‘mu’ being a mnemonic for imports). Thus

$$(1) \quad P = (P_{imp})^{\mu} (P_{dom})^{1-\mu}$$

As a matter of pure logic, the impact on the price index of changes in the two prices and the weight is:

$$(2) \quad \% \Delta P = \mu (\% \Delta P_{imp}) + (1 - \mu) (\% \Delta P_{dom}) + \Delta \mu (P_{imp} - P_{dom})$$

where  $\Delta$  stands for change, and  $\% \Delta$  for percent change. The first two terms tell us that overall inflation is the weighted average of the inflation of the two component prices (domestic prices and import prices). The third term is the share-change effect; shifting expenditure to cheaper goods slows inflation.

This mechanical decomposition points to three mechanical links between globalisation and inflation. First, the direct impact of imported final goods prices. If import prices rise slower than domestic prices (i.e.,  $\% \Delta P_{imp} - \% \Delta P_{dom}$  is negative), we can say that imports are slowing domestic inflation. Second, the imported goods share-change effect. If import prices are lower than domestic prices (i.e.,  $P_{imp} - P_{dom}$  is negative), then a rise in the expenditure share on imports, (i.e.  $\Delta \mu$  is positive), will pull down the domestic inflation rate.

Carluccio et al (2018) implement this approach focusing on France and distinguishing between imported goods from high-wage and low-wage nations. They show that the share-change channel did contribute to lower EA inflation, since expenditure shifted from domestic goods to goods imported from low-wage countries

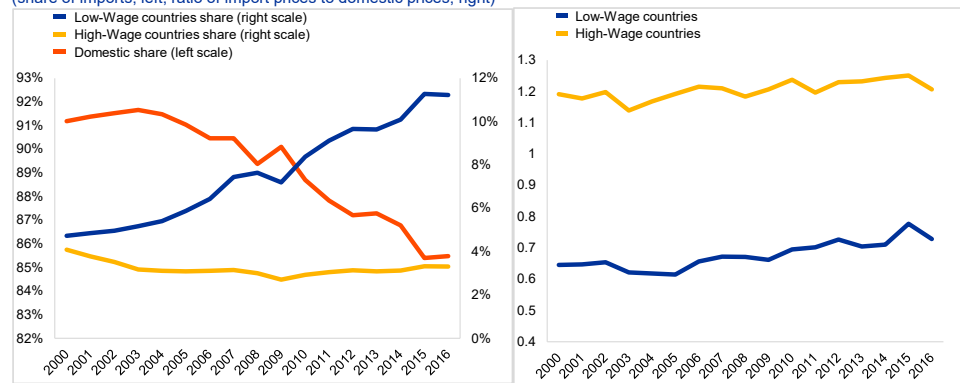
(left panel of Chart 16), and the price of imports from low-wage nations were substantially lower than goods made in EA nations (right panel). The right panel, however, indicates that the direct impact was small since the ratio of prices from low-wage nations rose faster than EA prices (i.e., the ratio of prices was rising in this period).

### Chart 16

Example of an application of the GIH to imported goods prices, Carluccio et al (2018)

#### Imports from low-wage were cheaper and replaced those from high-wage nations

(share of imports, left; ratio of import prices to domestic prices, right)



Sources: Data from Carluccio et al (2018), used with permission.

Notes:

The missing mechanism is the indirect impact of imported goods prices on domestic prices via various economic mechanisms ranging from the impact on price-cost mark ups, lower prices for imported intermediate inputs, and the impact of import competition on workers' wage bargaining power and thus wage hikes.

Carluccio et al (2018), quantified the three channels for France during two decades of the offshoring-expansion phase of globalisation (1994 to 2014). They found that taken together the three channels lower French annual inflation by a total of about 0.16 percentage points per year on average over the two decades. The three channels of imported deflation were found to be roughly equal in terms of quantitative importance.

There are several major difficulties in extending this approach to the globalisation of euro area service sectors.

## 5.1.2 Many HICP services are intrinsically nontraded and hard to price

The calculations used to estimate the impact of imported goods on the HICP relied on the fact that most of the goods in the HICP are traded. This fact, plus the existence of high-quality price data for imported goods imports, allowed Carluccio et al (2018) to match import prices with domestic prices, which was the first step to studying the impact of globalisation on prices in the HICP. When it comes to services, the situation is quite different on both scores.

Only a few of the services in the HICP are clearly traded. The HICP categories are not designed to distinguish between goods and services, but Eurostat publishes an HICP sub-index for “services (overall index excluding goods)”, and five sub-indices of the Services HICP index. These are – with their HICP basis-point (bp) weights in parentheses – are: 1) services related to communication (3bp), 2) service related to housing (11bp), 3) services - miscellaneous (9bp), 4) services related recreation, including repairs and personal care (15bp), and 5) services related to transport (7bp).

These service sub-indices are quite aggregate but plainly illustrate the inherent non-tradability of many of the services in the HICP. Most of the services related to communication are tradable, but most of them related to housing are not. But how do we move beyond this eyeballing approach to tradability?

As part of a research programme, it would be useful to classify all the services in the HICP index on a scale of tradability using statistical methods. For example, exchange rate movements of the euro will naturally move the prices of items that are traded but not the prices of items that are not traded. Thus, the estimated passthrough elasticity of euro movements on a panel of disaggregate HICP service price indices could be used as a proxy for tradability. One could expect that the passthrough elasticity for, say, the service ‘maintenance charges in multi-occupied buildings’ would be zero, but that it would be high for, say, ‘package international holidays’.

Another problem that is unique to services is the lack of import price data. This stems from the way trade in service statistics are typically gathered. In many cases, the service trade statistics are gathered by the central bank as part of its balance of payments accounting. Each international financial transaction has to be allocated to something crossing the border in exchange for the payment. If the thing is a good that has generated a customs form, then everything is clear. If not, it has to be allocated to a service of some kind. When I first took macroeconomics in the mid 1970s, these were called ‘trade in invisibles.’

Critically, the absence of a customs declaration obviates the usual source of trade price data. The customs form asks for the value of the shipment and for the quantity in the shipment. Often the quantity is listed in kilogrammes or units, say the number of flat-panel TVs. Dividing the value by the quantity yields a price-like thing called the unit value index. Most service transactions, however, are not associated with a quantity measure and so the unit value calculation is impossible.

As part of a work programme, a work-around might be employed. While governments have not seen the merit in gathering price data on traded services, the same is not true for domestic prices. As we saw with the HICP, services are important, so prices must be gathered. Moreover, services account for the lion’s share of GDP for most nations and so national statistical offices must develop estimates of the prices of produced services. Without them, they could not produce real GDP growth figures.

While these are domestic prices rather than traded prices, gaps between different nations' domestic service prices could be used as a proxy, or as an instrument for gaps between domestic and import prices as in equation (2).

## 5.2 Mapping white-collar robots and telemigrants into HICP prices

A fundamental difference between automation and globalisation of goods versus services concerns the economic impact point. When it comes to goods, data gathering and empirical analyses focus on firms, factories, and products. Masses of papers, for instance, have looked at the automation and globalisation of the auto sector. It has been relatively easy to map these impact points into prices. The statistical classification used for trade goods does not perfectly match the classification used for GDP accounts, but developing concordances is straightforward.

When it comes to services, the data-gathering and empirical analyses have focused on occupations or tasks. The globotics quadrant, for example, is presented in 'jobs space'; it is concerned with automatability and offshorability that is defined at the level of occupations. This is standard in the future of work literature, along with an alternative focus on 'task space' (i.e., automatability and offshorability of particular tasks rather than whole jobs). As argued, the explosive pace of digital technology will expose the various jobs to rapid enhancement, transformation, or replacement. The standard concern in this literature is the number of jobs created or lost. However there will be price considerations as well.

Mapping the impact of globotics on occupations to its impact on prices will require detailed knowledge of the intensity of various occupations in the production of the goods and services in the HICP. This is far from impossible, but it will require an extensive effort.

We can presume that in almost all cases, white-collar robots and telemigrants will be embraced by EA firms in order to lower costs or raise quality for a given cost. The net result will show up in profits, sales, and prices. To run down the price aspect of this, consider the price implication for a service that is highly "globotics exposed", i.e., a service whose production involves lots of workers in the occupations that are highly exposed to competition from white-collar robots and telemigrants. As digitech will lower costs fastest in the most globotics-exposed services, the prices of such services should rise less quickly than average. What is needed is a mapping of occupations into the products and services that appear in the HICP.

For example, the HICP sub index for 'out-patient medical services' includes prices for nine sub-categories. Two of these are 'dental services', and 'services of medical analysis laboratories and X-ray centres.' The work programme would establish a mapping between occupations/tasks and HICP elements. That is, it would identify which occupations are used in the production of these services and with what level of intensity. The result would be a matrix with occupations in the rows and HICP items in the columns where the elements reflect the relative importance of each occupation for each HICP item.

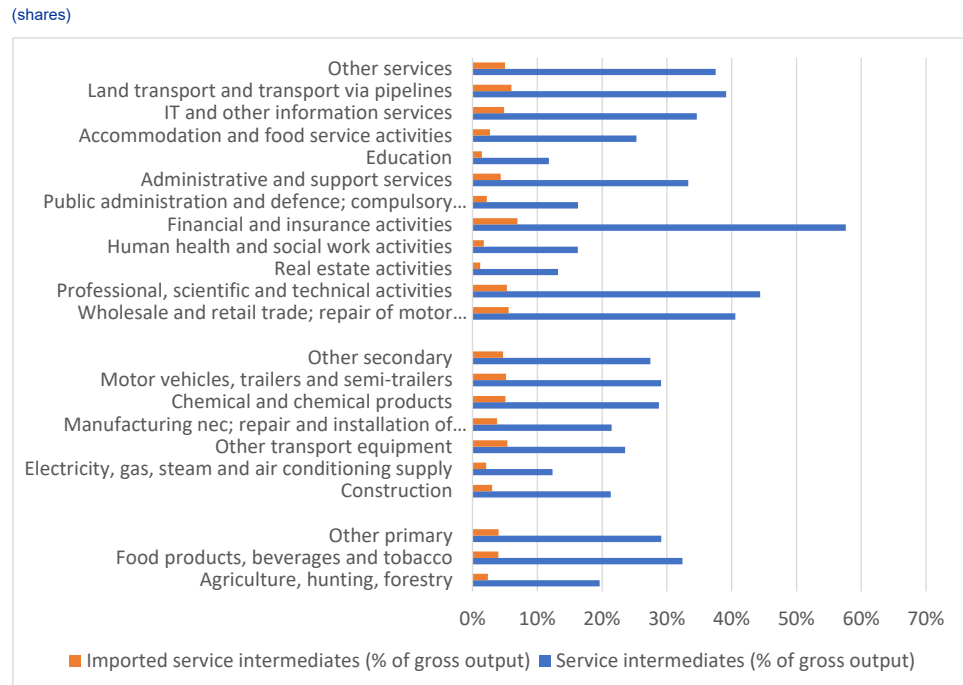
With this in hand, we could more accurately simulate the impact of rapidly advancing digital technology on individual HICP items and thus the overall trend in consumer prices. The background assumption in such simulations would be that costs would fall fastest for the services that were intensive in the use of highly globotics-exposed occupations.

### 5.3 Counting for services as intermediate inputs

The importance of intermediate services was illustrated by Table 1 at a high level of aggregation. Here I show the dependence at a finer level of aggregation – again focusing on France to be concrete (not all of the EA19 nations have data in the OECD database). The sectors in Chart 17 do not correspond to HICP items since they are the sectors available in the OECD’s TiVA database. Part of the work programme could be to map these sectors into HICP items.

The top set of bars shows the importance of intermediate services and inputs into the TiVA-listed service sectors. Note that since services are such a large share of GDP in all nations, the TiVA database categorises services into 20 different categories while industrial activity is slotted into only 19 categories. There are six primary categories.

**Chart 17**  
French sectors' use of services as intermediate inputs, total and imported, 2018



Sources: see Table 1.  
Notes:

The chart illustrates the pervasive role that intermediate service inputs have in all sectors. If the service sector is indeed subject to rapid globalisation and automation, the impact on final prices of goods and services in the HICP will be first order large.

### 5.3.1 Impact via wage formation

The rapid expansion of cheap imported goods from 1990 to the late 2000s had a measurable dampening effect on wage rises in G7 nations (Autor et al 2013). This third channel may also turn out to be important when it comes to the imports of services from low-wage nations. The salient point here is that about three-quarters of Europeans work in service sectors. Not all of these sectors are open to import competition, but many are. Those sectors will be subject to downward pressures on wages as service imports from low-wage nations multiply in coming years.

Thinking hard about quantifying this mechanism probably should also be part of the research programme I am outlining. Ultimately the empirical task would be to measure whether the historical expansion of the imports and exports of services had had an impact on wage formation in the euro area. Such an empirical investigation will be inhibited by the poor state of services trade data, and the lack of a mapping between domestic occupations and services trade categories.

There are at least two ways forward. The first would be to use an expert-based crosswalk between the services trade categories and the International Standard Classification of Occupations used by Eurostat. Given the lack of a natural experiment, one could test the null hypothesis that euro area wage formation – by occupation and by country – was unrelated to the rapid expansion of services trade. Given the cross-sector and cross-country variation in services trade, there should be enough data to reject the null if indeed the globalisation of services has affected wage formation processes.

A second approach would be shift-share instrumenting. The potential exposure of occupations would be defined using the indicators that predicted which occupations were ‘work from home’ suitable, i.e., teleworkable. An alternative ‘vulnerability to the shock’ proxy could be based on actual data on how many workers in the various occupations actually did work from home during the pandemic. The overall shock would be based on the rapid growth in service import aggregated to a level that could match aggregates of occupations. Both approaches would probably require many months of data preparation and matching.

## 6 Conclusions and future research

The definition of globalisation used by economic historians to establish the starting date for modern globalisation rests firmly on the co-movement of international and domestic prices (O’Rourke and Williamson, 2002). The thinking is guided by two theoretical extremes. In a fully open small economy, domestic prices are entirely unrelated to local supply and demand, while in a fully autarkic economy, domestic

prices have nothing to do with international factors. With these extremes in mind, it is natural to think of globalisation as shifting the economy to a price setting process that is ever less dependent on domestic supply and demand conditions.

Major central banks are in no danger of losing medium-term control of the inflation because today's mega economies are far closer to the autarky extreme than they are to the free-trade extreme. For example, the total of US goods and services sold to foreign nations never surpassed 20%, and US value added accounts for only about 90% of those export sales. This simple reality was down to two facts. International commerce has hereto been dominated by manufactured goods, and manufacturing accounts for a fairly small and shrinking share of domestic employment and value added.

The marginal importance of trade could shift radically if the service sectors became as globalised in the future as the manufacturing sectors are today. Opening sectors that employ 90% of the workers and produce 80% of the income is likely to have much larger effects than we saw from the opening of goods sectors over the past 25 years. This is why my conjecture – that the future of trade is in services – should matter to central banks.

Central bank policy is premised on the functioning of the local macroeconomy. The functioning of the macroeconomy is influenced by globalisation. Since globalisation is changing – in my view shifting rapidly to more emphasis on services – it is likely that the functioning of the local macroeconomy will also shift.

Here it is important to note that services are different than goods in a number of key ways. First, the data for trade in services is woefully inadequate. Indicators of prices are largely missing, and the classification of service categories is not suited to economic analysis of services trade's impact on jobs, incomes, and growth.

Second, service sector automation and globalisation are being driven rapidly forward by digital technology, but the changes are impacting the economy at the level of occupations and tasks. This is an important distinction since most of the analysis of the impact of automation and globalisation of goods sectors relied on impacts that happened at the level of products. For instance, globotics is not really a threat to US-based accounting firms, it is a threat to the office and professional workers performing intermediate service tasks within the accounting firm. To connect the impact on jobs and tasks to things like HICP prices and the slope of the Philips Curve, a mapping is needed between occupations and products and sectors.

All this is by way of an excuse, or apology for the lack of a “wow number” in my paper. I set out on what I thought was a straightforward mission. To take the excellent analysis that had been done in the 2000s for goods trade and apply it to trade in services. On the way I discovered that several substantial data collection, construction, and mapping exercises would be needed before I had a data set that would allow me to map service imports and prices to domestic sectors and eventually to HICP categories.

I close the paper with a plea for a research work programme that makes it easier to track how developments at the level of services imports, on the one hand, and occupations on the other hand, will impact items in the HICP index. If my conjectures are correct, future structural change will be coming into the euro area via changes in service sectors occupations and imported intermediate services.

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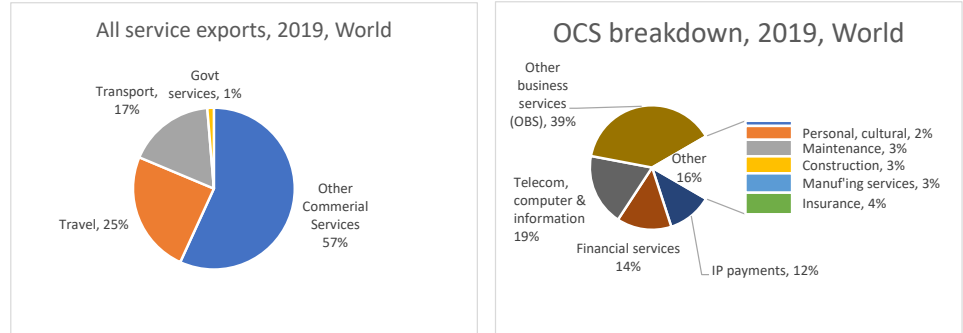
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### Chart 2.3

#### World exports of services pie charts, 2019

(units, axis description)



Sources: Author's calculations based on WTO data, downloaded from [stats.wto.org](https://stats.wto.org)

Notes: