



EUROPEAN CENTRAL BANK
EUROSYSTEM

CompNet Report

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Assessing European
competitiveness:

the contribution of CompNet
research

CompNet The Competitiveness Research Network



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Note: This report should not be reported as representing the views of the European Central Bank (ECB) or of the EU System of Central Banks (ESCB). The views expressed are those of the authors and do not necessarily reflect those of the ECB or the ESCB.

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Executive summary

Mandate

- Restoring competitiveness is broadly acknowledged as the critical building block for achieving sustainable growth, but defining competitiveness, both in terms of tools as well as objectives, is a matter of debate.
- The Competitiveness Research Network (CompNet) adopts a pragmatic approach, defining “a competitive economy [as] one in which institutional and macroeconomic conditions allow productive firms to thrive... [thus supporting] the expansion of employment, investment and trade” (Draghi, 2012).
- This approach requires handling (i) firm-level features, most notably productivity, (ii) macroeconomic factors, and (iii) cross-border aspects related to the operation of global value chains (GVCs).
- While at first concentrating solely on the original mandate of explaining export competitiveness, the Network has extended the scope of its research to broader aspects related to productivity drivers.
- The above is also in view of the fact that “structural and cyclical policies – including monetary policy – are heavily interdependent. Structural reforms increase both potential output and the resilience of the economy to shocks. This makes structural reforms relevant for any central bank, but especially in a monetary union” (Draghi, 2015).
- The objective of the Network is to identify the factors which contribute to raising the economy’s potential, by establishing a tight relationship between instruments, mechanisms and outcomes (such as regarding trade, per capita income, productivity and employment). To do so, it has developed novel indicators and databases, and it has undertaken original research.

Data and indicators developed by CompNet

Firm-level based dataset

- Building on members’ expertise and existing national data, CompNet has created a **novel EU firm-level based dataset** (a so-called “micro-distributed” database), which is unique in terms of its coverage (encompassing about 17 EU countries, around 60 sectors, and a 15-year time period) and cross-dimensional analysis potential, as it links, for example, trade or the financial status of firms with their productivity (see Box 1 for further details as well as some remarks on comparability issues, and Lopez-Garcia, di Mauro, and the CompNet Task Force, (2015).

- Over and above the dataset, CompNet has also created a **large, strong and highly competent team, comprised of researchers conducting firm-level research in EU national central banks (NCBs) and national statistical institutes (NSIs)**, with the drive and motivation needed to deliver results – at no additional administrative cost – on further critical research questions requiring firm-level information.

Mapping EU global value chains (GVCs)

Starting from existing databases (e.g. the World Input-Output Database, WIOD¹), CompNet has provided more and better evidence on European countries' integration and position within international production processes, proposing **alternative indicators** to measure GVC integration when assessing a country's competitiveness (such as exports of value added, GVC participation and position).

Competitiveness indicators

Drawing on existing databases – as well as the new one mentioned above – CompNet has developed a **large number of novel measures of competitiveness**, derived from (i) highly disaggregated sectoral data, (ii) the CompNet micro-distributed database, and (iii) global value chain indicators. The whole set of indicators – about 170 indicators/variables in total, 31 of which were actually created by CompNet members – can be found in the “**CompNet Compendium**”, which will soon be published under the ECB's Occasional Paper Series (i.e. later in June). This report will present details on how individual indicators complement each other, and will thus provide precise guidelines on how each indicator can be used for research and policy-making purposes. It is planned that the indicators will be updated regularly and made available upon request.

Main research results and policy implications

Publication record and external communication

To date, Network members have published about 40 papers with the CompNet logo under the ECB's Working Paper Series, as well as six refereed journal articles. In addition, about 30 projects are still ongoing.

CompNet has adopted a very open communication policy with regard to disseminating information on its methodologies and results within and outside the European System of Central Bank, more specifically by:

- maintaining a constantly updated website (14 newsletters so far) https://www.ecb.europa.eu/home/html/researcher_compnet.en.html

¹ See Timmer et al. (2013) and section 1.3.

- publishing eight policy briefs summarising research results of high policy relevance
- engaging in a dialogue with other central banks and institutions outside the EU, i.e. through the participation of Network members in various initiatives (conferences, seminars, presentations)

Research results and related policy implications included in this report will now be summarised according to the three main areas along which the report is structured:

1. trade and competitiveness;
2. shock transmission in a global context;
3. resource allocation and productivity.

Trade and competitiveness

Price and cost competitiveness measures are the most popular and widely used indicators of trade performance since the seminal work by Armington (1969) and McGuirk (1987). As described below, several CompNet projects have shown that macroeconomic price/cost indicators alone are unable to provide a comprehensive explanation of recent trade developments. CompNet has contributed to this debate in four ways.

- First, it has demonstrated that there are a number of non-price factors which appear to be empirically very relevant in terms of explaining trade results (see section 1.1). These include (i) quality and consumer taste (see Di Comite et al. (2014) and Benkovskis and Wörz (2013; 2014)), (ii) the extent of the globalisation of production processes (see Benkovskis and Wörz (2015a; 2015b)), (iii) domestic conditions faced by exporters (see Soares Esteves and Rua (2013) and Bobeica et al. (2015)), and (iv) the role of the geographical and product structure of exports (see Silgoner et al. (2013) and Benkovskis et al. (2013)).

European competitiveness must rely more on non-price elements related to innovation, technology and organisational capabilities rather than solely on prices, costs and wages.

- Second, it has assessed how a country's and sector's **trade performance is related to firm heterogeneity in productivity** (see section 1.2). CompNet's contribution has been twofold. First, it has been able to match the balance sheet information of a firm that is related to productivity with possible covariates, including financial constraints, employment and trade statistics; this is quite novel in the literature, given the countries (17 EU Member States), sectors, and time period covered (see trade module paper by Berthou et al. (2015)). Second, it has carried out more sophisticated – though mostly preliminary – empirical analyses (e.g. Barba Navaretti et al., (2015)).

The underlying dispersion in firms' productivity is a critical feature when it comes to assessing aggregate trade outcomes – and thus external competitiveness – over and above the average firm's productivity.

- Third, it has created systematic interactions between the analysis of trade performance and the operations of global value chains (see section 1.3). By extending the existing global input-output database (WIOD; see Timmer et al. (2013)), CompNet has provided a novel mapping of GVCs in Europe (see Amador et al. (2015), and di Mauro and Ronchi (2015a)), including new measures of GVC participation.

The cross-border dimension is essential to credibly assess competitiveness.

- Lastly, it has included both the cross-border and micro perspective in research on external imbalances (see section 1.4). On the one hand, CompNet researchers have measured how trade surpluses and deficits are distributed across countries when measured in value-added terms (see Nagengast and Stehrer, (2014)), and on the other, they have investigated how external imbalances relate to firms' productivity distribution (see di Mauro and Pappada', (2014)).

By leveraging on respective industries' GVC positions, policies should focus on promoting upgrades along the production process, via a reallocation of resources from low to highly productive firms, rather than focus on the "average firm".

Shock transmission in a global context

Against the background of persisting imbalances in the EU, CompNet research has investigated three different channels of cross-border shock transmission:

- First, it has shown that the exchange rate elasticity of exports is (i) shaped by the firm-level productivity distribution, (ii) tends to be much larger when estimated at the firm level, and (iii) varies greatly across sectors and types of firm (see section 2.1.1, Demian and di Mauro (2015) and Berthou et al. (2015b)).

Micro-based estimates of elasticities provide useful guidelines and new controls for improving the fit of the estimation of export equations for European countries and for assessing the relative price adjustment required for triggering the external imbalances process in the euro area.

- Second, it has developed new strategies to look at how external shocks affect domestic conditions at the micro level, and has provided estimates of the aggregate impact of external shocks on the domestic economy (see section 2.1.2 and Bobeica et al. (2015), Berman et al. (2015) and Bugamelli et al. (2014)).

It is essential to take account of the fact that exports' reaction to shocks is heterogeneous across firms (i.e. depending on their respective size and financial situation).

- Third, it has provided evidence that global production processes can explain (i) the dynamics of import demands (see Al-Hashimi et al. (2015)), and (ii) the stronger transmission of shocks witnessed during the financial crisis (see Altomonte et al. (2012), Endr sz and Skudelny (2015), and Nagengast and Stehrer (2015)).

From a policy perspective, all of the above findings call for a deeper consideration of firm-level channels when assessing the appropriate response to external shocks. This includes the need for more governance at the global level, particularly at a time when the presence of GVCs is weakening the effectiveness of trade policies.

Resource allocation and productivity

Given that, in the real world, resources are not allocated to their best use because of frictions, CompNet research has focused on analysing to what extent policy-induced distortions in labour, capital, and product markets have an impact on aggregate productivity and, ultimately, on growth. In particular, CompNet has provided three main contributions to this debate:

- First, CompNet has developed the tools required to explore the above hypothesis using its micro-distributed database, building measures for assessing **overall allocative efficiency** which are satisfactorily comparable across countries and over time (Lopez-Garcia, di Mauro and the CompNet Task Force (2015)). To this end, CompNet has collected a number of important stylised facts (related to labour productivity distributions, the employment growth of firms with different levels of productivity, the “OP gap” and other measures of allocative efficiency), highlighting that cross-country productivity differences are partly a result of differences in allocative efficiency.

From a policy perspective, these findings point to resource reallocation as an important, but possibly neglected, channel for boosting aggregate productivity, and therefore, potential output (see Draghi (2015)).

- Second, CompNet researchers have explored the issue of resource allocation (and policy-induced frictions) in specific markets. A number of critical stylised facts are now documented in research conducted under the respective “modules” – namely (i) labour (Fernandez et al., forthcoming in 2015), (ii) financial (A. Ferrando et al. (2015)), (iii) trade (Berthou et al. (2015)), and (iv) product (Amador et al. forthcoming in 2015) – as well as in a number of policy briefs (see di Mauro and Ronchi (2015) on labour market regulations, and the VOX EU article by Bartelsman et al. (2015) on financial frictions and labour market reallocation).

- Third, going beyond stylised facts, initial research points to some more solid evidence on frictions in financial and product markets. As regards Italy, for instance, initial work to be extended to cover other countries (see Ottaviano et al. (2015, forthcoming)) show that the provision of bank loans is weakly related to the productivity of recipient firms. In another paper, Ghironi et al. (2015, forthcoming) show that product market deregulation has a recessionary impact in the short run (which may be related to the malfunctioning of micro-channels), but an expansionary effect in the long run.

Overall, the richness of the micro database already provides some important answers to a number of key research questions with strong policy implications. Nonetheless, a tighter link between theory and data, more robust empirical methodologies and additional statistics are still needed to increase confidence in the validity of these findings, as well as to gain further knowledge on still unanswered questions.

CompNet: the way forward

Going forward, CompNet will be organised as a **self-managed** Network of research, with no formal periodical reporting to committees formed within the EU system of central banks. This implies that - even more so than at present - CompNet will be open to new collaborations with institutions outside the EU system of central banks, including universities and research centres, as well as non-EU central banks and international institutions. The Network will be led by a Steering Committee, composed by a small numbers of senior representatives (6-7) of active institutions who will rotate on a regular basis, and chaired by an ECB staff.

Overall, the main goal of CompNet will continue to be fostering state-of-art research on the broad themes of competitiveness and productivity enhancement, with the specific aim of tackling novel and upcoming issues of high policy relevance. While keeping its typical multi-dimensional approach aiming at conducting cross-country analysis, members will be left entirely independent in their choice on the specific topics of their research projects. This notwithstanding, and for the near future, the Network has identified two meta-research streams, which appear to be central to the current policy debates on secular stagnation and structural reforms: (i) “Resource allocation and growth” as well as (ii) “International trade and Global Value Chains (GVCs)” (more details about such research streams are provided in the Appendix).

In parallel with research, maintaining and regularly updating the databases created by CompNet is considered essential – given its relevance for research and policy - and is supported by the ECB. Overall, the Network will both (i) constitute an open and vibrant hub where academics and economists from central banks and international institutions will have the opportunity to discuss, receive feedbacks and develop their research projects on competitiveness-related themes, as well as (ii) promote the maintenance and further development of its firm-level based dataset, thus improving the battery of available competitiveness-related indicators.

Introduction

Competitiveness gaps are increasingly associated with divergent economic developments. They have also been identified as the principal reason for some of the most disruptive downturns, such as the recent crisis in the EU. Consequently, restoring competitiveness is broadly acknowledged to be the key building block for achieving sustainable growth. At the same time, when asked what competitiveness is all about, academics and policy-makers will respond rather differently, reflecting a debate that has been going on for decades. This report contributes to that debate by adopting a broad and eclectic approach, drawing on three years of research by the Competitiveness Research Network (CompNet), which was created in early 2012 by the European System of Central Banks.

Two statements by ECB President Mario Draghi summarise CompNet's overarching objectives. The first defines competitiveness in a purely pragmatic and a-theoretical manner: "a competitive economy ... is one in which institutional and macroeconomic conditions allow productive firms to thrive. In turn, the development of these firms supports the expansion of employment, investment and trade" (Draghi (2012)). This implies that, over and above price/cost factors, analysis of competitiveness must encompass at least three other factors: (i) firm-level features, most notably productivity, (ii) structural macroeconomic factors, and (iii) cross-border aspects relating to global value chains (GVCs).

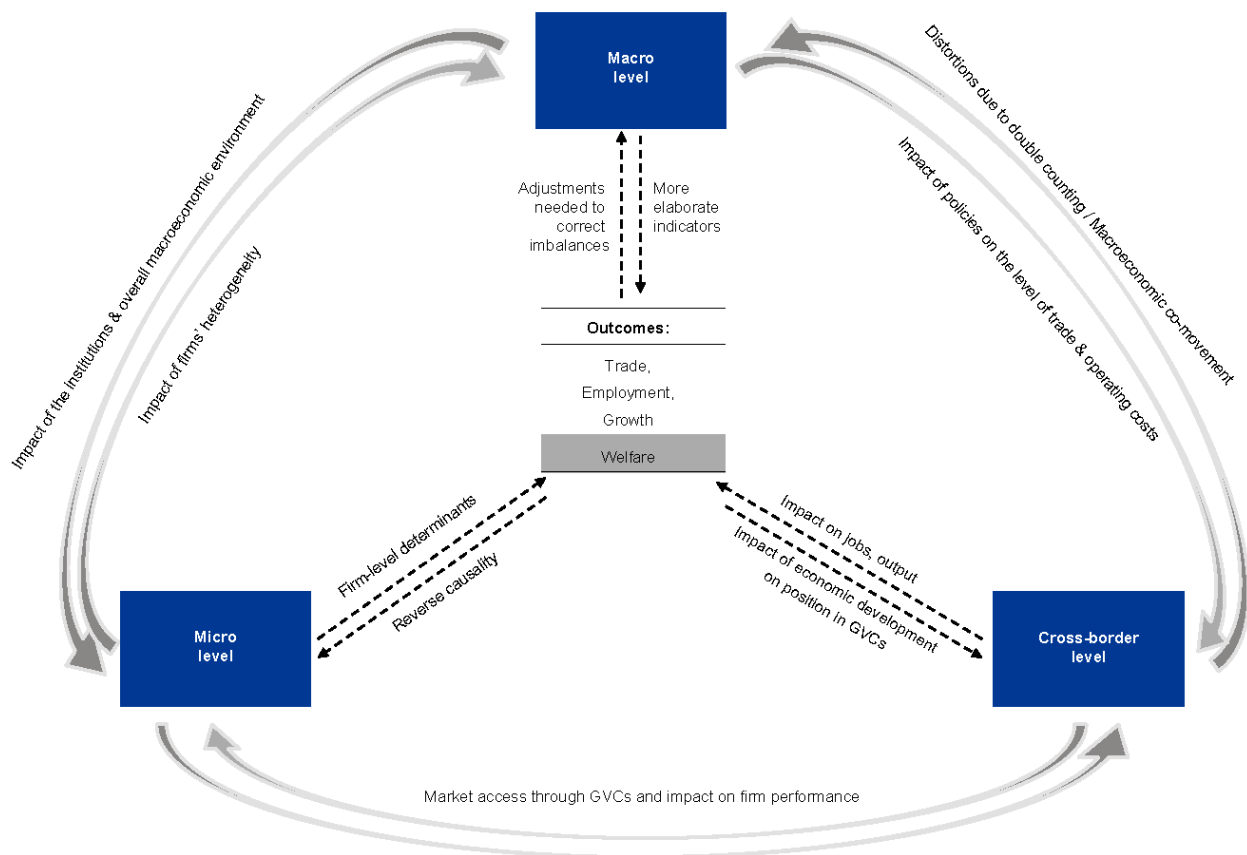
The second summarises the overarching motivation for the existence of the network: "Structural and cyclical policies – including monetary policy – are heavily interdependent. Structural reforms increase both potential output and the resilience of the economy to shocks. This makes structural reforms relevant for any central bank, but especially in a monetary union" (Draghi (2015)). The clear objective of the network is to identify the factors which will help to increase an economy's potential – i.e. increase its ultimate competitiveness – establishing close interaction between instruments, mechanisms and outcomes (such as trade, per capita income, productivity and employment).

In order to deliver on such objectives, CompNet has adopted a holistic approach to competitiveness, in which the three levels referred to above – the macro level, the firm level and the global value chains – are linked together, as is also suggested by most recent economic theory. Figure 1 gives an intuitive idea of the types of linkage running across the three dimensions considered by CompNet's comprehensive approach:

1. the macro level clearly affects the micro level, as it determines the overall institutional and macroeconomic environment in which firms operate;
2. the micro level, which is key to ascertaining the degree and the nature of firm-level heterogeneity within individual countries and sectors, shapes and informs the macro perspective;

- the increased integration in GVCs affects the macro level, as it modifies cross-border transmission mechanisms and both nurtures and is nurtured by firm-level features and performance.

Figure 1
CompNet mandate in a nutshell



Organisationally, CompNet comprises three workstreams, each addressing one of the above-mentioned dimensions. While primarily pursuing their individual research agendas, the three workstreams have increasingly interacted with each other in order to deliver a holistic assessment of competitiveness. It is for this reason that this report, rather than summarise the research output of the individual workstreams – as was done in the two previous interim reports (Bobeica and di Mauro (2013); di Mauro (2014)) – will instead show how the network has contributed to the literature on a number of aspects relating to competitiveness using a multidimensional perspective. These specific aspects – which correspond to individual chapters in this report – include (i) trade and competitiveness, (ii) the transmission of shocks in a global context and (iii) resource allocation and productivity.

In adopting this reporting strategy, we have chosen not to include all the papers produced by CompNet, in order to tell an interesting story in the context of the

chosen multidimensional approach, rather than simply produce a list of abstracts. This notwithstanding, for the sake of completeness, we summarise below the main areas in which CompNet has so far added value to the relevant literature. It should be noted, however, that in a number of areas there is considerable scope for further contributions, thus justifying a possible extension of CompNet's initial mandate for selected data gathering and research topics with particular potential.

1. Building on recent models and empirical literature, CompNet has **developed a large number of novel measures of competitiveness** – including non-price factors (such as taste or quality), the geographical and product structure of trade, domestic demand combined with capacity and liquidity constraints. Reflecting CompNet's approach to the assessment of competitiveness, indicators are derived not only from disaggregated macro data (export sophistication, export diversification, RCA, relative export prices adjusted for quality, etc.), but also from firm-level data taken from CompNet's micro-distributed database (total factor productivity (TFP), unit labour costs (ULCs), OP gap, skewness, quartile change, etc.) and GVC indicators built using the WIOD (exports of value added, GVC participation and positions, etc.). For all the new indicators, CompNet has published corresponding papers with the dual objective of (i) illustrating the methodologies adopted and (ii) showing how the individual measures relate to ultimate policy objectives, such as trade dynamics.

The whole set of indicators – around 200 indicators/variables, 52 of which are original and have been created by CompNet members – has been published in the CompNet Compendium (Karadeloglou et al. (2015)). This paper provides details of how individual indicators complement each other, thus providing precise guidelines on their use for research and policy. The indicators will be regularly updated and made available on request.

2. Building on existing microeconomic expertise among a number of network members, CompNet has **created a novel firm-level based dataset**, which is unique in terms of its coverage (around 20 EU countries, around 60 sectors and 15 years) and potential cross-dimensional analysis, as it links, for instance, trade or financial status with productivity at the firm level. Also, after more than two years working together, the network can now leverage a strong team of researchers of considerable competence and motivation, which could easily deliver – with no fixed set-up costs – on further critical research questions requiring firm-level information.
3. CompNet has provided a substantial **boost to the literature on resource reallocation**. At first, the analysis related mostly to individual countries for which micro data were available. Thereafter, research was extended to a multi-country set-up using CompNet's novel micro dataset. Contributions on this subject include:
 - the joint analysis of labour productivity or TFP with new financial indicators to see whether, and to what extent, credit allocation efficiency differs across time and across countries (see Financial module paper by Ferrando et al. (2015), as well as di Mauro et al. (2015));

- an investigation of the role of labour market structure and dynamics in driving firms' growth, exploiting interaction between CompNet and Wage Dynamic Network results (see Labour module paper by Fernandez et al. (2015), and di Mauro and Ronchi (2015b));
 - the use of the CompNet firm-level based dataset to examine the relationship between international trade, allocative efficiency and aggregate productivity (see Berthou et al. (2015c));
 - research projects aimed at establishing whether the crisis triggered changes in the distribution of labour over and above what happens in "normal" times by using joint moments of employment and productivity (see Bartelsman et al. (2015b)).
4. CompNet has contributed to the literature on **trade and productivity**, going beyond the single-country approach and strengthening the link between macro outcomes, such as gross exports and estimates of trade elasticities, and micro features such as firm productivity distribution (see Berthou et al. (2015b), Barba Navaretti et al. (2015), and di Mauro and Pappadà (2014)).
 5. CompNet has contributed to the mapping of **EU global value chains**, providing more and better evidence on European countries' integration and positions within international production processes, proposing alternative statistical indicators to measure the impact of GVCs' integration on European countries' main economic aggregates (Amador and Cabral (2014)) and establishing the role of GVCs in trade elasticities and their impact on the transmission of shocks across borders (Nagengast and Stehrer (2015)).

The rest of the report is structured as follows: Chapter 1 provides an overview of CompNet's approach to the analysis of the traditional relationship between competitiveness and trade, using the explanatory power of non-traditional indicators of competitiveness (from a macro, micro and cross-border perspective) to explain aggregate trade performance. Chapter 2 summarises CompNet's main empirical findings with regard to the mechanisms and implications of economic shock transmission in a global context, a traditional economic question that has retaken centre stage in the economic and policy debate after the global financial crisis. Finally, Chapter 3 adopts a microeconomic perspective to address the broad economic topic of resource reallocation and productivity, highlighting the relevant results achieved within CompNet using the new micro-distributed dataset. All three chapters start with a number of relevant policy questions, followed by details of relevant pre-existing literature and CompNet's contribution. Chapter 4 will provide some remarks on the way forward.

1 Trade and competitiveness

Very often in the economic literature, a country's competitiveness is associated with its trade performance and, in turn, its economic growth more generally. Against this background, assessments of competitiveness have traditionally focused on macroeconomic factors. Macro indicators, such as unit labour costs or current account deficits, are both easy to communicate and relate to macroeconomic instruments that policy-makers can generally avail themselves of. However, restricting this analysis solely to macroeconomic indicators (which are typically price/cost-based) has not allowed a comprehensive explanation of recent trade developments. This is not surprising when you consider, for instance, how the internationalisation of production has changed the competitive landscape by allowing firms to distribute tasks across borders, thus reducing labour costs as a percentage of overall production costs. CompNet research has provided strong empirical support for this view, as will be analysed in this chapter. It has shown, in particular, that a large portion of trade dynamics, both in the short term and in the medium to long term, can be explained only by supplementing traditional price/cost factors with non-price factors (consumer tastes or product quality, the geographical and product structure of trade, interaction between domestic demand and capacity and liquidity constraints, etc.). This has obvious and clear – though often neglected – **policy implications, which lie at the heart of CompNet's contribution**. Against the background of increased competitive pressures from emerging and developing markets, **European competitiveness must rely more on non-price elements related to innovation, technology and organisational capabilities**, rather than solely on prices, costs and wages. Starting with a few research questions of considerable policy relevance, the chapter will look at how CompNet research has contributed to the debate in four areas: (i) determinants of trade, (ii) interaction between trade and productivity, (iii) interaction between trade and GVCs, and (iv) external imbalances.

1.1 Determinants of trade

Are price and cost considerations really still so relevant as determinants of trade dynamics?

If so, how much do they account for with respect to other complementary factors?

Price and cost competitiveness measures have been the most popular and widely used indicators of trade performance since the seminal works by Armington (1969) and McGuirk (1987), and that remains the case today. Following on from this traditional stream of studies, CompNet's contribution to the empirical literature and

policy discussion on this subject has been twofold. First, CompNet studies have shown that there are in fact a number of non-price factors which appear to be empirically very relevant in explaining trade. These include (i) consumers' taste, (ii) the extent of the globalisation of production processes, (iii) domestic conditions faced by exporters, (iv) the role of financing constraints, and (v) exporters' size and experience. Second, a number of these studies have used micro information related to individual countries, experimental methodologies which can possibly be extended to other countries, now that CompNet's micro-level dataset has been completed.

Cross-country limitations of price-cost indicators: complementary information from firm-level data

Indicators of cost and price competitiveness (harmonised competitiveness indicators, HCIs) aim to capture developments in various costs or price indices (consumer price index, domestic sales producer price index, unit labour costs in manufacturing, etc.). There is no agreement in the literature, however, on which of these measures best reflects a country's trade developments. Within CompNet, Christodouloupoulou and Tkacevs (2014) estimate standard dynamic equations for exports and imports, where each HCI is one of the determinants, and compare elasticities for alternative HCIs (see Table 1). They conclude that, in most countries, exports of goods and services are sensitive to changes in at least one indicator of relative prices, but in most cases this sensitivity is relatively small. In general, relative price measures based on broad cost and price indices (namely the consumer price index, total unit labour costs and the GDP deflator) have a larger marginal effect on exports of both goods and services. However, as stressed by Giordano and Zollino (2015) of CompNet, it is not possible from an empirical standpoint to establish a general ranking of the explanatory power of the different HCIs. Country-specific analysis is therefore warranted.

Table 1
Long-run elasticity of export of goods relative to different HCIS

	AT	CY	EE	FI	FR	DE	GR	IE	IT	LU	MT	NL	PT	SK	SI	ES
CPI	-0.77	-2.07	-1.46	-1.42***	-0.73***	-0.54***	-0.86	-0.57	-0.30*	-0.14	-2.31***	-0.45***	-0.65	-0.32	-0.36	-0.80***
PPI	-0.36	-1.37	-0.12	-1.85***	-0.97***	-0.30*	1.00	-0.70	-0.55***	-0.12	-2.15***	-0.31**	0.06	-0.33	-0.4	-0.93**
ULCM	0.25	0.37	-0.98***	-0.75**	-0.76***	-0.38***	-0.46**	-0.03	-0.20*	-0.12	-0.65	-0.26**	-0.23	-0.25**	-0.05	-0.30
ULCT	-0.99**	-0.66	-1.05***	-1.64***	-0.89***	-0.48***	-0.17	-0.67**	-0.44**	-0.21	-0.82*	-0.25**	-0.22	-0.32*	-0.07	-0.69***
GDP	-0.85	-0.03	-0.78*	-2.41***	-0.79***	-0.50***	0.55	-0.45	-0.33*	-0.03	-2.66***	-0.39***	-1.12**	-0.43*	0.00	-0.55*

Source: Christodouloupoulou and Tkacevs (2014).

Notes: This table reports coefficients of solved long-run equations and their significance levels. ***, ** and * denote significance levels of 1%, 5% and 10% respectively.

However, CompNet's contribution to this strand of literature has also gone further with the use of firm-level information. At first, studies were done on individual countries where data with the required level of detail were already readily available. For example, Decramer et al. (2014), using a confidential Belgian firm-level dataset, found a negative correlation between the unit labour costs and exports of Belgian firms (with a 10% increase in ULCs implying a 2-4% decline in exports). Moreover, this elasticity varies between sectors and firms. Most notably, labour-intensive firms' exports are more sensitive to changes in unit labour costs. In addition, higher unit labour costs tend to (i) reduce the probability that non-exporters will start exporting and (ii) increase the probability that exporters will stop exporting.

Need to go beyond labour costs to explain trade results...

However, as previously stressed, there is a need to **“go beyond labour costs”**

(Altomonte et al. (2013)) to explain actual trade results. For instance, Christodouloupoulou and Tkacevs (2014) found that, within standard export equations, HCs are normally unable to explain more than 60-70% of the export variation. Moreover, the above-mentioned paper by Decramer et al. (2014) finds that the effect of unit labour costs alone on exports is rather limited, implying that other factors (such as taste and quality) may be important.

The role of taste and quality

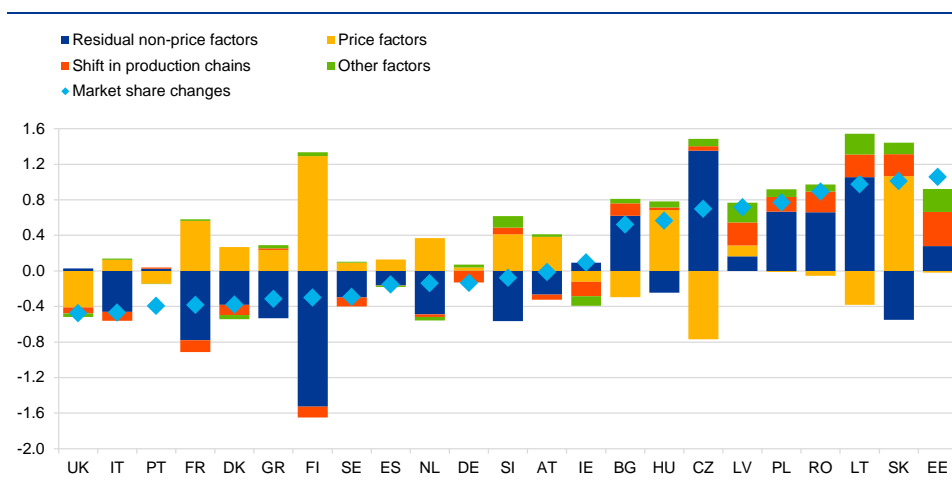
Against this background, CompNet has produced several papers uncovering **the role** in trade **of taste and quality**, admittedly difficult to measure. For example, using Belgian firm and product-level data, Di Comite et al. (2014) show the importance of taste as an idiosyncratic source of variation in trade data. Their findings suggest that taste and distance to destination may be highly correlated, which raises some doubts regarding the correct specification of many gravity models, where distance typically features as the prominent explanation for bilateral trade flows, but which may in fact capture taste effects that run along similar lines. The effect of quality and taste on trade flows is also explored by Benkovskis and Wörz (2013; 2014a). Using very detailed trade data from UN Comtrade, they showed that changes in non-price factors (relative taste and quality) made the strongest contribution to changes in the export market shares of the main world exporters, while the contribution of price factors was lower. Developed countries (“old” EU countries, the United States and Japan) suffered losses in non-price competitiveness, while the “new” EU countries and the largest emerging economies experienced gains in the relative quality of their exports.

Accounting for internationalisation of production

These findings, however, are to a large extent explained by the **globalisation of production processes**. For example, within CompNet, Benkovskis and Wörz (2015a; 2015b), after combining detailed trade statistics with data from the World Input-Output Database, show that the global production process is gradually shifting from old to new EU Member States. This affects global market shares both directly and indirectly. For instance, improvements in the relative quality of exports from the new EU Member States are, to a large extent, a result of the outsourcing process and the use of higher-quality intermediate inputs sourced from more developed economies. This notwithstanding, even after controlling for the effects of GVC integration, one can observe that new EU Member States are still catching up as regards the relative quality of production (for more about the role of GVCs, see section 1.3).

Figure 2

Decomposition of change in value-added export market share, 1996-2011



Sources: Benkovskis, K. and Wörz, J. (2015b)

The explanatory power of product and geographical specialisation

Another non-price determinant of competitiveness and export performance that is often overlooked when analysing trading performance is the **geographical and product structure of exports**. It appears that product and geographical specialisation, together with competition with a specific rival, may have significant explanatory power. Within CompNet, Silgoner et al. (2013) and Benkovskis et al. (2013) investigated the hypothesis that China's emergence as a trade competitor poses a threat to the EU countries. They found that in 2009, China was serving roughly 70% of all markets that were served by individual EU countries. Smaller western and southern EU countries had more overlap with China in geographical and sectoral export markets than the larger EU exporters. At the same time, new EU countries often enter markets that have traditionally been served by China. At the moment there is only very limited evidence that China is directly crowding out individual EU countries, although new EU Member States generally appear to be more exposed than larger EU countries.

Goods services react differently to demand and price factors

Having stressed this, it should be noted that the reaction of exports to demand and price factors differs for **goods** and **services**. Using detailed export data for Belgium, Ariu (2014) showed – within CompNet – that, following a 1% fall in GDP growth in destination countries, exports of services decrease 5% less than exports of goods, which explains why trade in services barely reacted to the crisis. This special characteristic of services is mostly accounted for by business services such as legal, management and accounting services. At the same time, Christodoulopoulou and Tkacevs (2014) found that exports of services are only sensitive to developments in HCIs in the big euro area countries. In other euro area countries, the effect is mostly statistically insignificant.

The role of domestic demand

Traditionally, the behaviour of exports is modelled only as a function of foreign demand and the real exchange rate. However, CompNet findings show that **domestic conditions** can influence firms' willingness or ability to supply exports. Soares Esteves and Rua (2013) and Bobeica et al. (2015) show that substitution between domestic and foreign market sales is an empirically relevant additional

adjustment channel, particularly when exchange rate movements are sticky. Furthermore, this relationship seems to be asymmetric, being stronger when domestic demand is declining. This suggests that firms try to substitute between domestic and foreign sales during periods of economic stress, but do not cease exporting when domestic demand recovers. This effect could be particularly relevant for countries undergoing a macroeconomic adjustment process (see section 2.1.2 for more details on shock transmission mechanisms).

1.2 Trade and productivity

How relevant is firm productivity for European exports?

How is the trade performance of a country or sector related to firm-level heterogeneity?

In the most recent literature on international trade, the heterogeneity of **productivity across firms** is an analytical cornerstone. After briefly reviewing the literature on this subject prior to CompNet, we will summarise the value added by our network, focusing on the EU.

Literature review: accounting for heterogeneity in firm productivity in the assessment of international trade

Bernard and Jensen (1995; 1997; 1999), using empirical evidence derived from US Census data – which is now available for many other countries – clearly established that, even within the same industry, exporters are more productive than non-exporters; they are also larger, more capital and skill-intensive, and pay higher wages than non-exporters. The same applies to importers, and the differences are even stronger for firms that are both exporters and importers (Bernard et al. (2007a; 2007b; 2009)).

Inspired by that evidence, Melitz (2003), Bernard et al. (2003), Melitz and Ottaviano (2008), and Melitz and Redding (2015) have proposed theoretical models where only firms whose productivity is above a given threshold are able to pay for trade costs and sell their products abroad. In these models, only productivity affects the export performance of a country through the self-selection mechanism described above, but trade feeds back into aggregate productivity by triggering an intra-industry adjustment with the reallocation of resources from less to more efficient firms. Indeed, subsequent empirical work has shown that trade liberalisation episodes in emerging countries (see Pavcnik (2002) for Chile) and trade agreements among advanced countries (see Trefler (2004) on the Free Trade Agreement between Canada and the United States) are followed by aggregate productivity improvements.

For the reallocation mechanism to work in this way, firm-level productivity must again play a role in determining how different firms are differently affected by **trade shocks**. On US data, Bernard et al. (2006a) confirm that competition from low-wage countries has a weaker impact on high-productivity and more capital-intensive plants.

In a companion paper, Bernard et al. (2006b) find that the impact on plant death is smaller for more productive plants. According to Bloom et al. (2011), the negative impact of import penetration from China on employment is stronger for low-tech firms. Bugamelli et al. (2015) show that, in Italy, the pro-competitive effect of cheaper imports from China is driven by low-productivity firms in less skill-intensive sectors.

The effect of trade on productivity is not limited to the passive adjustment that occurs with reallocation across firms within an industry. Trade can also trigger the adoption of new strategies and new technologies by firms. Known as the learning-by-exporting hypothesis, the idea here is that export participation may foster improvements in innovation and productivity. This could be due to the fact that a firm's expected profits from process or product innovation rise with the size of the final market (Rodrik (1988) and Yeaple (2005)) so increased exports allow the fixed costs of research and development activities to be borne and justified. Alternatively, one might think that trade flows facilitate international knowledge spillovers (Coe and Helpman (1995)) and thus contribute to the adoption of new technologies and the development of new, higher-quality products. The learning-by-exporting hypothesis has also found some empirical support. Bustos (2011) finds that Argentinian firms respond to the Mercosur Free Trade Agreement by increasing both export market participation and technology spending. On the basis of the Free Trade Agreement between Canada and the United States, Lileeva and Trefler (2010) show that Canadian firms' labour productivity increases as a consequence of US tariff cuts. De Loecker (2007) finds that new Slovenian exporters become more productive after entering foreign markets; moreover, their productivity premium relative to domestic firms increases over time as they gain export experience. In a cross-country harmonised exercise, the International Study Group on Exports and Productivity (ISGEP (2007)) finds some support for the learning-by-exporting hypothesis – albeit only for Italian firms, particularly smaller ones.²

CompNet contribution: going beyond the single-country approach

CompNet has contributed to this already rich literature on trade and productivity by going beyond the single-country approach that characterises most of the recent studies. In particular, leveraging its members' experience of individual country analysis, CompNet has applied its micro dataset, which has been developed for a large set of EU countries (see Box 1). This is particularly important in the case of Europe, where deep economic and monetary integration requires comparative analysis that takes account of country, sector and firm-level heterogeneities simultaneously.

Box 1

The CompNet firm-level dataset

The economic literature has long recognised that firm-level data deliver crucial information on drivers of competitiveness, since aggregate performance depends strongly on firm-level decisions

² Trade-induced productivity gains can also be due to quality improvements (Verhoogen (2008)), product selection (Bernard et al. (2011) and Mayer et al. (2015)) and improved firm-level organisation (Caliendo and Rossi-Hansberg (2012)).

and shocks have a different macroeconomic impact depending on the underlying distribution of firms. Firm-level data, however, are somewhat lacking in Europe, which is also related to confidentiality issues, particularly as regards cross-country comparability. In order to tackle this data issue, CompNet has designed computer programmes aimed at compiling firm-level based competitiveness indicators based on common methodologies, to be run at the country level. The underlying objective being to improve cross-country comparability and safeguard confidentiality (for more information, see Lopez-Garcia et al. (2015)).

Overall, three features of this dataset should be highlighted: (i) its uniquely wide country and sector coverage, with 17 European countries (including 13 euro area countries) and 56 industries (including both manufacturing and services) over the period 1995-2012, covering 70% of total EU GDP in 2013; (ii) the improved cross-country comparability of indicators (see the ECB statistics department's assessment of the quality of the micro database in Benatti et al. (2014)); (iii) the wide range of firm-level characteristics present in the data collected, including detailed statistics on almost 200 joint distributions connecting productivity with a number of critical covariates at the firm level, such as size, financial position, exporting status, employment creation or price-cost margins.

It is worthwhile mentioning here that the new database includes a wealth of new indicators for which a joint analysis with the productivity and competitiveness measures lies at the core of CompNet's mandate. These indicators are grouped in four different modules, namely the financial module, the trade module, the labour module and the mark-up module.³

For example, the **financial module**, aside from detailing the construction of a number of standard indicators of a firm's financial position and providing complete statistics on those indicators by sector or by sector and size, includes a firm-level indicator of credit constraints (ICC).

The aim of the **trade module** is, instead, to exploit information (first provided at the firm level) on the total value of exports and imports of manufacturing firms in order to jointly study the financial and productivity characteristics of exporting (and non-exporting) firms.

The CompNet database has also enabled the construction of so-called "transition matrices", which reflect firms' movements along the distribution of size, productivity or unit labour costs in three-year windows. Exploiting this powerful analytical tool, the **labour module** investigates the role of labour market structure and dynamics in driving firms' growth, as defined in terms of the number of employees or productivity.

Finally, the **mark-up module** is focused on product market imperfections, as a dimension of aggregate competitiveness. More specifically, it explores the evolution of the mean and median of price-cost margins computed from balance sheet data, as well as their dispersion, for the total economy and at the sector level.

In general, cross-country comparability of the indicators has been at the core of the work in CompNet, and much has been achieved with respect to the first round of data collection and, more broadly, with respect to other databases. However, harmonization of indicators based on firm-level data to allow cross-country comparability remains a work in progress. Some specific

³ For further details on the content of each module, please refer to the forthcoming module-specific methodology paper.

recommendations have therefore been defined (see both Benatti et. al (2014) and Lopez Garcia and di Mauro (2015)) to overcome such limitations.

As a general rule, CompNet data are perfectly suited to compare within-country performance (of low and high productive firms, or of firms experiencing or not credit constraints, for example), as well as compare dynamics across sectors, or retrieve micro-based information to calibrate macroeconomic models. When performing the above-mentioned analysis, a number of precautionary practices should nevertheless be enforced. Since the coverage of the sample might vary across indicators, some robustness check with different indicators should be conducted (e.g. labour productivity vs. TFP); moreover, as time series could change in certain country/industries due to the variability of the sample, averages across years (e.g. before/after crisis) or cumulative growth rates rather than specific yearly figures, should be preferred. All in all, due to the lack of full comparability, CompNet database has to be used for cross-country comparisons with a lot of caution if one wants to produce descriptive, unconditional cross-country statistics. If instead data are used in a within a regression analysis, the researcher can control for country or sector differences via a rich set of dummies. The exact set of dummies depends, obviously, on the researcher's question, but they should be able to address the biases which are likely to affect purely descriptive analysis.

Note: the aim of this Box is to give an overview of CompNet firm-level based dataset. Please refer to Lopez-Garcia et al. (2015) and Benatti et al. (2014) for data specifics.

Turning to the contribution made by CompNet using its novel database, we can distinguish at this stage between two broad types of contribution. The first relates to **statistical analysis of the dataset**, including relevant correlations, which provides important insight into the issue of trade and firm-level heterogeneity in the EU, using a comparable database which is of a unique nature. The second stream of contributions relates to more sophisticated – though mostly preliminary – **empirical analysis** using the dataset.

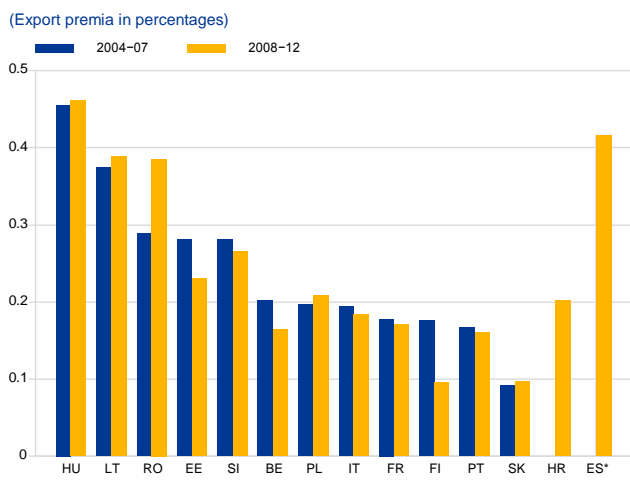
Productivity premia of exporters

Starting with the novel stylised facts, Berthou et al. (2015b) analyse the results of the joint distributions of firm-level exports and productivity which are included in the CompNet dataset. For their analysis, they use a subset of countries included in the

CompNet project for which data exist, matching firm-level productivity with trade data. They construct a panel of 15 European countries and 23 manufacturing sectors over the 2000s. Below is a brief account of some of the main results. Focusing on the extensive margin of trade, European exporters are more productive than firms operating solely at a domestic level, both before and after the 2008 crisis (see Figure 3).

Productivity premia for exporters, which are calculated using a non-parametric intra-industry approach, show substantial heterogeneity across countries. Productivity premia are around 20% in Belgium, Poland, Italy, Finland, France, Portugal and Croatia, and a little larger in some central and eastern European countries (Hungary, Lithuania, Romania,

Figure 3
Export premia in labour productivity, 2004-12



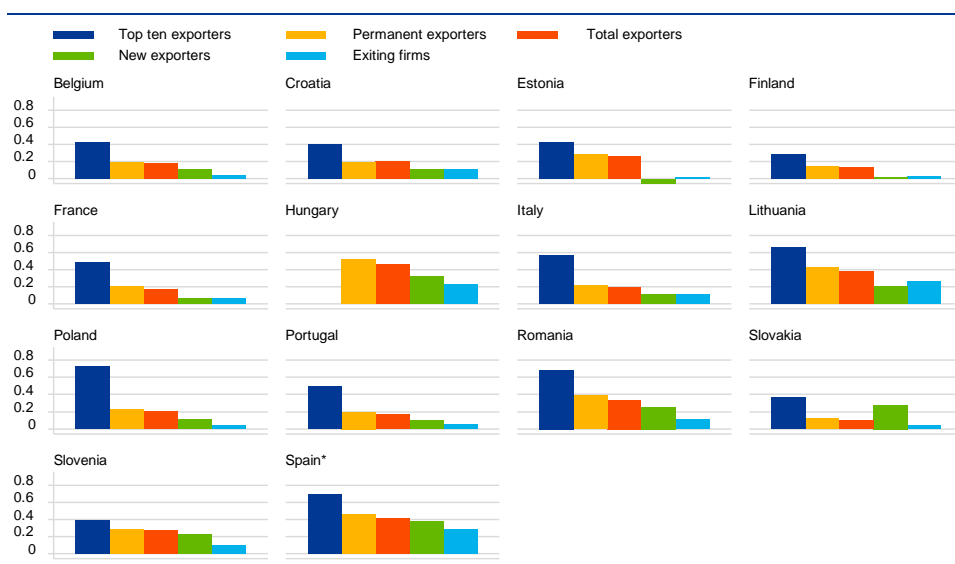
Sources: Berthou et al. (2015b)

Estonia and Slovenia), probably owing to foreign direct investment (FDI) and the integration of local firms into European supply chains.

Heterogeneity across exporters: the “happy few” story

However, productivity premia also differ across exporters. As shown in Figure 4, the top ten exporters in each country are markedly more productive than the average and up to 70% more productive than purely domestic firms. Moreover, while export entrants are more productive than non-exporters, they are, in most countries, markedly less productive than the average exporter. An important finding is that exporters’ productivity premium relative to non-exporters appears to increase with export experience. This pattern may be consistent with both the above-mentioned learning-by-exporting hypothesis, whereby firms learn about foreign market conditions over time, thus progressively enhancing productivity, and the selection mechanism, according to which only very productive firms are able to export permanently.

Figure 4
Average export premia in labour productivity by export status, 2004-12



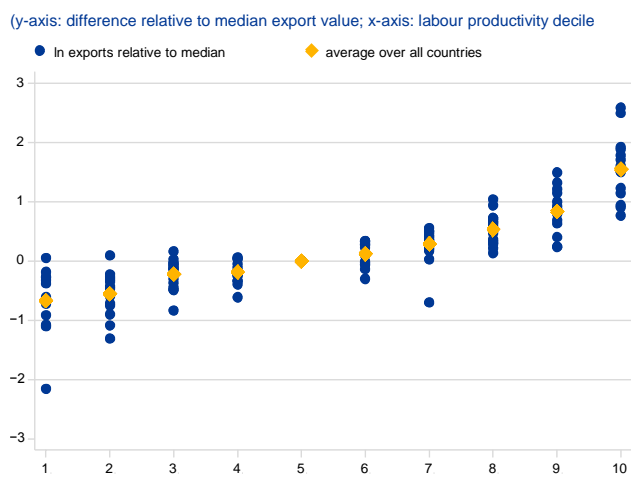
Source: Berthou et al. (2015b) , based on CompNet data (sample with 20+ employees, except for MT and ES).
Notes: Spanish data go up to 2011 and are not adjusted for reporting thresholds.

High-productivity exporters tend to export more than low-productivity exporters – i.e. the positive impact of productivity applies also when looking at the intensive margin of exports. Figure 5 reports export values for each productivity decile relative to the export value of the firm with median productivity. Firms in the top productivity deciles in all countries export an average 66% more than the median firm, while the exports of firms in the lowest decile are, on average, around 40% below the values for the median class

Figure 6 shows that the most productive firms (i.e. those in the last decile) account, on average, for more than a quarter of total exports, compared with less than 5% for all firms below median productivity. This finding confirms the “**happy few**” story proposed by Mayer and Ottaviano (2011), which is also supported by evidence from CompNet data (see section 4 of Berthou et al. (2015b)). Here enriched by a new

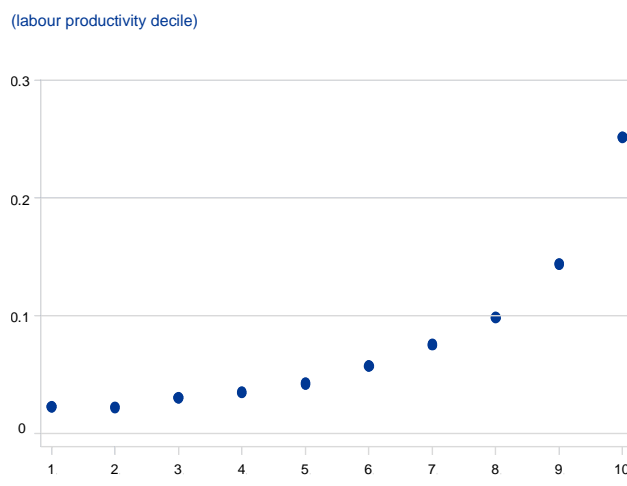
element: the top relatively few exports, that make a great part of the total exports of a single country, are also the most productive firms.

Figure 5
Value of firms' exports (logs) by productivity deciles



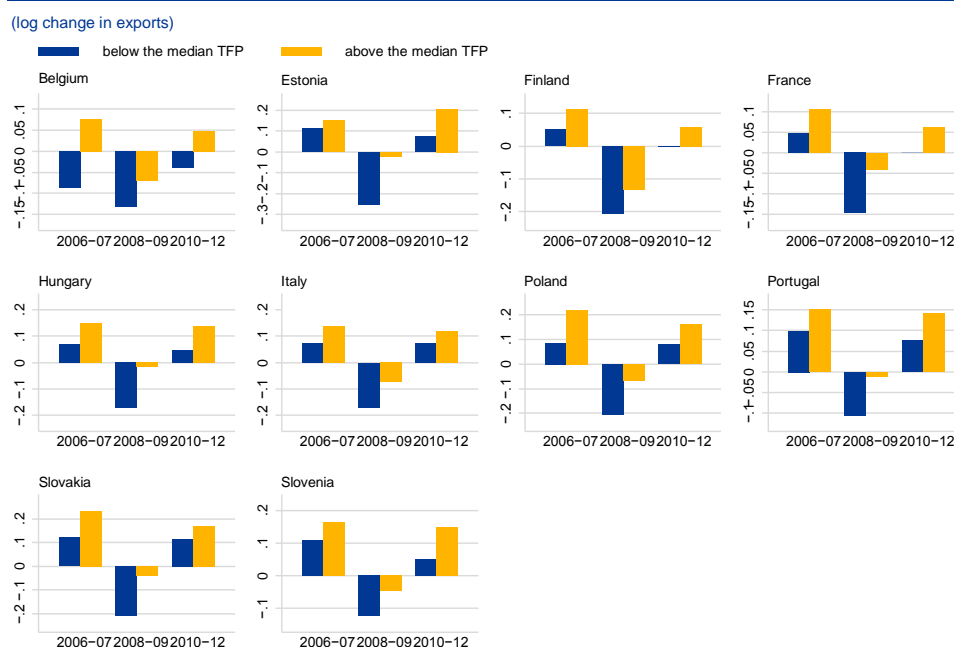
Source: Berthou et al. (2015b), based on CompNet data (sample with 20+ employees, except for MT and ES). Notes: Dots represent the values for each country.

Figure 6
Share of total exports by productivity decile (2006-12)



Source: Berthou et al. (2015b); based on CompNet data (sample with 20 or more employees, except for MT and ES). Notes: Averages across all countries, based on sector-level information.

Figure 7
Average export growth of firms below and above median TFP level, by country and sub-period (2006-12)



Source: Berthou et al. (2015b), based on CompNet data (sample with 20+ employees, except for MT and ES).

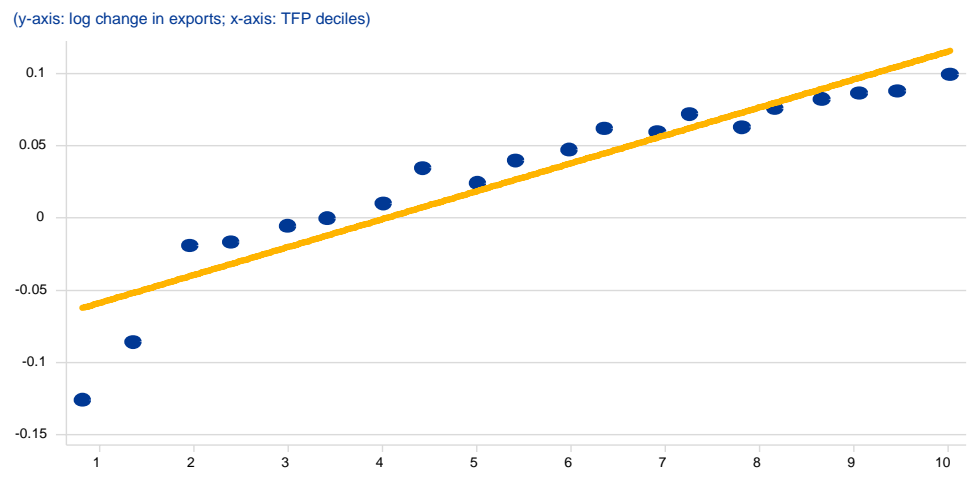
The role of productivity for exports' growth

Productivity matters not only for the level of exports, but also for their **growth**. Comparing exporting firms below and above median productivity, Figure 7 shows that, for all countries, and for all three periods considered – 2006-07 (before the crisis), 2008-09 (after the collapse of Lehman Brothers), and 2010-12 (the most

recent data available) – the most productive firms have always recorded, on average, the strongest export growth; when trade collapsed in 2008-09, their contraction was smaller than the average.

This result is confirmed when pooling all data and controlling for country, sector and year-specific effects (see Figure 8): there is a difference of around 20 percentage points between the export growth rates of the least and the most productive exporters.

Figure 8
Average export growth of firms by TFP decile



Source: Berthou et al. (2015b), based on CompNet data (sample with 20+ employees, except for MT and ES).

Interaction between trade developments at the macro level and productivity at the firm-level

Turning now to CompNet's empirical work, Barba Navaretti et al. (2015) examine the interaction between trade developments at the macro level and underlying firm-level productivity. Using CompNet's productivity dataset, they look at which features of a country's firm productivity distribution are related to its aggregate export performance. In doing so, they first estimate the exporter fixed effect (at sector level) for the CompNet sample of countries through state-of-the-art gravity regressions. Then they regress – again, within sectors – the estimated fixed effect on countries' average firm productivities, as well as on measures of the dispersion and asymmetry of firm productivity distributions. They provide robust evidence that not only the first but also **higher moments of such distribution matter**. In particular, they find a robustly positive contribution by the rightward asymmetry.

These findings are at odds with the predictions of the "standard" trade model of monopolistic competition with firm-level heterogeneity à la Melitz (2003) under the joint assumptions of constant elasticity of substitution of demand, "iceberg" trade costs and Pareto-distributed firm productivity, as these imply that only the first moment should matter.⁴ Instead, they sit well with existing evidence that the

⁴ Specifically, the "standard" trade model with firm-level heterogeneity generates a structural gravity equation in which aggregate exports are determined by the number of firms in the exporting country and their average productivity (Head and Mayer (2014)). As a result, the exporter fixed effect (termed "multilateral resistance"), which can, broadly speaking, be taken as a measure of the exporting country's competitiveness as an exporter, depends only on the first moment of the underlying firm productivity distribution. Other moments are irrelevant.

dominant share of a country's aggregate exports is due mostly to a small set of very large firms, the "happy few" (Mayer and Ottaviano, 2011) and with further evidence of "granularity" showing that aggregate economic outcomes frequently relate to the behaviour of a few large firms (Gabaix (2011)). Given that, within individual countries, the "happy few" are typically concentrated in the top percentiles of the firm productivity distribution, it would be reasonable to expect average **firm productivity not to be a sufficient statistic for aggregate outcomes** and for additional statistics to be needed. In particular, productivity distributions with identical means but different higher moments related to the features of the right-hand tail could well entail very different aggregate export performance.

With a similar idea in mind, Benkovskis and Bluhm (2015) link the firm-level indicators from the CompNet database with changes in real GDP per capita, TFP and export market shares at the macroeconomic level. Using a **Bayesian model averaging approach** for the subset of nine EU countries, they find that the skewness of the labour productivity distribution is highly significant in terms of explaining a country's competitiveness: a fatter right tail in the firm productivity distribution substantially contributes to stronger growth in real GDP per capita and TFP, implying that a country's competitive position is strongly driven by the most productive firms. In addition, the heterogeneity of firms affects the response of real GDP and export market shares to real exchange rate movements.

1.3 Mapping GVCs: characteristics and indicators

How can the existence of GVCs be incorporated in the competitiveness analysis?

How do GVCs affect overall trade dynamics?

Global value chains are now the dominant mode of production for most goods and services around the world. Production nowadays is vertically fragmented across different countries – i.e. parts and components are produced in distinct locations and are assembled either sequentially along the supply chain or in a final location. This phenomenon has gained momentum over the last few decades as the reduction of transport and communication costs, the acceleration of technological progress, and the removal of political and economic barriers to trade have greatly increased opportunities for international fragmentation of production, thus contributing to the expansion of GVCs and trade in value added (see Box 2 and di Mauro and Ronchi (2015a)). The growth observed in GVCs is thus linked to the strong expansion of international trade and foreign direct investment flows, as well as the growing importance of multinational corporations, which are the main players in the organisation of these chains.

Against this background, and given its mandate, CompNet has placed GVC analysis at the heart of its work in order to see how GVCs can be included in the analysis of EU countries' competitiveness positions. This is particularly relevant in the aftermath of the global financial crisis, which highlighted the need for a better understanding of **the effect of GVCs on trade dynamics**.

Building on existing literature, CompNet's contribution in this field consists of providing a novel way of mapping GVCs in Europe. This involved extending an existing global input-output database (Timmer et al. (2013)) and calculating new measures of participation in GVCs across EU countries and sectors.

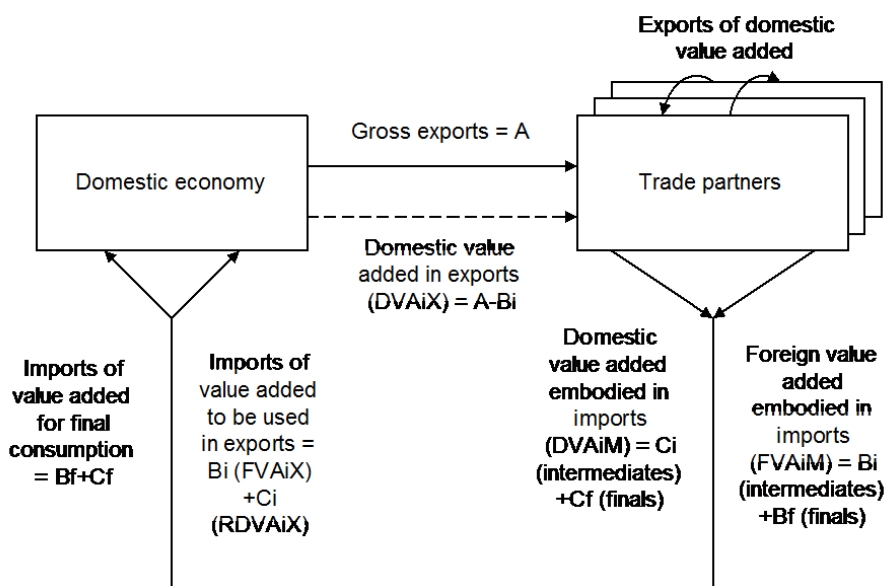
Box 2

GVCs and trade in value added

The economic literature has been making progress with the measurement and mapping of this phenomenon (for an extensive survey of literature on the drivers and measures of GVC, see Amador and Cabral (2014)). Building on the initial contributions by Feenstra and Hanson (1999) and Hummels et al. (2001), broader frameworks for computing the foreign and domestic content of exports have been suggested by Koopman et al. (2010), Johnson and Noguera (2012) and Stehrer (2012). These broader measurement frameworks rely on global input-output matrices, which identify the sources and uses of output in the economy, decomposing it by sectors and partner countries. The level of integration in GVCs is associated with the import content of exports, while the positioning in the value chain can be related to the re-exporting of domestic value added embodied in imports. Being positioned where most value added is concentrated implies that a large percentage of the domestic value added in total imports is re-exported (Figure A presents these dynamic linkages in a stylised manner).

Figure A

Flows of value added



Source: Amador and Stehrer (2014).

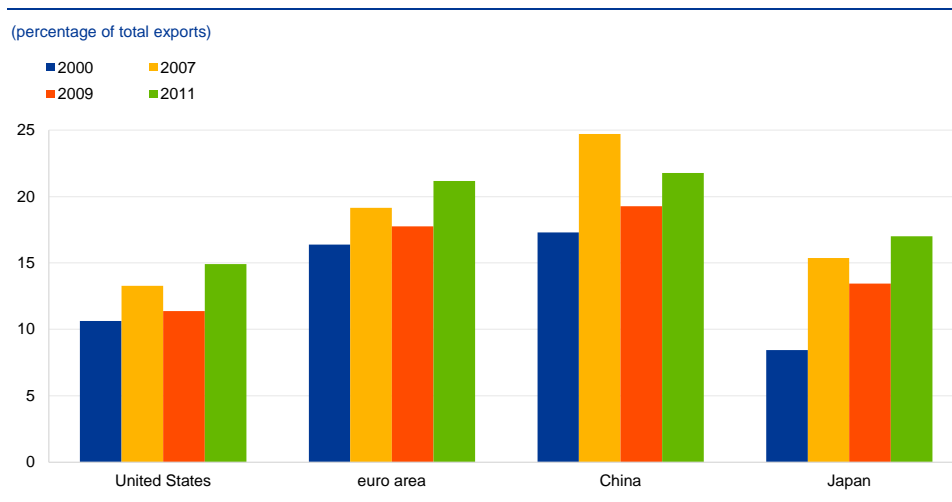
According to Baldwin (2012), these stages are either pre-fabrication, where R&D, product concepts and designs are defined, or stages closer to the final user, corresponding to post-fabrication services (sales, marketing and after-sales services). In this context, Santoni and Taglioni (2015) look at determinants of GVC entry and upgrading, showing that being well integrated with suppliers that, in turn, are well integrated in GVCs is what matters most, both in terms of export outcomes and in terms of outcomes measured as value added embodied in exports. Being close to the demand is also relevant, but less so. The authors also conclude that the key centres of technology and value added remain Japan, the United States and Germany/the EU. South Korea and China remain more peripheral than received wisdom would suggest – i.e. they are good buyers in GVCs, but not good sellers.

Mapping GVCs

CompNet's basic work on the **mapping of EU GVCs** is reported in Amador et al. (2015). They find substantial heterogeneity in the degree of involvement in GVCs across countries, though with a pattern of higher integration for more than half of them. This higher global integration notwithstanding, the euro area as a region constitutes a major economic block where international trade flows are comparable to those of other major economies such as the United States, China and Japan. Results show that in 2011, GVCs were as important in the euro area as they were in China – and more important than they were in the United States and Japan (see Figure 9).

Figure 9

Foreign value added as a percentage of total exports in major economies



Source: Amador et al. (2015).

Note: The euro area is taken as a whole (i.e. intra-euro area trade flows are disregarded).

In Europe, GVCs have a strong regional dimension. In the period 2000-11, the export share of foreign value added sourced within the euro area was more stable than that sourced from other regions, representing around 11% of total exports for the average euro area country. In other words, the growing relevance of external suppliers does not reflect a weakening of the production links within the euro area. Rather, it increases the possibility of exchanging resources with non-euro area countries.

Accounting for cross-country input linkages in global trade flow dynamics

This is particularly relevant in the aftermath of the international financial crisis, and it sheds light on the **linkages between GVCs and overall trade dynamics**.

Unexpectedly weak dynamics in global trade flows in 2012 and 2013 triggered a discussion on a potential structural change in global trade drivers, in addition to the cyclical weakness caused by subdued investment. As a result, there is a recent strand of literature on international macroeconomics and business cycles that takes into account cross-country input linkages. Di Giovanni and Levchenko (2010) find that bilateral trade is more important for generating business cycle co-movement in sectors that are characterised by greater vertical production linkages. Johnson (2014) incorporates input trade in a dynamic multi-sector model with many countries and finds that input trade promotes co-movement in gross output that is much stronger than in value-added terms. Moreover, Bems (2014) concludes that price elasticities differ in multi-sector multi-country macro models with and without intermediate inputs, thereby leading to substantially different predictions regarding the response of relative prices to external rebalancing. All in all, a consensus has emerged in the recent literature – to which a number of CompNet members have also contributed – that the great trade collapse can be attributed mainly to changes in final expenditure (e.g. Bems et al. (2010; 2011)), inventory adjustment (e.g. Altomonte et al. (2012)) and adverse credit supply conditions (e.g. Bricongne et al. (2012)). Within this strand of analysis, original work within CompNet by Nagengast and Stehrer (2015) provides a nuanced view of the great trade collapse in value-added terms, which will be presented in more detail in section 2.2.2.

GVCs and financial linkages

GVCs create not only production linkages, but also financial linkages between firms and countries. Within CompNet, Manova (2015) reviews the literature and states that credit market frictions have an important impact on the organisation of global production networks, individual firms' positioning in these networks and multinational companies' operational decisions. Along these lines, and prior to CompNet, Manova and Yu (2011) suggested that credit-constrained firms, and presumably financially underdeveloped countries as a whole, might be stuck in low-value-added stages of global value chains and unable to pursue more profitable opportunities. As a result, it is likely that strengthening capital markets might be an important prerequisite for moving into higher-value-added activities. The authors also stressed that global value chains and multinational activity transmit supply and demand shocks across borders, including contagion, sudden stops and reversals in international capital flows (see section 2.2.2 for selected research on GVCs' impact on shock transmission channels).

Multinationals: GVCs' key players

Multinational groups are key players in the operation of GVCs, which is mirrored in the expansion of FDI flows and closely linked to the liberalisation of capital flows. In this vein, within a CompNet project, Altomonte et al. (2015) used firm-level data on property linkages from ORBIS to construct a dataset mapping more than 50,000 multinational groups around the world in the year 2010, retrieving data on the number of affiliates operating in any given country-industry pair. In this way, the authors were able to track multinational business groups' linkages, across countries and industries, stemming from the presence of the same business groups through their affiliates. They augmented standard gravity regressions of bilateral exports by including indicators of the presence of the same multinational groups across countries and industries, studying the correlation patterns that emerged. The results are consistent with the standard findings of the gravity literature on gross export flows – i.e. distance

is negatively correlated with trade between countries when considering each value-added component separately. In addition, the gravity equations, augmented with indicators of the presence of the same multinational groups across countries, show a rich pattern of positive correlations with value-added trade flows. From a policy perspective, to the extent that multinational firms account for an ever larger share of GDP in most countries, the likelihood of protectionism and beggar-thy-neighbour policies decreases, while reinforcing the case for close economic cooperation across countries, notably on tax issues, as is currently done in the EU.

The role of GVCs for labour market developments

As reported by di Mauro and Ronchi (2015a), a politically relevant issue for the euro area is whether increasing integration into GVCs increases the risk of job shedding, as is often publicly claimed. Anecdotal evidence suggests that advanced countries are increasingly specialising in skill and capital-intensive activities within global supply production systems, more popularly described as turning into “headquarter economies”. To tackle this issue using the WIOD, Timmer et al. (2013a) developed new measures of the factor content of manufacturing production chains. In particular, they constructed an indicator named “GVC jobs”, which measures the number of jobs associated with activities that are directly or indirectly related to the production of final manufacturing goods. The authors show that, along with the increase in GVC participation, the importance of services in European countries, both directly and indirectly embodied in final manufacturing, has grown in terms of value added and job creation. Two notable cases are those of Germany and Spain, where, from the mid-1990s onwards, job creation in service activities more than compensated for job losses in declining traditional manufacturing activities. The bottom line here is that jobs, rather than disappearing, are just being distributed differently across high-skilled and low-skilled activities. In relation to this, the authors show that specialisation patterns differ between high-income and emerging economies that participate in these chains. In particular, the authors find that in most global value chains there is a strong shift towards value being added by capital and high-skilled labour. This can be seen in Table 2, which shows a bifurcation in the factor content of global value chains, with increasing capital and high-skilled labour income on the one hand, and declining shares for medium and – in particular – low-skilled labour on the other. More generally, we can say that, according to the literature, the rise of the GVCs accounts for a relevant part of the increase in the relative demand for skilled-labour in developed countries. However, according to the literature, the overall effect on the level of employment is small and differs across sectors, and participation in GVCs seems to have a positive impact on productivity.

Table 2
Factor shares in global value chains for manufacturing

	1995	2008	2008 minus 1995
Total value added (USD billions)	6,586	8,684	2,098
by			
capital (%)	40.9	47.4	6.5
high-skilled labour (%)	13.8	15.4	1.5
medium-skilled labour (&)	28.7	24.4	-4.2
low-skilled labour (%)	16.6	12.8	-3.8

Note: Shares of production factors in total value added, based on global value chains for manufacturing. Shares add up to 100%. Value added is at basic prices (i.e. excluding net taxes, trade and transport margins on output). It is converted to US dollars using official exchange rates and deflated to 1995 prices using the US CPI. Figures may not add up owing to rounding.
Source: Calculations based on World Input-Output Database as shown in Timmer et al. (2013b).

Accounting for firm heterogeneity in the analysis of GVCs

Within industry, **firm-level heterogeneity** is the main factor in the recent international trade models and **should be incorporated in the analysis of GVCs**. However, so far, such empirical evidence based on firm-level data is scarce. Work by Murphy and Siedschlag (2015) makes use of the EU-EFIGE dataset, which combines measures of firms' engagement in international activities (exports, outsourcing, FDI, imports, etc.) with quantitative and qualitative information on about 150 items, including R&D and innovation, labour organisation, financing and organisational activities, and pricing behaviour. The author shows that about one-third of the firms analysed served only domestic markets, while the share of firms engaged purely in internationalisation strategies (pure importers, pure exporters and pure international producers) was around 32.2%, slightly less than the share of firms engaged in two internationalisation modes (which stood at 34%). The complexity of the internationalisation strategies of the analysed firms varied across industries, with those with more complex strategies lying in the textiles, electrical and optical equipment, and transport equipment industries. Moreover, after accounting for firm-level heterogeneity, the complexity of internationalisation strategies appeared to increase with firms' size and performance, and within the group of firms engaging in international activities, trade intensity was positively correlated with the complexity of the international strategies. Although illuminating, existing evidence is still a long way from providing a comprehensive picture of the relationship between the micro and macro dimensions of GVCs' operations, a field where CompNet would potentially be well equipped to contribute in the future.

1.4 External imbalances

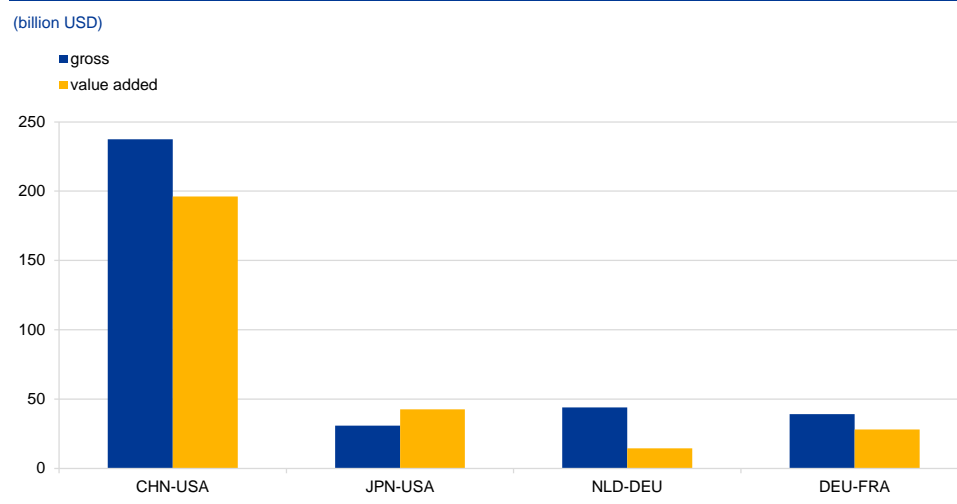
What is the relationship between GVCs and external imbalances?

How are the latter driven by firms' heterogeneity?

In the light of the previous discussion, the pervasiveness of GVCs and the importance of firm-level heterogeneity have an impact on the interpretation of external imbalances. On the one hand, thinking in terms of value added reshapes the

way in which trade surpluses and deficits are distributed across countries. And on the other hand, given the high level of intra-country, intra-sector firm-level heterogeneity, it seems natural to look at how external imbalances relate to the characteristics of firms. In this regard, drawing on CompNet research, this section will discuss some aspects related to both dimensions and derive a few policy implications.

Figure 10
Bilateral trade balances in 2011



Source: Nagengast and Stehrer (2014); calculations based on WIOD.
Note: The first country in the pair is the surplus country.

Starting from the interpretation of external imbalances once the pervasiveness of GVCs has been accounted for, we know that when bilateral **trade balances are measured in gross terms**, a deficit with an exporter of final goods can be overstated because it is affected by the value of inputs supplied to this exporter by third countries (Johnson and Noguera (2012)). Along these lines, Nagengast and Stehrer (2014) showed, within CompNet, that in 2011 the US trade deficit with China was approximately 17% smaller when measured on a value-added basis, while the US trade deficit with Japan was 39% larger (see **Figure 10**).

In policy terms, under a scenario of persistent trade deficits, the pressure for rebalancing increases the **risk of protectionist responses based on an inaccurate perception of the origin of trade imbalances**, which could hit countries positioned at the end of the GVC. In fact, GVCs pose substantial challenges to the World Trade Organisation (WTO) multilateral trading system, as its principles are based on the existence of localized production within nations and not on internationally fragmented production systems. Moreover, in a monetary union, trade imbalances are also important. The recent crisis has shown that continued external imbalances and the accumulation of strong negative international investment positions expose economies to risk and lead to financing difficulties in the event of international financial shocks. Therefore, although total external imbalances are the most widely used variable for macroeconomic imbalances surveillance assessment, bilateral value-added balances would provide important additional insight.

Table 3

Breakdown of intra euro area value added flows, bilateral linkages 2011 in per cent

To:	AUT	BEL	CYP	DEU	ESP	EST	FIN	FRA	GRC	IRL	ITA	LUX	MLT	NLD	PRT	SVK	SVN	euro area
From:																		
AUT	-	0.2	0.0	2.6	0.2	0.0	0.0	0.3	0.0	0.0	0.7	0.1	0.0	0.1	0.0	0.1	0.1	4.4
BEL	0.2	-	0.0	2.2	0.6	0.0	0.1	1.8	0.1	0.1	0.8	0.4	0.0	1.5	0.1	0.0	0.0	8.0
CYP	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
DEU	4.0	2.8	0.0	-	2.8	0.1	0.7	7.2	0.5	0.5	4.9	0.5	0.0	3.4	0.5	0.6	0.2	28.8
ESP	0.2	0.6	0.0	2.2	-	0.0	0.1	2.9	0.2	0.2	1.7	0.2	0.0	0.6	1.4	0.0	0.0	10.3
EST	0.0	0.0	0.0	0.0	0.0	-	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
FIN	0.0	0.1	0.0	0.5	0.1	0.1	-	0.1	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	1.3
FRA	0.3	1.9	0.0	4.9	2.7	0.0	0.1	-	0.2	0.3	2.6	0.3	0.0	1.0	0.3	0.1	0.1	14.8
GRC	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	-	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3
IRL	0.0	0.2	0.0	0.6	0.3	0.0	0.0	0.3	0.0	-	0.3	0.0	0.0	0.2	0.0	0.0	0.0	2.0
ITA	0.7	0.6	0.0	4.1	1.7	0.0	0.1	3.1	0.5	0.2	-	0.1	0.1	0.5	0.2	0.1	0.2	12.2
LUX	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.1	-	0.0	0.0	0.0	0.0	0.0	0.9
MLT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	0.0	0.1
NLD	0.2	3.0	0.0	4.2	1.0	0.0	0.3	1.4	0.2	0.3	1.5	0.1	0.0	-	0.2	0.1	0.0	12.5
PRT	0.0	0.1	0.0	0.3	0.7	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.1	-	0.0	0.0	1.7
SVK	0.2	0.0	0.0	0.5	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	-	0.0	1.2
SVN	0.2	0.0	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	-	1.2
euro area	6.1	9.9	0.2	23.0	10.1	0.2	1.7	18.0	1.9	1.8	13.2	1.7	0.2	7.6	2.8	1.1	0.7	100.0

Note: Domestic value added in exports from row country to column country, as percentage of total intra-euro area value added trade. Cells above 2 per cent are shaded in light grey and above 4 per cent in dark grey.

Mapping bilateral flows of value added

With respect to what has been said above, Amador et al. (2015) provide a complete **map of the flows of value added** that are traded between country-pairs in the euro area in 2011 (Table 3). The geographical decomposition of each country's value added exported to the euro area is presented as the sum of the contribution of each row. Therefore, that number represents also the country's contribution of the total value added supplied to the region. The sum of each column represents instead the share of value added "consumed" by each country. Therefore, the difference between countries' supply and demand of value added can be interpreted as a proxy of "trade balance in value added" within the euro area. These numbers suggest that Germany, as well as the Netherlands, run a "surplus in trade of value added" within the euro area, whereas France for example exhibits a deficit. On the contrary, the similar magnitude in the shares of value added supplied and consumed within the euro area by Spain and Italy suggests that in 2011 these two countries were very close to achieve a balanced trade account

The role of domestic demand for bilateral trade balances

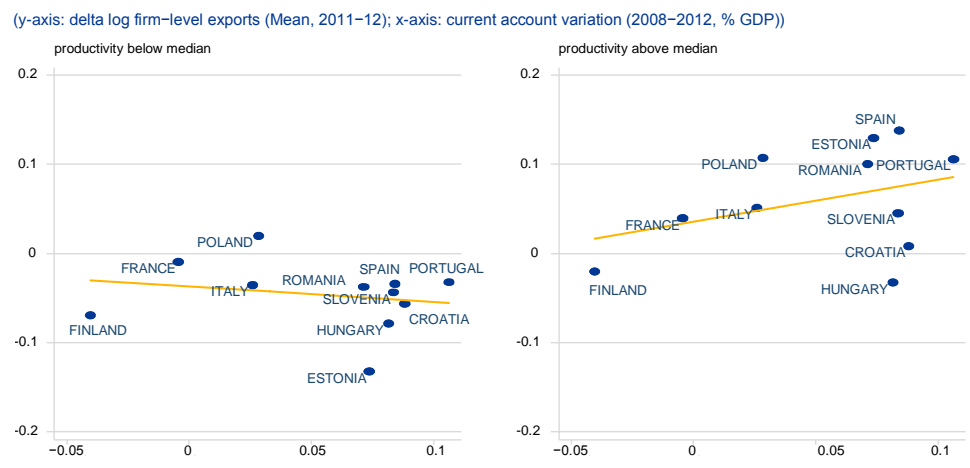
Against this background in a world of international production sharing the bilateral trade balance between two countries is to some extent a **function of the demand in the rest of the world** (Nagengast and Stehrer (2015)). More specifically, a decrease in domestic demand leads to an adjustment of the portion of the trade balance capturing value added absorbed by the two trade partners, whereas by definition it will have no effect on the part of the trade balance which is due to demand in third countries. Therefore, a completely balanced bilateral gross trade position is unlikely to be a good benchmark for assessing demand or price adjustments. This analysis suggests that intra-European trade imbalances were overstated while those with countries outside the European Union were slightly underestimated. In 2011 the

value added trade balance vis-à-vis the European Union as a whole was smaller (and therefore the one with non-EU countries larger) than the gross trade balance for 21 of the 27 countries. A similar result holds for the euro area for which the value added trade balance of individual countries with the EMU aggregate was smaller than the gross trade balance for 15 out of 17 countries. This finding makes it undesirable to assess intra-EU (intra-EMU) imbalances in terms of gross trade flows since a sizeable share of these are in fact trade imbalances with countries outside of the European Union (euro area), which are by definition unaffected by adjustment of domestic demand within the European Union (euro area).

The role of capital flows for external imbalances

External Imbalances are obviously tightly related to **capital flows**. In particular, Gabrisch and Staehr (2014) find that changes in capital flows appear to affect cost competitiveness in the short term, while changes in competitiveness appear to have no effect on capital flows in the short run. These findings may shed light on developments in Europe prior to the global financial crisis. Increasing capital flows from the core to the periphery of Europe may partly explain the deteriorating cost competitiveness in many countries in Southern and Central and Eastern Europe. The reversal of these capital flows after the outbreak of the global financial crisis may lead to ensuring changes in cost competitiveness. Thus, the paper points to the importance of the monitoring of external capital flows as a means for understanding developments in cost competitiveness. The results also suggest that the measures in the Euro Plus Pact to restrain the growth of unit labour costs may not affect the current account balance in the short term.

Figure 11
Current account adjustment and export growth by productivity level



Source: Berthou et al. (2015).

Impact of productivity distribution for current account adjustments

Given the high level of within country and/or within sector **firm heterogeneity**, it seems natural to investigate how external imbalances relate to the characteristics of firms. CompNet data allows exploring such relationship. Figure 11 plots the current account adjustment recorded 15 European countries between 2008 and 2012 (as a percentage of GDP) against export growth in 2011-12 for two groups of firms: high productivity (above median) and low productivity firms. The data shows that there is a strongly positive correlation between the current account adjustment and export

growth, but only as far as the most productive firms are concerned. This evidence would suggest that the reduction of external imbalances within Europe might have been mostly driven by the export performance of the highly productive firms in deficit countries.

Following the same intuition, di Mauro and Pappada' (2014) use CompNet information on the distribution of total factor productivity, to analyse the impact of productivity differences on trade balance adjustment. The authors build a general equilibrium model with three countries and heterogeneous firms. They show that the external adjustment of the trade balance is facilitated when the right tail of the firm productivity distribution is "fat-tailed", i.e. there exists a fringe of very high productive firms which could potentially become exporters thus, exploiting the extensive margin of trade. In particular, the calibration of the model with CompNet data⁵ shows that Spain and Italy (the deficit countries) are characterized by a lower mean and a less fat right tail of the productivity distribution, with respect to Germany (the surplus country). This micro structural characteristic of the euro area countries, a piece of information which is cross-country comparable in CompNet dataset, implies that the external rebalancing in Spain and Italy requires a larger relative price adjustment, compared to countries that would benefit from a higher density of high productive firms. A direct **policy implication** of this finding is that the response of external imbalances to a price competitiveness improvement may be fostered by structural policies that allow more productive firms to grow and to respond to export opportunities in foreign markets.

Table 4
External account rebalancing, 2007-13

	Spain		Italy	
	RER _{ES/DE}	RER _{ES/ROW}	RER _{IT/DE}	RER _{IT/ROW}
Counterfactual	1.26	1.53	0.53	0.44
Benchmark	3.63	3.79	1.38	0.87
Higher elasticity of substitution for deficit countries	5.98	3.28	2.45	0.73

Source: di Mauro and Pappad  (2014).
Notes: Percentage changes in real exchange rates. A positive number refers to real exchange rate depreciation.

1.5 Concluding remarks

Very often in the economic literature the concept of a country's competitiveness is associated with its trade performance. Aggregate indicators such as ULCs and the exchange rate are used as proxies of competitiveness, reflecting the leading notion according to which good trade performance requires what is called "price" and "cost competitiveness". However, recent studies have stressed the importance of adopting a holistic approach going beyond cost factors and aggregate indicators. CompNet has therefore expanded the general approach towards the analysis of trade and

⁵ The actual results have to be taken with caution since calibration utilises the first round of CompNet firm level database, which are subject to cross- country comparability issues.

competitiveness by including both a firm-level and a cross-border perspective in its studies. Its main findings can be summarised as follows:

All in all, results point to the need of broadening the range of indicators considered over and above relative price and cost, when analysing trade performance of a country. Non-price factors like taste or quality explain a large portion of trade dynamics for European countries; moreover, the geographical and product structure of trade matters a lot. Not only foreign, but also domestic conditions can influence ability and willingness to export via capacity and liquidity channels.

When dealing with international trade and competitiveness, productivity is the cornerstone dimension of firm heterogeneity. The CompNet database has clearly reaffirmed for 15 European countries the well-known empirical fact that firms involved in international trade are more productive than purely domestic ones. Using the rich amount of information collected within the network, CompNet has also shown productivity premia increase with the degree of export experience and involvement. In line with the “happy few” hypothesis, in most European countries, total exports are accounted for by a small share of very productive firms. CompNet makes a step forward in this direction and shows that properly accounting for this set of firms greatly improves our understanding of various indicators of international performance, like world market shares, export growth and current account balances. Last but not least, it suggests rethinking some of the key assumptions of the ‘standard’ trade models that do not provide empirically valid predictions on the supply side factors that are relevant for aggregate competitiveness.

The world economy is undergoing a period of deep transformation, in which production of goods and services is increasingly fragmented across different countries. In this context, the rise of the global value chain requires rethinking growth strategies and trade policy. These transformations will also have repercussion on labour markets and the way economies develop their comparative advantage.

In an increasingly interconnected world, interpreting external imbalances simply in terms of cost and price differences is not appropriate. Countries specialise and position themselves along GVCs. Therefore, policy should focus on identifying and promoting the capabilities necessary to upgrade along the production process, and to recognise that looking at the “average firm” may lead to less effective outcomes.

2 Shock transmissions in a global context

How macroeconomic shocks are transmitted within countries and across borders, and how they affect the choices of agents (i.e. governments, firms or households) is a central question driving the work of economists and researchers in all central banks. In the current European context, which is marked by strong external and internal imbalances (especially within the euro area), two important policy questions have been raised by the crisis: What is the relative price adjustment in deficit and surplus economies that is required to rebalance the external accounts of these economies and ensure stronger economic growth? And how are demand shocks transmitted across borders? Traditionally, various models, such as dynamic stochastic general equilibrium (DSGE) models or real business cycle (RBC) models, have been used to simulate shocks, such as changes in the policy environment (e.g. fiscal or monetary policy) or supply and demand shocks, or to look at how the presence of frictions in the labour or financial markets changes reactions to these shocks. The calibration of the external dimension of these models requires estimates of trade elasticities (both relative price elasticity and the demand elasticity of exports or imports), the values of which have a clear impact on the simulation outcomes of these models (Bodenstein (2010)). There is, however, no consensus on these values. In particular, while trade economists tend to assign a high value to relative price elasticities (often above five), macroeconomists tend to assign a low value to these elasticities for the calibration of RBC models, often setting their values below one.

To estimate these elasticities, recent economic research has looked at how their values are affected by structural characteristics of the population of firms operating in a country or sector, such as firms' size and productivity distribution. Indeed, the aggregate reaction of exports and imports to real exchange rate movements is determined, at the micro level, by a firm's decision to start international activities or expand existing ones. A second structural factor potentially affecting trade elasticities is the greater integration of countries and firms in global value chains. The great fragmentation of production across borders can have an impact on the value of trade elasticities through many channels. For instance, when production processes are internationalised, a decline in the nominal exchange rate creates both (i) an increase in competitiveness through the reduction of firms' export prices in external markets and (ii) a complementary increase in the price of inputs being sourced from foreign countries not sharing the same currency. For these reasons, the increased internationalisation of production processes has received a lot of attention. Indeed, it has been identified as a natural ground for explaining some of the recent trends in international trade, such as the strong elasticity of trade to GDP variations during the late 1990s and the early 2000s (and its more recent decline), or the trade collapse and recovery episodes in the early years of the Great Recession.

Within CompNet, researchers have developed new data and empirical strategies to investigate these policy questions. The results obtained so far can be used to better

assess – both qualitatively and quantitatively – how supply shocks, demand shocks and policy shocks are transmitted across borders.

The first section of this chapter reports some estimates of trade elasticities obtained using microeconomic information on firms' activity – specifically the information contained in the micro-based CompNet dataset. It shows that using microeconomic information can substantially improve such estimates, as it allows several estimation biases reported in the literature to be addressed, such as simultaneity bias or aggregation bias. The results also show that controlling for the dispersion of firms' productivity or size within each country or sector improves the estimation of relative price elasticities. Finally, the first section also provides new evidence of the transmission of demand shocks across borders at both the micro and the macro level. The second section of the chapter focuses on the role of global value chains in trade elasticities and their impact on the transmission of shocks across borders. In particular, it looks at how taking account of the existence of GVCs can explain changes in the long-term relationship between trade and GDP growth, as well as help towards an assessment of their impact on the transmission of shocks across borders. The research summarised in this chapter shows that the indicators of productivity dispersion and participation/integration in GVCs that have been developed within CompNet can be used to calibrate existing theoretical models or as additional controls in the estimation of aggregate export and import equations. In doing so, it also provides new guidelines for future research and policy work.

2.1 Micro versus macro estimates of trade elasticities

How much do exports respond to relative price changes, and what factors determine this reaction?

How are demand shocks transmitted across borders?

How can microdata help to examine these questions?

Microdata benefits for estimating trade elasticities

The response of trade to relative price changes is a key parameter in analysing the adjustment of external imbalances through real exchange rate adjustments. However, traditional macroeconomic estimates of trade elasticities based on time series analysis are often found to be low and not statistically significant (e.g. Hooper et al. (1998)). This finding has been challenged by recent literature inspired by the work of Feenstra (1994), who was the first to highlight the strong endogeneity and aggregation bias affecting traditional macro estimates of trade elasticities. The recent availability of firm-level datasets allows us to address the endogeneity issue affecting macro estimates and investigate the heterogeneity in firms' responses to real exchange rate movements within each sector. This new strand of literature tends to uncover much larger trade elasticities. In this context, the CompNet data have proved extremely useful: by providing unique firm-level based data, they address the

problem of aggregation and simultaneity bias. In addition, harmonisation across countries allows a multi-country approach to trade elasticities. Section 2.1.1 presents the main results of the estimation of trade elasticities by CompNet members, while section 2.1.2 summarizes work examining the transmission of demand and financial shocks across countries.

2.1.1 The reaction of exports to changes in price or cost competitiveness

Table 5 below summarises estimates of aggregate trade elasticities obtained from data disaggregated at the sector or product level. These elasticities have been used to assess the impact of changes in relative prices on export performance, as well as the impact of trade openness on aggregate productivity and welfare.

Table 5
Estimates of aggregate trade elasticities (references)

Not CompNet	
Hooper, Johnson and Marquez (1998)	G7 countries' long-term price elasticities: Exports: [-1.6; -0.2] Imports: [-0.06; -0.9]
Feenstra (1994)	Import elasticities of substitution for the United States: [2.96; 8.38]
Broda et al. (2006)	Median import elasticity of substitution for the United States: 3.1
Imbs and Méjean (2009)	Aggregate import elasticity of substitution for the United States: 7
CompNet	
Corbo and Osbat (2013)	Import elasticities of substitution: [2.6; 4.8] Export elasticities of substitution for EU 27: [3.0; 6.5]
Benkovskis and Wörz (2015a)	Import elasticities of substitution for the United States, China, Germany and Japan: [2.4; 3.4]

[New trade elasticity estimates ...](#)

Within CompNet, Corbo and Osbat (2013) contribute to this new micro approach. Using Eurostat ComExt data disaggregated at the sector level, they extend Feenstra's empirical framework in order to estimate aggregate elasticities of substitution for both exports and imports. They find that the aggregate elasticity of substitution for European countries' imports ranges from 2.6 to 4.8 (with a median value of 3.4), while values for export elasticities are slightly larger, ranging from 3.0 to 6.5 (with a median value of 3.8). Additionally, their results point to significant heterogeneity in the elasticity of substitution at the sector level across countries, which may partly explain the differing reactions of trade flows to relative price changes at the country level. Following a similar approach, Benkovskis and Wörz (2015) find import elasticities of substitution to be between 2.4 and 3.4 for the major world economies (the United States, China, Germany and Japan).

[... from micro data ...](#)

While the above papers draw on disaggregated trade data, microeconomic firm-level data have been the focus of other papers, as they present a number of advantages. The first is that they allow us to address both the aggregation bias and the simultaneity problem affecting macro estimates at the country or sector level (Dekle et al. (2009)). The development of these micro-based studies was, of course, made possible by greater access to micro datasets reporting information about exports and imports at the firm level. Within CompNet, various projects have provided estimates of these micro elasticities using firm-level information, focusing initially on single-country analysis.

... highlight the role of firm-level characteristics

Using the detailed information now available in CompNet’s micro-based dataset (specifically its trade module), two CompNet projects have provided new micro-based estimations of the exchange rate elasticity of exports at the country-sector and firm level. In particular, these projects emphasise the role of within-country and sector productivity heterogeneity as an important determinant of the aggregate reaction of exports following exchange rate movements. First, di Mauro and Demian (2015) investigate the response of exports to exchange rate fluctuations using CompNet sectoral information for a set of EU countries and look at how this response is affected by the shape of the productivity distribution. Controlling for the shape of the productivity distribution in an export equation significantly increases the real exchange rate elasticity by reducing the unobserved bias (the estimated elasticity increases from 0.35 without controlling for productivity distribution to 0.77 when controlling for productivity distribution). In addition, the results indicate lower elasticity in sectors with high levels of productivity dispersion. Overall, they provide useful guidelines and new controls for improving the fit of the estimation of export equations for European countries.

Lower elasticities in larger and more productive firms

Second, Berthou et al. (2015a) investigate the underlying factors driving the heterogeneous response of European exporters to exchange rate fluctuations, taking advantage of the detailed information available in the trade module of the CompNet database (see Berthou et al. (2015b) for a detailed description of the information included in this specific module). In section 1.1 of the report, the results obtained using the CompNet data indicate that more productive firms tend to have more rapid growth in exports. More productive (larger) firms may also react differently to exchange rate movements, compared with less productive (smaller) firms. Berthou et al. (2015a) uncover new evidence on the impact of exchange rate movements on exports for European firms. In particular, the data used allow a distinction to be drawn between firms within sectors on the basis of their level of productivity or size. In their empirical specification, they relate firm-level export performance to changes in the real effective exchange rate (REER), while allowing the elasticity to vary across different categories of firm. After controlling for other macroeconomic determinants (foreign demand) and sector or firm-level characteristics (such as productivity or size) with a direct impact on export growth, estimation results show substantial heterogeneity across the different categories, with large (and more productive) firms reacting less than the average firm to changes in exchange rates.

Table 6
Export elasticities relative to ULC-REER by size and productivity quartile

	$\Delta \ln REER$		$\Delta \ln REER$
Size – Q1	-1.760***	TFP – Q1	-1.678***
Size – Q2	-1.165***	TFP – Q2	-1.229***
Size – Q3	-0.766***	TFP – Q3	-0.670***
Size – Q4	-0.477*	TFP – Q4	-0.599**

Source: Berthou et al. (2015a).
Note: *** p<0.01; ** p<0.05; *p<0.10.

Firm-level heterogeneity affects aggregate outcomes.

This heterogeneity in the responses of exporters facing the same exchange rate shock has a substantial influence on aggregate outcomes, which helps to understand why the trade elasticities computed at the aggregate level are fairly low. In fact, as

most trade flows are concentrated in the largest and most productive firms, the low trade elasticities found at the macro level may be explained by the low elasticities estimated on the far right of the size and productivity distributions. This result has important implications for the impact of relative price adjustments on the aggregate export performance of European countries. First, the reaction of aggregate exports to a real decline in the exchange rate is quite limited in the short or medium term and is largely determined by the reaction of the largest and most productive firms in each country. For European economies, this result implies that the external rebalancing process in the euro area requires large relative price adjustments, both in surplus and in deficit countries. For instance, according to the results of this study (which consist of a macroeconomic relative price elasticity of about -0.6), a 10% increase in the aggregate export value requires a real exchange rate decline of around 16%. Second, the greater elasticity estimated for small exporters suggests that an exchange rate decline can compensate for their lower productivity, as some of them may not otherwise compete in international markets. While we expect the entry of young exporters to have a limited impact on aggregate export growth in the short run owing to their small size, the decline in relative prices could have a larger impact in the medium or long term as these firms expand their activity in foreign markets.⁶ On the policy side, this extensive margin channel would be reinforced by the implementation of adequate structural policies sustaining the reallocation of resources towards more productive firms within each country and sector.

2.1.2 The transmission of demand shocks across borders: micro and macro approach

Revived interest in shock transmission

The financial crisis in the United States, and the subsequent contagion in euro area economies, has rekindled academics and policy-makers' interest in understanding how demand and financial shocks are transmitted across countries. A key question is how external shocks affect domestic conditions in labour and capital markets and, ultimately, economic growth. Against this background, new strategies have been developed to identify precisely what the transmission mechanisms are at the microeconomic level (i.e. how external shocks are reflected in firm-level performance) to provide estimates of the aggregate impact of external shocks on the domestic economy.

The response of exports to foreign demand shocks ...

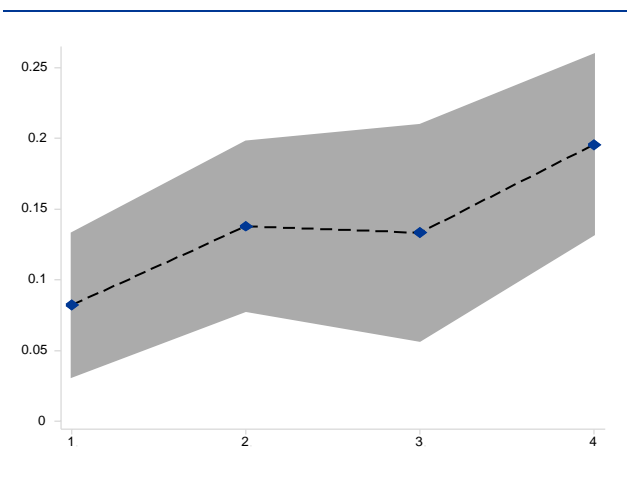
Berman et al. (2015b) have contributed to this line of work within CompNet, exploring how French exporters react to foreign demand shocks at the microeconomic level. Their work focuses on the linkages between sales in home and foreign markets, distinguishing between a "direct" and an "indirect" shock transmission channel. Direct transmission refers to foreign demand shocks which modify firm-level use of labour and capital through changes to exports, while indirect transmission refers to the interaction between firms' exports and domestic sales.⁷ They estimate that a 10%

⁶ See Berthou and Vicard (2014) for an investigation of French exporters. After controlling for size, young exporters are found to grow more rapidly in export markets and contribute to a substantial percentage of aggregate export growth in the long run.

⁷ For instance, Hummels et al. (2014) and Carluccio et al. (2015) show that these shocks can modify wages and that elasticity is affected by labour market institutions.

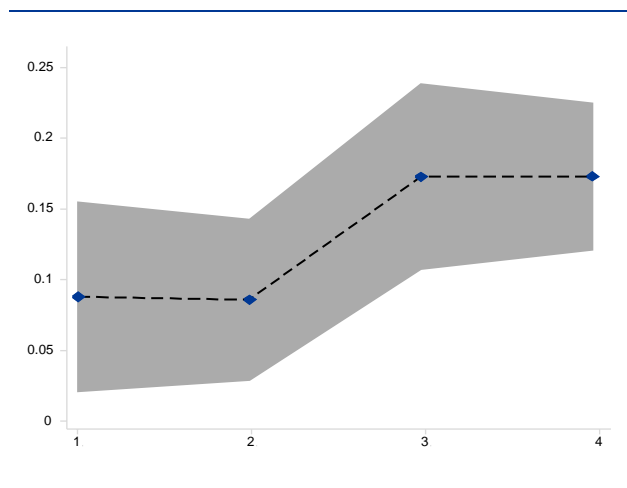
decline in firm-level exports leads to a 3% fall in domestic sales. This response is heterogeneous across firms, being larger in liquidity-constrained firms (see Figure 12 and Figure 13). This implies that, in the context of severe liquidity and financial constraints, foreign demand shocks can be expected to have a stronger effect on the domestic economy. This result is also supported by work focusing on the US economy, which finds that financial constraints played an important role in the propagation of the strong demand shock in the United States during the Great Recession, with high-leverage firms reducing their employment more rapidly than low-leverage firms (Giroud and Mueller (2015)). In addition, the authors find that domestic sales are more sensitive to export demand shocks in SMEs. This may affect aggregate productivity, either by preventing the growth of highly productive firms facing negative demand shocks in some of their markets, or simply by preventing some productive firms from starting to export or expanding in foreign markets. This result has important policy implications. Exporting may be a very risky activity for SMEs exploring foreign markets, as deteriorating foreign demand conditions can weaken their financial health and impede their growth in the domestic market. Therefore, improved financing conditions for SMEs, through increased and more secure access to short-term liquidity, would improve their resilience to external demand shocks and could, in turn, foster aggregate productivity growth in the long term.

Figure 12
Domestic sales to export elasticity by WCR quartiles



Source: Berman et al. (2015b).
Notes: "WCR" denotes firms' working capital requirements and is an indicator of the liquidity constraint. Estimations based on firm-level trade and balance sheet data for France (Douanes and INSEE).

Figure 13
Domestic sales to export elasticity by short-term debt ratio quartiles



Notes: The short-term debt ratio is the ratio of firms' short-term debt to total debt and is an indicator of the liquidity constraint. Estimations based on firm-level trade and balance sheet data for France (Douanes and INSEE).

A related question, which has produced mixed macroeconomic empirical evidence outside CompNet (Ball et al. (1966), Dunlevy (1980), Haynes and Stone (1983) and Zilberfarb (1980)), is how variation in domestic demand influences aggregate exports in the short term. The sharp decline in domestic demand in "stressed" euro area countries during the crisis and their subsequent good export performance has revived this empirical debate.

... and domestic demand shocks

The CompNet working paper by Bobeica et al. (2015) explores this question using

estimates provided by an error correction dynamic panel model for 11 euro area countries. In contrast with the work by Berman et al. (2015b), this paper adopts a macro approach, focusing on the macroeconomic impact that variation in domestic demand has on aggregate export growth in the short term, mainly reflecting the behaviour of very large firms. Its empirical model relates export growth in sampled countries to foreign demand growth, real effective exchange rate variations, domestic demand variations, and a long-run co-integration relationship between aggregate exports and foreign demand. The results confirm the presence of domestic demand pressure for some European economies during the crisis at an aggregate level. Controlling for changes in relative prices, a 10% decline in domestic demand is associated with an improvement of around 1% in aggregate exports in the short run. Importantly, this empirical relationship between aggregate domestic demand variation and European countries' total exports in the short run is only identified when domestic demand decreases (identified from the first quarter of 2007 onwards). This result supports the hypothesis that, following the very sharp decline in domestic demand in "stressed" euro area countries during the crisis, some firms – notably the largest ones – were able to reallocate part of their production to external markets in the short run, with a significant macroeconomic impact on aggregate exports. A direct implication of this result is that foreign demand growth in "non-stressed" euro area countries contributed to the external rebalancing process in "stressed" countries. Therefore, besides the negative impact on imports, the decline in domestic demand may translate into a positive effect on exports, reinforcing the correction of external imbalances. (See section 1.4 for more on external imbalances, and see section 1.1 for more on the relevance of domestic demand as regards explaining aggregate export performances). These results are also confirmed by research outside CompNet. For instance, Belke et al. (2014) find that declining domestic demand and low capacity utilisation are a significant additional factor for higher exports. The empirical analysis supports this hypothesis for Spain, Portugal and Italy, as there is a substitutive relationship between domestic demand and exports, with particularly strong effects during periods of economic stress. For Ireland and Greece, there is weak evidence of a substitutive relationship, even during periods of low capacity utilisation. This can be explained by the greater flexibility of the economy in the case of Ireland and by the lack of adjustment capacity, institutional weakness and structural rigidities in labour and product markets in the case of Greece.

2.2 The contribution of GVCs to the transmission mechanism

Does international vertical fragmentation of production affect import demand dynamics?

Do GVCs affect the transmission of demand shocks across borders?

Market integration affects the transmission of shocks

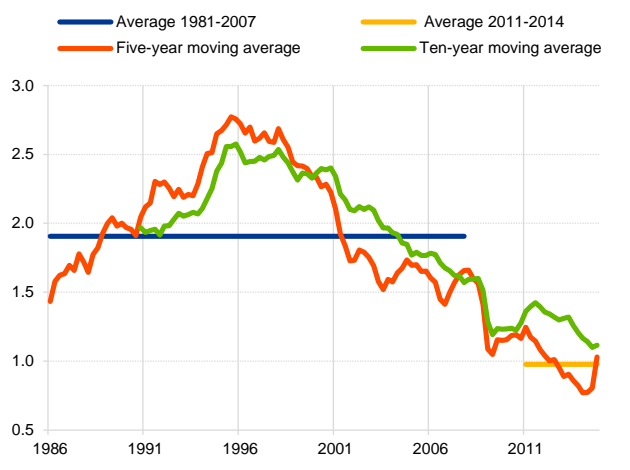
Besides the firm-level perspective considered above, the transmission of shocks is also likely to be affected by the increasing linkages across different countries. These

linkages stem not only from exports and imports of final goods across countries, but also from the growing importance of global value chains. As explained in section 1.3, vertical fragmentation across different countries has increased and is expected to amplify the international transmission of shocks, while at the same time accelerating the shock-reverting time. Such developments are crucial for the global economic outlook, imbalances, exchange rate movements and economic projections (with a potential bearing on monetary policy, which is partly based on the medium-term outlook of the projections). Against this background, CompNet research has focused on two areas: changes in the impact of demand on trade, and the impact of global value chains on the transmission of shocks.

2.2.1 Implications of GVCs for elasticities

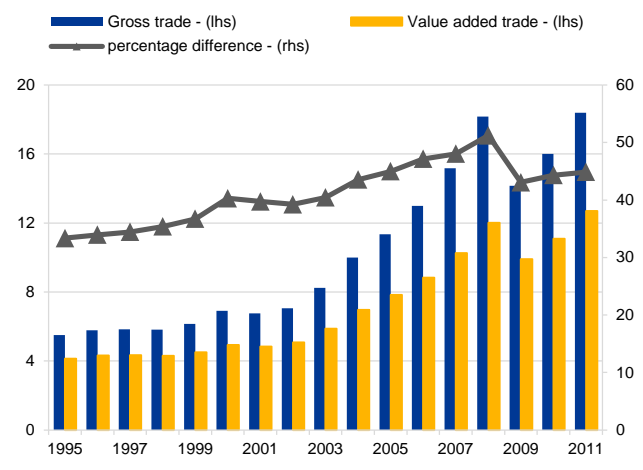
Global value chains resulting from the vertical fragmentation of production processes across borders have important implications for the ways in which the main drivers of standard trade equations affect trade flows. Taking vertical specialisation in trade into account when measuring the real effective exchange rate results in substantial differences relative to traditionally computed real effective exchange rates (e.g. Bems and Johnson (2012)).

Figure 14
Ratio of global import growth to GDP growth



Source: Al-Haschimi et al. (2015).
Note: The last observation refers to the fourth quarter of 2013.

Figure 15
Global gross versus value-added trade



Source: Al-Haschimi et al. (2015).
Note: The green line represents the difference between gross and value-added trade (expressed in percentage points). Right-hand side scale is expressed in trade volume.

GVCs affect not only trade statistics
...

Within CompNet, Al-Haschimi et al. (2015) analyse the nexus between trade and demand. The paper brings together international trade data from three different sources to assess structural changes in global trade drivers and cyclical weaknesses associated with the global financial crisis in 2009. The econometric model employed for import demand accounts for the international fragmentation of production and hence the role of global value chains in the global trade-to-income ratio. The authors show that the global imports-to-GDP ratio peaked at almost 2.0 during the period 1981-2007, before dropping to 1.3 in 2011-13 (see Figure 14). This decline in trend started in the mid-2000s and stabilised after the global financial crisis. However, it

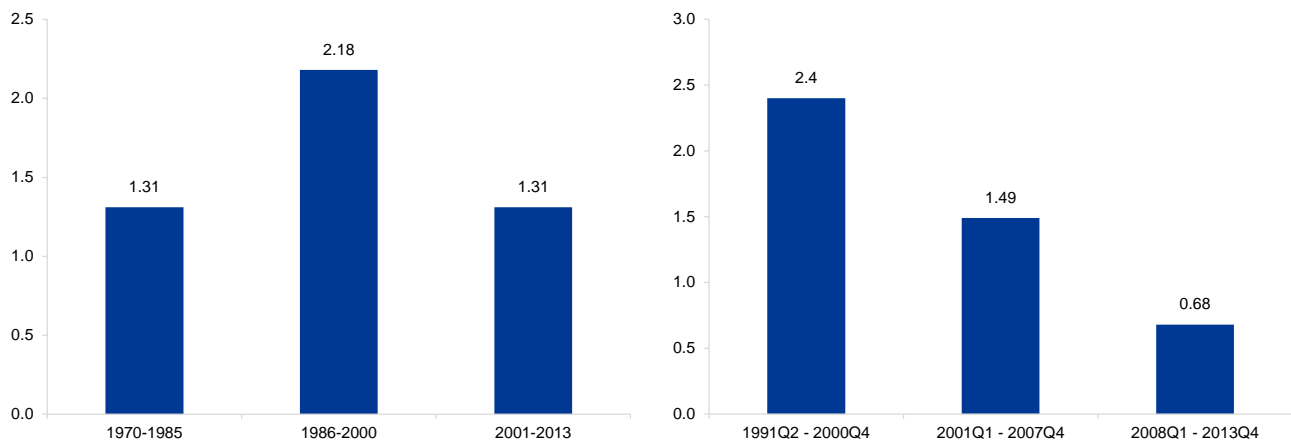
coincided with a doubling of value added's share in total trade (see Figure 15). As it has been widely reported in international trade literature, this seems to suggest a change in the recent dynamics of production towards international vertical fragmentation.

... but also import demand dynamics ...

The model of Al-Hashimi et al.'s (2015) consists of a bilateral import demand equation controlling for demand, prices and participation in global value chains. The authors show that demand has a significant impact on income's elasticity relative to imports, with coefficients ranging from 1.0 to 1.5 across different specifications during the period 1996-2011. Moreover, the importing country's demand and participation in global value chains play a significant role in explaining the dynamics of import demand. The interaction term of demand and GVC participation has a significant coefficient, which suggests that a combination of cyclical factors (demand) and structural factors (participation in global value chains) determine the recent dynamics of import demand, reducing the traditionally high level of income elasticity to trade.

Constantinescu et al. (2015) estimate the income elasticity to be 1.7 for the period 1970-2013 based on annual data. When estimating different sub-periods, they find a somewhat higher elasticity for the period 1986-2000 (i.e. 2.2), while it is estimated to be 1.3 for the period 2000-2013, which is most similar to the estimation of Al-Hashimi et al. (2015). Based on quarterly data, they find a demand elasticity of 2.4 for the 1990s, which shrinks to 1.5 for the period 2001Q1-2007Q4, and further to 0.7 for 2008Q1-2013Q4 (see Figure 16).

Figure 16
Long-term trade elasticity relative to GDP



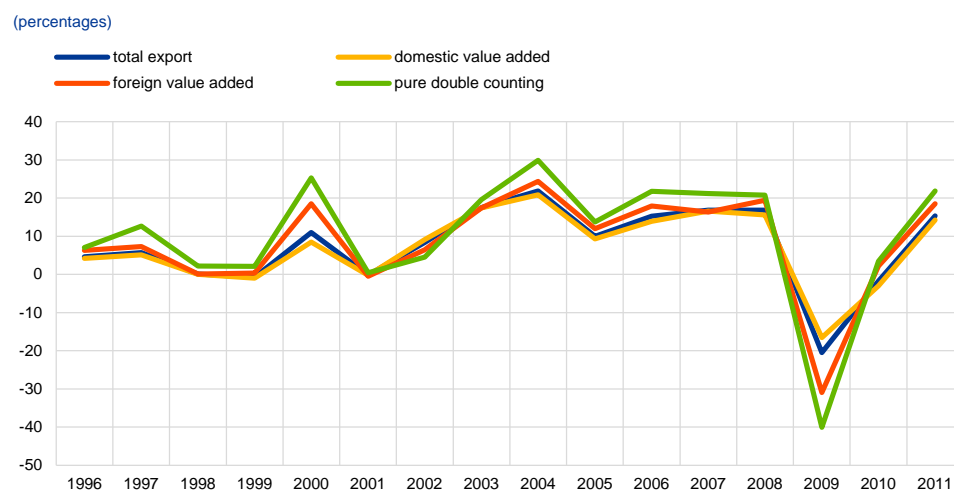
Source: Constantinescu et al. (2015).

... as well as export growth and volatility.

To examine the relationship between GVC-specific trade flows and aggregate exports, Altomonte et al. (2015) exploit a new dataset (Wang et al. (2013)) allowing the precise measurement and decomposition of the different kinds of bilateral trade flow that have emerged within GVCs across countries and industries – in particular, the increased intensity of intermediate goods crossing national borders multiple times (referred to as the “pure double counting” component of value-added trade flows). The authors provide evidence showing that these GVC-specific trade flows have

probably been responsible for the increases seen in both the volatility and the growth rates of aggregate exports since the 2000s, while at the same time being hit hardest by the crisis (leading to trade falling by more than GDP in 2008/09, as shown in Figure 17). They also offer statistical evidence that the long-term relationship between trade and GDP growth has not been structurally damaged by the crisis, although the different trade components adjust to the long-term average at different speeds, with GVC-related trade flows displaying a lower coefficient than traditional ones (around five and three years respectively). As the slow-adjusting GVC-related components of trade are also those that have been hit hardest by the crisis, the authors conclude that the relative slowdown in international commerce is likely to be a transitory phenomenon, with the different components of trade flows eventually adjusting to their long-term average growth rate.

Figure 17
Growth of exports and its different value-added components



Source: Altomonte et al. (2015).

Notes: The GVC component of trade flows can be proxied by foreign value added + pure double counting.

2.2.2 GVCs' impact on the transmission channels across business cycles

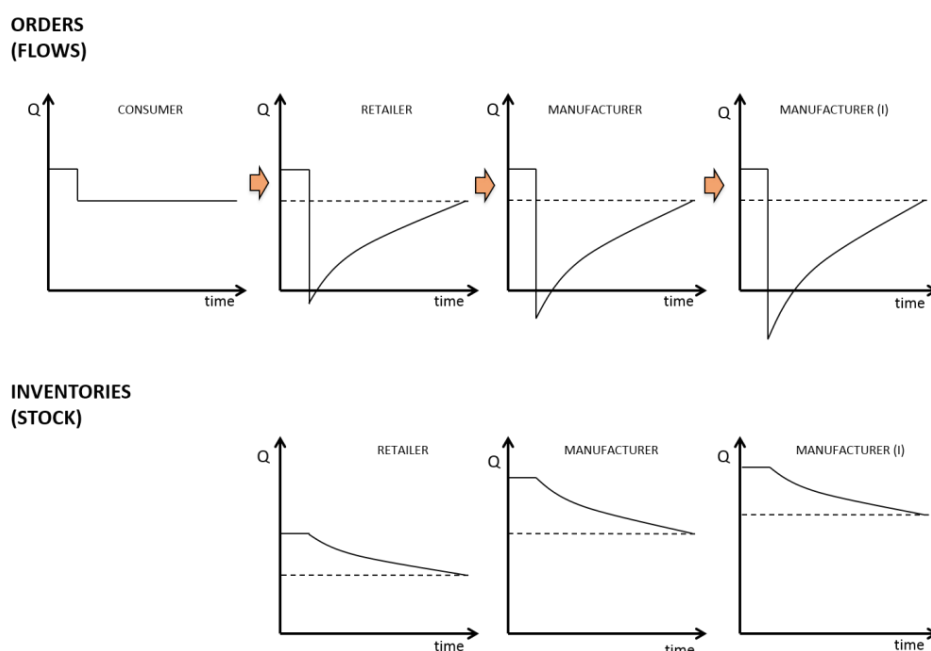
In addition to looking at how global value chains relate to changes in trade elasticities, recent literature has focused on the impact that GVCs had on the transmission of shocks during the global financial crisis. In fact, given the increased interlinkages across countries owing to the expansion of GVCs, the effects of a negative shock can be amplified through its effect on supply of and demand for intermediate goods.

GVCs may also amplify shocks.

Research by Altomonte et al. (2012) within CompNet, alongside Alessandria et al. (2011), argues that a demand shock leads to amplified fluctuations along the supply chain, a phenomenon known as a "bullwhip effect". As an explanation for the amplification of shocks, they propose the adjustment of inventories, which accumulate over the value chain, thereby increasing the overall impact. This is depicted in Figure 18, which shows orders and inventories for a simplified value chain consisting of a consumer, a retailer and two manufacturers. The shock to the

flow variable (orders) increases as inventories are adjusted in each step of the value chain. Using firm-level data for France, Altomonte et al. (2012) find that intra-group trade in intermediate goods reacted more strongly to the crisis than arm's length trade, but also recovered faster.

Figure 18
Bullwhip effect after a negative demand shock



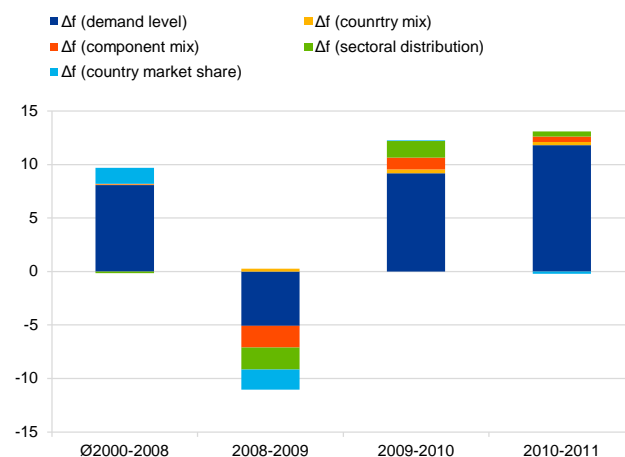
Source: Altomonte et al. (2012).

All in all, a consensus has emerged in the literature that the great collapse in trade can be attributed mainly to changes in final expenditure (e.g. Bems et al. (2010; 2011)), inventory adjustment (e.g. Altomonte et al. (2012)) and adverse credit supply conditions (e.g. Bricongne et al. (2012)). Within this strand of analysis, original work in CompNet by Nagengast and Stehrer (2015) provides a nuanced view of the great trade collapse in value added terms and quantifies the contribution of the proximate factors that led to changes in value added exports in the last decade. The authors use value-added trade data from the WIOD and consider changes in the international organisation of production as an additional variable explaining the trade collapse using a structural decomposition analysis framework (see Figure 19). In addition to the factors highlighted above, they show that changes in vertical specialisation and a variety of different compositional demand factors contributed substantially to the decline in value added trade (see figure Figure 20). During the crisis, the share of inputs sourced from national suppliers grew, to the detriment of those from international suppliers. Overall, this exercise shows that both before and after the crisis the bulk of the impact came from the demand side, while during the crisis other factors also played an important role.

Figure 19
Decomposition of changes in world value-added trade



Figure 20
Contribution of final demand to changes in world value-added trade



Source: Nagengast and Stehrer (2015).

GVCs also affect demand shocks.

While the papers above focus on the driving forces behind the collapse in trade, global value chains also have a bearing on the propagation of GDP shocks. A CompNet paper by Endr sz and Skudelny (2015) analyses the role of trade networks in propagating the global financial crisis. They use quarterly GDP data from 2008 and 2009 to define different crisis indicators, capturing the length and depth of the crisis, for most G20 and EU countries. The impact of global value chains on different crisis indicators is then evaluated using network indicators based on value-added trade data and controlling for macroeconomic variables, using a Bayesian model averaging approach. They find some evidence that a country and its neighbours being directly involved in value-added trade networks amplified the crisis.

2.3 Concluding remarks

Ongoing market integration significantly affects the transmission of shocks across borders. With the aim of improving our understanding of the effects of international linkages, CompNet research investigates the structural factors underlying transmission channels using both existing and new data. The research summarised in this chapter highlights the fact that the new indicators of productivity dispersion and participation/integration in GVCs that have been developed within CompNet can be used to calibrate existing theoretical models or as additional controls in the estimation of aggregate export and import equations.

The availability of new disaggregated data and micro-distributed data within CompNet has proven useful in the estimation of trade elasticities, addressing issues of estimation and allowing cross-country comparisons. New results suggest that elasticities are much larger than was previously thought. In addition, elasticities vary

greatly between sectors and are affected by the shape of the productivity distribution, as well as firm-level characteristics such as productivity and size.

New microdata have also provided insight into the transmission of shocks across borders. CompNet work has found that the effect of external demand shocks on exporters depends on firms' financial conditions, as well as their size. Similarly, findings showing that negative domestic demand shocks positively affect exports in the short run provide evidence that firms are able to reallocate their production to external markets.

The transmission of shocks depends not only on firm-level characteristics, but also on the international integration of production. CompNet research presents evidence of an increase in international vertical fragmentation of production, as well as evidence of its importance in explaining the dynamics of import demand. Other research shows that it has an equally significant impact on exports, leading to increases in both the volatility and the growth rates of exports. In addition, our analysis reveals that the transmission of shocks depends on the performance of highly productive firms, which suggests that the heterogeneous response of firms to domestic and external shocks may have important consequences for aggregate outcomes.

While the importance of the role of interlinkages in transmission mechanisms is in line with expectations, it has important implications for policy-makers: first, in terms of the reaction to shocks to the domestic economy, which is partly a result of spillover effects from other countries and in turn also has spillover effects on other countries; and second, in terms of changes to relationships in trade equations that have a bearing on projections, and therefore monetary policy. These results point, once again, to the rising importance of governance at a global level as the increasing interdependence of economies through global value chains makes trade policies at the national level less effective than was previously the case.

3 Resource allocation and productivity

In a frictionless market economy, resources like capital and labour would be allocated in the optimal manner – i.e. they would flow to the firms that used them the most productively. This is because the capital returns and wages offered will be highest at the most productive firms. However in real economies, resources may not be allocated in this way owing to a host of frictions. Some of the frictions are related to preferences and technology and are thus beyond the direct reach of policy. Other frictions may be caused directly by policy-induced distortions and may be reduced through institutional or regulatory innovations to improve allocation.

Recent academic research has hypothesised and found evidence that improving the process of resource allocation has important implications for aggregate productivity, business cycles and growth. First, recent literature (see Bartelsman et al. (2013) or Hopenhayn (2014)) analysing cross-country competitiveness indicators built from firm-level data shows that cross-country productivity differences can be partially accounted for by differences in allocative efficiency. In other words, aggregate productivity in a country may, in part, be lagging behind because inputs are not allocated efficiently across firms within an industry. This finding provides a potential new channel for boosting aggregate productivity, and therefore potential output – i.e. the reallocation of resources away from poorly performing firms towards the most productive firms. Second, improved reallocation can increase the resilience of an economy in the face of shocks, be they idiosyncratic or sector-specific, internal or external, or supply or demand-side. If information about the shocks travels throughout the economy via changes in relative prices, fluid reallocation can quickly shift resources to their new best use without much lasting harm to aggregate output and resource utilisation. By contrast, frictional input and output markets can distort price signals and generate misallocation of resources, leading to persistently lower output and underemployed resources. Finally, incentives for firms to push back the productivity frontier or adopt technology with a view to moving towards the frontier are higher in economies with better resource reallocation (see, for example, Acemoglu et al. (2013)).

The CompNet project has developed the tools required to explore the above hypotheses. Most importantly, CompNet provides harmonised information on cross-country firm-level dynamics (see Box 1), which is key to understanding cycles and growth, given that the nature and timing of shocks vary across countries. Furthermore, the policy environment, which may affect all firms in a country in similar ways, varies across countries and over time. This variation, together with detailed evidence on firm-level behaviour and sectoral and macro outcomes, allows the identification of policy effects. Furthermore, by combining information from firm-level data with sectoral and macro indicators, it becomes possible to identify determinants of micro behaviour and trace the effects through outcomes at an aggregate level.

The policy questions on reallocation which are to be addressed by CompNet research are mostly related to understanding how the policy environment aids or

impedes the labour, capital and product markets when it comes to channelling resources to their best uses. However, there are other highly policy-relevant issues in the research agenda regarding the causes of the crisis and its macroeconomic impact: What was the role of misallocation of resources in the building-up of macro imbalances during the pre-crisis period? How do capital, labour and output markets respond to shocks, and what is the role of resource reallocation? Has the global financial crisis fostered within-sector and between-sector reallocation? Do aggregate patterns of net hiring and investment depend on micro-level resilience? Are sectors with better allocation of resources able to recover faster as financial conditions and demand normalises? Has there been any “scarring” as a result of the recession (e.g. credit constraints restricting the establishment and growth of a new generation of innovative firms)?

At present, CompNet researchers have only just started exploring these issues, exploiting the rich dataset made available by system-wide cooperation. In line with other chapters, the next few sections will address some of the critical policy questions in this area. They will provide an account of existing literature and show how CompNet researchers have helped to provide answers to policy questions via original contributions to the academic community. The chapter will end by looking at some of the many lines of research that can be explored in the future using current CompNet data, as well as possible additions to the CompNet datasets in the next collection rounds that can help to answer open and emerging policy questions.

3.1 Allocative efficiency: evidence from the new CompNet database

How can we measure the overall allocative efficiency of an economy, and what evidence have we collected across countries and over time using our dataset?

For policy purposes, we need to be able to see where the level of frictions impeding resource reallocation is most acute. What evidence do we have for specific markets (labour, financial, product)?

Are we able to identify some of the possible determinants of these frictions (e.g. specific regulations in labour markets)?

Heterogeneity in productivity is key for reallocation.

In general terms, allocative efficiency refers to a situation where available production resources are put to their best possible use. If all firms were identical, resource allocation would not be an issue. However, the most recent economic literature has stressed that firm-level heterogeneity in terms of productivity and other characteristics is a cornerstone of any analysis of competitiveness (see the literature review in section 1.2). This is true not only across countries, but also within countries and narrowly defined sectors. In particular, empirical literature for both the United States (Bernard et al. (2011)) and a number of EU countries (Mayer and Ottaviano

(2011), CompNet Task Force (2014) and Lopez-Garcia et al. (2015)) have confirmed that, in general, firm-level productivity is highly dispersed and is typically distributed asymmetrically. Given this evidence, aggregate productivity will depend not only on the productivity of the average firm, but also on the extent to which factors of production are allocated efficiently. A direct implication of this, as suggested by Altomonte et al. (2011), is that the effectiveness of policies aimed at enhancing competitiveness can only be evaluated using firm-level data; unfortunately, the lack of available micro-based data has, until now, prevented meaningful analysis – particularly cross-country analysis.

Against this background, section 3.1.1 reviews the most interesting descriptive findings derived from CompNet data as regards overall allocative efficiency. Section 3.1.2 then summarises original research contributions looking at whether, and to what extent, policy-induced distortions have an impact on resource allocation in specific markets – namely labour, capital and product markets.

3.1.1 Stylised facts: differences in allocative efficiency across countries and sectors and over time

Value of CompNet to resource allocation literature

CompNet has made a significant contribution to the literature on resource reallocation, first using data on individual countries and then expanding its analysis by adopting a multi-country approach. Contributions in this area include interrelated approaches to the descriptive analysis of resource allocation. An intuitive way of exploring the issue involves depicting the productivity distribution in a given sector or country in different periods. Even if all firms were of optimal size and resources were fixed, resource reallocation could still improve if the right-hand tail of the productivity distribution became fatter over time – i.e. if more productive firms replaced less productive firms or firms become more productive. Moreover, we can exploit available information on the employment, or capital, share and growth of firms in different positions in the productivity distribution. If resources are reallocated efficiently, we would expect employment (or capital) growth to be stronger among the most productive firms. CompNet also contains indicators of allocative efficiency used in the literature, such as the OP gap or the productivity growth decomposition used by Foster et al. (2006), as well as proxies for the misallocation of labour and capital like the within-sector dispersion of the marginal productivity of capital and labour, in the spirit of Hsieh and Klenow (2009).

The analysis of labour productivity distribution

High labour productivity dispersion

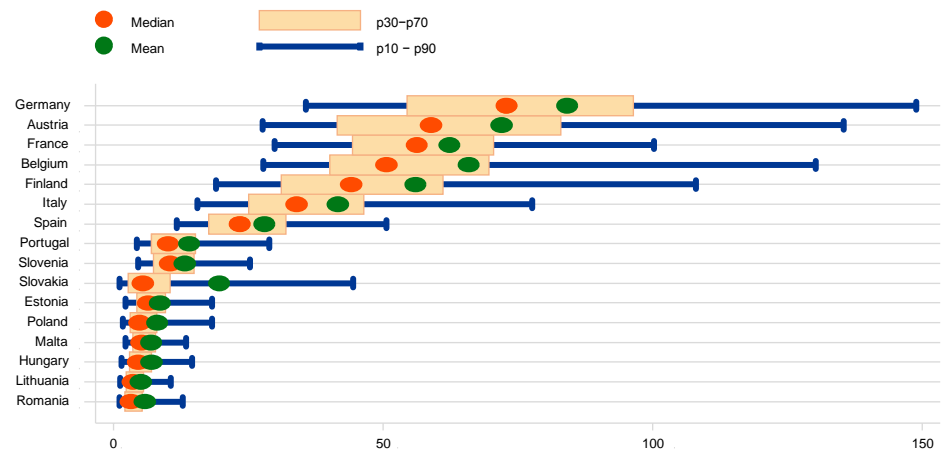
As stressed in previous chapters, a compelling reason to use firm-level data to complement macro or sectoral data in the assessment of traditional competitiveness indicators is the fact that aggregate figures hide the mechanisms underlying firms' responses to the policy environment. In this regard, at the ECB Forum on Central Banking in Sintra in May 2015, the ECB President, Mario Draghi, using evidence provided by CompNet, stressed that “the type of policies that could release an upward shock to potential growth are not just those focused on price flexibility. They

include, [...] on the TFP side, policies that encourage the reallocation of resources – which could be powerful in the euro area given the wide and skewed distribution between the least and most productive firms”. In particular, CompNet data point to considerable dispersion of labour productivity (calculated as real value added per employee averaged over the period 2003-07) within even narrowly defined sectors, as well as a high degree of skewness in the distribution (as

Figure 21 shows). As a result, given that in each country the distribution of labour productivity is far from normal, median labour productivity is significantly below the mean in every country.

Figure 21

Moments of the distribution of labour productivity by country, pre-crisis period



Sources: CompNet data (sample with 20 or more employees) and authors' calculations.
Notes: average across years over the period 2003-2007. Data are reliable for dispersion comparisons, while particular caution is required for level comparisons.

Visualising labour productivity dispersion

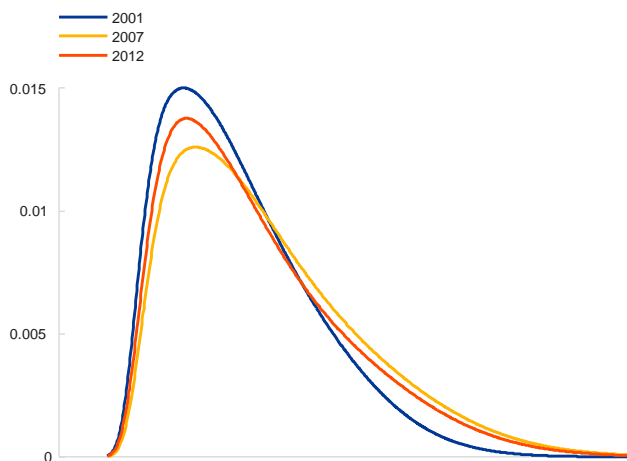
The new CompNet database can further the analysis of the dispersion and asymmetry of labour productivity distribution thanks to the collection of sufficient moments to be able to non-parametrically estimate the distribution for each country/sector/year. This provides a more intuitive picture of the shape of the productivity distribution across sectors and countries. Figure 22 below shows the kernel densities of labour productivity in three countries with different experiences (Germany, Spain and Italy) in three different periods (2001, 2007 and 2012), demonstrating the pre-crisis and crisis dynamics. Between 2001 and 2007 (i.e. during the boom) the right-tail of Germany's productivity distribution got thicker, whereas it barely changed in Spain and Italy. During the crisis (i.e. between 2007 and 2012), the distribution in Germany and Spain shifted slightly back to the left, while it did not move in Italy.

Figure 22

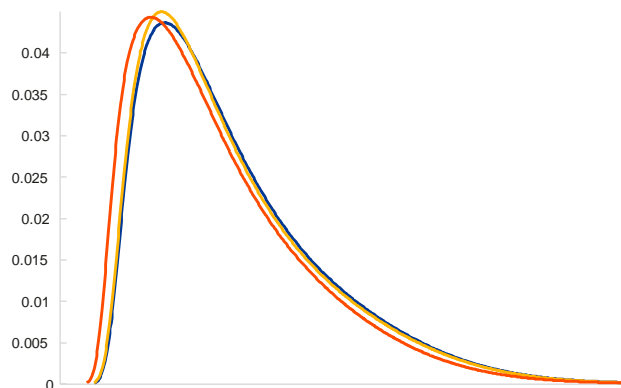
Distribution of labour productivity in Germany, Spain and Italy

(y-axis: density; x-axis: labour productivity)

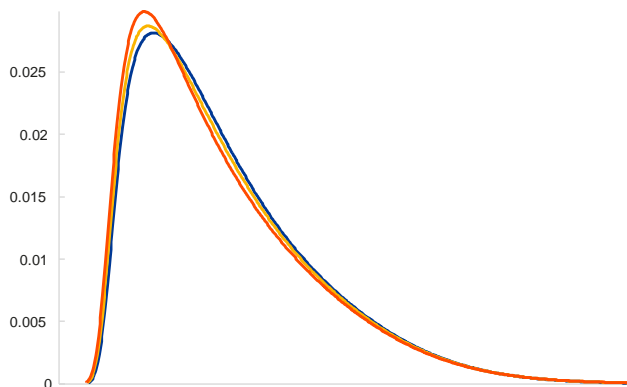
Germany



Spain



Italy



Sources: CompNet data (full sample) and authors' calculations.

This very simple analysis suggests that, during the pre-crisis period, resource reallocation in Germany prompted an increase in the number of highly productive firms, which helped to push up aggregate productivity. In Spain and Italy, by contrast, resource flows were not able to generate any change in the distribution of firm-level productivity, so there was no change in aggregate performance.

Employment growth of firms in different productivity deciles

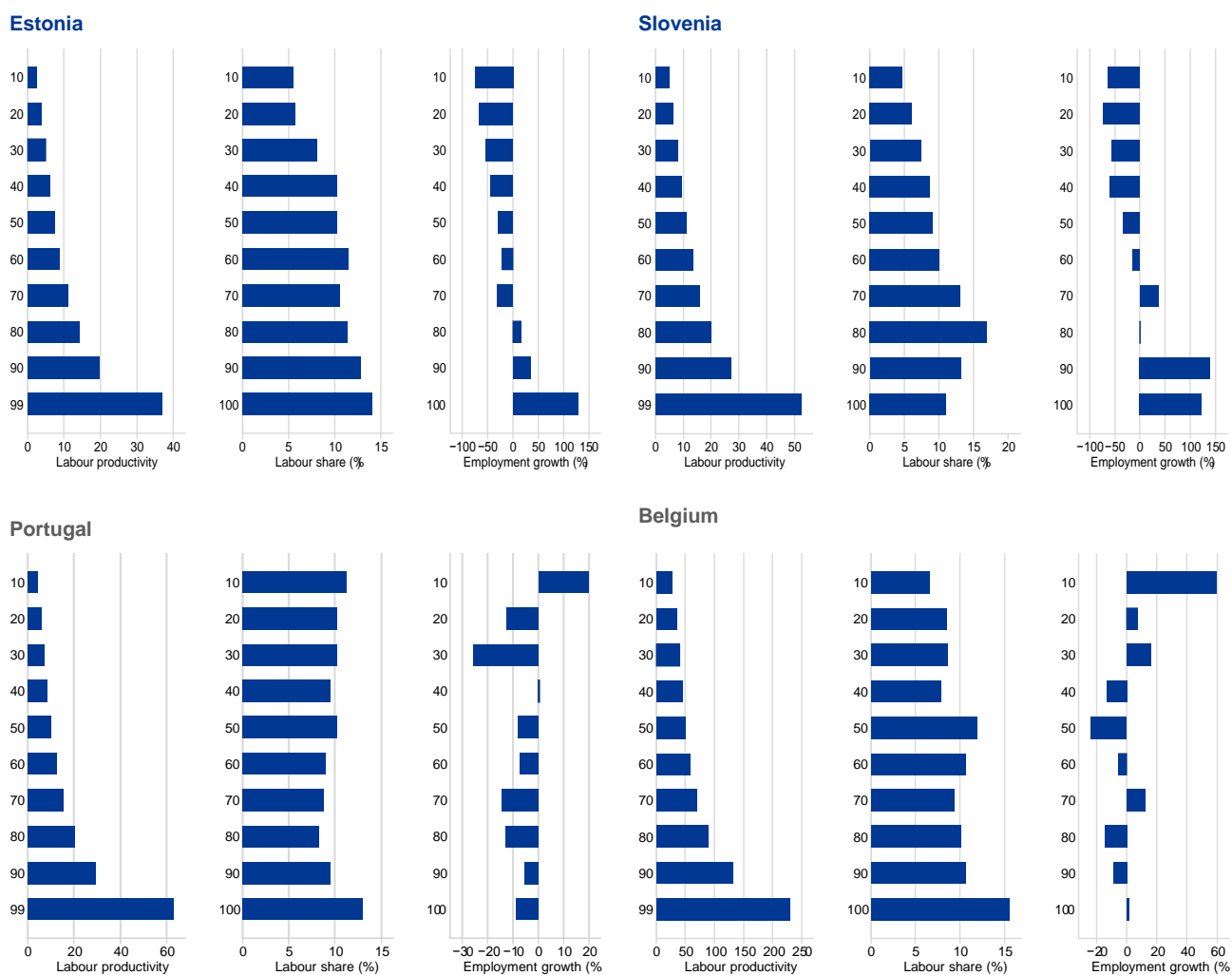
Evidence on employment growth by productivity level ...

Efficient reallocation of resources implies that the employment growth of the most productive group of firms in a country or sector is stronger than that of less

productive firms.⁸ This results in the employment shares of the most productive deciles increasing over time. Figure 23 below uses CompNet data on joint distributions to show the median productivity level, employment share and annual employment growth of firms in each productivity decile, with those deciles calculated using the sum of labour productivity over the period 2001-12.

Figure 23

Labour productivity, labour shares (in percentages) and employment growth (in percentages) broken down by labour productivity decile



Sources: CompNet data (full sample) and authors' calculations.
Note: 20E Sample

The upper panel shows developments in Estonia and Slovenia, and the lower panel shows Portugal and Belgium. In Estonia and Slovenia, the employment growth of the most productive firms (i.e. those in deciles 8, 9 and 10) was, on average, superior to

⁸ The efficiency of a positive relationship between firm productivity and size holds under general assumptions used in firm dynamics models – i.e. fixed entry fees, stochastic productivity, and slight decreasing returns to scale for flexible factors. Thus, even if all individual firms across the productivity distribution are of optimal size, with marginal revenues equal to marginal costs, reallocating resources through the extensive margin can enhance productivity.

the employment growth of the lower deciles during the period, which is consistent with an efficient allocation of resources. In Portugal and Belgium, however, this was not the case, with employment shares almost uniform across productivity deciles (especially in Portugal) – i.e. not dependent on the productivity levels of firms.

... clarifies labour reallocation processes.

These results are obviously very important for policy, since they provide a cross-country benchmark as regards the labour reallocation process occurring among firms within individual economies. In turn, they can help to highlight the market distortions which may have hampered the reallocation of resources towards the most productive firms in some economies, thus dampening aggregate productivity (see also section 3.1.2). Needless to say, this analysis is only possible because our database contains complete information on a number of critical variables – in this case, the full joint distribution of firms' productivity in relation to their labour force.

The OP gap and other measures of allocative efficiency

Estimating static allocative efficiency

The literature on heterogeneous firms has identified two closely linked measures of allocative efficiency – one static and the other dynamic. Static allocative efficiency refers to the extent to which, in the cross-section, firms with higher than average productivity have a larger than average size in the sector. That is to say, the static concept of allocative efficiency provides a snapshot of how resources are allocated at a certain moment in time. Olley and Pakes (1996) measured this concept by decomposing an index of industry-level productivity into an unweighted average of the labour productivity of all firms in the industry and a covariance term between relative labour productivity and the relative size of the firm. The covariance term reflects the contribution to an industry's productivity resulting from a more efficient allocation of resources across firms operating in that industry relative to a situation in which resources are allocated randomly. Hence, a low covariance indicates that aggregate productivity can improve by reallocating resources towards the most productive firms. More concretely:

$$y_{st} = \sum_{i \in S} \theta_{it} \omega_{it} = \bar{\omega}_{st} + \sum_{i \in S} (\theta_{it} - \bar{\theta}_{st}) (\omega_{it} - \bar{\omega}_{st}),$$

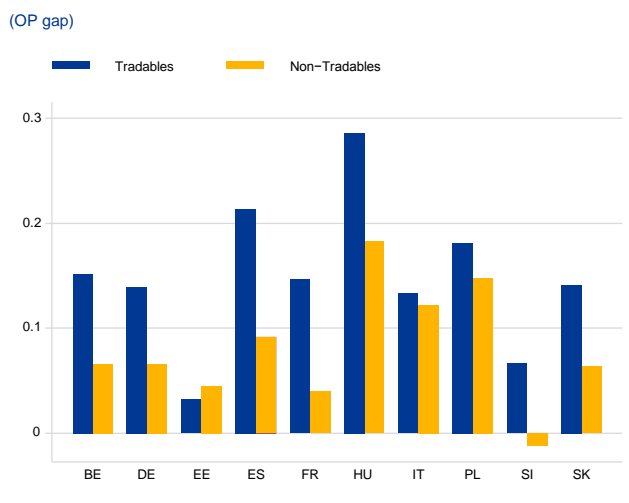
where y_{st} is the weighted average productivity of sector s at time t , S is the set of firms belonging to industry s , θ_{it} and ω_{it} represent, respectively, the size and productivity of firm i at time t , and $\bar{\theta}_{st}$ and $\bar{\omega}_{st}$ represent, respectively, the unweighted mean size and productivity of industry s at time t .

Given the importance of being able to measure the degree of allocative efficiency for the assessment of competitiveness at the country level, CompNet's micro-distributed database includes information on the evolution of the OP gap at the sector level for each country in the sample.

Allocative efficiency is higher in tradables.

Figure 24 presents the same indicator, while distinguishing between tradable and non-tradable sectors, which roughly correspond to manufacturing and services. As can be seen, there are striking within-country differences in allocative efficiency when comparing tradable and non-tradable sectors. In fact, with the sole exception of

Figure 24
Covariance between size and labour productivity – pre-crisis levels



Sources: CompNet data (sample with 20+ employees) and authors' calculations.
Note: Average of estimated OP gap over 2003-2007 period.

Estonia, allocative efficiency is higher in tradables for all countries. This large difference in terms of allocative efficiency between tradables and non-tradables has also been confirmed by Arnold et al. (2008) and the European Commission (2013). This result might reflect the fact that regulatory reforms in non-tradable sectors have been more hesitant, especially in mature European countries, and these sectors might be more sheltered from competition. Further evidence supporting the above conjecture comes from Lopez-Garcia (2014)⁹, who used a simple framework involving CompNet data and measured sector-specific regulation using the regulatory impact indicator devised by the Organisation for Economic Co-operation and Development (OECD), finding that allocative efficiency is significantly more affected by sector-specific regulation in non-tradable sectors.

Hsieh and Klenow (2009) develop a theoretical framework where production inputs are allocated

across heterogeneous firms operating in a given sector. In narrowly defined sectors, they assume that the marginal cost of labour and capital are equal for all firms operating in that market. If markets are efficient, this would imply that the marginal productivity of labour and capital should also be equal across all firms. If this is not the case, it is due to market distortions. On the basis of this result, the authors propose to measure resource misallocation with the within-sector dispersion of marginal productivity of capital and labour. Those indicators of resource misallocation are also included in the CompNet database. Figure 25 shows the analysis of these indicators undertaken by Gamberoni et al. (2015) for five countries. The figure shows the time evolution of the dispersion of the marginal productivity of capital (upper panel) and of labour (lower panel). Similarly to Kalemli-Ozcan et al. (2015), these graphs suggest that misallocation of capital increases over time in all countries analysed, with the exception of Germany, whereas the within-sector dispersion of the marginal productivity of labour displays a rather flat profile.

Productivity growth during the crisis

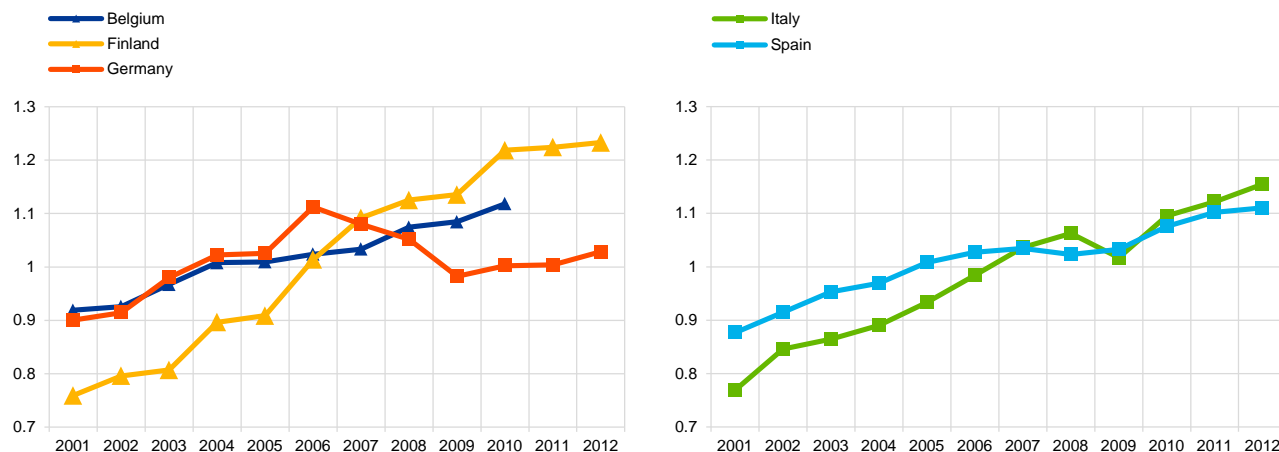
Figure 25 shows that, during the pre-crisis period, financial frictions, coupled with large capital inflows in some countries, may have increased capital misallocation in Europe. The dispersion of the marginal productivity of labour does not increase over the period analysed, which does not mean that labour is efficiently allocated, but rather that misallocation did not increase significantly over the period. This evidence merely suggests that more research is required, both to establish the facts and also to understand the factors behind these developments. An analysis of the interaction between market distortions and allocative efficiency is the objective of the following section.

⁹ See Box in the ECB internal report "The Impact of Structural Reforms in the Macroeconomic Projections" (2014), edited by an ad-hoc Task Force of the Working Group on Forecasting (WGF).

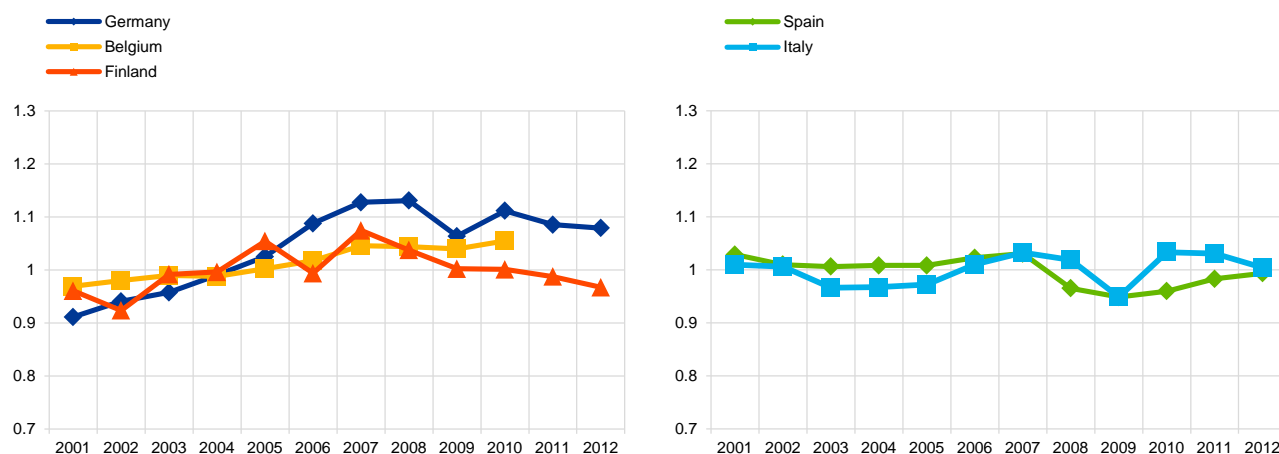
Figure 25

Time evolution of within-sector dispersion of capital and labour, selected countries

Panel A: Within-sector dispersion of marginal productivity of capital



Panel B: Within-sector dispersion of marginal productivity of labour



Sources: CompNet data (full sample) and authors' calculations.

Notes: Within-sector dispersion of marginal productivities is measured at the 2-digit industry level and then aggregated to the country level using a country-specific set of value added weights.

3.1.2 Resource allocation and the policy environment: empirical evidence for specific markets

Understanding drivers of resource misallocation

While possibly indicative of the state of affairs in the various countries, the aggregate measures of allocative efficiency analysed in the previous section are too crude to be able to provide specific hints on the most needed reforms aimed at improving resource reallocation. In order to look at this issue in greater depth, CompNet has therefore concentrated on three critical markets – the labour, capital and product markets – using a number of additional more specific indicators of allocative efficiency. Given that, as Restuccia and Rogerson (2013) showed, resource misallocation across heterogeneous firms lowers the aggregate total factor

productivity of the economy, the aim of this section is to understand the underlying factors causing such allocation distortions. Such factors include frictions in capital markets and distortions derived from ill-suited policies affecting the labour and product markets. There is a vast amount of literature providing empirical evidence of the importance of such frictions for aggregate economic output, which we will review in this section. To make things clearer, we will start by focusing on labour market frictions, then move to financial and product market frictions. In addition to summarising CompNet findings and contributions, we will also review other relevant literature.

Labour market frictions

Labour market frictions and labour reallocation

Ever since the seminal contributions of Mortensen and Pissarides (1994; 1999, etc.), the existence of labour market frictions has become widely accepted. The heterogeneous agent framework, with job searches, vacancy posting, and the creation and destruction of jobs, has been used to analyse how economic institutions affect labour market outcomes (Hopenhayn and Rogerson (1993); Bertola and Rogerson (1997)). Empirical work in the early years used micro-level data on employees and job flows (e.g. Davis et al. (1996)). More recently, firm-level data and matched employer-employee data have been used in order to better understand the role played by labour demand – i.e. the firms posting vacancies and hiring workers (Lentz and Mortensen (2005)). Also, such data have been used to track how labour reallocation behaves cyclically, with emphasis on the effects of the global financial crisis (Foster et al. (2014)).

Employment growth in CompNet data

The CompNet project has built on this literature – albeit focusing on EU countries, rather than US states – by assessing patterns of job reallocation and looking at how they are affected by various institutional factors. More specifically, CompNet research looks at labour reallocation and cleansing over the cycle and the role played by wage-bargaining institutions. The basic variables we use are derived from information that CompNet collects on firms' characteristics, which are based on their growth trajectories. More specifically, using a rolling three-year window, CompNet researchers can follow whether individual firms grow, decline or remain unchanged in terms of the scale of their employment over time. This is what Fernandez et al. (2015) call a "transition matrix" in their paper in the CompNet labour module. The analysis then consists of identifying the factors – in this case, in the labour market – which may have determined the specific firm-level growth dynamics. Two CompNet papers that use this strategy are summarised below.

Wage-bargaining institutions affect reallocation

In CompNet Policy Brief No 8, di Mauro and Ronchi (2015b) look at the degree of centralisation of wage-bargaining institutions across firms in order to explain the fact that – following the crisis – firms adopted very different cost-cutting strategies. Their paper shows that wage-bargaining institutions play a statistically significant role in shaping the way in which a negative shock is distributed across firms through reductions in wages and numbers of employees. In particular, they find that labour markets where a higher proportion of firms apply centralised collective bargaining are characterised by a larger percentage of companies reducing the number of

employees. They show that this could partly be due to a higher degree of downward wage rigidities. In addition, their results suggest that the decision of many European countries to move, over the last two decades, from fully centralised bargaining to multi-level regimes did not limit the reduction in employment. This work shows that CompNet data, when combined with information from other sources (in this case, information on wage-bargaining institutions from the WDN; see ECB (2009)), can help to assess the resilience of the business sector to shocks.

Job reallocation is procyclical.

In another paper, Bartelsman et al. (2015b) focus on the pattern of “cleansing” via the labour market. The authors start by measuring job reallocation as the sum of job creation and job destruction at the firm level. They then engage in empirical investigations aimed at explaining the pattern of such job reallocation. Among the most notable results, they find that, overall, gross labour reallocation is procyclical, although to a lesser extent over the recent period given the large drop in job creation; a result which is in line with evidence for the United States.¹⁰ Figure 26, taken from that work, shows average job creation and destruction for selected sectors in a sample of EU countries. It can be observed that both job creation and destruction rates are lower in manufacturing than in services, as already established in the literature. As regards construction, a boom-bust cycle is visible, with job creation rates outpacing job destruction rates prior to the crisis, and there being a sharp increase in job destruction following the crisis.

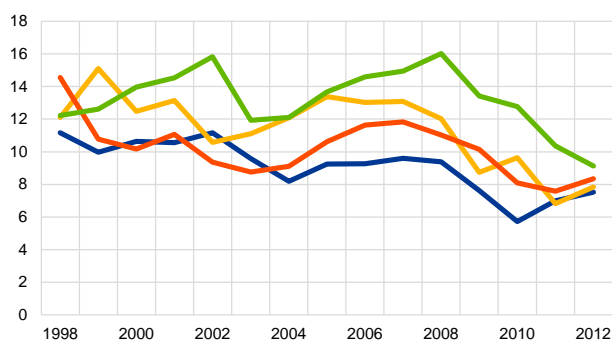
Figure 26

Average job creation and job destruction in selected sectors of a sample of EU countries, 1995-2012

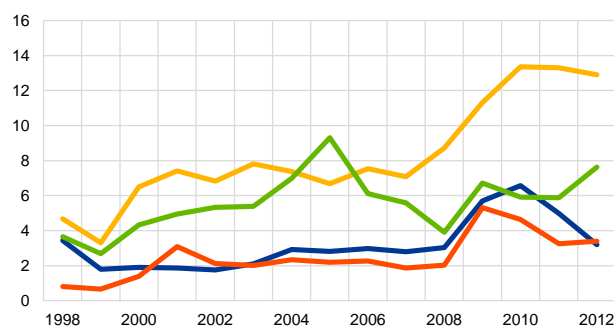
(percentages)

Job creation rate

- Manufacturing
- Construction
- Information and communication
- Professional, scientific and technical a



Job destruction rate



Source: Bartelsman et al. (2015b).

Evidence of a cleansing effect

To assess whether the recession had a cleansing effect on labour reallocation, employment growth, measured using the transition matrices computed by CompNet,

¹⁰ While economic literature has shown that in the United States this pattern has occurred over time because job destruction rises rapidly during a downturn but job creation is less cyclical, we do not have sufficiently long time series for Europe to look at this pattern over multiple cycles and assess whether the same explanation applies.

is regressed on an indicator of the cycle, on initial productivity of the firm, and on a set of controls. Employment growth exhibits a significant positive response to cyclical movements. The effect of initial productivity on firm-level employment growth is significantly positive, showing that, on average, reallocation is cleansing or productivity enhancing. This result is similar to that found by Foster et al. (2014). However, the within-sector cleansing effect is declining over time and in 2012 was lower than before the crisis. It is noteworthy that the correlation between initial productivity and net employment growth is still positive and significant if one analyses only medium and large firms (firms with at least 20 employees) but lower than when the full sample of firms is considered. Moreover, cleansing among medium and large firms has not changed significantly over time. The declining trend is to be found only in the sample including small firms.

Productivity-enhancing reallocation can also occur as resources move from low to high productivity sectors in an economy. In the pre-crisis years, the contribution of between-sector reallocation to aggregate productivity was negative in most countries, with the boom in construction playing a prominent role. Since the crisis, between-sector reallocation has been contributing positively to aggregate productivity.

Financial frictions

Increasing misallocation in southern Europe

There is growing literature on the interaction between financial frictions and productivity. In a recent paper, Gopinath et al. (2015) model savings and capital accumulation by heterogeneous firms facing financial constraints. They show that the fact that capital is misallocated (i.e. it moves towards firms that are not necessarily the most productive) explains why a decline in real interest rates could generate the twin phenomena of increased capital inflows and declining total factor productivity. In particular, they focus on finding the factors behind the slow productivity growth in southern Europe (i.e. Italy, Portugal and Spain) after the large capital inflows that followed the introduction of the euro. Using measures of the dispersion of the marginal revenue product of capital (MRPK) and labour (MRPL) for the empirical analysis – computed using commercially available firm-level datasets (e.g. Orbis and Amadeus) – they detect an increasing misallocation of capital in the southern European countries and a large negative effect of the crisis that did not affect northern countries.¹¹ Overall, they show that trends in measures of the dispersion of MRPK (but not MRPL) can be quantitatively important in understanding the evolution of manufacturing TFP over time, especially in southern Europe.

Estimating credit allocation efficiency

One of CompNet's main contributions in the area of financial frictions consists of analysis of the efficiency of credit allocation. To this end, CompNet has estimated a firm-level "indicator of credit constraints" (ICC), using data drawn from the balance sheets and profit and loss accounts of firms, together with a survey of bank lending (SAFE).¹² By tracking the joint distribution of productivity with the ICC, Bartelsman et

¹¹ The distributions of both MRPK and MRPL can be found in the CompNet database.

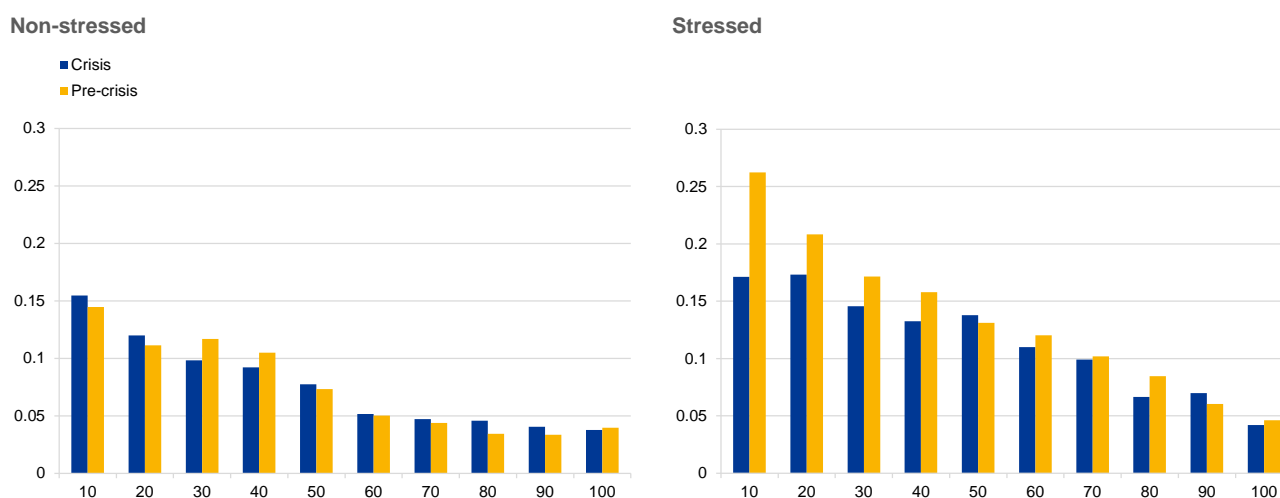
¹² For more information on the SAFE survey, visit: www.ecb.europa.eu/stats/money/surveys/sme/html/index.en.html

al. (2015a) shed light on the efficiency of credit allocation over time and across countries. The authors compare developments in this indicator before the crisis (2004-08) and during the crisis (2009-12) for two subsets of euro area countries – i.e. stressed and non-stressed countries. Figure 27 shows the share of credit-constrained firms in each decile of the productivity distribution. Using CompNet data, the least productive firms are found to be more credit-constrained in both groups of countries, though this trend is more pronounced in firms in stressed countries. This indicates that small firms tended to suffer more (and still do in some countries) from being denied proper access to the credit market, which is consistent with anecdotal evidence.

There is evidence that the effects of the crisis on the estimated percentage of credit-constrained firms have been substantially different in the two groups of countries. In non-stressed economies, CompNet data point to no significant changes. In stressed countries, by contrast, it seems that the number of credit-constrained firms has substantially increased, particularly among less productive firms.

Figure 27
Percentage of credit-constrained firms by labour productivity decile in stressed and non-stressed economies

(deciles of productivity)



Source: Bartelsman et al. (2015a), based on CompNet data (sample with 20+ employees).
Notes: CompNet The non-stressed countries are Belgium, Germany, Finland and France, while the stressed countries are Spain, Italy and Slovenia.
Pre-crisis data cover the period 2004-08 (with the exception of Spain, for which only 2008 data are available), while crisis period data cover the period 2009-12.

Bank loan issuance and productivity

In order to investigate whether banks and financial markets allocate credit and capital to their most productive uses, di Mauro et al. (2015) test the extent to which variation in bank loan and bond issuance responds to variation in firm productivity, which they use as a proxy for investment quality. Preliminary results from the pilot run for Italy deliver important insights. The elasticity of loan allocation is positive and significant for real value added and labour productivity, at around 12% and 5% respectively, while estimates are smaller for TFP (0.8%) and even negative for the marginal product of capital (-0.4%). Size appears to matter in terms of impact. For instance, the above elasticity of loan allocation is stronger for smaller firms. In terms of the stability of the estimated parameters, it would appear that loan allocation to Italian

firms has become slightly more responsive to productivity in the period after the crisis. All in all, credit allocation seems to respond very little to key variables such as the marginal product of capital and TFP, which are probably difficult to observe for banks and investors. Credit is more elastic to more easily observable variables such as value added and labour productivity.¹³

Bartelsman et al. (2015b) also provide evidence of how credit constraints may affect “cleansing”. In particular, using a firm-level indicator of credit constraints from the SAFE survey, the authors find that sectors with a higher percentage of credit-constrained firms show less cleansing. However, the effect is only significant for the full sample (not for the sample including only firms with more than twenty employees), which calls for further investigation.

Product market frictions

A competitive environment is critical in order to promote effective resource allocation and boost growth. As indicated by the OECD (Koske et al. (2015)), two main ingredients are necessary: (i) product market regulation which does not hamper competition; and (ii) an effective antitrust framework to ensure a level playing field for firms. Furthermore, Single Market policies that reduce intra-EU trade frictions and increase effective market size will also improve resource allocation.

The literature on trade and productivity, such as the research by Melitz (2003) discussed above, provides many of the elements needed to understand the links between product market frictions, resource allocation and productivity. The frictions that a firm faces in order to export its products can be overcome via fixed costs and ad-valorem transport costs. A reduction of these costs will change trade flows directly, but also affects resource allocation through firm selection. However, there may be other types of frictions in product markets that could prevent efficient outcomes, such as search and matching frictions (Nosal et al. (2015)). Some very recent theoretical work, linking heterogeneous firm models to search frictions in output markets, allows a better understanding of how policies related to product markets can affect allocation and productivity (see, for example, Eaton et al. (2015)). While this work points to interesting directions for future research, current empirical work on product markets, resource allocation and growth is more closely related to the mark-up and trade literature (e.g. Melitz and Ottaviano (2008) and De Loecker and Wazynski (2012)).

Product markets in CompNet data

Within CompNet, we have looked at product markets and their impact on firms’ productivity from a number of perspectives. First, we established a specific “mark-up” module within CompNet’s Workstream 2 (Amador et al. (2015)), which was tasked with computing a set of competition indicators – derived from firm-level information – and then analysing the competitive business environment across European

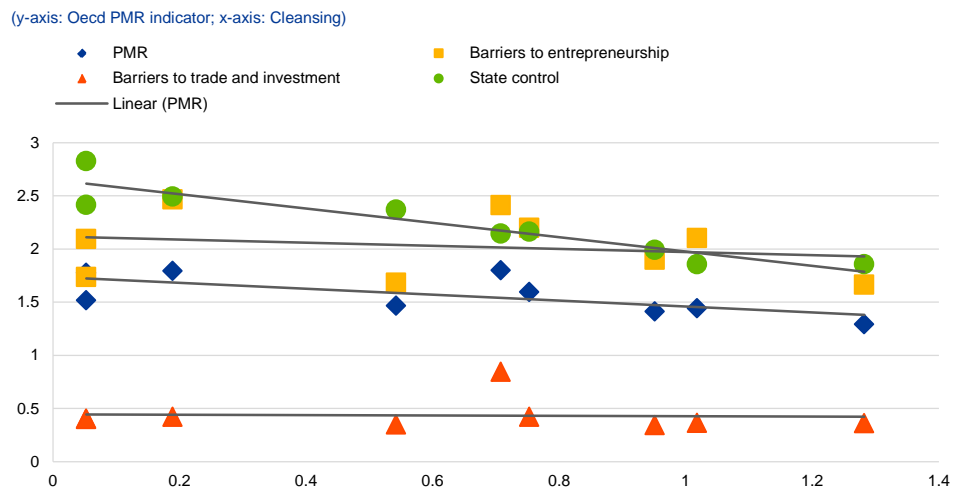
¹³ This is currently being extended to other countries thanks to the cooperation of CompNet’s national teams, which will provide extremely policy-relevant cross-country benchmarks.

economies.¹⁴ Second, we have conducted a number of specific studies using data from CompNet’s firm-level database. We will report on three such studies below.

Using Spanish data in the CompNet database, García-Santana et al. (2015) show that deterioration in the allocative efficiency of productive factors across firms may lie at the root of the low rates of TFP growth observed in Spain from 1995 to 2007. They use firms’ administrative data to calculate Olley and Pakes (1996) covariances and potential TFP gains which are due to factor reallocation, following Hsieh and Klenow (2009). Furthermore, they find this phenomenon to be present in all sectors of activity, which casts doubt on the widespread view that specialisation in low-productivity sectors such as construction was the main force driving Spain’s low TFP growth. According to their empirical results, “crony sectors” (which they define as sectors that are susceptible to monopoly, require licensing or are highly dependent on government regulation) experienced significantly larger increases in misallocation. A possible explanation might be that firms in such sectors operate with a size or input mix that is far from optimal and still survive. The same results are found significant when they consider the sectoral Bribe Payers Index, looking at the influence of the public sector.

In the aforementioned paper by Bartelsman et al. (2015b), estimates were made showing how the cleansing effect of reallocation across firms has changed over time. Across countries and time, there is a clear negative correlation between product market deregulation (PMR) – as proxied by the OECD indicators – and the cleansing effect (Figure 28). Broken down by sub-indicators of PMR, it can be seen that state control in particular has a strong negative effect on cleansing, similar to the results found by García-Santana et al. (2015).

Figure 28
Correlation between cleansing and PMR over time, selected countries



Source: Bartelsman et al. (2015b).
Notes: Germany, France and Spain; 2003, 2008, 2012

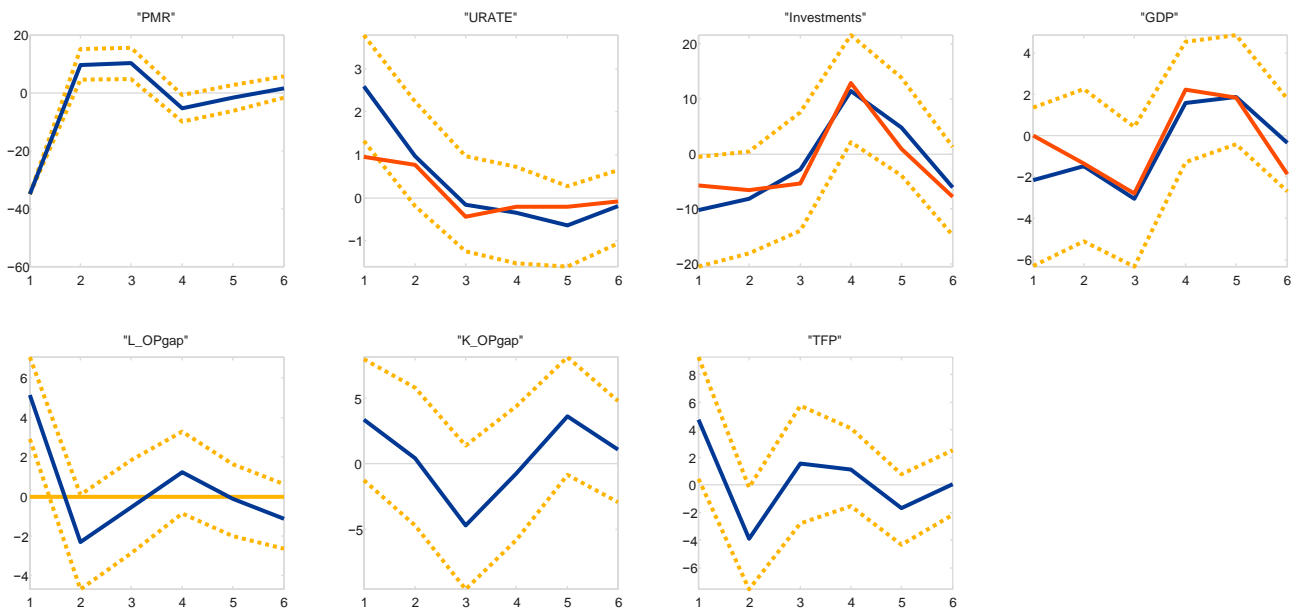
¹⁴ Work on this module is still unfinished and will be reported in a few weeks’ time.

Using the regression of employment growth on initial productivity of firms, Bartelsman et al. (2015b) also compare the cleansing effect across sectors. The largest positive cleansing occurs in the manufacturing sector, while in construction and professional services, cleansing is significantly lower. Competition, either resulting from trade or the entry of new firms, may play a role. This is explored further, showing that the cleansing effect is significantly lower in sectors featuring relatively high mark-ups.

Structural reforms affecting growth via productivity ...

Looking at the impact of product market regulation on firm productivity, Aiello et al. (2015) show that PMR promotes economic growth, but with a lag. As soon as it is implemented, PMR is associated with recessionary effects on all aggregate variables analysed – i.e. unemployment, investment and GDP (see Figure 29). The main novelty in their analysis is the attempt to trace the effects of structural reforms on the above-mentioned macro variables via the analysis of productivity at the firm level, which is estimated using CompNet data. Their paper shows that the most important channel through which structural reforms increase economic growth is the pro-competitive effect resulting from the subsequent lowering of entry barriers to new firms, which leads to higher aggregate productivity and higher allocative efficiency – as measured by the above-mentioned OP gap. Furthermore, they find that the erosion of mark-ups resulting from the implementation of structural reforms is larger for firms with greater market power, leading to a contraction in their potential future profits and a subsequent improvement in the overall level of competitiveness.¹⁵

Figure 29
Panel VAR impulse responses to deregulation shocks



Source: Aiello et al. (2015).
Notes: All of the variables have been co-integrated (first difference). Investments, GDP, L_OPgap, K_OPgap and TFP are in percentage deviations from the trend; Unemployment is in deviations from the trend. PMR is an index of product market regulation.

... provide policy lessons.

In conclusion, the authors show that the pro-competitive effect driven by the

¹⁵ The “price-cost margin” is the difference between the price and the marginal cost over the price. It is a measure of the distance between the market and the ideal of perfect competition, so indicates the level of competition in the market.

implementation of structural reforms results in a permanent increase in the OP gap and aggregate TFP. The main lesson from this paper from a policy perspective is that when designing structural policies, it is crucial to include measures aimed at promoting the reallocation of resources towards the most productive firms. At the macro level, this may imply that there is scope for less ambitious macro-policy targets, which could alleviate the short-term costs of necessary structural policies on economic activity.

3.2 Possible venues for research

Much of the CompNet research described above is descriptive or provides statistically robust correlations. Trends, correlations and other patterns in the firm-level data are compared across countries, industries and time using simple methodologies. The richness of the data already provides some important answers to a number of key research questions. Nonetheless, a closer link between theory and data, more robust empirical methodologies and additional data could all help to increase confidence in the validity of the findings, as well as shedding light on unanswered questions.

While we have presented some evidence of the misallocation of resources in the years leading up to the crisis, as well as pointing to some of the potential policy causes of such misallocation, the empirical findings do not yet allow us to quantify the effect of policy changes on growth. For this, policy simulations using a calibrated heterogeneous firm model could be used. An increasing number of studies using such a methodology are appearing in the literature, but they do not specifically address economic issues in the EU. The CompNet data provide many moments on distributions and correlations that can be used to identify structural parameters for models describing firms' responses to their policy environment. For example, models with firing costs and collateral constraints can shed light not only on how frictions in labour and capital markets affect hiring and investment decisions at individual firms, but also on how interaction between individual firms leads to macro outcomes in terms of output and employment.

Determining how resilient the EU business sector is to shocks is high on CompNet's research agenda. While our findings do show firm-level employment responses to shocks and how these vary over time and across countries, both the methodology and the data could be improved. To start with, Bartelsman et al. (2015a) use simple indicators of shocks, namely value-added growth in the relevant country and industry. The exogeneity of these indicators could be improved by using downstream weights from input-output tables instead of simple averages. A better econometric methodology would not posit the two types of shock in advance, but would identify the shock processes from the data itself using a specific model formulation.

Thus far, CompNet research on resilience has looked at the responses of real quantities to shocks. Other researchers have looked at the responses of prices. Combining the two, for example by adding wage and price data to the CompNet databases, could provide better insight into how resilience varies over time and

across sectors and countries. The EUKLEMS dataset contains annual data on wages, intermediate goods, investment goods and output prices. Unfortunately, these data have not been maintained post-2010 and have been collected on the basis of the old NACE-1 industry classification.

The question of the business sector's readiness to respond to improving conditions has partly been addressed in Chapter 1. CompNet's work has shown, for example, how exports' responses to exchange rate movements vary with the firm-level distribution of productivity. So far, research looking at whether and how long-run productivity growth has changed during the crisis has not been completed. In this area of research, CompNet data alone are likely to be insufficient, and information from other sources on ICT, intangible investment and human capital will be necessary. Here, data from the Eurostat project ESSLait could be useful, although such data are not available post-2011 and have been collected on the basis of the old NACE-1 industry classification.

4 CompNet: the way forward

As this report has shown, CompNet has a substantial record of achievements in terms of research output and data/indicators generation related to the broad subject of competitiveness analysis. Most notably, CompNet is by now a solid and widely recognised Network of researchers united by strong common research interests of high policy relevance, fuelled by frequent interaction.

As the Network has matured and its potential for additional research output is high – as shown by the feedbacks received during the Conference held in Frankfurt on June 25-26, 2015 – there is a need to delineate how to match the new challenges ahead with a renewed and lean organisation. In this chapter, we will briefly handle the issue within two sections. The first describes the main objective and organisation of CompNet as a flexible and dynamic research network. The second section summarizes the overall research objectives of CompNet and suggests two meta research objectives in the near future. It is however understood that researchers are free to choose their own topics.

4.1 CompNet Mandate

CompNet objective is to pursue research on the broad themes of competitiveness and productivity enhancement, taking a multi-dimensional perspective. Building on its successful approach, CompNet research will encompass (i) conducting cross country analyses for the sake of providing benchmarking on best practices, as well as (ii) adopting a multidimensional perspective, where - to the extent possible - macro, firm level and GVCs analyses complement each other. At the same time, maintaining and regularly updating the databases created by CompNet is considered essential – given its relevance for research and policy - and is supported by the ECB. Overall, the Network will both constitute an open and vibrant hub where academics and economists from central banks and international institutions will have opportunities to discuss, receive feedbacks and develop their research projects on competitiveness-related themes, as well as promote the maintenance, update and possibly the creation of original firm-level based data and competitiveness-related indicators.

With respect to what has been said above, the *glue* across members will keep deriving from the conviction that when investigating competitiveness and productivity related matters, firm-level data analysis is an essential complementary tool to other methodologies and must be integrated as much as possible, including in regular policy analysis. This also implies setting up a clear framework regarding data updates and usage as well as membership to the Network, both of which are described in the next two sub-sections.

4.1.1 Data set maintenance and update

As mentioned above, maintaining and regularly updating the Databases created by CompNet is considered essential – given its relevance for research and policy - and is supported by the ECB. In this regard, a number of procedures are being set up to allow this to happen, which are designed in order to help relevant Central Banks and National Statistical institutes to continue participating on a voluntary basis in the firm-level based dataset project. As for the sector and product level dataset described in the CompNet Competitiveness Compendium (see Benkovskis, Karadeloglou and the CompNet task force, ECB Occasional paper, June 2015, forthcoming), there is also a commitment to put it online and to update it on an annual basis. As for the World Input-Output Dataset (WIOD) - that is of crucial importance in developing research on Global Value Chains (GVCs) – there are at present no concrete plans to update it, although the Network is investigating possible venues to outsource this task.

Overall, the combination of these three databases still constitutes the strength of CompNet, both for research and policy use. In this regard - and particularly for the firm level based data set - the Network encourages additional NCBs and other institutions to join in order to extend the current country coverage of the database and make it an even stronger tool for cross country comparison and benchmarking. In this context, the Network is committed to continue exerting pressure to relevant statistical institutions in order to achieve improvements in the underlying firm level data and samples, which are used to construct the indicators, thus improving their cross-country comparability once aggregated. Contributing to set up an EU firm level based dataset, which is top in terms of coverage and reliability and at least at par in terms of quality and detail to the ones existing in the USA, is a very strong long term objective of the network.

4.1.2 Organisation and Governance of CompNet

CompNet will be organised in the future as a **self-managed** Network of research, with no formal periodical reporting to committees formed within the EU system of central banks. This implies that - even more so than at present - CompNet will be open to new collaborations with institutions outside the EU system of central banks, including universities and research centres, as well as non-EU central banks and international institutions.

The Network will be led by a Steering Committee, composed by a small numbers of senior representatives (6-7) of active institutions who will rotate on a regular basis, and chaired by an ECB staff. The steering committee will replace the current structure of CompNet based on three workstreams, which will be dissolved. Members of the Committee will be selected in order to provide an appropriate balance between macro, micro and GVC experts. The duties of the Steering Committee – which will be counselled by a small academic advisory board - will be the following:

- Discuss promising research directions which could be investigated ;

- Establish possible needed changes in the data collection before updates of the databases are launched;
- Set up and implement the rules for data release and usage by the research community. The aim will be to establish non-bureaucratic procedures which will facilitate the dissemination and the appropriate use of the data for research. Such procedures will be published in the website of CompNet towards the end of summer 2015;
- Set up referee procedures for the papers based on CompNet data and submitted to the ECB Working Paper CompNet Series.

4.2 CompNet Research Objectives

Overall, the main goal of CompNet is to foster state-of-art research on the broad themes of competitiveness, with the specific aim of tackling novel and upcoming issues of high policy relevance. While keeping its typical multi-dimensional approach aiming at conducting analysis within a multi-country framework, members will be left entirely independent in their choice on the specific topics of their research projects. This notwithstanding, and for the near future, the Network has identified two meta-research streams, which appear to be central to the current policy debates on secular stagnation and structural reforms, namely: (i) “Resource allocation and growth” as well as (ii) “International trade and Global Value Chains (GVCs)” (more details about such research streams are provided in the Appendix).

First, studies on aggregate productivity and potential output growth have received further impetus¹⁶. By constructing a novel firm-level database, harmonised across some 20 EU countries, CompNet can provide further stimulus to that research, underlining in particular the role of resource reallocation in fostering aggregate productivity. This stream of research has substantial relevance for monetary policy. It provides insights on the stumbling block for productivity enhancement, which is obviously hampering the transmission mechanisms. In particular, it allows an understanding of the degree to which the efficiency of the reallocation varies over the business cycle and of how financial frictions could distort the allocation of capital.

Second, while CompNet has contributed over the last few years to the literature on trade elasticities and on international supply-chain linkages, the work of CompNet on this broad spectrum of topics still appears to have a large potential. The research stream “International trade and Global Value Chains” thus aims at determining the channels through which shocks transmit across countries and sectors as well as assessing the magnitude of their effects. In this regard, the Network could provide substantial contributions, especially in two dimensions that are crucial for policy making. First, it could determine the impact of the emergence of GVCs on

¹⁶ In March 2015, the IMF staff published a discussion note (i.e. IMF, 2015) on productivity trends in advanced economies. The main findings point to a decline in TFP growth as a result not only of the reallocation of resources to sectors with slower productivity growth, but also of a decline in productivity growth within sectors.

international trade and macroeconomic dynamics as well as on the transmission of shocks. Second, it could further investigate the importance of firm heterogeneity for trade dynamics, and in particular in explaining the observed patterns in supply-chain linkages.

As for the output, research results by CompNet members will continue to be published in the dedicated ECB Working paper series – before being submitted to journals – and presented in an annual high profile Conference. The focus and the topics discussed at each conference will be chosen in a way to keep up-to-date with research questions and debates that will be of main relevance. In addition, dedicated workshops may be organised in order to foster interaction of members on specific lines of research.

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Appendix

The Appendix describes in more detail the two meta-research streams, which the Network is interested in developing due to their relevance for the current debates on secular stagnation and structural reforms. Section A.1 and A.2 present questions that are relevant for policy makers and constitute an interesting research agenda. While Section A.1 presents the research stream “Resource allocation and growth”, Section A.2 suggests research venues closely related to “International trade and Global Value Chains (GVCs).”

A1 Resource allocation and growth

In light of the current debates on global secular stagnation and – within Europe – on structural reforms to foster growth, **studies on aggregate productivity and potential output growth have received further impetus**¹⁷. To this purpose, in the last few years CompNet has devoted substantial work to identify the drivers of competitiveness and productivity using firm-level based information available in a number of European countries. Most recently, by constructing a novel firm-level database, harmonized across some 20 EU countries, CompNet has provided further stimulus to that research, underlining in particular the role of resource reallocation in fostering aggregate productivity.

This stream of research has substantial relevance for monetary policy. It provides insights on the stumbling block for productivity enhancement, which is obviously hampering the transmission mechanisms. In particular, it allows an understanding of the degree to which the efficiency of the reallocation varies over the business cycle and of how financial frictions could distort the allocation of capital.

Continuing the work already started, the stream will use the novel database in the context of the following literature.

- (a) The work of Bergeaud et al. (2014) confirms the evidence of substantial and persistent differences in the observed long-run trends of aggregate productivity across countries. Also, following Restuccia and Rogerson (2008) and Hsieh and Klenow (2009) among others, the literature explored the role of heterogeneity in firm-level productivity to explain these facts¹⁸.
- (b) A recent body of research studies the dynamics of misallocation over time and the implications for long-run trends in aggregate productivity and potential

¹⁷ In March 2015, the IMF staff published a discussion note (i.e. IMF, 2015) on productivity trends in advanced economies. The main findings point to a decline in TFP growth as a result not only of the reallocation of resources to sectors with slower productivity growth, but also of a decline in productivity growth within sectors.

¹⁸ Also, Bartelsman et al. (2004) analyse 2-digit industries in 24 countries and provide consistent evidence of substantial reallocation of resources across heterogeneous firms.

output growth¹⁹. Bartelsman et al. (2013) investigate the variation in the within-industry allocation of resources across countries and over time, and find that idiosyncratic firm-level distortions have large effects on aggregate outcome via resource misallocation.

- (c) Following a similar approach, an ongoing project in CompNet aims at extending the work of García-Santana et al. (2015) to other European countries. The authors conduct their study on Spain and find that the deterioration in the allocative efficiency of productive factors across firms is the main determinant of the decrease in TFP growth observed between 1995 and 2007. The work in progress at CompNet then analyses the evolution of within-sector allocative efficiency across Euro area countries with the purpose of identifying factors that could explain common patterns or observed differences in long-run trends of aggregate productivity and output growth.
- (d) Since the CompNet data set collects variables measuring the misallocation of labour and capital as well as balance sheet and financial variables, CompNet researchers can contribute to the growing literature which looks at the interaction between capital allocation, productivity and financial frictions. For example, the work in progress of Gopinath et al. (2015) shows that in a model with financial frictions and investment adjustment costs a decline in real interest rate generates an increased capital inflow and a decline in TFP where the latter results from deterioration of the misallocation of capital. Hence, research should assess the degree to which financial frictions induce misallocation of capital across firms and thus affect aggregate productivity, as well as identify the groups of firms to which policies should be directed to relax the financing constraints and improve the efficient allocation of resources.
- (e) The Network could also address questions related to the link between the microeconomic evidence of the CompNet database and macroeconomic outcomes. As highlighted by Fort et al. (2013), firms respond differently to business cycle fluctuations. The analysis of the evolution in the second and third moments of factors, such as TFP growth, employment growth and sales growth among others, could indicate relevant patterns, especially during recessions. Research could then shed light on how the efficiency of the within-industry resource allocation and its impact on aggregate productivity and potential output growth varies over the business cycle.

A2 International trade and Global Value Chains (GVCs)

In the last few years, CompNet has contributed to the literature on trade elasticities as well as on GVCs by mapping EU GVCs. It has also investigated how the

¹⁹ The work in progress of Gopinath et al. (2015) documents that between 1999 and 2007 the dispersion in marginal revenue product of capital in Italy and Spain substantially increased and countries in Southern Europe experienced large increases in the dispersion in the aftermath of the financial crisis. Also, Larrain and Stumpner (2013) show that episodes of financial market liberalization in Eastern European countries were followed by changes in the allocation of resources.

emergence of international supply-chain linkages affects trade patterns among Euro area countries and with the rest of the world. **Nevertheless, the work of CompNet on this broad spectrum of topics still has a large potential. Determining the channels through which shocks transmit across countries and sectors as well as assessing the magnitude of their effects constitute main questions for monetary policy.** In this regard, the contribution of the Network could be two-fold. First, it could determine the impact of the emergence of GVCs on international trade and macroeconomic dynamics as well as on the transmission of shocks. Second, it could further investigate the importance of firm heterogeneity for trade dynamics, and in particular in explaining the observed patterns in supply-chain linkages. These two meta-research avenues are described in more detail below.

First, resources should be directed towards the understanding of the macroeconomic impact of the higher degrees of input-output linkages in advanced Euro area countries (Levine, 2012) and of the integration within global supply chains on international trade. Research by Baldwin and Lopez-Gonzalez (2013) and Baldwin (2012) documents the emergence of global patterns in international production networks and highlights their relevance for policy implications. Promising research topics would include the quantification of international macro linkages via demand and price channels, and exchange rate pass-through. Similarly, a global environment characterized by the increased importance of GVCs could be subject to a higher degree of vulnerability due to the amplified transmission of shocks. Supply-chain networks could not only generate large aggregate fluctuations as a result of microeconomic idiosyncratic shocks (Acemoglu et al. 2012), but also substantial spillover effects across countries due to local exogenous shocks (Carvalho et al. 2014). Therefore, it is crucial to identify the role of GVCs in explaining patterns of trade among and outside Euro area countries, quantify their magnitude and assess their impact on the degree of systemic risk to which European countries are exposed.

Second, the international trade literature and the findings in Ghironi and Melitz (2005, 2007) among others highlight the relevance of accounting for firm heterogeneity (which should not necessarily be defined in terms of productivity) when studying international trade and macroeconomic dynamics. In line with ongoing research projects, the Network could therefore conduct research aimed at understanding the role of firm-level heterogeneity for international trade, and especially at quantifying trade elasticities and exchange rate pass-through. Moreover, by exploiting the strong interdependence between the observed heterogeneity in firm characteristics and the globalization of supply-chain networks, firm-level heterogeneity could provide evidence on the characteristics of the firms which participate in GVCs and provide further insights on the microeconomic mechanisms through which the transmission of shocks takes place at the macro level. Indeed, the emergence of international supply chains could substantially affect the transmission of shocks and the systemic vulnerability of Euro area countries. By accounting for firm heterogeneity, CompNet could then promote and coordinate research investigating these questions. Such efforts would produce useful recommendations on the design of current and future monetary policy in an economic environment characterized by fundamental, structural changes.

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Competitiveness Research Network

This report presents research conducted under the Competitiveness Research Network (CompNet). The Network is composed of economists from the European System of Central Banks (ESCB; the 27 national central banks of European Union (EU) Member States and the European Central Bank), a number of international organisations (the World Bank, Organisation of Economic Co-operation and Development and the European Commission), universities and think tanks, as well as a number of non-European central banks (those of Argentina and Peru) and organisations (United States International Trade Commission).

The objective of CompNet is to develop a more consistent analytical framework for assessing competitiveness; one which allows for a better correspondence between determinants and outcomes.

The research is carried out in three workstreams: 1) Aggregate Measures of Competitiveness; 2) Firm Level; 3) Global Value Chains. CompNet is chaired by Filippo di Mauro (ECB). Workstream 1 is headed by Konstantins Benkovskis (Latvijas Banka) and Pavlos Karadeloglou (ECB). Workstream 2 is headed by Antoine Berthou (Banque de France) and Paloma López-García (ECB), and Workstream 3 is headed by João Amador (Banco de Portugal) and Frauke Skudelny (ECB).

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