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Abstract

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

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Keywords: Globotics, services trade, global inflation hypothesis

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Globotics and macroeconomics: Globalisation and automation of the service sector

By Richard Baldwin[1]

Abstract

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

1 Introduction

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

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

[1] Graduate Institute, Geneva

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

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

What does any of this have to do with running a central bank?

1.1 Globotics and central banking

Policy choices depend critically upon how the macroeconomy works – especially the economic mechanisms that determine prices, wages, employment, and growth. Globotics will create and displace jobs, will raise productivity and quality, will lower costs, and is likely to quicken growth-enhancing innovation. Globotics will buffer the links between local labour market conditions and wage formation by creating better substitutes for local labour. These changes may affect the equilibrium rate of unemployment. Or they may create a new form of unemployment as steady jobs are replaced by precarious work arrangements rather than overt joblessness. It could further flatten and globalise the Philip's Curve. It could depress inflation by slowing wage growth and boosting import competition in the service sector. In this exploratory paper, I concentrate on the impact of globotics on the Harmonised Index of Consumer Prices (HICP).

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

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

[2] See ECB (2020) and ECB (201a, b, c).

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

2 Has globalisation peaked?

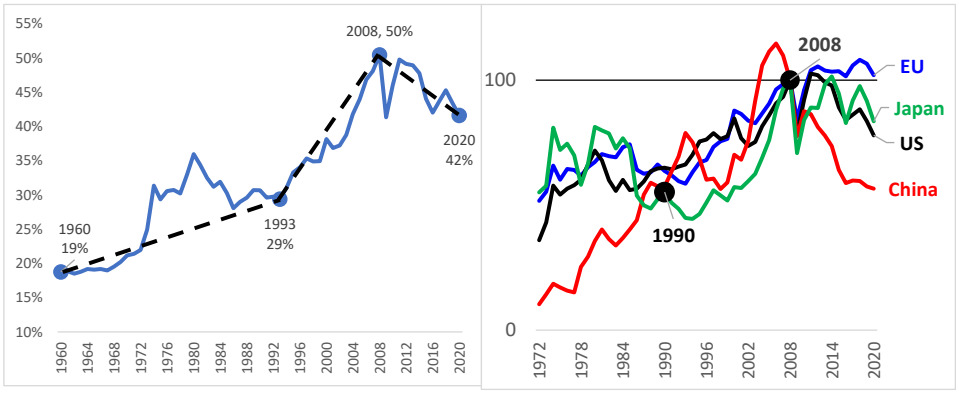
The answer to this question is twofold: for trade in goods and the phase of globalisation that has driven it since 1990, the answer is probably yes; for trade in services the answer is surely no.

2.1 False peaks in trade in goods

Chart 1 shows the standard case for 'peak globalisation.' The left panel shows the ratio of world trade in goods to world GDP from 1960 to 2020. The 'lazy narrative' asserts that trade in goods was globalising gradually until the ICT revolution launched an acceleration around 1990 that was fatally wounded by the 2008 Global Financial Crisis and attendant Great Trade Collapse.

Chart 1

Peak globalisation in goods– the 'lazy narrative'



Sources: Author's calculations based on WTO trade data, downloaded from stats.wto.org, and World Development indicators GDP data, downloaded from wdi.worldbank.org.
Notes: Trade in goods (imports plus exports), and GDP figures measured in current price US dollars.

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

The falsity of the single peak does not change the fact that the globalisation of markets for goods is no longer rising as it had been between the 1990s and the mid-

2000s. “Slowbalisation” is the term coined by The Economist (2019). Particularly striking is the shift in China’s trade to GDP figures (right panel of Chart 1). For deeper analysis and empirical investigation, see Antràs (2021) and Lund (2021).

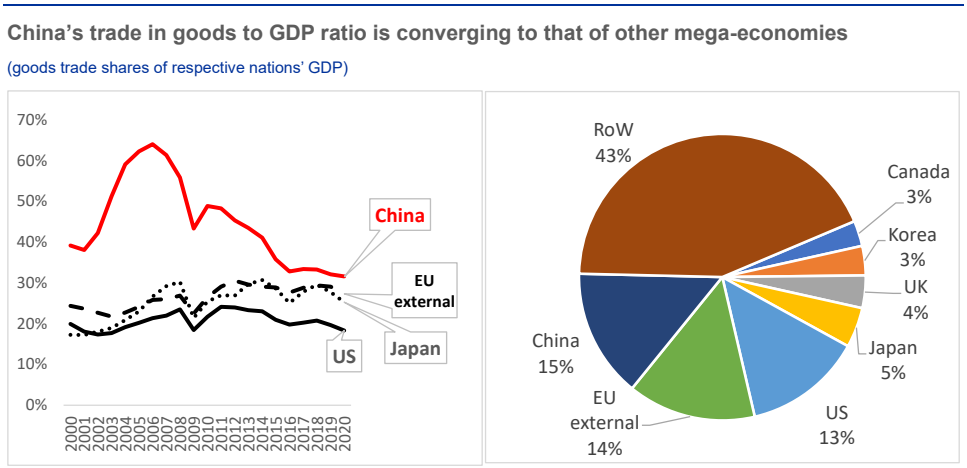
The complexity behind the global peak matters because of the misguided attempts to associate the changes in globalisation with the trauma of the Global Financial Crisis of 2008 and the Great Trade Collapse of 2008-2009. While the intensity of global trade in goods is undoubtedly declining, there is no overarching explanation. What Chart 1 tells us is that we need explanations that vary from nation to nation. As the world’s largest trader (Chart 2 right panel), China deserves special attention.

2.1.1 What’s going on with China?

China’s rapid industrialisation, which started with globalisation’s offshoring-expansion phase in the early 1990s, was unusually fast by historical standards. Before the 1990s, many nations – including all the G7 nations apart from the UK – industrialised the old-fashioned way. They built up their industrial base behind high tariff walls. China, and a handful of other emerging economies, industrialised in a radically different way. They did it by lowering tariffs, welcoming offshored stages of production, and importing many of the intermediate inputs that they could not yet produce. The industrialisation was so rapid due, in part, to the massive inflows of manufacturing knowhow that offshoring G7 firms sent to China along with the stages of production.

Chart 2

China’s openness ratio, 2000-2020



Sources: Author’s calculations based on WTO trade data, downloaded from stats.wto.org, and World Development indicators GDP All data, downloaded from wdi.worldbank.org. All data behind the shares and ratios are in millions of current USD.
Notes: Trade in goods include imports and exports. Trade and GDP figures measured in current price US dollars; ‘EU external includes only goods trade with non-EU nations.

The offshoring produced a great deal of new Chinese trade in intermediates and thus a rapid rise in its trade-to-GDP ratio, as Chart 2 (left panel) illustrates. By the 2000s, however, the easy fruits of offshoring had been harvested, so the pace of new offshoring slowed, and, more importantly, the Chinese industrial base achieved ‘escape velocity.’ Further growth was accompanied by what might look like de-

globalisation because China was substituting locally made inputs for imported ones. Chart 3 shows how the drop in Chinese trade in goods was due to an asymmetric decline in its purchases of imported inputs but a simultaneous expansion of its sales of intermediates to nations around the world.

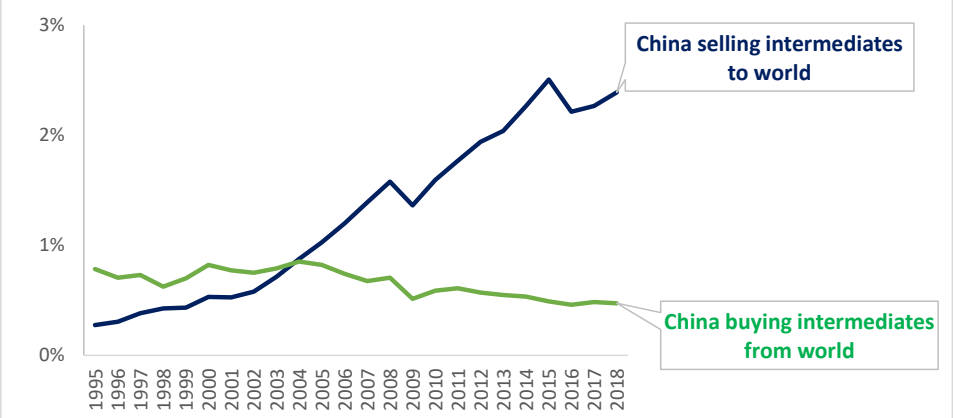
The key points are that China's trade-to-GDP ratio is falling towards a level of openness that is usual for mega economies, and this process is driven by its asymmetric engagement with global supply chains.

Chart 3

China's asymmetric engagement with global supply chains, 1995 - 2018.

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

(shares of world gross output)



Sources: Calculations undertaken by Rebecca Freeman and Angelos Theodorakopoulos using concepts developed in Baldwin, Freeman and Theodorakopoulos (2022), based on OECD's TiVA database.
Note: The gross trade concept is used in both measures so as to match the gross world output which forms the denominator of both measures.

2.2 No peak in trade in services

While trade in goods has peaked, trade in services has continued to boom. Chart 4, which shows the value of trade (not trade-to-GDP ratios as in Charts 1 and 2) illustrates the point but understanding the figures requires a bit of background.

First, data on services trade are not really fit for the purpose of tracking their impact on the global economy. The data are of a much lower level of quality and detail than is available for trade in goods. Second, trade in services is an amalgamation of several things that are driven by very different economic mechanism. At the most aggregate level, trade in services is broken down into three bins. The first two – travel (which includes tourism) and transportation – are well measured and easily interpreted. The third category, which accounts for about 60% of world trade in services is a grab bag of services called 'Other Commercial Services' (the 'commercial' is added to indicate the service providers are private as opposed to public entities). 'Other Commercial Services' (OCS) includes a very wide range of commercial activities. It includes, for instance, the famous Indian IT outsourcing

providers and call centres in the Philippines as well as payments made to Apple's App Store. See Box 1 for more detail on the composition of OCS.

Here I focus on OCS since international transportation services are closely associated with trade in goods. The 'travel' category is closely associated with people crossing borders. While transport and travel services are important in their own right, they are not the future of globalisation since they are not profoundly affected by the explosive advance of digital technology. By contrast, OCS mostly takes place electronically and so is profoundly affected by digital technology.

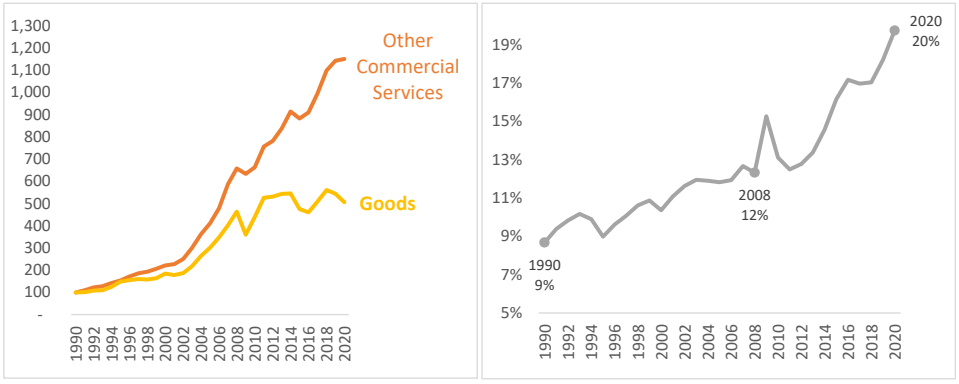
Chart 4 (left panel) displays data on worldwide OCS flows and goods flows. To emphasise the long-term growth divergence, both series are indexed to 100 in 1990. The main takeaway is that OCS has grown faster than trade in goods for decades (left panel). Since recovering from the Great Trade Collapse of 2008-2009, the differences in the paths of the two types of trade became more pronounced. The level of the series in 2020 reveals the cumulative growth over the last three decades. Between 1990 and 2020, goods expanded about five times while OCS multiplied by eleven times.

Chart 4

Trends in world trade in goods versus world trade in services since 1990

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

(left panel, 1990=100, right panel, shares of world imports and exports of goods and services)



Sources: Data downloaded from stats.wto.org.
Notes: These flows are not normalised by world GDP. The charts stop in 2020 since the pandemic had severe and historically unprecedented effects on services trade (see Box 1).

The right panel shows how the different growth rates have greatly boosted the relative importance of services in overall international commerce. In 1990, OCS accounted for only 9% of all trade in goods and services but, by 2020, that figure had tripled. The ratio's rise shows no sign of abating. The same pattern holds for the euro area economy (not shown in the chart).

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

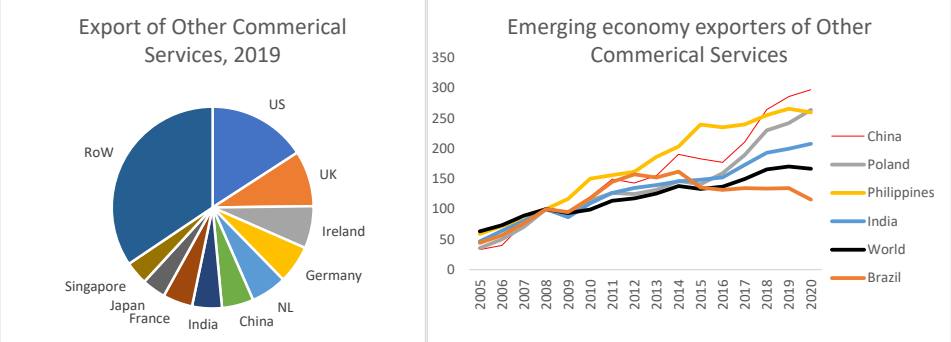
2.2.1 Who are the big players in the services trade?

The global shares of the largest OCS exporters are shown in Chart 5 (left panel). The top ten exporting nations account for about two thirds of all service exports. The US, UK, Ireland, Germany, and the Netherlands alone account for about 40% of world exports. Adding in India and China brings the total to over half. The right panel shows that most of the large emerging economies are seeing faster than average growth in their service exports (Brazil is an exception). This matters since the wages for their office and professional workers are far lower than they are in the euro area (Baldwin and Dingel, 2022). As digitech makes remote workers less remote and easier to weave into workflows in high-wage nations, emerging markets are likely to offer a large reservoir of attractively priced service sector workers (more on this below).

Chart 5

Top ten exporters of services and emerging market exporter trends

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



Sources: Stats.wto.org.
Notes: The series presented are a splice of the old BOP5 series and the recent BOP6 series for Other Commercial Services. See Box 1 for an account of the types of services covered by Other Commercial Services.

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

The growing importance of emerging economies in global services trade has been widely remarked in the world of development economics. The International Labour Organisation's flagship report in 2021, for instance, noted that: "The role of digital labour platforms is transforming the world of work." It goes on to point out that: "a trend has developed towards outsourcing work, both low-skilled and high-skilled, especially as traditional businesses look to digital labour platforms and digital tools to meet their needs for human resources. These platforms host workers from around the world, enabling businesses to complete their tasks at a faster pace and lower price than if the tasks were performed on site. In many instances, the work is outsourced on these platforms by businesses in the global North and performed by workers in the global South."

Box 1

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

The services trade data are gathered either from balance of payment statistics, or enterprise surveys. Both sources provide statistical agencies with the value of imports and exports of services. The categories for reporting services trade were last updated in 2010 which, as Chart 4 shows, was just when the role of OCS started to take off. This box focuses on 2019 which was the last year before Covid-19 massively distorted services trade (see below). As mentioned in the text, the three highest level aggregates are transportation (about 17% of total services trade) and travel (24% of total services trade). The rest is OCS.

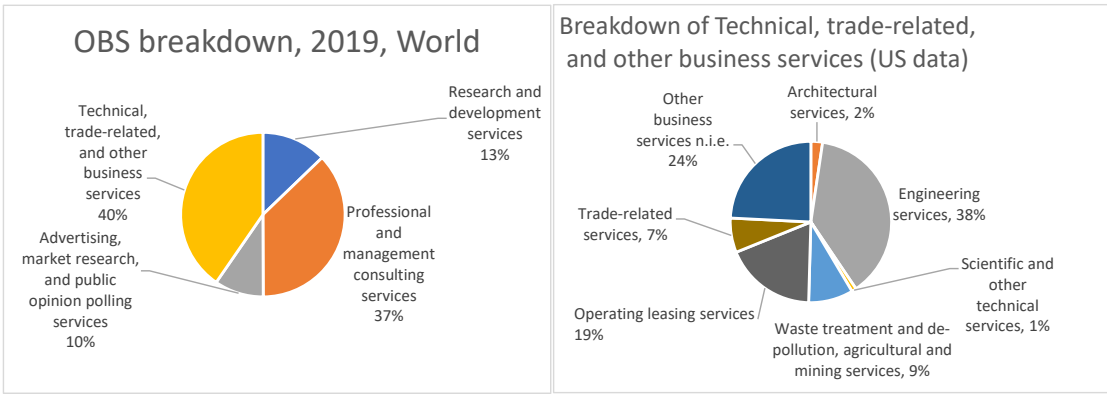
The OCS category consists of a few big items and many small items. Some are easily recognisable. Among the bigger categories are Financial Services (9% of OCS), and payments for intellectual property rights 13% of OCS). The category Telecommunications, Computer and Information Services accounts for 20% of OCS. Much of this is made up of computer services related to software, but a large share is tossed into the category 'Other computer services other than cloud computing' (this is typical of the lack of precision in services trade statistics).

Chart A

Breakdown of components of other business services (OBS), 2019, World

OBS, which is 23% of OCS, includes many of the classic service offshoring activities

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



Sources: Data downloaded from stats.wto.org.
Note: services measured in current US dollars.

The largest sub-category of OCS is 'Other Business Services' (23%). Peeling off another layer of the onion, Chart A shows the components of OBS. The largest categories are: professional and management consulting services (37% of OBS), and technical, trade-related, and other business services not included elsewhere. Disaggregate figures for the 'technical, trade-related, and other business services not elsewhere' included (TTOBS) category are not available for the whole world, but some nations – like the US – provide more detail. The right pie chart in the figure shows these. It indicates that the big items are: engineering services (38% of TTOBS), leasing services (19% of TTOBS), other business services, not included elsewhere (24% of TTOBS).

As Chart B shows, the pandemic had a peculiar impact on services trade stemming from the 'great lockdown.' In 2020 and 2021, travel and transport services plummeted but other types of services

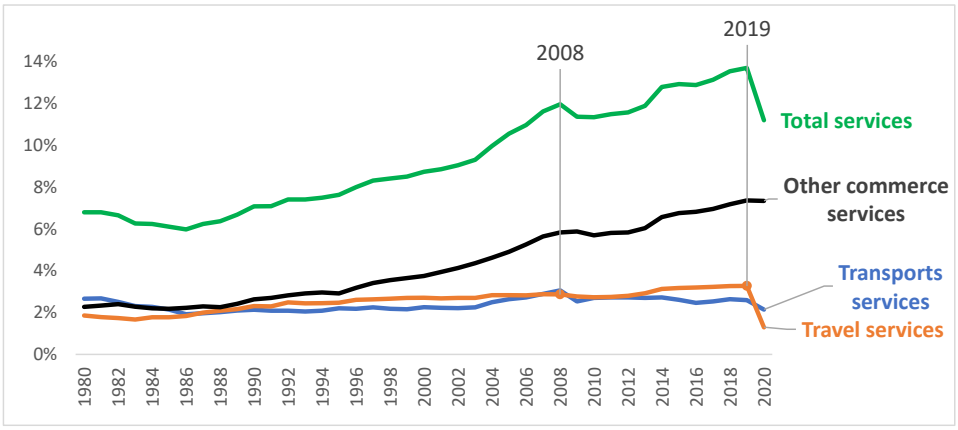
trade continued to expand at their usual pace. The reason is that travel is mostly made up of international tourism and business travel – much of which was directly shutdown by Covid-linked restrictions and indirectly by consumer hesitancy. The impact on travel was so severe that it sharply pulled down the total service figure.

Chart B

Impact of pandemic and lockdowns on components of world services trade

OCS has continued to rise during Covid-19 but trade in travel services was hit hard and transport slowed

(shares of world GDP in %)



Sources: Author's calculations based on WTO trade data, downloaded from stats.wto.org, and World Development indicators GDP data, downloaded from wdi.worldbank.org.
Note: services and GDP are measured in current US dollars.

3 Why did globalisation change?

The charts in Section 2 showed that the boom in goods trade that started around 1990 slowed around the mid-2000s but the boom in services trade powered ahead throughout the whole period. Moreover, the change in 2008 was just the latest transformation in globalisation over the past couple of centuries. How can we make sense of these changes and differences?

This section provides a simple bit of intellectual infrastructure to organise thinking about how and why globalisation changed in the past, and, more importantly, to lay the foundations for thinking about future globalisation. The intellectual infrastructure is based on the 'globalisation as arbitrage' approach that derives from my early thinking on globalisation (Baldwin 2006) and refinement in my 2016 book, *The Great Convergence: Information Technology and the New Globalisation* (Baldwin 2016).

3.1 Arbitrage and globalisation's great unbundlings

Arbitrage drives globalisation. Putting capital flows aside, globalisation can be defined as all the things that happen when goods, services, investment, expertise, and knowhow cross international borders.

Arbitrage is what drives these cross-border flows. When things are relatively scarce (and thus relatively dear) in one place and relatively abundant (and thus relatively cheap) in another, firms arbitrage the differences by making them in the latter and selling them in the former.

As David Ricardo taught us at the dawn of modern globalisation, there is always a counter arbitrage to be done since the dissimilarities concern relative differences. Because the differences are relative, the things that are relatively scarce in one nation are, by the definition of relative, relatively abundant in the other. This is the heart and soul of international commerce. This is exactly what Ricardo's comparative advantage is all about.

Such arbitrage is constrained by three main types of separation costs: trade costs (which constrains arbitrage in goods), communication costs (which constrains arbitrage in knowhow), and face-to-face costs (which constrains arbitrage in labour services). When the separation costs are high, arbitrage is difficult, so things remain 'bundled' together within economies. For example, before the 19th century transportation revolution, most production and consumption were bundled together inside nations, so trade was rare (Federico and Tena, 2016). Autarky is the jargon for the extreme version of the bundling of production and consumption.

The history of globalisation is best regarded, in my view, as the sequential relaxing of the three arbitrage constraints. During the first great transformation (farms to factories), steam power lowered separation costs for goods trade and thus allowed the international unbundling of production and consumption. During the second great transformation (factories to offices), ICT allowed the unbundling and offshoring of stages of manufacturing that were previously all bundled in factories in high-wage nations.

To test the approach's utility, we use it to structure a quick trot through two centuries of globalisation.

3.1.1 Globalisation's two historical unbundlings

Globalisation's 'first unbundling' happened when steam power and Pax Britanica radically lowered the cost of moving goods but lowered the other separation costs much less. Goods trade boomed (Findlay and O'Rourke 2007). The trade boom reshaped the world. It set off self-enforcing cycles of agglomeration and innovation that spurred growth in the small club of economies that used to be called the industrialised countries. The rest of the world grew more slowly for 170 years. The result was the 'Great Divergence' (Chart 6) that saw the G7's share of global GDP rise from a fifth to two thirds while China's and India's share plunged.

Globalisation changed dramatically again around 1990 when it entered its offshoring-expansion phase, or what I have called the 'second unbundling' (Baldwin 2006). This unbundling was triggered by the ICT revolution which relaxed the second separation cost – communication and coordination costs. ICT made it feasible for G7 firms to unbundle highly complex industrial processes into production stages, and then

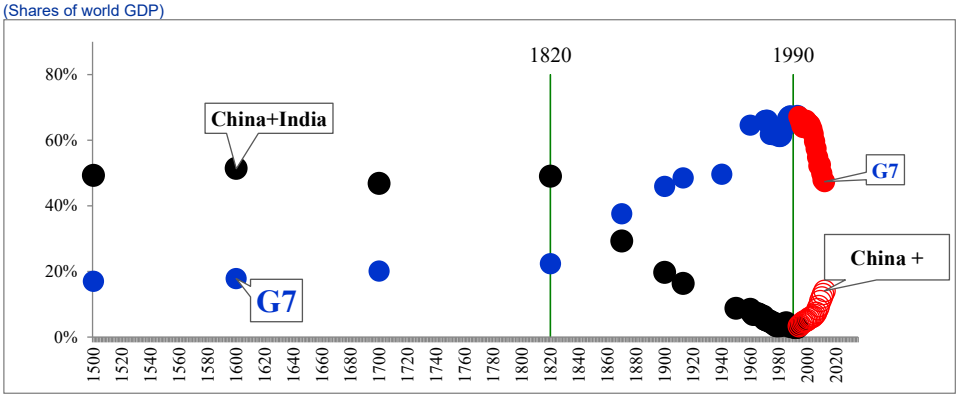
offshore some stages to low-wage nations. This can also be called globalisation's offshore expansion phase. The impacts on global GDP shares from 1990 were spectacular (Chart 6). The G7's share tumbled. The China-plus-India share soared. This is the Great Convergence. In a sense, the offshoring-expansion phase is what put the 'emerging' into the 'emerging economy' label.

Chart 6

World GDP shares, G7 and China+India, 1500-2012

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

(Shares of world GDP)



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

But how could a few offshored factories reverse the course of globalisation? The answer is that the offshoring G7 firms sent their manufacturing knowhow along with the production stages because the offshored process had to continue to operate as if it were still bundled. GM factories in Mexico, for example, are using GM technology, not Mexican technology. In this phase of globalisation, we have factories crossing borders, not just goods. As a result, China, India, Thailand, and a handful of other emerging economies started to produce and export manufactured goods that they could never have produced with their own technology. In my view, the second unbundling was really about arbitraging differences in the knowhow per worker. The ratio was high in G7 nations and low in emerging economies.

In a nutshell, the Great Divergence flipped over into the Great Convergence because globalisation now involved massive movements of manufacturing knowhow from a handful of high-wage to a handful of low-wage nations. The booming trade-to-GDP ratio was one symptom of the switch over. That is, as factories now straddled international borders, parts and components passed through custom posts multiple times, for instance first as intermediate goods on their own and then again once they were embedded in exported final goods. The world trade-to-GDP ratio naturally took a step up while offshoring was in its expansion phase (as Chart 1 showed).

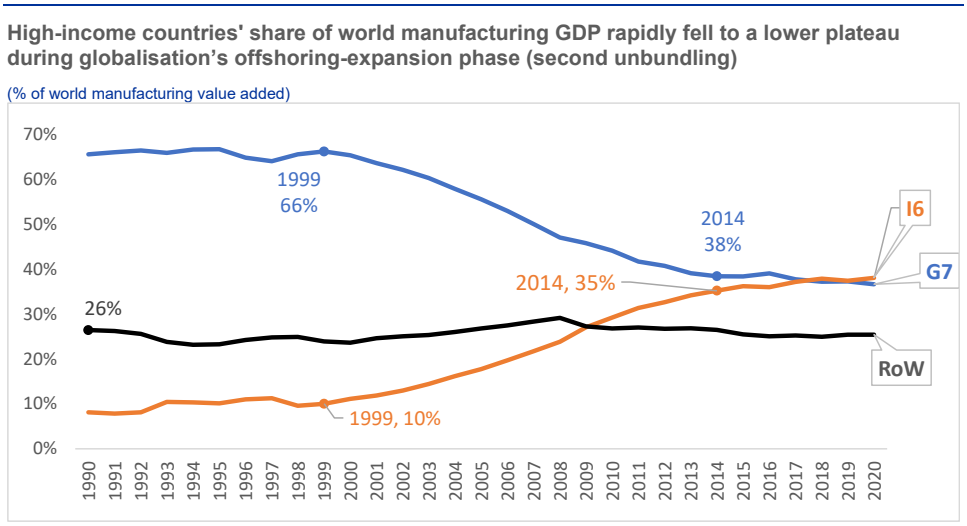
The second-unbundling arbitrage created a new way to make industrial goods. Before, G7 firms' competitiveness was founded on high wages and high tech. Developing nations' competitiveness was based on low wages and low tech. The second unbundling allowed a new combination – high tech and low wages (more on

this in the next sub-section). The expansion phase eventually slowed once the most profitable arbitrage opportunities had been harvested.

Is there any evidence behind this narrative? From 1990 or so, the new possibility of making things with high tech and low wages fostered a rapid shift of manufacturing away from high-wage nations and towards a handful of low-wage developing nations. Chart 7 exhibits the impact on world manufacturing shares. The share of high-wage nations (proxied by the G7) started out at a high and stable level of about two-thirds. As the offshore-expansion phase dialled up, the G7 share declined rapidly up to the mid-2010s – dropping from 66% to 38%. Since then, the share seems to have plateaued, or at least the drop has slowed substantially. This is one indication that the offshoring-expansion phase has ended.

Chart 7

Shifting shares: World manufacturing value added shares, 1990-2020



Source: Author's calculations based on UNIDO data, Manufacturing Value Added, current USD.
https://stat.unido.org/database/National%20Accounts%20Database.
Notes: I6 is China, India, Korea, Indonesia, Thailand, and Brazil; the G7 is France, Italy, Germany, UK, Japan, US, and Canada.

Where did the G7's loss of world share reappear? The chart also displays the share for six rapidly industrialising emerging economies. The six were selected since they are the only economies whose global manufacturing shares rose by at least half of one percentage point between 1990 and 2020. They are, with their percentage point gain in parentheses, China (+16.2), India (+1.5), Korea (+1.5), Indonesia (1.0), Thailand (0.5), and Brazil (0.5). The share of the Industrialising six (I6) is plotted in the chart along with the share of the rest of the world (RoW).

The behaviour of the G7 and I6 shares are almost mirror images of each other. This is consistent with the idea that the second unbundling triggered a process that shifted manufacturing knowhow, and thus comparative advantage, from the G7 to the I6. The G7's loss of 38 percentage points between 1990 and 2014 is almost fully matched by the I6's gain of 35 percent points. The balance was spread across the hundreds of nations in the RoW aggregate.

The offshoring and attendant technology flows had growth effects and trade effects. The growth gradient reversed. After 1990, many poor nations grew faster than the rich ones. This produced a rapid reversal of global GDP shares from about 1990 (Chart 6). The slowing of the offshoring-expansion phase, and thus Global Value Chain (GVC) trade, is part of the explanation for why the intensity of goods trade peaked in the 2000s (Chart 1). Moreover, multiple-border-crossing trade is unwinding since industrial automation is reducing the labour cost share of manufacturing and with it the profitability of offshoring stages to low-wage nations. Reshoring, in other words, is driven by secular technological changes in addition to any medium-term rise in trade costs and risks (Baldwin and Freeman 2021).

3.1.2 Comparative advantage was partly de-nationalised

A point that is not sufficiently recognised is how different the arbitrage driving the second unbundling was from that of the first. From 1820 to 1990, the arbitrage driving the first unbundling could be thought of as following Ricardo's law of comparative advantage. Rich nations had higher knowhow-to-labour ratios (and thus higher wages) but in some sectors their high tech more than offset their high wage and so they were price competitive. In other sectors, the opposite held and nations with a low-tech-low-wage combination were price competitive. Two-way trade resulted.

A schematic diagram helps nail this down (top panel of Chart 8). The top two bars show the traditional determinants of Ricardian comparative advantage during the pre-1990 globalisation. Nations that had high knowhow-to-labour ratios (take the G7 nations to be concrete) had high wages. G7 nations had a comparative advantage in sectors where their high productivity more than outweighed their high wages. The second bar shows the situation of Emerging Markets (EMs) whose low knowhow-to-labour ratios produced low wages that were, in their comparative advantage sectors, low enough to offset their low productivity.

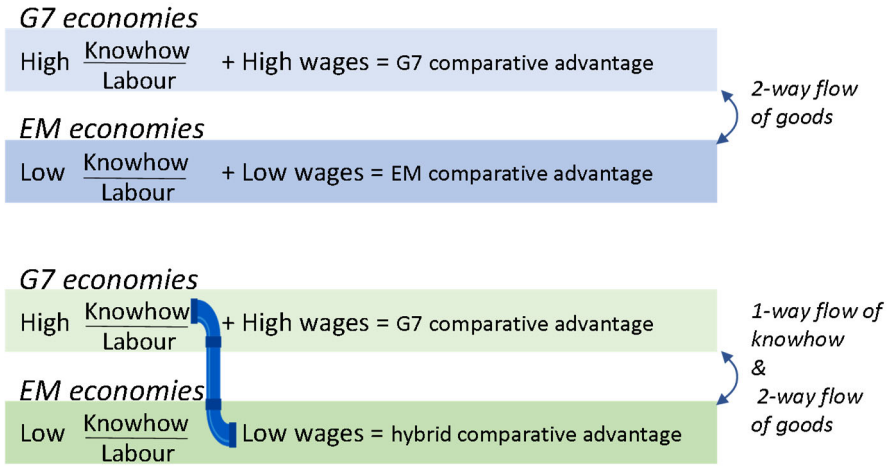
The second unbundling (second set of bars) was driven by arbitrage in manufacturing knowhow (Grossman and Rossi-Hansberg 2008). This arbitrage worked on very non-Ricardian principles. Manufacturing firms in rich nations owned lots of technical, managerial, and marketing knowhow, but high communication costs had traditionally restricted them to combining their technology only with rich-nation workers. ICT opened previously non-existent arbitrage opportunities that led to a one-way flow of knowhow out of G7 nations and into a handful of emerging economies. In the chart, this is illustrated as a pipeline that allowed G7 firms to combine their high technology with low wage workers abroad. For example, when Ford makes auto parts in Mexico, it is using American knowhow and Mexican labour – not Mexican technology and Mexican labour. Before the advent of ICT, this was not practical. This created a hybrid competitiveness that was very much **not** in the spirit of Ricardian trade. It meant that comparative advantage was defined at the level of companies' internationalised manufacturing processes, not national boundaries. It meant that the basis of the rich nations' Ricardian comparative advantage

(technology) was crossing borders, not just the goods that were the fruits of the comparative advantage.

Chart 8

How and why comparative advantage changed around 1990

Simplifying to clarify, the arbitrage that drove globalisation up to the 1990s involved 2-way flows of goods and no flows of knowhow. The arbitrage driving the offshore expansion phase involved North-to-South knowhow flows and two-way flows of goods.



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

This brings us back to the original question: Why did services trade behave so differently?

3.2 The future: globalisation's third unbundling

Digital technology is refashioning the future of trade. Today we are seeing a third unbundling. It is driven by the modern version of ICT – namely digital technology. But rather than enabling arbitrage in manufacturing knowhow via GVCs, it is enabling the arbitrage of labour service sector via international remote work, or 'telemigration.' This trend is an unbundling (the third unbundling) in the sense that it involves the spatial separation of labour services and the labourers providing them.

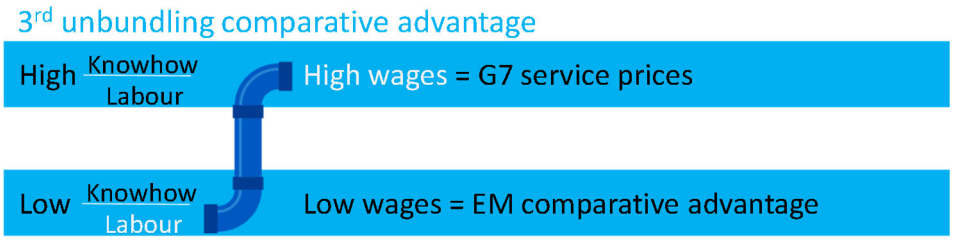
Chart 9 schematically illustrates some differences between the third unbundling and the first two. The first unbundling was arbitrage in goods, with knowhow locked inside nations. The second unbundling allowed the source of Ricardian comparative advantage (knowhow) to be arbitraged internationally. The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

The third-unbundling arbitrage is between the low service-sector wages in emerging economies and the high service-sector wages in G7 nations with digitech opening the pipeline that allows the export of office work without the office workers migrating. Since the job is not always won by the cheapest, the export of labour services is two-way as we saw in Chart 5.

Chart 9

Why services trade did not peak in the mid-2000s

The third unbundling is similar to the first unbundling in that it does not involve the sources of comparative advantage crossing borders, only the fruits of the comparative advantage (services in this case)



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

As with the first two, the third unbundling will, in my view, affect the macroeconomy by strengthening the connection between domestic and international prices while weakening the connection between domestic labour supply and demand conditions and the wage formation process.

3.2.1 The third unbundling as service-sector wage arbitrage

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

Some of the arbitrage is done via online freelancing platforms like Upwork, Freelancer, and Zhubajie (these are like eBay but for services). Wage comparisons based on worker-level data scraped from such online freelancing platforms confirm the presence of enormous wage gaps, although the size varies greatly according to the data selection criteria. Data from a number of the largest freelance platforms reported in ILO (2021) indicate that average hourly earnings paid in a typical week for those engaged in online work is US$4.9, with the majority of workers (66%) earning less than the average. While $4.90 an hour seems like a low wage in Europe, it corresponds to full-time equivalent salary of about $10,000 per year – a salary which is considered comfortably middle class in most countries.

An important difference between goods and services barriers arises from the nature of some services. While most goods can be put in a box and shipped, some services

require real face-to-face contact. This need will shield some rich-nation service workers from direct wage competition.

The next topic is a presentation of the argument that the future of globalisation lies in services trade.

3.3 The future of globalisation is trade in intermediate services

“The future is already here – it's just not evenly distributed,” is one of the more famous quotes ascribed to the science fiction writer William Gibson. The quote seems to be purpose-built for the future of trade in intermediate services. As Chart 4 shows, OCS services are already 20% of all international commerce and rising fast. This section presents the argument that this trend will continue for the foreseeable future and may well accelerate.

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

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

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

What are intermediate services? They are the tasks done by occupations like bookkeepers, forensic accountants, CV screeners, administrative assistants, online client help staff, graphic designers, copyeditors, personal assistants, corporate travel agents, software engineers, lawyers who can check contracts, financial analysts who can write reports, etc. The key identifier is that the service tasks are done for a company, not a final customer.

The second fact is that digitech is rapidly lowering the technological barriers to trade in intermediate services and pandemic-linked changes accelerated the reduction in separation costs (MGI 2021). Combining these facts tells us that that services-trade

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

The third fact is that export capacity in emerging markets is not as great a limiting factor in services as it is in goods since every nation has a workforce that is producing intermediate-service tasks. All emerging market economies have workers who are already providing intermediate services to domestic companies. There is no need to develop whole new sectors, build factories, or develop farms or mines. This fact, by the way, is the basis of a broad re-evaluation of development pathways for emerging markets – as has been noted by several recent, high-profile reports stressing the role of services trade in development (WTO, 2019; Nayyar, Hallward-Driemeier, and Davies, 2021; ILO, 2021; ADB, 2022). Also see Baldwin and Forslid (2020).

The fourth fact is that the demand for imported intermediate services is not as great a limiting factor as it was for trade in goods. Businesses in G7 nations spend a great deal on services (more on this below). Many services, say housing services, are nontraded but many are potentially tradable. Roughly speaking, if the service could be provided by someone working remotely during the pandemic, then it is a candidate for competition from imported services – although there are many caveats (Baldwin and Dingel 2022). Moreover, tradeable intermediate services are inputs into many nontraded final services. For instance, a company that manages rental properties might be able to cut costs and thus rents by offshoring some back office services to a low-wage nation.

The deduction is simplicity itself. Barriers are radically higher and falling radically faster for services versus goods, and, unlike farm and factory goods, there is no capacity constraint when it comes to intermediate services. Ergo, the future of trade lies in intermediate services. The specific conjecture is that the share of OCS in international commerce will continue to rise as it has for decades (Chart 4).

3.3.1 How important are imported intermediate services to the euro area?

While official trade data does not distinguish between final and intermediate services, the OECD's TiVA database has, via estimation rather than observation, identified the bilateral flows in intermediate services. The TiVA database covers only the advanced economies and a few large emerging markets, and it covers only 1995 to 2018 but its focus on intermediate inputs of goods and services is ideal for the purpose at hand. Or, almost ideal. The TiVA database categories of services do not line up with standard international services trade categories, like OCS, so I use the TiVA category 'business services' (this encompass all non-governmental services).

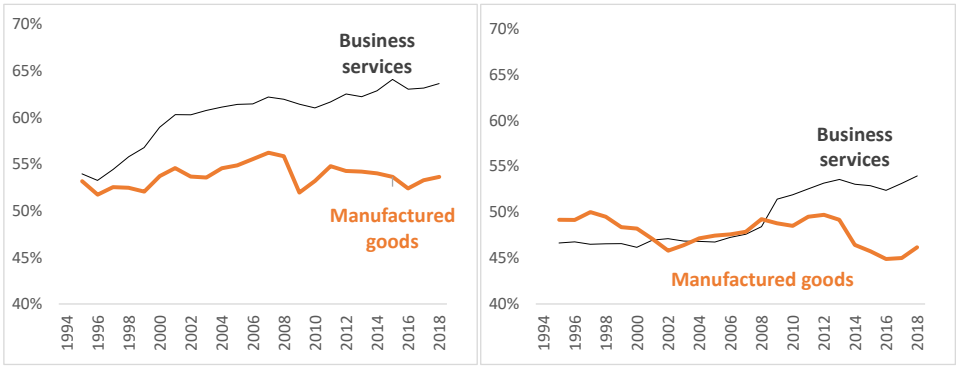
The left panel of Chart 10 shows, for the euro area, the importance of imported intermediate services in EA19 overall imports of business services. Starting with the familiar, note that the share in intermediates in imports of manufactured goods is about half. This indicates that EA19 manufacturing sectors are highly dependent

upon imported intermediate goods. The trend is rising to the mid-2000s but declining gently since 2008. This confirms the trends documented in Section 2.

The trend and level are quite distinct for the share of intermediate services in total EA19 imports of business services. The level starts out a bit higher for services than goods and the rises to astounding two-thirds by 2018. The right panel, which presents UK data for comparison, shows that the facts are similar when it comes to trends, even if the levels are somewhat lower.

Chart 10

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



Sources: Author's calculations based on OECD TiVa data, downloaded from stats.oecd.org
Notes: TiVA data are only available for the 1995-2018 period. Imports in the charts are measured on the usual 'gross' basis (not value added basis). Business services encompass all non-governmental services (the TiVA database categories of services do not line up with standard trade in services categories, like OCS). It includes travel and transport but since the series ends in 2018, the 2019-2020 disruption is absent.

The main conclusion is that trade in intermediate services is not a matter for the distant future. Euro area imports of services are already dominated by intermediate services.

4 Services are important and different

Services are an enormously important part of the euro area economy and getting more important, as Chart 11 shows. Service jobs accounted for about two thirds of all jobs in 2001. This rose to three quarters by 2019 (the last year before the pandemic disruptions). Over the same period, the service sector's GDP share rose from 63% to 66% but has stagnated since the Global Crisis. The divergence between the share of jobs and GDP is due to the well-known fact that labour productivity is, on average, lower in services than it is in other sectors. The divergence in the trends show that the productivity gap has been widening. The bottom line in the left panel shows the weight of services in the HICP index. This is a proxy for the importance of services in EA19 final consumption. As we see, people devote a large fraction of their expenditure to services, about 40% in 2001 with the figure rising to about 45% in 2019. This is an important part of the evolution of the role of services in the EA

economy. It shows that there is an upward trend in the demand for services from consumers.

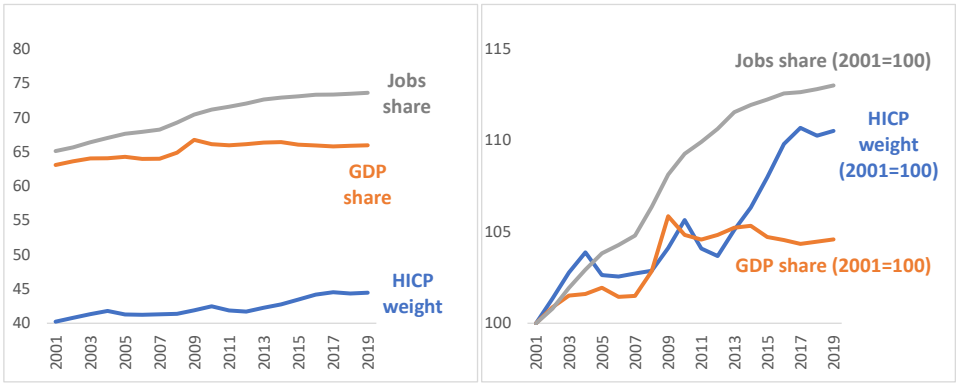
The right panel focuses on trends for the same variables by indexing the left-panel series to equal 100 at the start of the period in 2001. This illuminates the fact that the importance of services in employment has been rising quite fast. The rise in expenditure shares is almost as fast but the behaviour of the GDP share is quite different. It rises quickly up to 2008 but stagnates thereafter.

Chart 11

'Servicification' of EA19 economy – jobs, GDP, and expenditure shares, 2001-2019

The service jobs share is high and rising fast; the GDP and expenditure shares are lower

(left panel: service sector shares; right panel shows indices with 2001 = 100)



Sources: Authors elaboration of data from World Bank's World Development Indicators database (jobs and GDP shares) and Eurostat data (HICP services weight).
Notes: The right panel shows the left-panel variables indexed to 2001 = 100 to illustrate the cumulative growth. The service jobs share is employment in services, % of total employment (modelled ILO estimates), and GDP share is value added as % of GDP., service expenditure share is proxied by the HICP expenditure weight on all services.

A remarkable feature of these charts is the substantial difference between services' weight in consumer expenditure and their weight in the general economy. Since the EA's net export of services is a small share of GDP (around 1%), the difference must lie in the fact that many services are either sold to other final users whose expenditure patterns are not reflected in the HICP (government or investment expenditure) or are used as inputs into the production of goods and services.

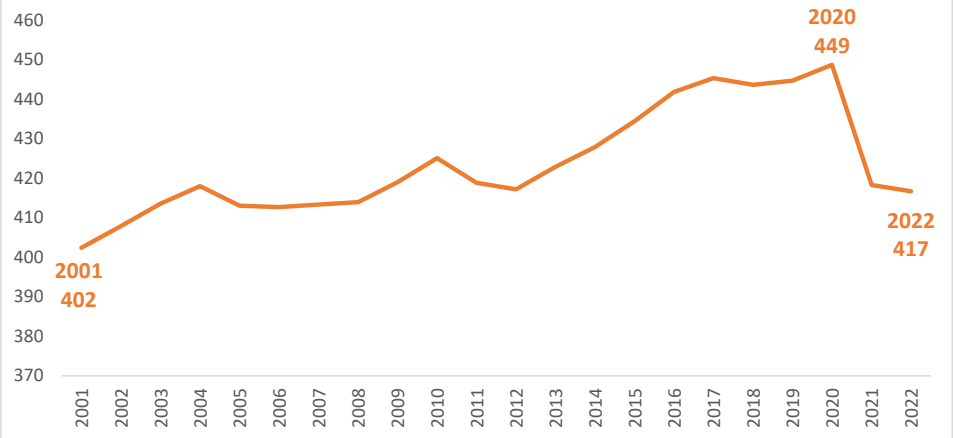
Chart 12 shows that the secular rise in the importance of services in consumption expenditure was suddenly and sharply reversed during the period of intense Covid lockdown policies. The future will tell, but the reversal is likely to be reversed going forwards as the lockdowns and restrictions become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

Chart 12

The weight of service prices in HICP, 2001 to 2022

The weight services in the HIPC index of inflation rose for a decade but fell sharply during the pandemic disruptions as consumers switched to spending more on goods

(weight of all services items in basis points)



Sources: Author's elaboration of Eurostat online data.
Note: The series is 'Services (overall index excluding goods)'; 2022 is the estimate used to calculate this year's inflation rate. The total weight is 1000, so the weight of, say, 417 indicates an HICP share of 41.7%.

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

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

Chart 13 – which looks at the French economy in 2018 as an example – shows that at the level of the whole economy (right bars), intermediate service inputs account for 30% of the total gross output, while manufactured intermediates account for only 11%. Note that 'gross output' is value added (i.e., GDP) plus the value of all intermediates used up in the production of the final value added.

The usage of services and manufactures as inputs naturally varies across sectors as the three leftmost rows of columns show. The share of manufactured goods in all intermediates used by the service sector is only 5% while the services intermediates' share is 32%. When it comes to the manufacturing sector, manufactured inputs account for 25% of inputs while services account for 24% (the rest is from the primary sector). For the primary sector the inputs' shares for services and manufactures are 28% and 17% respectively.

Plainly, service inputs are consistently important in primary, secondary, and tertiary sectors, while manufacturing usage is concentrated in the manufacturing and primary goods sectors. This consistency, teamed with the outsized importance of the

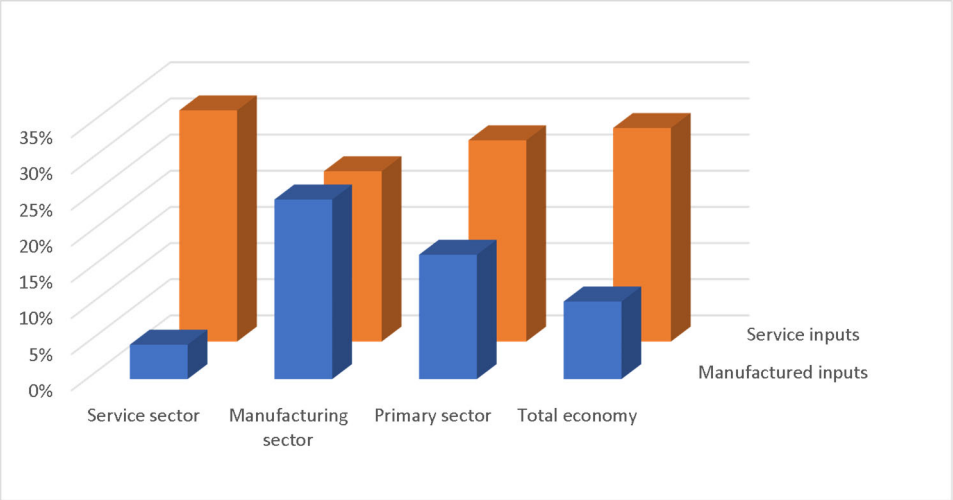
service sector (68% of French GDP), is why service inputs are so much more important at the economy-wide level.

Chart 13

Share of services vs manufacturing intermediates by sector, France, 2018

The use of services as intermediate inputs is three times more important than the use of manufactured goods as inputs

(% of French gross output of relevant sector in 2018)



Source: Author's elaboration of calculations produced by Rebecca Freeman and Angelos Theodorakopoulos using the OECD's inter-country input-output data base. See Baldwin, Freeman, Theodorakopoulos (2022).
Notes: The inputs are from all sources, domestic and foreign, and the shares are a percent of the buying sector's gross output.

Looking at the same calculations for the earliest available year, 1995, reveals the growing role of services. In 1995, intermediate services accounted for 25% of France's gross output while manufactured intermediates accounted for 14% (not shown in the chart).

Digital technology applied to services is affecting the euro area economy via an entirely separate route – automation.

4.2 Service sector automation

This impact of digital technology on the service sector requires some background on important but insufficiently remarked upon differences between ICT and digital technology. Today's digitech impulse is quite different than the impulse that triggered the second automation (called computerisation). It is true that both involve the gathering, transmission, storage, and processing of data but the way these are employed in the workplace is dissimilar.

When computers and integrated circuits started becoming useful in the 1970s, automation crossed a 'continental divide' of sorts. Before this, automation was all about mechanisation – it was about providing manual workers with more powerful tools for their hands. Computerisation, by contrast, was a shift from hands to heads. Computers before the mid-2010s, however, could do only a highly restricted type of mental work. They were not thinking in any real sense. They were just following an

explicit set of instructions called a computer program. Today's computing does it differently.

Digital technology pushed computing across a second continental divide. The divide lines up exactly with what the psychologist Daniel Kahneman called 'thinking fast and thinking slow' (Kahneman 2011). 'Thinking slow' is the conscious, explicit reasoning that humans could teach computers using programming languages. 'Thinking fast' is the unconscious, instantaneous, instinctive thinking that we could not teach computers by writing code. The ultimate limitation was that humans did not understand how they perform unconscious thinking, so it was impossible to write a programme that would get a computer to mimic the process.

A type of AI called 'machine learning' allowed computers to jump over this limitation. While the basic technology is decades old, it did not really move the dial until 2016 or 2017 when our ability to gather and process data became gigantic. With massive data sets and amounts of processing power that were unattainable in the early 2010s, computer scientists estimated extremely large non-linear statistical models that could recognise patterns in data. That is why today computers are as good or better than humans in some instinctual, unconscious mental tasks – things like recognising speech, identifying faces, and identifying diseases from X-rays.

The upshot is that computers now have cognitive capacities that they never had before 2017 (which was dubbed the "Year of AI" by Fortune magazine). While progress in machine learning was smooth, in 2016 it started producing models that allowed computers to do shocking things, like beat the world's best Go player. This matters for the issue at hand since some of computers' new cognitive skills are allowing firms to automate some service sector tasks. Before 2016, automation was mostly about farming and factory jobs. Since 2017, automation has increasingly been applied to the service sector.

This is leading to automation of services that had previously been thought to be immune to automation. Software packages like Robotic Process Automation, virtual assistants, and chatbots are taking over some service tasks. More sophisticated AI packages like IBM's Watson are automating some aspects of professional jobs. Take as an example the news media industry where the New York Times, Washington Post, BBC, and Reuters are using robo-reporters to write some stories.

The BBC's white-collar robot (WCR), 'Juicer,' continuously monitors the newsfeeds of over 850 global news outlets. Using it, a journalist who is looking for the latest stories on, say Donald Trump, can pull up an inventory of related content in just minutes. No need for hours of research by the reporter or research assistants. Reuter's white-collar robot, 'News Tracer,' tracks breaking news, so journalists can jump straight to the latest news. The Washington Post's white-collar robot, called 'Knowledge Map,' undertakes routine research tasks, and its robot-reporter, 'Heliograf', can write simple stories. Heliograf was first used to expand and quicken the coverage of the 2016 Olympics. Similar white-collar robots are used in financial planning, logistics planning, architecture, legal services, and many more service sectors.

In a very different industry, WCRs are automating more sensitive tasks. Some aspects of the work of parole boards in the US are partly automated with WCRs. One such system is called Compas (Correctional Offender Management Profiling for Alternative Sanctions). Designed by the company Northpointe, a criminal justice research and consulting company, it is used in Michigan and New York. It combines standard risk factors (criminal history, age, etc.) with other data to calculate an inmate's probability of breaking parole. The company points out that it should only be used as a tool by human members of parole boards. Northpointe's chief scientist, told the Wall Street Journal that parole boards should override the WCR's conclusion in eight to fifteen percent of the cases (McCaney 2013).

The takeaway from these examples is simply that many service sector and professional tasks that were previously 'unautomatable' are now, thanks to machine learning and massive data sets, partly automatable. Moreover, it is not just routine, unskilled tasks. Algorithms trained by machine learning are essentially data-based pattern recognition programmes. As experience-based pattern recognition is the core of many high-skilled jobs, this new form of automation is an issue for high education and low education workers alike. This is quite different from the impact of ICT over past decades where it tended to help the fortunes of high-education workers but hurt the fortunes of low-education workers.

While both the new globalisation and the new automation is likely to affect the workplace at the task level more than the occupation level, it is useful to look at which types of occupations have a high share of tasks that are vulnerable to globalisation, or to automation, or to both.

4.3 Which jobs are offshorable and automatable?

A couple of famous attempts have been made to classify occupations by teleworkability and automatability. Here we use the two most well-known efforts to classify jobs, namely Frey and Osborne (2013) for automation, and Dingel and Neiman (2020) for teleworkability. These were done on US data.

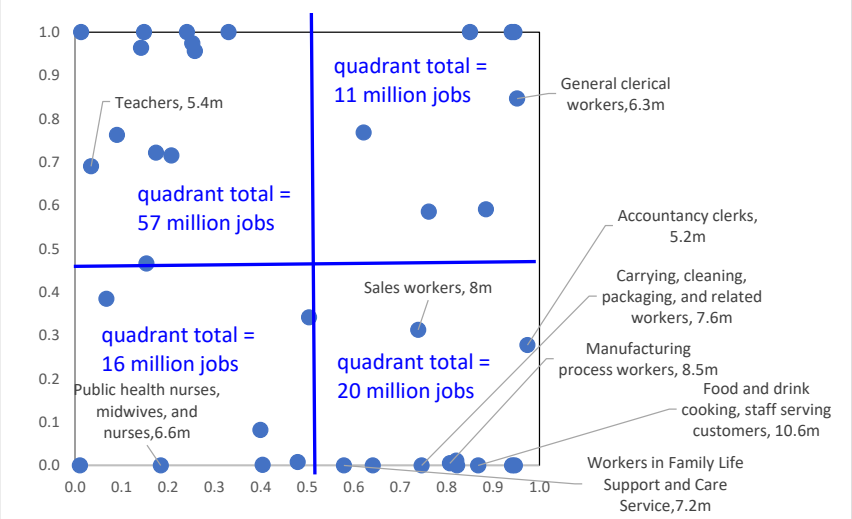
Following Baldwin and Okubo (2022), the data by occupation are presented in a scatter plot (Chart 14) to stress that jobs and thus prices are being affected by both globalisation and automation. The resulting 'globotics quadrant' places each occupation according to whether it is above or below average automatability (horizontal axis) and whether it is above or below average teleworkability (vertical axis). To reduce clutter, occupations are aggregated from the original 700+ Bureau of Labour Statistics categories of occupations into Japan's 37 occupations.

It would be too messy to label every point in the scatter plot but occupations that have at least 5 million workers are labelled in the chart. See Table 1 for a full list of occupations by quadrant.

Chart 14

Globotics quadrant for the US, occupations by automatability and teleworkability

(Horizontal axis is Automatability Score (0 to 1, Median=.503), Vertical axis is Teleworkable Score (0 to 1, Median=.466) units)



Sources: Author's elaboration of the globotics quadrant diagram first introduce by Baldwin and Okubo (2022).
Notes: Automatability score based on Frey and Osborne (2013); the teleworkability score is based on Dingel and Meiman (2020). Blue lines indicate median values of the normalised series. The US job categories used by these authors (over 700) are grouped together into Japan's NIRA categorisation of occupations, weighted by employment levels. See Table 1 for a list of occupations in each quadrant.

Table 1

Occupations by globotics quadrant

NW quad	Million jobs	NE quad	Million jobs	SW quad	Million jobs	SE quad	Million jobs
Workers in religion	0.1	General clerical workers	6.4	Food and drink cooking, staff serving customers	10.6	Public health nurses, midwives, and nurses	6.6
Teachers	5.4	Management, finance and insurance professionals	1.6	Manufacturing process workers	8.6	Security workers	2.8
Researchers	1.0	Manager of residential facilities and buildings	0.4	Sales workers	7.9	Medical Technology and Healthcare Professionals	1.8
Other specialist professionals	1.1	Office appliance operators	0.2	Carrying, cleaning, packaging, and related workers	7.6	Occupational health and hygiene service workers	1.8
Manufacturing engineers	1.4	Outdoor service workers	0.4	Workers in Family Life Support and Care Service	7.2	Professional social welfare workers	1.7
Management and business consultants	1.4	Sales clerks	1.3	Accountancy clerks	5.2	Manufacturing engineers	1.4
Legal Professionals	0.8	Transport and post clerical workers	0.5	Transport and machine operation workers	3.8	Other service workers	1.0
Data processing and communication engineers	4.6			Construction and mining workers	3.4	Doctors, dentists, veterinarians, and pharmacists	0.9
Authors, journalists, editors	0.2			Production-related clerical workers	1.1		
Artists, designers, photographers, film operators	0.6			Other service workers	1.0		
Architects, civil engineers and surveyor	0.6			Agriculture, forestry and fishery workers	0.5		
Administrative and managerial workers	2.5			Agriculture, forestry, and fishery engineers	0.0		
Total by quadrant	**19.8**		**10.7**		**57.0**		**17.9**

Sources: Baldwin and Okubo (2022),
Notes: See notes for Chart 14.

Observe that there are many occupations in all four quadrants. This means that there is no obvious correlation between automatability and teleworkability as would be the case if most occupations were in the northeast and southwest sectors. The

clustering of occupations with the lowest possible teleworkable scores but high automatable scores in the lower right corner is noteworthy. Examples include serving staff in restaurants, and cleaners. These non-teleworkable jobs will tend to be shielded from international wage competition but will find competition for at least some tasks from automation. There is a second clustering of occupations at the other end, namely highly teleworkable but not very automatable in the top left corner. Examples include workers in religion, civil engineers, and architects. These are likely to see heightened competition from telemigrants when it come to at least some of the tasks they perform today.

The northwest quadrant – which lists occupations that are above average teleworkable but below average automatable – is the most populated. The number of US workers with such occupations adds up to 57 million. The second biggest in terms of jobs is the southwest quadrant with 20 million. These jobs are above average automatable but below average teleworkable. The occupations here include food and drink staff servicing customers, workers in family life support, and manufacturing process workers. The two on-diagonal quadrants – which list occupations that are below-average prone to automatability and teleworkability (southwest) or above-average prone to automatability and teleworkability (northeast). The latter is the most vulnerable according to these rankings but there are only eleven million US workers with such jobs. The most shielded jobs are in the southwest corner. There are 16 million jobs in this quadrant.

The whole discussion up to this point has been background and preparation for the next section, namely what all these facts and arguments could mean for the functioning of the euro area macroeconomy in the medium term. Globalisation and automation affect the functioning of the euro area macroeconomy in many, many ways. Here I will focus only on the impact on the HICP.

5 Globotics and HICP developments

When it comes to the evolution of prices, the first thing to note is that goods and services' prices in the HICP behave very differently. This is important since services taken together accounted for about 45% of the HICP price basket in 2020, so the evolution of services' prices has a big impact on HICP headline inflation.

Over past decades, service prices have risen faster than goods prices but have been notably less variable (Chart 15). The service price sub-index rose by 44 points since 2001, while the goods price sub-index rose by only 34 points (left panel). Disaggregated data (not shown) tells us that this faster service inflation was strongest in the low-income euro area members like Estonia, Latvia, and Lithuania.

The observed difference in the trend inflation rate of goods versus services is very much in line with a well-known stylised fact called the Balassa-Samuelson effect. It is typically thought of as arising due to two other stylised facts, namely that productivity advances faster in goods than services, and services are less traded than goods. According to the Balassa-Samuelson mechanism, ongoing globalisation pulls

workers into the most productive (export) sectors with the result that wages rise economy-wide. As services are nontraded, labour-intensive and enjoy slower labour productivity growth, service prices rise faster than goods prices.

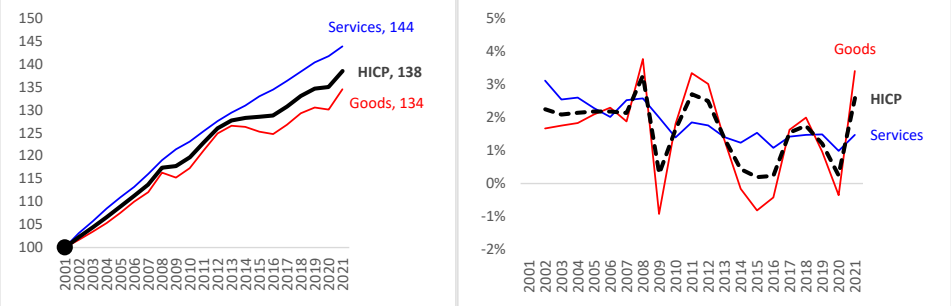
The right panel of the chart shows that services have played a stabilising role in annual inflation rate. For the last 20 years, service prices have been less volatile than goods prices. This outcome is surely related to the fact that the service prices in the HICP involve services that are nontraded and thus not subject to the vagaries of international price shocks in the same way goods prices are.

Chart 15

Euro area HICP index, levels and annual inflation rates, 2001-2021

Goods and services sub-indices of the HICP behave very differently; service prices have risen faster but with less volatility than goods prices since 2001

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



Sources: Author's elaboration of online Eurostat data.

A more detailed disaggregation of HICP elements contrasts the price evolution of industrial goods, energy, food, and services (Chart 16). Here we see that – since 2001 – both the food and energy prices have risen even faster than service prices, with industrial goods prices rising the least rapidly over the two-decade period. The twenty-year inflation rate for energy is 77%, while for food it is 52%. For services, the equivalent figure is 44%. Industrial goods prices – which were deeply affected by the changed nature of globalisation discussed in Section 3 – show the slowest rise with a twenty-year inflation rate of 26%. These twenty-year rises are unweighted. The overall HICP, which rose 38% over this period, is a weighted average of the sub-indices.

The right panel of Chart 16 displays the trends in the five major HICP sub-indices related to services. The standout item is services related to communication. The price of these services, which are directly linked to the rapid advance of digital technology, have fallen sharply over the last two decades. The rises in the other sub-indices are similar to each other and none of them is particularly volatile.

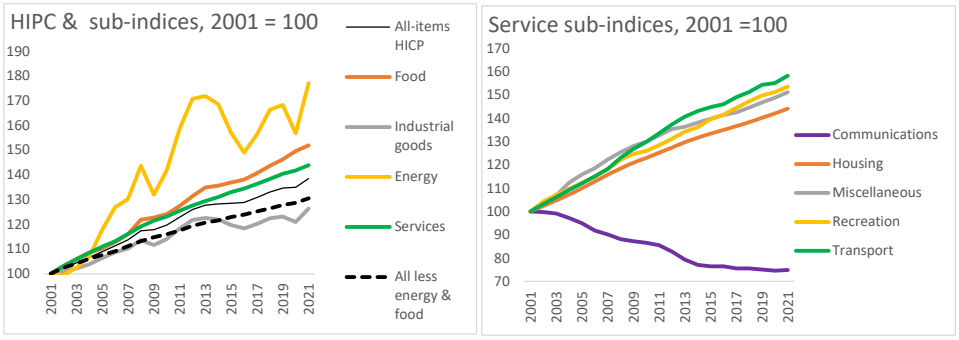
In terms of volatility, energy is the most variable since it is the most exposed to international demand and supply shocks. The standard deviation of the sub-index's annual inflation is 6.3% versus 0.9% for the HICP as a whole. Industrial goods and food are the next most volatile with standard deviations of 1.8% and 1.0% respectively. These volatility numbers are not shown in the chart.

Chart 16

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

Apart from communication services all service sub-indices rose faster than the all-items HIPC

(indices 2001 =100)



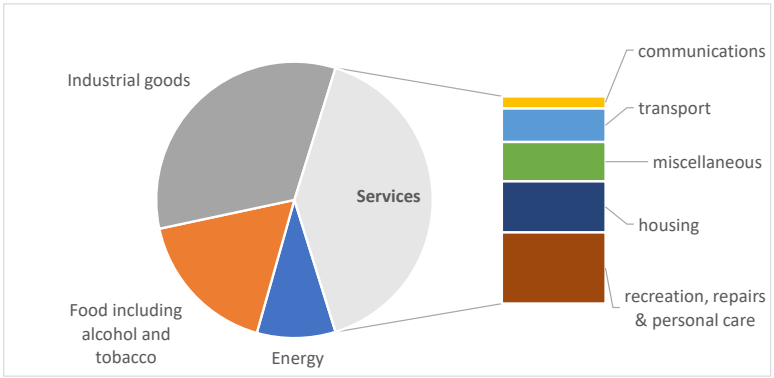
Sources: Author's elaboration of Eurostat online data.
Notes: Food refers to Food including alcohol and tobacco, and Services refers to Services (overall index excluding goods).

Chart 17

HICP weights for sub-indices with a focus on service sub-indices, 2019

Most services in the HICP index are non-tradable

(weights in HICP overall index)



Sources: Author's elaboration of Eurostat online data.
Notes: see notes for Chart 16.

The weights of the non-service aggregates are listed in Chart 17 along with the weights of the components of the services sub-index shown in the right panel of Chart 16. The most important fact here is that most of the HIPC weight on services is placed on services that are profoundly nontraded. No amount of digital technology or work-from-home software will make it possible to trade housing, local transportation, or local recreation, repair and personal care services. In the next section, I point to some economic mechanisms that could still create a link between deeper service sector globalisation and these nontraded service prices.

Having laid out the baseline facts, it was my intent when I started this paper to extend to trade in services the 'imported deflation' analyses that had been done in the 2000s for trade in goods. In particular, I thought I could simulate what impact an important increase in services globalisation and automation could have on the HICP in the medium term. Upon reflection, I believe that it is not possible without an extensive work programme.

The next sub-section explains the reasoning starting with a quick recap of the classic imported de-inflation analyses (e.g., Auer and Fischer 2010; for a review see Balatti et al 2021).

5.1 The goods-based 'Globalisation of Inflation Hypothesis'

During the offshoring-expansion phase, say 1999 to 2014 as per Chart 7, many analysts presented evidence showing that inflation became less sensitive to domestic cyclical conditions and more sensitive to global factors. The studies include Borio and Filardo (2007), White (2008), BIS (2014, 2015). See Forbes (2019) for a recent re-evaluation of the findings.

The set of empirical findings came to be known as the 'globalisation of inflation hypothesis' (GIH). The received empirical judgement that emerged held that competition from imported manufactured goods held down inflation modestly but the simultaneous commodity supercycle drove up commodity prices leading to imported inflation that largely offset the imported deflation effect. Forbes (2019) finds that the GIH does not work for wages which are a key determinant of service prices given how labour-intensive they are.

Many of the GIH studies approached the mechanism along Phillips Curve lines, namely the linkages between domestic inflation and global versus domestic demand slack variables (IMF, 2016b, ECB 2021a). While there is less consensus on the empirical importance of this mechanism, ECB Executive Board member Professor Isabel Schnabel recently concluded that, "global economic slack matters for domestic underlying inflation and that globalisation may have lowered the sensitivity of inflation to domestic slack, that is the slope of the Phillips curve … a failure to properly account for them may result in significant forecasting errors … the pandemic, and more recently Russia's invasion of Ukraine, are providing tangible evidence in favour of the second hypothesis [the GIH] " (Schnabel 2022).

Many other GIH studies estimate the total impact of imports from low-wage nations on domestic prices using instrumental variables. Still others take a 'decomposition approach' that starts from the role of imported prices in a price index such as the HICP. Here I will focus only on the latter approach as it is the most direct, most transparent way to demonstrate my key point – that the impact of services trade on inflation dynamics is a matter that requires much more research.

5.1.1 An accounting decomposition: goods trade and domestic inflation

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

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

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

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

where Δ stands for change, and $\%\Delta$ for percent change. In the expression, $\%\Delta P$, is the headline inflation rate. The first two terms on the righthand side tell us that overall inflation is the weighted average of the inflation of the two component prices (domestic prices P_{dom} and import prices P_{imp}). The third term is the share-change effect; shifting expenditure, via $\Delta\mu$, slows inflation if import prices are below domestic prices.

This accounting decomposition points to two mechanical links between globalisation and inflation. First, the direct impact of imported final goods prices. If import prices rise slower than domestic prices (i.e., $\%\Delta P_{imp} - \%\Delta P_{dom}$ is negative), we can say that imports are slowing domestic inflation. Second, if import prices are lower than domestic prices (i.e., $P_{imp} - P_{dom}$ is negative) then a rise in the expenditure share on imports (i.e., $\Delta\mu$ is positive) will pull down the domestic inflation rate. A third indirect link can arise if competition from imports affects the determinants (e.g., wages and markups) of domestic price inflation.

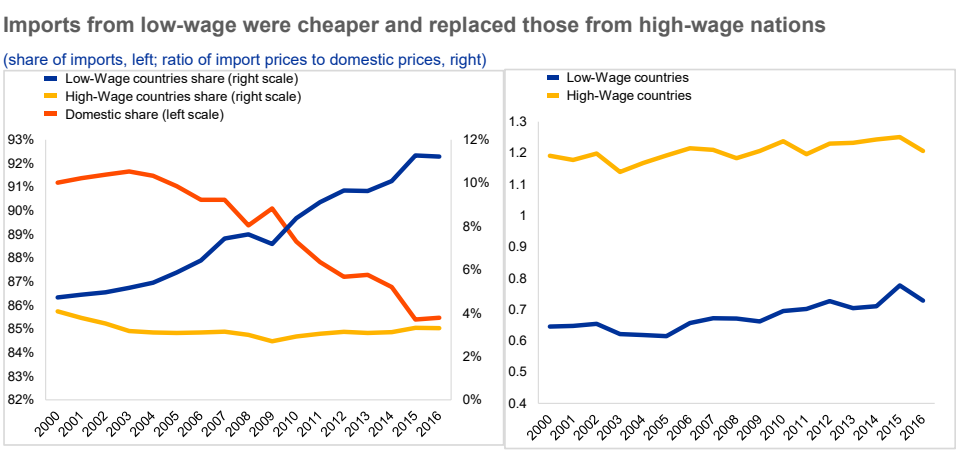
Carluccio et al (2018) implement this approach focusing on France and distinguishing between imported goods from high-wage and low-wage nations. They show that the share-change channel did contribute to lower HICP inflation since expenditure shifted from domestic goods to goods imported from low-wage countries (left panel of Chart 18), and the price of imports from low-wage nations were substantially lower than goods made inside the euro area nations (right panel). The right panel, however, indicates that the direct impact was small since the ratio of prices from low-wage nations rose faster that EA prices (i.e., the ratio of prices was rising in this period).

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

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

Chart 18

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



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

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

5.1.2 Many HICP services are intrinsically nontraded and hard to price

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

Only a few of the services in the HICP are clearly traded. The HICP categories are not designed to distinguish between goods and services, but Eurostat publishes an HICP sub-index for “services (overall index excluding goods)”, and five sub-indices (see Chart 17). These service sub-indices are quite aggregate but plainly illustrate the inherent non-tradability of many of the services in the HICP. Most of the services related to communication are tradable, but most of them related to housing are not. But how do we move beyond this ‘eyeballing’ approach to tradability?

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

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

Critically, the absence of a customs declaration obviates the usual source of trade price data. The customs form asks for the value of the shipment and for the quantity in the shipment. Often the quantity is listed in kilograms or units, say the number of flat-panel TVs. Dividing the value by the quantity yields a price-like thing called the unit value index. Most service transactions, however, are not associated with a quantity measure and so the unit value calculation is impossible. The other way of gathering service trade statistics is enterprise surveys but these too fail to ask for quantities as well as values. Indeed, it is not clear how one would define quantity in this setting. The notion of quantity is much harder to define for services than it is for goods since services tend to be customised and bundled.

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

While these are domestic prices rather than traded prices, bilateral gaps between different nations' domestic service prices could be used as a proxy, or as an instrument for gaps between domestic and import prices as in equation (2). Using bilateral weights from official trade in services data, one could define a surrogate for a nation's import service prices.

5.2 Mapping white-collar robots and telemigrants into HICP prices

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

When it comes to services, the data gathering and empirical analyses have focused on occupations or tasks – not products. The globotics quadrant, for example, is presented in 'jobs space' since it reflects concerns about automatability and offshorability at the level of occupations. This is standard in the future of work literature (OECD 2021), along with an alternative focus on 'task space' (i.e.,

automatability and offshorability of particular tasks rather than whole jobs). As argued, the explosive pace of digital technology will expose the various jobs to rapid enhancement, transformation, or replacement. The standard concern in this literature is the number of jobs created or lost. There will, however, be price considerations as well.

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

Mapping the impact of globotics on occupations to its impact on prices will require detailed knowledge of the intensity of various occupations in the production of the goods and services in the HICP. For example, the HICP sub-index for 'out-patient medical services' includes prices for nine sub-categories. Two of these are 'dental services', and 'services of medical analysis laboratories and X-ray centres.' The work programme would establish a mapping between occupations/tasks and HICP elements. That is, it would identify which occupations are used in the production of these services and with what level of intensity. The result would be a matrix with occupations in the rows and HICP items in the columns where the elements reflect the relative importance of each occupation for each HICP item. This is far from impossible but it will require an extensive effort.

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

5.2.1 Impact via wage formation

The rapid expansion of cheap imported goods from 1990 to the late 2000s had a measurable dampening effect on wage rises in G7 nations (Autor et al 2013). This channel may also turn out to be important when it comes to the imports of services from low-wage nations. The salient point here is that about three quarters of Europeans work in service sectors. Not all of these sectors are open to import competition, but many are. Others, as Chart 14 showed, are also subject to automation. Those sectors will be subject to downward pressures on unit labour costs as service imports from low-wage nations multiply in coming years and the abilities of white-collar robots advance.

Thinking hard about quantifying this mechanism probably should also be part of the research programme I am outlining. Ultimately the empirical task would be to

measure whether the historical expansion of the imports and exports of services had had an impact on wage formation in the euro area. Such an empirical investigation will be inhibited by the poor state of services trade data, and the lack of a mapping between domestic occupations and services trade categories.

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

A second approach would be shift-share instrumenting. The potential exposure of occupations would be defined using the indicators that predicted which occupations are teleworkable as in Dingel and Neiman (2020). An alternative 'vulnerability to the shock' proxy could be based on actual data on how many workers in the various occupations actually worked from home during the pandemic. The overall shock would be based on the rapid growth in service import aggregated to a level that could match aggregates of occupations. Both approaches would probably require many months of data preparation and matching.

6 Conclusions and future research

The definition of globalisation used by economic historians to establish the starting date for modern globalisation rests firmly on the co-movement of international and domestic prices (O'Rourke and Williamson, 2002). The thinking is guided by two theoretical extremes. In a fully open small economy, domestic prices are entirely unrelated to local supply and demand, while in a fully autarkic economy, domestic prices have nothing to do with international factors. With these extremes in mind, it is natural to think of globalisation as shifting the economy towards a price-setting process that is ever less dependent on domestic supply and demand conditions and ever more dependent on international factors.

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

The importance of trade in HICP developments could shift radically if the service sectors became as globalised in the future as the manufacturing sectors are today. Opening sectors that employ almost 75% of the workers is likely to have much larger

effects than we saw from the opening of goods sectors over the past 25 years. This is why my conjecture – that the future of trade is in intermediate services – should matter to central banks.

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

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

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

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

Such a work programme would likely yield a high reward in the medium term. The argument is straightforward. Central bank policy is premised on the functioning of the local macroeconomy. The functioning of the macroeconomy is influenced by globalisation and automation. Since globalisation and automation are changing – in my view shifting rapidly towards services – it is likely that the functioning of the local macroeconomy will also shift. Without much better data, the nature of the shift will be impossible to pin down.

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