

Trade and inequality in Europe and the US

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Executive summary

- **The last four decades saw rapid growth in global merchandise trade, an extraordinary increase in the importance of low-income countries in world trade, growing trade imbalances across exporting and importing countries, and the growth of global value chains.** All of these changes were most evident in the 1990s and 2000s and have slowed since the financial crisis. A common factor contributing to these patterns was the emergence of China as an exporting powerhouse.
- **Evidence from Europe and the United States shows that trade has increased inequality not just between workers of different skill levels, but also between those of different industries and those of different geographic regions.** Growing import competition from China caused declines in both employment and wages for workers in trade-exposed industries and locations. Increases in offshoring and in exports were associated with employment and wage gains for at least some workers.
- **Manufacturing employment declined the most in countries that experienced a rising trade deficit in their goods exchange with China.** While a rapid increase in imports from China was pervasive across high-income countries, there was much greater international heterogeneity in exports to China. Countries such as Germany and Switzerland strongly expanded exports to China and experienced little decline in domestic manufacturing employment, while the number of manufacturing jobs sharply contracted in countries such as the UK and the US where exports to China lagged behind imports.
- **We provide new evidence on the impact of Chinese import competition on consumer prices in the UK.** While consumers benefit from lower prices thanks to increased trade, these benefits are comparably large for low-income and high-income households.
- **Growing import competition and its adverse labour market impacts have also been connected to a range of social problems and measures of discontent.** Regions with greater exposure to import competition experienced higher crime rates, a deterioration of health outcomes, a dissolution of traditional family structures, and greater support for far-right political parties. We present evidence that attitudes towards international trade in the general population were deteriorating in the 2000s, but have rebounded over the last decade.
- **New import tariffs such as those imposed by the US in 2018 and 2019 are unlikely to help the losers from globalisation.** Instead, displaced workers may be supported by a combination of transfers that avert financial hardship, skills training that facilitates their reintegration into the labour market, and place-based policies that stimulate job creation in depressed locations.

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1. Introduction

Many economies in Western Europe have experienced a sizeable increase in income inequality since the 1980s, and inequality has grown even more rapidly in the United States. Whereas educated workers in skilled occupations benefited from rising salaries, wages have stagnated for many less educated workers in unskilled occupations. The rising inequality in advanced economies coincided with a period of globalisation that was characterised by rapid growth in international merchandise trade.

Basic economic models predict that trade could contribute to greater inequality in skill-abundant advanced economies, as globalisation leads such countries to specialise in skill-intensive industrial sectors, which raises labour demand for skilled workers but reduces demand for unskilled ones. Yet despite this theoretical link between trade and inequality, empirical analyses long concluded that increased trade was not a major cause of increasing inequality in advanced economies. However, this perspective on trade and inequality has evolved during the decade of the 2010s, as a growing body of empirical research found sizeable impacts of trade shocks on labour markets and inequality. During the same period, international trade has become a more contentious subject in political debate, and a many-decades-old trend towards greater trade liberalisation has been broken by new tariffs that resulted in a 'trade war' between the US and China.

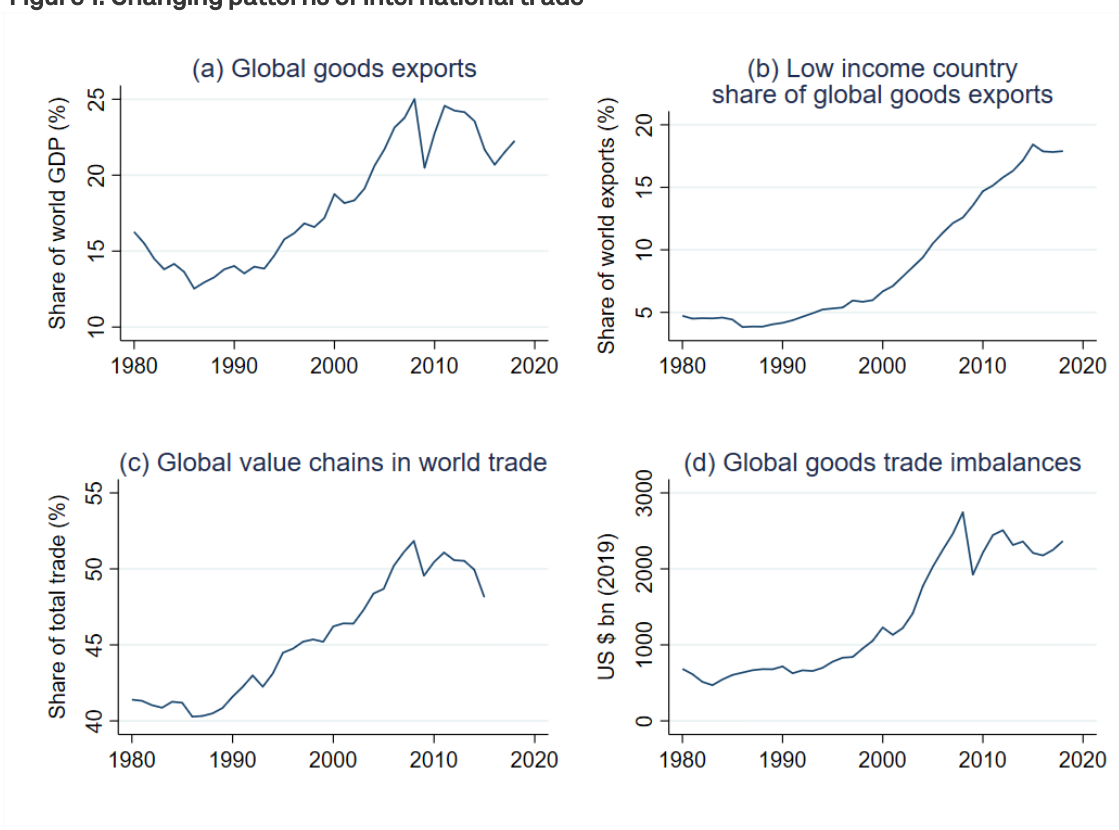
We begin this chapter by describing the remarkable changes in patterns of international trade that have taken place over the last four decades (Section 2), and the contemporaneous conceptual advances in the economic analysis of trade's impact on the labour market and inequality (Section 3). We next discuss recent evidence on the impact of trade on labour markets (Section 4) and consumer prices (Section 5) in advanced economies. The following sections discuss broader implications of adverse trade shocks, including their social and political repercussions (Section 6), as well as options for public policies that seek to support globalisation's losers (Section 7). We conclude with a discussion of our findings (Section 8).

2. Changing patterns of international trade

We begin by documenting four salient patterns of change in international goods trade that have taken place since 1980. These patterns help in understanding the context and focus of recent empirical analyses of trade's impact on labour markets and inequality.

Pattern 1: Rising world trade in goods. The last four decades have witnessed a large increase in worldwide merchandise trade, whose value grew from \$740 billion in 1980 to \$19 trillion in 2018.² The annual value of goods traded across national boundaries increased considerably faster than worldwide GDP. Panel a of Figure 1 shows that the ratio of world exports to world GDP grew from 16.3% in 1980 to 22.3% in 2018. However, that increase was unevenly distributed over the last four decades. The export-to-GDP ratio actually declined during both the 1980s and the 2010s, and all of the overall expansion occurred in the two intermittent decades of the 1990s and 2000s. During that period, worldwide exports rose rapidly from 13.8% of world GDP in 1993 to 25.0% in 2008.

² World Bank (2021). Figures are in 2019 dollars, and deflated with the US GDP deflator. Throughout this chapter, we focus on trade in goods rather than services. Goods trade accounts for about three-quarters of OECD countries' international trade, and it tends to be better measured and more widely studied than services trade.

Figure 1. Changing patterns of international trade

Source: Panels a and b are based on data from World Bank (2021). The World Bank defined low-income countries as those that had a per-capita gross national income (GNI) less than \$480 in 1987. Countries that did not exist in 1987 or were not in the data in 1987 were assigned their World Bank income designation for their first available year. Panel c is figure 1.2 in World Bank (2019). The GVC share measures the share of world exports that flow across at least two borders. Panel d is based on data from International Monetary Fund (2021a). It shows the total goods trade deficits of all countries whose trade balance in goods was negative in a given year. Dollar values are deflated to \$2019 with the US GDP deflator.

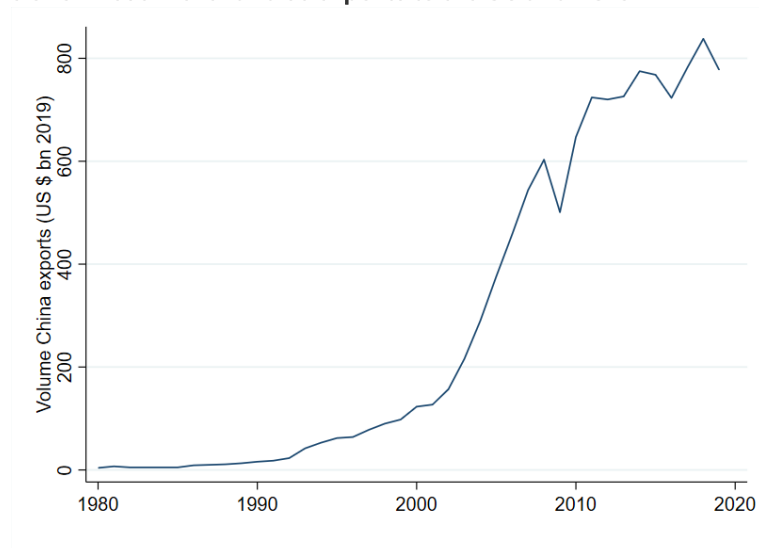
Pattern 2: Rising share of low-income countries in world exports. The expansion in trade's overall volume coincided with remarkable changes in the composition of trade flows. One of these changes was the rising importance of goods exports from low-income countries. Panel b of Figure 1 shows that these countries, which had per-capita annual incomes below \$480 in 1987, accounted for a mere 3–5% of world exports during the 1980s. The low-income country contribution to world exports slowly increased during the subsequent decade, from 4.2% in 1990 to 6.7% in 2000. In the following 15 years, low-income countries rapidly rose to prominence as exporters of goods, and their share of global exports nearly tripled to 18.4% in 2015, before levelling off in the most recent years.

Pattern 3: Rising share of global value chains in world trade. Another important change in the composition of world trade comes from the rising importance of global value chains (GVCs), where different stages of production take place in different countries. One measure of this international segmentation of production is the amount of trade that crosses borders multiple times because a country's exports embody inputs sourced from abroad. Panel c of Figure 1 indicates that the fraction of trade associated with GVCs rose from 41.4% in 1980 to 48.1% in 2015, the last year covered in the underlying World Bank (2019) data series. As with the global export-to-GDP ratio, this growth was concentrated in the middle two decades. The GVC share of world trade grew from 41.6% in 1990 to a peak of 51.8% in 2008, and has declined slightly since.

Pattern 4: Growing trade imbalances. While overall goods trade grew and changed in composition, some countries increasingly specialised as manufacturing hubs whose exports exceeded their goods imports. These countries therefore experienced a growth in their trade surpluses. Other countries instead expanded their imports by much more than their exports, and thus realised large trade deficits. Panel d of Figure 1 shows the combined value of the goods trade deficits of all countries whose trade balance in goods was negative in a given year. Echoing the time pattern of the previous figures, the aggregate trade deficit changed little between 1980 (\$685 billion) and 1990 (\$717 billion), but then expanded rapidly, reaching values of \$1,230 billion in 2000 and \$2,745 billion in 2008, before stabilising at somewhat lower levels.³

The four patterns of rising world trade, a greater share of world exports accounted for by low-income countries, a growing prominence of trade within global value chains, and larger global trade imbalances all have an obvious common characteristic: most or all of these changes in patterns of international trade took place between the early 1990s and the 2008 financial crisis. During the preceding decade of the 1980s and the subsequent decade of the 2010s, the volume, composition and balance of trade were considerably more stable.

Figure 2. Volume of Chinese merchandise exports to the US and EU15



Source: International Monetary Fund (2021a). Dollar values are deflated to \$2019 with the US GDP deflator.

What sparked the remarkable change in trade patterns during the 1990s and 2000s? One major contributing factor is the transition of most communist countries towards a market-oriented economic system during this period, which unleashed an enormous potential for growing participation in international trade. In Europe, the fall of the Iron Curtain in 1989 spurred a rapid increase in trade between Western European countries and their formerly communist eastern neighbours. The annual volume of Germany's imports from Eastern European countries grew by more than 800% over the two decades from 1988 to 2008 (Dauth, Findeisen and Suedekum, 2014).⁴ At a global level, however, the most important transformation was not the opening of

³ While some major deficit countries, notably the US and the UK, operate a surplus in services trade, these are not large enough to offset their substantial deficits in goods trade. In the US in 2019, the surplus on services trade was only \$285 billion compared with a goods trade deficit of \$862 billion. Service exports are more significant in the UK, but the surplus on services trade (at \$132 billion) still fell short of offsetting the deficit in goods trade (£167 billion) (International Monetary Fund, 2021b).

⁴ The integration of Eastern European countries into the European Union also led to important migration flows in Europe, which are discussed in Dorn and Zweimüller (2021).

Eastern Europe to international trade, but the dramatic economic expansion of the world's most populous country, China. As Figure 2 shows, Chinese merchandise exports to the US and EU15 countries (including the UK) grew from just \$4 billion in 1980 to \$777 billion in 2019 – an astonishing 194-fold increase. Chinese worldwide exports reached \$2.4 trillion in 2019, making it the world's largest goods exporter.

China's rapid expansion had an important impact on all four of the global trade patterns shown in Figure 1. During the 1990s and 2000s, China was the largest contributor to the worldwide growth in exports-to-GDP, as well as the largest contributor to rising trade in global value chains.⁵ Appendix Figure A1 shows that China's share in worldwide goods exports grew from a mere 0.9% in 1980 to a high of 13.6% in 2015. Over the same period, other low-income countries' share in world exports rose only modestly from 3.8% in 1980 to 4.8% in 2015, implying that China alone was responsible for more than 90% of low-income countries' combined export growth over that period. Of the dramatic doubling of aggregate global goods trade imbalances between the years 2001 and 2008, one-fifth was due to the astonishing growth in China's surplus. Much of this was accounted for by the growth in bilateral imbalances with the US. In 2018, the bilateral US–China deficit accounted for 18% of global goods trade imbalances, while the US goods trade deficit with China accounted for 48% of the total US trade deficit. The UK's deficit with China accounted for 19% of its total deficit in the same year.

China's rise followed several decades of poor economic performance during the Maoist era, which kept China well inside its production frontier and generated abundant potential for later catch-up growth. Much of that growth was realised during the two decades of the 1990s and 2000s, as China transitioned from an economy with strong central planning and little foreign trade to a market-oriented economy with a sizeable private sector and vibrant trade. China's market opening allowed for a dramatic rise in productivity, with output per worker in manufacturing rising at an annual rate of 8% from 1998 to 2007 (Brandt, Van Biesebroeck and Zhang, 2012). As productivity in China surged, manufacturing industries in Europe, North America and elsewhere were increasingly confronted with a 'China shock' of rapidly rising import competition by Chinese manufacturers (Autor, Dorn and Hanson, 2016). However, the growth of Chinese manufacturing exports slowed considerably towards the end of the 2000s. By this time, China had arguably realised much of the catch-up growth that was enabled by its earlier economic reforms. Moreover, the industrial planning of the Chinese government gave state-owned enterprises an increased prominence again, and China's productivity growth slowed down considerably from 2009 onwards (Brandt et al., 2020).

China's prominent contribution to changing patterns of world trade during the globalisation wave of the 1990s and 2000s explains why many recent empirical analyses of trade's impact on inequality in Europe and the US focus on the 'China shock'. However, the one-time event of the former communist bloc's integration into the worldwide market economy and international trade systems also coincided with important declines in trade and communication costs, which further contributed to the expansion of world trade.

The rapid improvement of computer technology and in particular the spread of the internet facilitated communication even over long distances. Malgouyres, Mayer and Mazet-Sonilhac (2021) show that French firms expanded their international goods imports by 25% once their geographic location got access to broadband internet between 1997 and 2007. Furthermore, the

⁵ While Germany and the US had leading roles in contributing to the rising fragmentation of GVCs, China's contribution to the expansion of GVCs came primarily from a scale effect where its share in GVC trade grew as its share in overall trade expanded (World Bank, 2019).

increased use of computer-aided design and manufacturing facilitated offshoring, as it became easier for firms to transmit exact production specifications to suppliers abroad (Fort, 2017). Technological improvements also contributed to a gradual decline in the costs of international air and sea freight shipping during the 1990s and 2000s (Hummels, 2007).

The 1990s and 2000s also witnessed a continued decline in global tariff rates. The worldwide average tariff for goods shipments declined from 13.6% in 1986 to 7.5% in 2008 (Antràs, 2020). This period covers the establishment of the World Trade Organization (WTO) in 1995, and the creation of new regional free-trade zones such as in South America (Mercosur in 1991), Southeast Asia (ASEAN Free Trade Area in 1992) and North America (NAFTA in 1994).

The global decline in tariffs resulted primarily from a reduction of tariff rates applied by developing countries. The average tariff applied by developed countries, which had already fallen to 6.2% by 1990, declined only a little further to 3.8% by 2016 (World Bank, 2019). As a consequence, the rapid growth of imports from China into Europe and the US was arguably not primarily a consequence of trade policy.⁶ However, both Western Europe and the US were involved in the expansion or creation of their own regional free-trade zones. The European Union (EU) negotiated association agreements with various Eastern European countries during the 1990s, whose provisions included reductions in tariff rates. These so-called 'Europe Agreements' were followed by the admission of eight Eastern European countries into the EU in 2004. The economic integration between Europe's east and west was characterised by rapidly growing Eastern European exports to the west, and rising Western European investment in the east (Barysch, 2006). In North America, the 1994 NAFTA treaty between Canada, the US and Mexico facilitated trade between the higher-income countries Canada and the US and their substantially poorer southern neighbour Mexico.

3. Conceptual advances in analysing the labour market impacts of trade

The classical textbook model in economics that links trade to labour market inequality is the Heckscher–Ohlin factor proportions model (Heckscher, 1919; Ohlin, 1933), whose implications for inequality were studied by Stolper and Samuelson (1941). The Stolper–Samuelson theorem posits that a reduction in the relative price of low-skill intensive products will lower the real wage of unskilled workers but raise the real wage of high-skilled workers. A country in Europe or North America with a relatively well-educated workforce would thus experience rising wage inequality following trade integration with developing countries, where a relative abundance of unskilled labour allows for cheaper production of low-skill intensive products.

While this theoretical link between trade and inequality had long been known, empirical research connecting trade to the labour market gained momentum in the 1990s, when economists debated the causes of the rapidly rising wage differential between college-educated and high-school-educated workers in the US and elsewhere. Empirical studies soon confirmed that international trade did contribute to the rising skill premium in advanced economies, but also

⁶ In 2000, the US granted China the status of Permanent Normal Trade Relations, after which the tariff rates applied to Chinese goods were no longer subject to annual re-approval by US Congress. While this policy change did not directly affect tariff rates, it reduced the threat of a later tariff hike (Pierce and Schott, 2016; Handley and Limão, 2017). As we show in the last subsection of Section 4, Chinese exports to the US accelerated notably after 2000, but so did Chinese exports to the EU. Beyond tariffs, one important sectorial policy change was the phase-out of the Multifibre Arrangement, through which the EU and the US had protected their domestic apparel and textile industries from foreign competition. The phase-out of that policy by 2005 led to a large spike in imports of Chinese apparel and textiles (e.g. Harrigan and Barrows, 2009; Khandelwal, Schott and Wei, 2013; Utar, 2014).

found that the magnitude of trade's labour market effect was modest. Krugman (1995) noted that 'a preponderance of the research to date suggests that the impact of third world exports on first world labour markets has been small, or at least elusive'. Indeed, the academic debate about the causes of rising income inequality increasingly rejected trade as a major influence and, according to Wood (2018a), 'by the year 2000, the debate was over. Most economists joined a consensus that the main explanation [for rising income inequality] was skill-biased technological change'.⁷

There was also reason to expect that the impact of low-income country imports on inequality in high-income countries may become even smaller in future years. While Wood (1995) argued that much of the contemporaneous literature underestimated the extent to which unskilled workers in developed countries had been hurt by imports from developing countries, he also noted that 'I do not expect unskilled workers in developed countries to be much hurt by even major new entry into the world market for low-skill-intensive manufactures, simply because these goods are no longer produced in developed countries. The entry of China and India, pushing down the world prices of these goods, will benefit developed-country workers, skilled and unskilled alike'. The increasingly widespread notion that trade has small and perhaps even declining effects on the labour market reduced scholarly interest in the topic after the 1990s. The JEL classification code F16 for 'Trade and Labor Market Interactions', which was introduced towards the end of that decade, was present on 19% of the articles that the *American Economic Review* published in the field of international trade during the years 1998–2000, but only on 9% of the trade papers published in 2001–10.

One intuitive candidate explanation for the small impact of trade on wage inequality in early empirical studies is their reliance on data from the 1980s and early 1990s, a period when both overall trade and exports by low-income countries barely increased (see panels a and b in Figure 1 above).⁸ The view that trade had little consequence in the labour market took hold precisely at a time when patterns of trade had started to change rapidly. By the late 2000s, Krugman (2008) warned that 'the consensus that trade has only modest effects on inequality rests on relatively old data'.

However, updating earlier calculations with newer data did not change the conclusions regarding trade's impact on inequality. Irwin (2008) notes that a simple factor proportions model proposed by Krugman (1995), which explained 11% of the rise in the US skill premium from 1979 to 1992, still only explained 11% of the growing skill premium when Bivens (2007) extended the underlying data to cover the years 1979 to 2005. Edwards and Lawrence's (2010) analysis of goods prices and wages in the US concluded that 'US imports from developing countries mandated no change in US wage inequality from 1993 to 2006' and that 'fears of rising US wage inequality from developing-country imports in recent years are unwarranted'. They argued that there was little substitutability between the goods produced in the US and those produced in

⁷ Trade and technology are not entirely separate explanations for rising income inequality, since both can facilitate each other. For instance, trade can play a part in incentivising skill-biased technological change. Acemoglu (2003) found that incorporating endogenous technological change into a model of international trade doubled estimates of the impact of trade on the skill premium between 1980 and 1995. However, trade still accounted for only a fifth of the overall growth of the skill premium.

⁸ Leamer (1996) contended that trade volumes should be of little relevance when analysing the Heckscher–Ohlin model since it relates wages to the prices rather than the quantities of traded goods. However, other authors argued that trade volumes are relevant for the quantification of counterfactuals in a Heckscher–Ohlin setting (e.g. Krugman, 1995), or they used trade volumes directly to analyse trade's impact on the labour market by measuring the labour content embodied in traded goods (e.g. Wood, 1994; Borjas et al., 1997).

developing countries, such that greater imports from low-income countries did not create substantial competitive pressure for US manufacturers.

The consensus that trade had little impact on inequality was eventually challenged not primarily by newer data, but by the use of new theoretical and empirical approaches for the investigation of trade's labour market impacts. Dissatisfaction with several poor empirical properties of the Heckscher–Ohlin model led to the development of new theoretical models that linked trade and labour, including ones that integrated labour market frictions such as costly job matching, nominal wage rigidity, or costly mobility of workers across industries and geographic regions (see Helpman (2018) for a detailed literature review). The assumption of labour market frictions sharply contrasts with the costless worker mobility of the Heckscher–Ohlin model, which ensures that any wage difference across sectors among workers of the same education level would immediately be equilibrated through sectorial mobility. By contrast, models with costly mobility allow for wage differences across sectors or geographic regions to persist at least transitionally.⁹

Guided by the Heckscher–Ohlin model, empirical research on trade's labour market impact long measured inequality as the wage difference between workers of different skill levels. The wage premium of college-educated versus high-school-educated workers provided a convenient and easily measurable metric of inequality. However, according to Wood's (2018b) (self-)critical assessment of the 1990s literature, 'people's visions of reality were blinkered by HO theory', which led other margins of inequality to be overlooked. Based on the explicit or implicit assumption of frictional labour markets, more recent empirical work instead investigates how labour markets adjust to trade shocks not only through wage changes, but also through changes in employment and unemployment. Moreover, frictional labour markets allow for inequality to emerge not only between the workers of different education levels, but also between workers of different industries and between those of different geographic regions. As a consequence, our review of empirical findings in Section 4 does not seek to explain a single metric of inequality, but instead discusses the impact of trade on multiple margins of inequality.

To estimate causal impacts of trade shocks on the labour market, the empirical literature increasingly draws on quasi-experimental identification techniques that are widely used in labour economics. The assumption of exogenous trade shocks to a country is arguably most plausible when these shocks originate outside the country – for instance, due to economic reforms implemented by an important trading partner that improve the partner's productivity or lower its trade costs. Autor, Dorn and Hanson (2013a and 2016) argue that China's reform-driven economic expansion presented a major export supply shock to the US and other advanced economies. To isolate the component of Chinese export growth that most plausibly results from China's rising comparative advantage in specific industries, they instrument for US imports from China with China's exports to other high-income countries (thus purging variation in US imports that results from US-specific demand shocks), or alternatively estimate China's changing comparative advantage directly from a gravity regression model of trade. Dauth, Findeisen and Suedekum (2014) similarly argue that the fall of the Iron Curtain in Europe and the transition of Eastern European countries to market-based economies during the 1990s created a trade shock for countries in Western Europe such as Germany.

Instead of analysing trade shocks that resulted from a bundle of political and economic reforms in transition economies, other research estimates causal effects of trade shocks based on a

⁹ Trade shocks also have a larger impact on the average wage differential between skilled and unskilled workers when labour market frictions hinder the reallocation of workers towards sectors with rising labour demand (Burststein and Vogel, 2017).

single trade policy reform, including reforms originating in the country whose labour market outcomes are the object of interest. Well-studied episodes of trade policy reform include large import tariff reductions in emerging economies such as Brazil (e.g. Kovak, 2013; Dix-Carneiro and Kovak, 2017; Helpman et al., 2017) or India (e.g. Topalova, 2010) during the early 1990s, the reduction of trade policy uncertainty following the US's decision to grant Permanent Normal Trade Relations to China in 2000 (Pierce and Schott, 2016; Handley and Limão, 2017), the phase-out of textile import quotas in the EU and US under the Multifibre Arrangement in the early 2000s, and the US–China 'tariff war' in 2018 and 2019 (Flaaen and Pierce, 2020; Autor et al., 2021). A further approach to identify causal impacts of trade relies on large and persistent changes in exchange rates, such as the devaluation of the British pound following the Brexit referendum (e.g. Breinlich et al., 2019; Costa, Dhingra and Machin, 2019) or the appreciation of the Swiss franc following the removal of its peg to the euro in 2015 (Kaufmann and Renkin, 2017; Auer, Burstein and Lein, 2021).

Thanks to new theoretical and empirical approaches to the analysis of trade's labour market impacts, and the recognition that these impacts were larger than previously appreciated, interest in research on trade and labour rebounded during the 2010s. While the subject of 'Trade and Labor Market Interactions' accounted for 6 of the 65 publications on international trade that the *American Economic Review* published during the decade 2001–10, that contribution more than doubled to 15 of the 78 *AER* trade publications during the decade 2011–20.

4. Labour market impacts of trade during the 1990–2010 globalisation

We next discuss recent empirical evidence on the impact of trade on labour markets in Europe and the US.¹⁰ As we emphasised in Section 2, international trade expanded rapidly during the 1990–2010 period (panel a in Figure 1), and included a rising fraction of exports from low-income countries (panel b in Figure 1) that was due largely to the emergence of China as the world-leading exporter of manufactured goods. As a consequence, much recent literature has focused on the impact of import competition by China (and sometimes other emerging economies) on firms, workers and geographic regions in developed economies, which we study in the first two subsections below. The subsequent two subsections change the perspective from import competition to imports of intermediate products, and from developed countries' imports to their exports.

The impact of import competition on firms and workers

The enormous expansion of Chinese goods exports during the 1990s and 2000s created rapidly growing import competition for manufacturing firms in Europe and the US. Between 1991 and 2007, more than 90% of the manufacturing industries in countries such as Germany, Spain and the US faced rising imports from China.¹¹ However, the extent of that import competition varied substantially across industries, even within narrower manufacturing sectors such as textiles and apparel (Autor, Dorn and Hanson, 2016). Empirical research has used this cross-industry variation to measure the impact of import competition on manufacturing firms in Europe and the US.

¹⁰ For a survey of trade's impact on inequality in developing countries, see Pavcnik (2017).

¹¹ Autor, Dorn and Hanson (2016) match data on traded goods to a comprehensive set of 397 manufacturing industries that produce these goods. The nine developed countries covered by their data experienced rising imports from China in anywhere between 343 industries (Switzerland) and 385 industries (US).

Bloom, Draca and Van Reenen (2016) show that in a sample of firms from 12 European countries, those who operated in industries with larger growth of Chinese imports between 1995 and 2017 experienced falling employment and a greater likelihood of firm exit, with more adverse effects in less innovative firms. Several studies from individual European countries confirm that Chinese import competition reduced firms' employment growth and probability of survival (e.g. Mion and Zhu (2013) for Belgium, Branstetter et al. (2019) for Portugal and De Lyon and Pessoa (2020) for the UK). These European results echo early findings from the US, where exposure to low-income country imports was associated with higher rates of plant exit during the 1977–97 period (Bernard, Jensen and Schott, 2006). From 1991 to 2007, Chinese import competition reduced sales, employment, capital stocks, and market valuations of publicly traded US firms (Autor, Dorn, Hanson, Pisano and Shu, 2020).¹²

The decline of import-competing firms could in principle affect inequality by shifting the distribution of income between the firms' capital owners and their workers. However, evidence on the impact of trade on inequality through changes in capital incomes is scarce since data on the incomes of capital owners are more limited than data for workers' earnings. Aghion et al. (2021) find that Chinese import competition reduced labour's income share in French manufacturing firms from 2000 to 2007, while Autor, Dorn, Katz, Patterson and Van Reenen (2020) observe no significant change in capital's and labour's income shares in import-competing US firms from 1992 to 2007, as firms' payrolls contracted by roughly the same proportion as their value added.¹³

The contraction of employment in import-competing industries and firms is of course fully consistent with the mechanisms of the Heckscher–Ohlin model. That model would also predict that the employees of contracting industries are not worse off than their peers in other sectors. Instead, workers who lose their jobs due to import competition should rapidly and costlessly move to other industries, such that wages equilibrate across industries for all workers of the same skill group. However, structural analyses of workers' industry choice reject the notion of costless worker mobility. A European study by Ashournia (2017) estimates that Danish workers who switch sectors face a one-time switching cost corresponding to 10–19% of their annual earnings. This switching cost substantially slows the labour market's adjustment to shocks. If a hypothetical trade shock permanently reduced manufacturing prices by 10%, then it would take nearly a decade before 90% of the induced worker mobility across industries were completed. Simulation results from Artuç, Chaudhuri and McLaren (2010) for the US similarly suggest that due to switching costs, it would take eight years to complete 95% of the sectorial adjustment mandated by a 30% tariff reduction. Dix-Carneiro (2014) emphasises that worker reallocation across industries following trade shocks will be slowed further if capital is imperfectly mobile. It is difficult to directly compare estimates of industry-switching costs across analyses from different countries, since such estimates are sensitive to many modelling assumptions such as unobserved worker heterogeneity that can partly explain industry choices. However, a pervasive insight is that there appear to be substantial industry mobility frictions which prevent workers from costlessly or rapidly moving across sectors following trade shocks. As a consequence, the

¹² Research on the impact of Chinese import competition on innovation in Europe initially found positive results (Bloom, Draca and Van Reenen, 2016), but more recent work shows an inconclusive picture (Campbell and Mau, 2019), while innovation effects in the US appear negative (Autor, Dorn, Hanson, Pisano and Shu, 2020). See Shu and Steinwender (2018) for a literature survey.

¹³ Over a longer period of 1992 to 2012, which spans the Great Recession, firms in import-competing sectors experienced a greater decline in value added than in payroll, and the Chinese import shock thus increased the labour income share.

workers of declining import-competing industries will obtain lower earnings than their peers in other sectors.¹⁴

The structural analyses of sectorial moving costs are complemented by reduced-form studies that trace the differential labour market trajectories of workers in response to the import competition shocks faced by the industries that initially employ them. Studying longitudinal worker data from the UK, De Lyon and Pessoa (2020) find that manufacturing workers were more likely to move across firms and industries if their initial industry was exposed to greater growth in Chinese import competition from 2000 to 2007. However, despite this increased mobility, workers from more import-exposed industries accumulated lower earnings. Comparing a manufacturing worker at the 75th percentile of Chinese import exposure with one at the 25th percentile, the former accumulated 3.1% lower annual earnings during the years 2000–07, conditional on pre-period earnings and other worker and industry characteristics. These UK estimates are remarkably close to US results by Autor et al. (2014), who find that a manufacturing worker at the 75th percentile of exposure to Chinese import competition accumulated 2.9% lower earnings per year between 1992 and 2007 compared with a worker at the 25th percentile of exposure. Other studies also find adverse impacts of Chinese import competition on the earnings trajectories of workers in Finland (Nilsson Hakkala and Huttunen, 2016), and of imports from Eastern Europe and China on the earnings of workers in Germany (Dauth, Findeisen and Suedekum, 2021).¹⁵

These results indicate that trade shocks can create earnings differentials between workers who have similar skill levels but are employed in industries with different trade exposure. However, the reduced-form estimates additionally show that the earnings effects of import competition are considerably more adverse for workers from lower income strata. Both De Lyon and Pessoa (2020) and Autor et al. (2014) classify workers into three income terciles based on their position in the earnings distribution of workers with the same birth year that was observed prior to the outcome period.¹⁶ In both the UK and the US, the proportional loss in annual earnings as a result of a unit import competition shock is more than 60% larger for workers in the bottom earnings tercile than for those in the middle tercile. The workers who initially belong to the highest-paid tercile of their birth cohort suffer the smallest earnings loss.¹⁷ These results are also consistent with findings by Utar (2018), who studied the 2002–10 adjustment of workers from the Danish textile sector to the phase-out of import quotas under the Multifibre Arrangement. She finds sharp declines both in cumulative earnings and in cumulative work hours for employees who possess at most a high-school degree, but no significant changes for those with college education. Workers whose initial firm lost protection through import quotas were also more likely to experience unemployment spells. That unemployment effect was largest for individuals

¹⁴ Artuç and McLaren (2015) estimate that in addition to switching costs across sectors, US workers also face similar costs for moving across occupations, while Traiberman (2020) finds that frictions for occupational switching dominate in Denmark.

¹⁵ Studying an earlier episode of trade liberalisation, Devlin, Kovak and Morrow (2020) find that the 1988 Canada–US Free Trade Agreement had little impact on the earnings trajectories of workers in Canada.

¹⁶ The classification of workers based on within-cohort earnings rank can be interpreted as a proxy for categorising workers by education. The underlying UK data from the Annual Survey of Hours and Earnings and US data from Social Security Administration records do not provide direct information on education.

¹⁷ In an analysis for Germany, Dauth, Findeisen and Suedekum (2021) show that exposure to import competition has the most adverse impact on earnings for workers who have a low worker fixed effect in a panel wage regression that controls for both worker and firm fixed effects. A low worker fixed effect can result from a low education or skill level based on which a worker obtains relatively low earnings with any employer.

with manufacturing-specific vocational degrees, who presumably struggle most to find alternative jobs that fit their skills.

A remarkable finding of the aforementioned analyses for the UK and the US is that greater exposure of a worker's initial industry to Chinese import competition causes only greater subsequent worker mobility across firms and industries, but not greater worker mobility across local labour markets. Both De Lyon and Pessoa (2020) and Autor et al. (2014) find that workers' exposure to import shocks has a small and insignificant *negative* effect on the number of employment years that a worker spends outside their initial region during the outcome period.¹⁸ These limited spatial mobility responses suggest that an important part of labour market adjustment to import competition shocks takes place within geographically defined local labour markets, which we discuss next.

The impact of import competition on local labour markets

Analyses of trade's impact on local labour markets have rapidly achieved popularity in recent years. Local labour markets are geographic regions that are typically connected to other such regions by only weak commuting and worker relocation flows.¹⁹ As a consequence, there can be fairly persistent differences across local labour markets in such outcomes as wage levels or unemployment rates.

Local labour markets are differentially exposed to import competition based on the extent to which they are specialised in import-competing industries. Analyses of labour market outcomes across regions with differential trade exposure do not simply provide a geographic aggregate of the impact of industry-level trade shocks on the employees of exposed industries. Instead, such analyses also capture all spillover effects of trade shocks that take place at a local level. Such spillovers can result from local demand multipliers, from the propagation of industry-level shocks along local supply chains, or from worker reallocation across industries within a region. Consistent with such spillover effects, both the UK analysis by De Lyon and Pessoa (2020) and the US analysis by Autor et al. (2014) show that individual workers acquire lower earnings not only when their own industry of employment is exposed to greater import competition from China, but also when they live in a local labour market where all other workers on average face a large import exposure shock. Even workers who are not themselves employed in import-competing firms may be indirectly affected when the contraction of such firms creates negative local demand spillovers or reduces job opportunities in their local labour market.

Reduced-form analyses of geographic regions have been used to study the labour market impacts of Chinese import competition in many developed economies, including the UK (Foliano and Riley, 2017), Germany (Dauth, Findeisen and Suedekum, 2014), France (Malgouyres, 2017a), Italy (Citino and Linarello, 2019), Spain (Donoso, Martin and Minondo, 2015), Norway (Balsvik, Jensen and Salvanes, 2015) and the US (Autor, Dorn and Hanson, 2013a). These studies produce three common findings. First, regions with greater exposure to Chinese import competition experienced a statistically significant differential decline in manufacturing employment in all

¹⁸ In the case of Germany, Dauth, Findeisen and Suedekum (2014) find some evidence for small positive migration responses of workers whose industries were exposed to rising import competition from Eastern Europe and China.

¹⁹ In the European context, researchers have often used the European Union's NUTS-3 geographic areas as a measure for local labour markets. There are 1,390 such areas across the EU28 and EFTA countries, which mostly correspond to administrative regions in the respective countries. Most recent local labour market analyses in the US have studied outcomes at the level of 722 commuting zones, which consist of counties that are connected by strong commuting ties.

countries. We discuss the magnitude of these declines across countries in the last subsection of this section.

Second, trade-induced declines in manufacturing employment were not simply offset by greater local employment in other sectors. While the studies from Spain and Norway find that greater non-manufacturing employment partially compensates for the manufacturing job losses, the analyses from Germany, France, Italy and the US observe an additional but often modest local employment decline outside of manufacturing.

Third, the subset of studies that also analyse changes in local wage rates all find a negative but often small local wage effect of import competition. However, the overall effect of import competition on households' wage and salary incomes operates not only through the wages of those who have a job, but also through job loss. Autor, Dorn and Hanson (2013a) calculate that two-thirds of the decline in average household earnings in import-competing US local labour markets is explained by lower employment, while only one-third of the income decline is due to lower wage rates for those who stay employed.

A key insight from these analyses is that Chinese import competition shocks had sizeable effects on *inequality across local labour markets*, as the adverse consequences of these shocks were concentrated in the regions where import-exposed industries had clustered. While reduced-form analyses establish that import-exposed local labour markets experienced lower income growth than less exposed locations, they are not immediately indicative about changes in regions' absolute level of economic well-being. In particular, aggregate gains from trade in the form of lower consumer prices (which we study in Section 5) cannot be identified from a comparison of local labour markets when price changes are uniform across space. Several recent papers thus use reduced-form empirical results to calibrate quantitative trade models that estimate the welfare effects of Chinese imports across local labour markets in the US (Caliendo, Dvorkin and Parro, 2019; Rodríguez-Clare, Ulate and Vásquez, 2019; Adao, Arkolakis and Esposito, 2020; Galle, Rodríguez-Clare and Yi, 2020). Using different theoretical assumptions on the nature and extent of spatial mobility frictions, most of these papers estimate that the average welfare gain of US residents due to Chinese imports was of the order of 0.2–0.3 percentage points. These small average gains combine with a sizeable variation of gains across local labour markets, such that some localities experienced an overall decline in welfare due to the trade shock. For instance, Galle, Rodríguez-Clare and Yi (2020) estimate that the welfare change was as high as plus 1.64 percentage points in the US local labour market that gained most from trade with China, but as low as minus 1.42 percentage points in the location that was most negatively affected. Reduced-form analyses indicate that trade's impact on the income dispersion across local labour markets is even substantially larger than suggested by quantitative trade models, which implies that a substantial minority of the US population live in regions where the absolute impact of China's trade on welfare has been negative (Autor, Dorn and Hanson, 2021).

Analyses of average outcomes in local labour markets of course mask the fact that not every resident of a city is equally affected by a trade shock. Indeed, local labour market analyses also show that Chinese import competition increased *inequality within local labour markets*, as less-educated, lower-wage workers were more adversely affected by import shocks than their better-educated and higher-paid peers. For instance, while import competition led to similar declines in manufacturing employment among college- and non-college-educated workers in Norway and the US, in both countries the increase in unemployment was much larger among the non-college-

educated group (Balsvik, Jensen and Salvanes, 2015; Autor, Dorn and Hanson, 2013a).²⁰ Moreover, the China shock increased wage inequality within US commuting zones. Chetverikov, Larsen and Palmer (2016) show that while the trade shock reduced wages at all percentiles of the local labour market wage distribution, the declines were larger at lower percentiles, with the 20th wage percentile declining twice as much as the 80th wage percentile.

While most of the recent literature on the local labour market impacts of trade in Europe and the US focuses on trade with China, there is also a growing body of evidence on the regional impacts of trade integration within continents. Dauth, Findeisen and Suedekum (2014) show that rising imports from Eastern Europe were associated with declining manufacturing employment in exposed German regions, and that German employment reacted more strongly to growing trade with Eastern Europe than to trade with China. Hakobyan and McLaren (2016) study effects of the 1993 North American Free Trade Agreement (NAFTA) on US regions. Their estimates indicate that greater exposure to import competition from Mexico reduced wages in more exposed US localities. As in the analyses for the China import shock, the most adverse outcomes were found for workers with lower education levels. Choi et al. (2021) additionally show that the US locations that were most exposed to rising Mexican import competition experienced more sluggish employment growth following NAFTA.

The impact of trade shocks on local labour markets can be remarkably persistent. Autor, Dorn and Hanson (2021) analyse outcomes in US regions nearly one decade after the China import shock plateaued around 2010. In the year 2018, local labour markets that had been exposed to greater import competition still suffered from reduced employment rates and income levels, and there is little evidence for a recovery from the past trade shock. While these localities eventually experienced some differential net outmigration, such migration occurred only with a substantial time lag (Greenland, Lopresti and McHenry, 2019) and was limited to younger and foreign-born workers (Autor, Dorn and Hanson, 2021).²¹

Offshoring and propagation of import shocks along the supply chain

International trade increasingly occurs within global value chains, as shown in panel c of Figure 1 above. The traded goods thus include not only final products that are sold to consumers, but also intermediate goods that are used as inputs for subsequent production processes. A subset of the international trade in intermediate goods is related to offshoring, where a firm imports an input from abroad that the firm itself could have produced domestically.²²

The distinction between final and intermediate goods is challenging empirically because goods often cannot be unambiguously classified into these categories. For instance, imported car tyres are final goods when they are sold to individual car owners, but they are intermediate goods when sold to car manufacturers. Empirical research has operationalised intermediate goods either by studying goods imported by manufacturing firms that presumably use them as inputs, or by using national input–output tables to assess the extent to which the outputs of one industry serve as inputs for another industry. Even once an imported good is identified as an intermediate

²⁰ Eriksson et al. (2019) additionally show that US local labour markets with less-educated workforces, as well as those with higher wages and manufacturing industries towards the end of a product cycle, experienced the largest employment declines as a result of rising Chinese import competition.

²¹ A study from Brazil indicates that following a one-time trade liberalisation, regional earnings even continued to differentially decline in localities that experienced a larger surge in import competition (Dix-Carneiro and Kovak, 2017).

²² The term 'offshoring' is used variably in the literature. We adopt the definition proposed in a literature review by Hummels, Munch and Xiang (2018), who characterise offshoring as an international import of intermediate goods by firms that themselves could plausibly have produced these goods.

input, it remains difficult to determine whether its import constitutes offshoring, where a firm relocates actual or potential in-house production to a foreign supplier or subsidiary, or whether the firm obtains inputs from abroad instead of buying them from a domestic supplier. Early work on offshoring by Feenstra and Hanson (1999) argues that firms could more likely have produced goods in-house if those goods are closer to the firms' own outputs in the product space. They propose the term 'narrow offshoring' for imports of goods from the same or similar industries and the term 'broad offshoring' for imports from substantially different industries.

It is instructive to consider how studies of import competition, such as those discussed in the previous two subsections, take imports of intermediate goods and offshoring into account. These analyses construct measures of import exposure that assign all goods to the industries that produce them. Car imports thus provide import competition for car manufacturers, while imports of car parts generate competition for domestic parts producers. At the same time, input-output tables indicate that many industries obtain substantial amounts of intermediate inputs from other firms of the same narrow industry. A firm may import car parts and, after a few production steps, sell them as car parts again. Therefore, industry-level studies of import competition actually estimate the combined effects of import competition and narrow offshoring within industries. Moreover, studies of import competition at the level of local labour markets capture not only trade's effect on the directly import-competing industries, but also the spillover effects along industry supply chains that operate within local markets.

By contrast, analyses of manufacturing firms' imports of goods allow the effects of narrow offshoring to be isolated, and often combined with the impacts of broader offshoring, i.e. firms' imports of goods from different industries. An early application of this approach is Biscourp and Kramarz's (2006) analysis of goods imports by French manufacturing firms during the period 1986–92. The authors observe that greater imports were correlated with lower firm-level employment growth. This negative association was particularly strong for narrow offshoring, i.e. for goods that a firm could plausibly have produced itself but whose production it instead chose to offshore. The relative employment losses related to offshoring were largest for less-skilled production workers. Mion and Zhu (2013) similarly note that Belgian manufacturing firms' imports of Chinese goods between 1996 and 2013 were associated with weaker overall employment growth and a falling employment share of production workers in these firms. Hummels et al.'s (2014) analysis of Danish manufacturing firms over the period 1995–2006 complements this evidence on offshoring's employment effects with results on earnings. Using a shift-share instrumental variables strategy to isolate a world export supply shock that induces greater offshoring, they show that there are substantial earnings losses for both low-skilled and high-skilled workers who leave a firm during a year with a large offshoring shock. Among workers who remain in the offshoring firms, wages decline for employees without tertiary education, while the less than 20% of Danish manufacturing workers who possess a tertiary education experience a differential increase in wages. The combination of the effects for leavers and stayers yields a negative overall wage effect for low-skilled workers. A doubling of a firm's goods imports reduces their hourly wage by 3.9% in the year following the offshoring shock, and the wage remains 1.1% lower even three years later. For high-skilled workers, a doubling of offshoring reduces hourly wages by 1.3% in the following year, but raises them by 1.5% three years after that.

Firms that offshore the production of intermediate inputs may obtain these inputs either from foreign supplier firms or from their own foreign subsidiaries. Becker, Ekholm and Muendler (2013) analysed data from German multinational enterprises (MNEs) in order to assess the correlation between an MNE's domestic employment composition and the share of its total

employment that is in foreign affiliates. Their results show that a greater share of foreign employment within MNEs is correlated with a more highly educated employment structure in the MNE's domestic German operations. Kovak, Oldenski and Sly (2021) use survey data on US MNEs to study the causal impact of offshoring on domestic employment. They exploit the staggered introduction of bilateral tax treaties between the US and 18 other countries between 1988 and 2007, which allow US MNEs to avoid the double taxation they may otherwise face on goods shipments between their foreign affiliates and their domestic operations. The introduction of a tax treaty with a foreign country caused MNEs that were already present in that country to expand their employment there. At the same time, for every 10% increase in the foreign affiliates' employment, these firms also increased domestic employment in the US by 1.3%. The authors interpret this as a positive scale effect, where MNEs increase their operations both abroad and at home in response to the reduced tax burden. However, this expansion of MNEs comes partly at the expense of domestic firms without international operations, which experience declines in employment and presumably lose market shares to MNEs. The effect of MNEs' offshoring on domestic employment at the industry level remains positive, but is smaller than the employment gain in the MNEs themselves. That offshoring should generally have positive employment effects is, however, far from clear. Boehm, Flaaen and Pandalai-Nayer (2020) show that US establishments owned by MNEs experienced lower employment growth from 1993 to 2011 than similar non-MNE establishments, with the MNEs accounting for 41% of the aggregate loss of US manufacturing jobs over that period.

While the trend in recent decades has been towards more offshoring, Costa, Dhingra and Machin (2019) instead study a recent episode where offshoring became less attractive. The 2016 Brexit referendum in the UK led to a strong and unanticipated depreciation of the British pound, which increased the costs of imported intermediate inputs.²³ Over the two years following the referendum, workers in industries that were more exposed to higher input prices experienced lower wage growth. Consistent with the view that offshored inputs complement high-skilled workers, wage impacts were more negative for graduates than for non-graduates.

Analyses of offshoring are interested in imports that occur upstream from a domestic industry within a supply chain. While narrow offshoring can involve the import of intermediate goods from other firms of the same industry or from foreign affiliates of MNEs, a more broadly defined offshoring will involve imports from different supplier industries. A domestic producer of tyres may, for instance, be affected by the availability of cheaper imports of synthetic rubber and steel fibre, which allows the firm to offshore its own production of these inputs or to switch from domestic suppliers to foreign suppliers of such goods. However, import shocks can propagate along supply chains not only downstream from supplier industries to their customers, but also upstream from customers to suppliers. An increased import of foreign cars may, for instance, reduce the ability of domestic tyre producers to sell their products to domestic car manufacturers.

Acemoglu et al. (2016) investigate both the downstream and upstream propagation of Chinese import shocks across US industries based on national input–output linkages between industries. For each industry, they measure a direct exposure to Chinese import competition based on imports of the industry's own products, a downstream-propagating exposure based on imports at the level of an industry's supplier industries, and an upstream-propagating exposure based on imports by an industry's customer industries. Their results indicate that direct exposure to Chinese import competition caused significant job losses in US manufacturing industries over the

²³ There was no significant impact of the pound's devaluation on the prices of UK exports.

1991–2011 outcome period. Greater import exposure at the level of supplier industries, which includes broadly defined offshoring, created a positive but statistically insignificant employment effect in manufacturing industries and an insignificant negative effect in non-manufacturing industries. Studying data from France over the period 2000–07, Aghion et al. (2021) similarly observe a positive but insignificant effect of imported inputs from China on employment in manufacturing firms. While some firms will benefit from access to cheaper foreign inputs, others may face disruptions when their domestic suppliers succumb to import competition. Drawing on coarser data from the World Input–Output Database, Kiyota, Maruyama and Taniguchi (2021) show that supplier exposure to Chinese import competition from 2000 to 2014 caused only modest employment changes not only in US industries, but also in their counterparts in the UK and France. Instead, job gains in Germany were significant.²⁴ Adao, Arkolakis and Esposito (2020) integrate input–output linkages into a local labour market analysis. They find that US regions whose industries buy more inputs from supplier industries that are exposed to Chinese import competition did not experience differential changes in employment or wages due to this indirect trade exposure.

There are stronger results for shocks that propagate upstream along the supply chain. Acemoglu et al. (2016) find that both manufacturing and non-manufacturing firms experienced employment declines when their customer industries faced greater Chinese import competition. These upstream effects are large in magnitude. The authors estimate that out of a total manufacturing employment loss of 1.4 million jobs that they attribute to the Chinese import shock, about 60% is due to direct import competition faced by manufacturing industries, while the remainder stems from import shocks at the level of these industries' customers or the customers of customers. The job losses outside of manufacturing in industries such as mining or business services which sell their outputs to import-exposed manufacturing are about 85% as high as the employment decline within manufacturing.²⁵

In summary, there is some evidence that offshoring can have favourable wage and even favourable employment effects in the domestic European and US labour markets, though gains appear concentrated among high-skilled workers, while low-skilled workers often experience employment and wage declines. At least for the Chinese import shock, the total domestic employment effect remains negative even when the effects of offshoring and the propagation of the shock along the supply chain are taken into account alongside the effect of direct import competition.

Labour market effects of exports

Recent research on trade and labour market inequality has emphasised the impacts of imports more than those of exports. While the most basic models of trade assume that the value of a country's goods imports matches the value of its exports, there is no fundamental need for a country's trade to be balanced. Indeed, as indicated in panel d of Figure 1, global trade imbalances increased rapidly during the 2000s. One contributing factor to these imbalances was trade

²⁴ Kiyota, Maruyama and Taniguchi (2021) estimate that the growth of imports of intermediate goods from China was 24% of the growth in total imports in the UK, 27% in the US, 31% in Germany and 36% in France, while more than two-thirds of South Korea's imports from China were intermediate rather than final goods.

²⁵ Adao, Arkolakis and Esposito (2020) observe that US local labour markets experienced differential declines in employment and wages when not only these regions themselves, but also their geographic neighbours, faced a large direct exposure to Chinese import competition. These geographic spillovers may partly reflect adverse demand spillovers along supply chains, where the contraction of industries in neighbouring regions reduces the demand for intermediate inputs produced by the supplier industries located in a region. However, Autor, Dorn and Hanson (2021) estimate that such geographic spillovers across nearby local labour markets are small.

between high-income countries and China, because many countries in Europe and the US experienced large increases in imports of Chinese goods without seeing an equivalent growth of goods exports to China.

Germany stands out as a major high-income country that was able to build up a large trade surplus at a time when other major high-income economies incurred sizeable deficits. Dauth, Findeisen and Suedekum (2014) emphasise that Germany's exposure to trade with countries from the former communist bloc occurred not primarily through its relationship with China, but through rapidly growing trade with nearby countries in Eastern Europe. By 2008, Germany's trade volume with the 10 Eastern European countries that had joined the EU a few years earlier and with the successor countries of the USSR was about three times larger than its trade with China. While Germany had a modest trade deficit in its goods exchange with China, it actually ran a surplus relative to Eastern Europe. The authors use shift-share shocks similar to those in Autor, Dorn and Hanson (2013a) to identify the exposure of German local labour markets from 1988 to 2008 not only to import competition, but also to export demand shocks in the industries that are present in a region. They find that growing exports to Eastern Europe and China are associated with both rising employment and rising median wages in local labour markets.

The notion that rising exports are associated with gains for workers is also supported by firm-level evidence. Biscourp and Kramarz (2006) observe that growing exports by French firms to the rest of the world during the late 1980s and early 1990s were correlated with higher employment growth in these firms, especially for skilled production workers. Moreover, greater demand for the exports of Danish firms during the 1990s and 2000s had positive wage effects for the employees of these firms (Hummels et al., 2014). Different from offshoring, which raised skill premiums within firms, exports led to a roughly similar proportional increase in wages for workers with and without tertiary education.

The local labour market analysis by Dauth, Findeisen and Suedekum (2014) reveals that the positive employment effects resulting from Germany's rising exports are remarkably symmetric to the negative effects of import competition. In the case of Germany's trade with Eastern Europe, a growth of exports by €1,000 per worker over a decade raises the share of working-age individuals who are employed in manufacturing by 0.90 percentage points, while a growth of imports by €1,000 per worker reduces that share by 0.97 percentage points. Estimates for the effects of Germany's exposure to trade with China tend to be smaller and considerably more noisily estimated. Overall, the results of Dauth et al. suggest that German local labour markets experienced declines in manufacturing and total employment due to import competition from Eastern Europe and China, but they enjoyed even larger gains in manufacturing and total employment thanks to rising export demand.

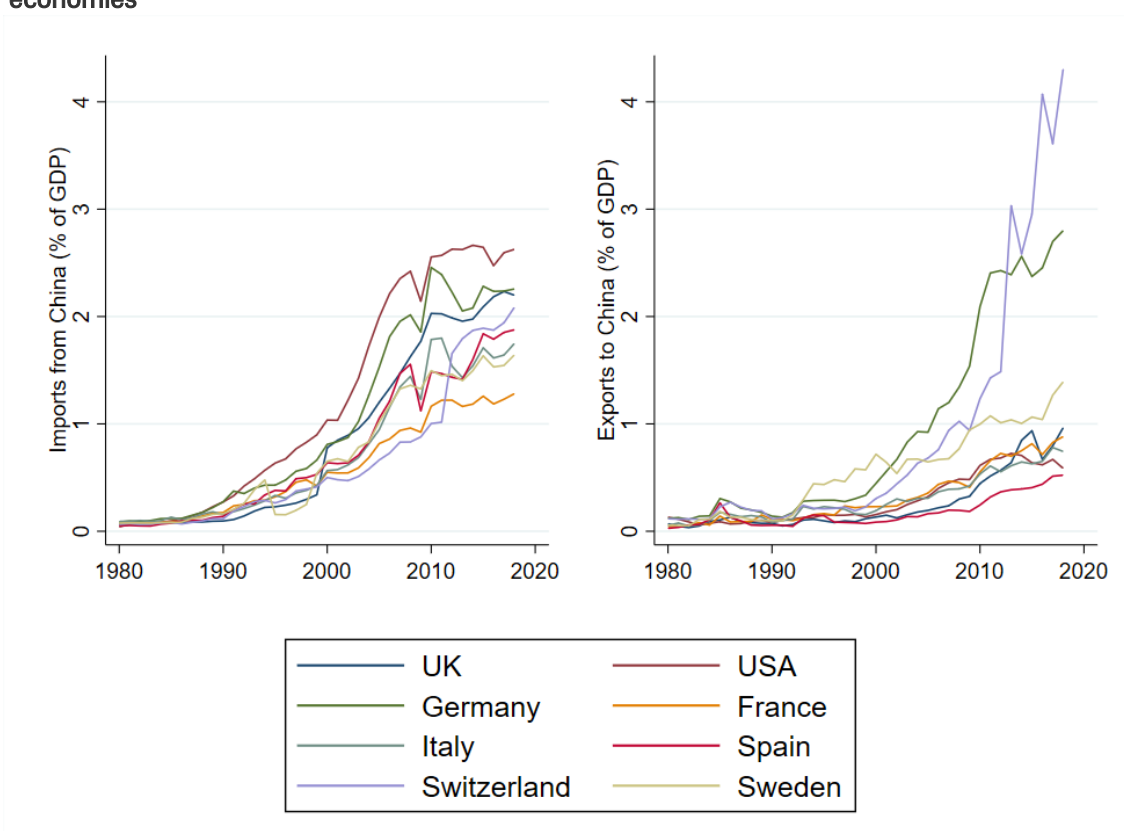
International comparison of the China shock's labour market effects

The rapid surge of Chinese goods exports to Europe and the US (as shown in Figure 2 above) spurred research on trade's labour market impacts in many countries. As a consequence, there is now broad international evidence on the labour market impacts of this 'China shock' that allows for a cross-country comparison, subject to some caveats noted below.

We begin this comparison by plotting in Figure 3 the goods imports from and exports to China relative to domestic output for the US and seven of the largest Western European economies. The left-hand panel of the figure shows that all of these countries experienced a rapid growth of imports from China. While the value of annual imports from China amounted to below 0.3% of GDP in all countries in 1990, that value grew to between 0.5% and 1.1% by the year 2000, and to

between 0.8% and 2.4% by 2007, prior to the Great Recession. Chinese imports scaled by domestic GDP were largest in the US throughout this period, though other countries such as Germany and the UK did not lag by much. While one might expect that the US's decision to grant Permanent Normal Trade Relations to China in 2000 caused a substantial acceleration of imports into the US due to a reduction in trade policy uncertainty, the aggregate trade data indicate that import growth similarly accelerated in Europe after the year 2000. From 2000 to 2007, US imports from China relative to GDP grew 2.4 times faster than in the previous seven years. In Germany that number was 2.8, and on average over the seven European countries in Figure 3 it was 2.1. Instead, the US differs from the European countries mostly by having a larger growth of Chinese imports already during the 1990s.²⁶ Overall, the time-series patterns for aggregate imports from China are notably more homogeneous across countries than the patterns for exports to China, which we discuss next.

Figure 3. Change in imports from and exports to China as a share of national GDP in developed economies



Source: Authors' calculations using data from International Monetary Fund (2021a) and World Bank (2021).

The right-hand panel of Figure 3 plots countries' annual goods exports to China as a percentage of GDP. A comparison of the two panels indicates that export growth lagged well behind import growth for most countries during the 1990s and 2000s, thus contributing to the global trade imbalances shown in panel d of Figure 1 above. For countries such as the US, the UK or Spain, trade with China grew largely through an expansion of these countries' imports from China, while exports to China played a minor role. The notable exceptions to that pattern are Germany,

²⁶ The UK saw a slightly faster increase in Chinese imports relative to GDP than the US over this period. However, the jump in Chinese imports to the UK in the late 1990s most likely reflects a change in the treatment of imports from Hong Kong that originated in China (Baranga, 2018).

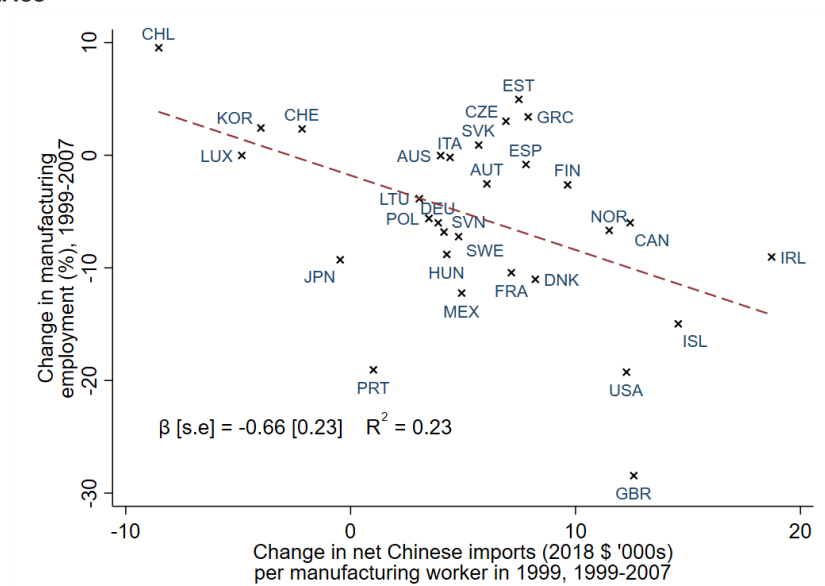
Switzerland and, to a lesser extent, Sweden. These countries were able to rapidly expand their exports to China, and maintained a roughly balanced trade relationship with regard to China in most years.²⁷

Why were patterns of aggregate import growth more similar across countries than patterns of export growth? One potential explanation is that many imports from China are consumer goods such as apparel, shoes, toys, home electronics or furniture that are demanded to a similar extent by consumers in the US and in European countries. Autor, Dorn and Hanson (2016) notice that the cross-industry correlation in import growth from China in the US and in Germany during 1991–2007 was 0.91, which implies that both the US and Germany imported very similar goods from China during that period.²⁸ Instead, China's own import demand was concentrated in specific industries in which only some of the western countries possessed an export strength. Appendix Figures A2 and A3 show a breakdown of exports to China by industry for the strong exporters Germany and Switzerland, as well as the weaker exporters the UK and the US, in 1992 and 2010. As in Figure 3, these export volumes are normalised by the exporting country's GDP in order to absorb size differences across countries. A first noteworthy pattern in the appendix figures is the important role of machinery in exports to China. Li (2020) emphasises that China long lagged behind in its domestic development of modern production machinery, such that China's astonishing growth of manufacturing production was critically reliant on imports of foreign machinery. Germany and Switzerland were already important exporters of machines to China in 1992, and were able to substantially increase their machine exports during the following two decades. By contrast, the US was never an important exporter of machines to China. Germany was also the only country in this comparison that had large car exports to China in 1992, and these exports subsequently increased more than tenfold relative to Germany's GDP through to 2010. In other product categories, such as chemicals and medical products, Germany, Switzerland, the UK and the US all had similar exports to China in 1992, but Germany and Switzerland were more successful at expanding their exports subsequently.

Trade imbalances have potentially important impacts on trade's labour market impacts. Dix-Carneiro et al. (2021) show that in a multi-sector, multi-country model of trade, imbalanced trade generates stronger expansions and contractions of different sectors relative to a benchmark of balanced trade. In particular, a growing deficit in a country's merchandise trade will be associated with a sharp contraction in its domestic manufacturing employment, which in the presence of labour market frictions can also generate elevated unemployment. Evidence from German local labour markets, discussed in Section 4 above, indeed indicates that manufacturing employment contracted in those regions that were exposed to trade with Eastern Europe primarily through a rise in import competition, while regions whose industries primarily benefited from new export opportunities in the East experienced employment gains. Following this logic, one may hypothesise that high-income countries' rapidly rising trade with China during the 2000s may have led to larger declines in manufacturing employment in countries where import growth from China strongly exceeded export growth, and more modest employment changes in countries whose trade with China remained balanced.

²⁷ Switzerland is the only country in this comparison that has signed a free trade agreement with China (in 2013). Swiss exports to China grew rapidly during the last decade, driven largely by pharmaceuticals and jewellery (Dadush, Domínguez-Jiménez and Bruegel, 2020).

²⁸ The cross-industry correlation in import growth across 397 detailed manufacturing industries between the US and a group of eight other developed economies (Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain and Switzerland) was 0.92.

Figure 4. Percentage change in manufacturing employment and Chinese import competition in OECD countries

Source: Authors' calculations from OECD STAN database and UN Comtrade data. Figures are for OECD countries excluding Israel, Latvia, New Zealand and Turkey (which do not report manufacturing employment over the relevant time period) and the Netherlands and Belgium (see footnote 30).

We find evidence consistent with that hypothesis in Figure 4, which shows a simple correlation between OECD member countries' growth in net goods imports from China per manufacturing worker between 1999 and 2007, and the percentage change in their country's manufacturing jobs during the same period.²⁹ The figure shows a statistically significant negative relationship between the growth of a country's net imports from China and the change in its manufacturing employment.³⁰ Indeed, three of the five countries with the largest increase in net Chinese imports per manufacturing worker are also among the five countries with the largest contraction in domestic manufacturing employment: the UK, the US and Iceland. Conversely, the only two European countries whose goods exports to China increased by more than their imports either experienced a modest growth in manufacturing jobs (Switzerland) or saw no change (Luxembourg).

While Figure 4 shows a significant negative correlation between net import growth from China and growth of domestic manufacturing employment in developed countries, it is noteworthy that employment changes can differ substantially across countries with similar China exposure. For

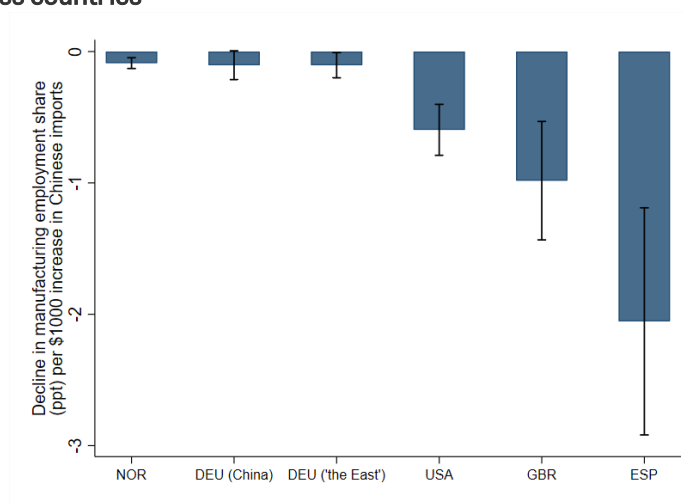
²⁹ Following Autor, Dorn and Hanson (2013a), we scale the dollar change in a country's net imports from China by the country's manufacturing employment at the start of the period. By focusing on net Chinese import exposure (i.e. imports minus exports), one implicitly assumes that the association between export growth and changing manufacturing employment has the opposite sign but otherwise the same magnitude as the association between imports and manufacturing employment. Dauth, Findeisen and Suedekum (2014) show that imports from and exports to Eastern Europe indeed had such symmetric employment effects in German local labour markets.

³⁰ We exclude the Netherlands and Belgium whose trade statistics are sometimes considered problematic. Both the Netherlands and Belgium have major port cities that channel a large volume of trade between other European countries and the rest of the world. The so-called 'Rotterdam-Antwerp effect' in international trade refers to the fact that some of the goods that just transitorily pass through these countries are counted both as imports and as exports in these countries' trade statistics. When the Netherlands and Belgium import goods from China and re-export them to other European countries, their own net import exposure to China will be inflated. The inclusion of these two countries in the Figure 4 analysis would yield a somewhat smaller but still statistically significant association (coefficient of -0.43 and standard error of 0.16).

instance, the UK, the US, Canada and Norway all experienced similar growth of Chinese net imports, yet manufacturing employment contracted more dramatically in the UK than in the other three countries.

To investigate the reaction of a country's labour market to a trade shock of a given magnitude more systematically, we next study results from comparable local labour market analyses from the UK (Foliano and Riley, 2017), Germany (Dauth, Findeisen and Suedekum, 2014), Spain (Donoso, Martin and Minondo, 2015), Norway (Balsvik, Jensen and Salvanes, 2015) and the US (Autor, Dorn and Hanson, 2013a). A common feature of these studies is that they estimate the impact of Chinese import competition (measured in thousand dollars of imports per worker) on the share of a country's working-age population that is employed in manufacturing. While all of these studies use an empirical design similar to that of Autor, Dorn and Hanson (2013a), the country-specific regression analyses differ in terms of the periods they cover, the geographic concepts of local labour markets they use and the control variables they incorporate. All of these features can potentially influence estimated effect sizes.³¹

Figure 5. Effect of a unit increase in Chinese import competition on local manufacturing employment across countries



Note: Based on authors' calculations from studies of Chinese import competition from the US (Autor, Dorn and Hanson, 2013a), Germany (Dauth, Findeisen and Suedekum, 2014), Norway (Balsvik, Jensen and Salvanes, 2015), Spain (Donoso, Martin and Minondo, 2015) and the UK (Foliano and Riley, 2017). Each bar is the coefficient estimate from a regression of the manufacturing-to-population ratio on the growth of import exposure (in thousand US\$ 2007 except in Spain where import exposure is measured in current dollars). Whiskers indicate a 95% confidence interval based on the coefficient estimate. Specifications are chosen to ensure maximum comparability across studies. See Appendix Section B for more details.

Having this caveat in mind, we show in Figure 5 the decline in the percentage of the working-age population employed in manufacturing that is associated with a \$1,000 per worker increase in annual imports from China. The bars in the figure indicate regression coefficient estimates, while whiskers provide 95% confidence intervals for the regression estimates. The figure shows that all studies consistently find a statistically significant negative impact of Chinese import competition on the fraction of the local working-age population that is employed in manufacturing.³² However,

³¹ Appendix Section B details the differences across local labour market studies from different countries.

³² The figure omits studies by Malgouyres (2017a) for France and Citino and Linarello (2019) for Italy, which use different variable constructions either for the import shock or for the manufacturing employment outcome. We show in Appendix Section B that the negative impact of a unit import shock on log manufacturing employment is slightly larger

the magnitude of these effects varies from a 0.1 percentage point per year decline in Norway and Germany, to a 2.1 percentage point decline per year in Spain.³³ Results for the US and the UK are in between these extremes.

To gauge the economic magnitude of these effects, it is instructive to multiply the Figure 5 coefficients by the decadal growth of Chinese imports per worker in the corresponding countries. This simple quantification suggests that relative to a local labour market with zero import exposure, a location facing average import competition suffered an additional loss of manufacturing jobs ranging from 0.2% of the working-age population in Norway, to 2.6% of the working-age population in Spain. In the US and the UK, this scaled manufacturing job loss amounted to 1.0% and 1.1%, respectively.³⁴ To interpret these numbers, it is important to note that the manufacturing sector only employs a small minority of the working-age population in advanced economies. For instance, the manufacturing-to-population ratio in the US fell from 12.7% in 1990 to 10.5% in 2000 and 8.5% in 2007. The rise of Chinese import competition may thus explain a sizeable fraction of the observed decline in manufacturing employment.

What could explain the sizeable international differences in the elasticity of manufacturing employment to import competition shocks shown in Figure 5? We first note that the particularly adverse employment effect of import competition in Spain appears consistent with the observation that the Spanish labour market also tends to adjust to adverse cyclical shocks with job losses that are much larger than in other European countries (Bentolila, Cahuc, Dolado and Le Barbanchon, 2012).

Dauth, Findeisen and Suedekum (2014) further argue that employment effects in Germany may have been smaller than in the US because Germany invests more in active labour market policies that help displaced workers to transition to other jobs. Appendix Table A1 provides OECD measures of spending on active labour market policies (including benefit administration, employment incentives, training and direct job creation). Of the countries considered in our Figure 5 comparison, Norway spent the most on such policies relative to its unemployment stock in 2007, followed by Germany. The UK and especially the US spent the least on such policies. While it is difficult to draw firm conclusions from a comparison of a small number of countries, the Table A1 data provide some support that countries with greater emphasis on active labour market policies were more successful at containing the job loss due to rising import competition.³⁵

in France than in the US, while import-exposed local labour markets in France additionally experienced a large decline in non-manufacturing jobs (Appendix Table B4). In Italy, the trade-induced decline in the manufacturing-to-population ratio as measured by the product of the average growth of import exposure and the estimated employment decline per unit of exposure is twice as large as in Norway and slightly smaller than in Germany (Appendix Table B3).

³³ We convert results to be expressed in thousands of 2007 US\$, except for Spain where results are expressed in terms of current dollars (from 1999 to 2007) as we could not convert them using the figures reported in Donoso, Martin and Minondo (2015).

³⁴ See Appendix Table B3 for details of these calculations.

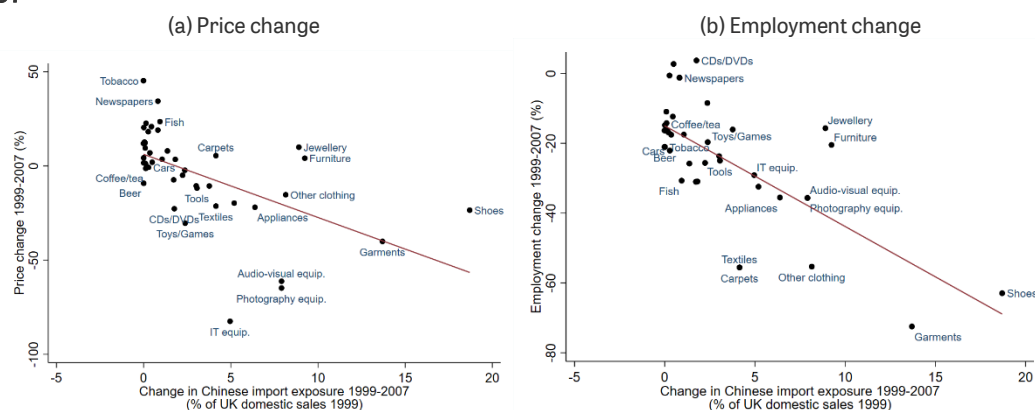
³⁵ Worker-level evidence from the UK (De Lyon and Pessoa, 2020) and the US (Autor et al., 2014) indicates that workers who find a job outside their initial import-exposed industry are more likely to move to another manufacturing industry rather than the non-traded sector. To the extent that active labour market policies facilitate a reallocation of workers within the manufacturing sector of a local labour market, one would expect to see smaller coefficient estimates in Figure 5 for those countries that invest more in such policies.

5. Import competition and consumer prices

Research on trade and inequality often emphasises the differential impacts of trade shocks on the labour market outcomes of different groups of workers. A less analysed channel through which trade can impact inequality is consumer prices. Basic models of international trade posit that trade is welfare-enhancing because consumers gain access to lower-priced imported goods. Moreover, consumers may benefit from access to a broader variety of goods (e.g. Broda and Weinstein, 2006), and import competition can induce domestic producers to reduce their prices (e.g. Feenstra and Weinstein, 2017). While the impact of trade on average consumer prices in a country is interesting in its own right, a price shift will generate inequality in society only when different population groups experience differential price changes for their consumption bundles.

We provide new evidence on the impact of imports from China on consumer prices in the UK. We study the evolution of components of the UK's Consumer Prices Index (CPI), which captures the change in prices of both imported and domestically produced goods, and which also seeks to account for changes in product mix and quality that result from the introduction of new product varieties. To measure the exposure of CPI product categories to Chinese import competition, we first compute the growth of Chinese import competition at the level of 836 industries, and then use a crosswalk to map 48 CPI product categories to the industries that manufacture the corresponding goods.³⁶ For illustrative purposes, we also compute the employment changes in the industries that map to a given goods category.³⁷ Details of our computations are provided in Appendix Section C.

Figure 6. Change in Chinese import exposure, price changes and employment changes, 1999–2007



Note: Figures exclude services and fuel. Chinese imports include imports from Hong Kong.

Source: Authors' calculations using data from the CPI, UN Comtrade and the Business Structure Database. Employment data from the Office for National Statistics (2020).

Figure 6 plots a simple correlation between the growth in Chinese import penetration and the change in either prices (panel a) or employment (panel b) in the UK for the period 1999–2007. Import penetration grew most for textile and apparel products, for furniture, and for consumer

³⁶ Our analysis excludes CPI categories for services, which are not directly exposed to goods trade.

³⁷ We map import changes and employment changes to consumer product codes using a conversion based on the shares of consumption spending devoted to different industries' output of different products in 2010. We use the same mapping to estimate the number of workers employed in the production of different consumer products (after an adjustment for spending on imported goods). See Appendix Section C for more details.

electronics products and appliances. The product categories with greater import growth generally experienced both larger price and employment declines in the UK.

The price data include two sets of goods that are notable outliers. First, the prices of goods related to fuel and heating increased much faster than the prices of all other goods from 1999 to 2007, with increases ranging from 34% for vehicle fuel to 89% for gas and 161% for liquid fuel (these goods are omitted from Figure 6 to improve visibility). Other than energy products, the good with the largest price increase was tobacco, which shares with fuel products a high level of product taxes. Since fuel and tobacco prices often exhibit large changes that are unrelated to international trade, our subsequent analysis probes the robustness of its results to the exclusion of these goods.³⁸ Second, the largest price declines by far were observed for technology products such as IT equipment (–82%), photography equipment (–65%) and audio-visual equipment (–61%). While these goods benefit from low-cost assembly in China, their sharp price decline may primarily be a consequence of rapid technological improvement and the associated introduction of better product varieties (Houseman, Bartik and Sturgeon, 2014), rather than changing patterns of trade. We thus also analyse the robustness of our results to excluding these technology goods.

Table 1. Effect of Chinese import competition on UK consumer prices and employment

	(1)	(2)	(3)	(4)	(5)	(6)
a. Δ CPI (ppt)						
Δ Chinese import exposure	–4.929** (0.839)	–3.838** (0.633)	–3.173** (0.537)	–0.752 (0.619)	–0.643* (0.318)	–0.702* (0.298)
b. Δ Employment (ppt)						
Δ Chinese import exposure	–2.880** (0.632)	–2.945** (0.629)	–3.175** (0.782)	–3.270** (0.770)	–3.060** (0.736)	–1.796** (0.418)
Product fixed effects				X	X	X
Excl. fuel and tobacco		X	X		X	X
Excl. tech. goods			X			X
N	92	82	76	92	82	76

Note: Panel a shows the annual average percentage point change in consumer prices for each percentage point increase in Chinese import exposure (results weighted according to each product's weight in the overall CPI in 1999). Panel b shows the percentage point change in estimates of the numbers of UK workers employed making each product for each percentage point increase in Chinese import exposure (weighted by employment in each industry in 1999). Standard errors in parentheses. Chinese import exposure is measured as the annual average change in the real value of Chinese imports between 1999 and 2007 and between 1994 and 1998 relative to UK domestic sales in 1999 (including imports from Hong Kong). Regressions include time period fixed effects. Instruments are the change in Chinese imports in each industry entering Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Spain, Switzerland and the US (but not including imports from Hong Kong). + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table 1 provides results of a regression analysis that pools annualised changes in import competition, prices or employment for the outcome period 1999–2007 with the corresponding values for the preceding period of 1994–98. All regressions include a period indicator, and instrument for UK imports from China with other developed countries' imports from China. The

³⁸ The rapid economic growth of China and its rising demand for natural resources likely contributed to rising oil prices during the 1999–2007 period. However, oil prices subsequently declined considerably even as China's output grew further.

product categories are weighted either by their weight in the UK CPI (for price regressions) or by their employment share in the UK (for employment regressions) in 1999. We exclude cars and sports equipment as these two goods categories do not have price data going back to 1994, leaving us with 46 goods over the two time periods.

Panel a of Table 1 presents results for price changes. The result of the first column suggests that for each additional percentage point of Chinese import penetration in the UK, prices of the corresponding good fall by 4.9% per year. This effect becomes smaller when fuel, tobacco and technology products are omitted in columns 2 and 3. One concern with these regressions is that they may capture secular price changes across product categories that persist over the full outcome period. We therefore control in column 4 for product fixed effects, such that the regression now measures whether products for which the growth of Chinese import competition *accelerated* in 1999–2007 relative to 1994–98 also experienced an accelerated price decline. The augmented regression specification yields a substantially smaller effect of Chinese import competition on UK prices. In the column 4 model with all products, prices fall by 0.75% per percentage point increase in import penetration. The column 6 model, which removes energy products, tobacco and technology products, yields a slightly smaller but more precisely estimated coefficient of minus 0.70%.

Our estimates are readily comparable to a recent analysis of US CPI data by Jaravel and Sager (2019). Using the same instrumental variable strategy applied here and controlling for product fixed effects, they find that US prices fall by 1.44% per additional percentage point of Chinese import penetration, which is about twice as much as our estimate in column 4 of Table 1.³⁹ Jaravel and Sager further show that much of the estimated price decline in the US appears to be due to US manufacturing firms adjusting their price markups downward in reaction to Chinese import competition, rather than the low prices of Chinese import goods per se.

For illustrative purposes, panel b of Table 1 also studies the impact of Chinese import penetration on employment changes in the UK. In the column 1 regression estimates without product fixed effects, we find a 2.9% decline in manufacturing employment per percentage point increase in Chinese import competition.⁴⁰ Unlike the price estimates in panel a of the table, the estimated employment effect changes little when we control for product fixed effects, but it falls once we remove technology products in column 6 to yield a 1.8% employment decline per percentage point of import penetration.⁴¹

To interpret the magnitude of these price and employment effects, we can perform a simple quantification exercise which assumes that imports had no impact on prices or employment in

³⁹ Jaravel and Sager's (2019) preferred estimates instrument US imports from China both with other developed countries' imports from China and with Pierce and Schott's (2016) measure of industries' exposure to the threat of US tariff increases that was present prior to the US granting China 'Permanent Normal Trade Relations' in 2000. Using the two instruments simultaneously, they obtain a price decline of 1.9% per additional percentage point of import penetration. Earlier work by Auer and Fischer (2010) similarly estimated that a 1 percentage point increase in market penetration by low-wage country imports reduces US prices by 2.4% per year from 1997 to 2006.

⁴⁰ Using a specification similar to that of our column 1 model, Acemoglu et al. (2016) estimate a 1.3 log point decline in employment per percentage point of Chinese import penetration in a panel of detailed US manufacturing industries over the period 1991–2011.

⁴¹ In Appendix Table C1, we report results on the employment effects of Chinese import competition using alternative industry classifications (for 362 industries defined by either three- or four-digit UK SIC codes and for 60 industries defined by two-digit SIC codes). We find that the more detailed industry classifications yield smaller employment estimates (employment declines between 1.6% and 0.8% per percentage point increase in import penetration once we control for industry fixed effects), while the estimated impacts are much larger but less precisely estimated when we use the more aggregate industry definitions.

goods categories that had no direct exposure to import competition.⁴² A reduction in prices of final consumer goods of 0.70–0.75% for each percentage point increase in Chinese import penetration (Table 1, columns 6 and 4) would translate to a total gain for consumers of £6.3–6.9 billion, or £375 to £402 per family between 1999 and 2007.⁴³ We can further express these gains in relation to workers displaced by import competition. The coefficients in columns 6 and 4 of panel b in Table 1 imply that Chinese import competition led employment in affected industries to fall by 194,000–352,000 workers. This implies benefits to consumers worth between £19,400 and £32,900 per displaced job.⁴⁴ Note that this simple calculation does not incorporate potential price benefits to consumers that result when firms lower their prices because they gain access to cheaper inputs from China. It also does not include the indirect employment effects along the supply chain that we discussed in Section 4.

The Table 1 results suggest that Chinese import competition had a beneficial overall effect on consumer prices in the UK, but they are not informative about any distributional impacts of trade-induced price changes. In a cross-country analysis, Fajgelbaum and Khandelwal (2016) show that spending shares on food and manufactured goods are smaller in higher-income countries. To the degree that this pattern also holds within countries, one may expect that low-income households benefit more from declining goods prices than more affluent households.

We use data from the 2001 Living Costs and Food Survey to investigate spending patterns across income strata in the UK. The relationship between income and spending shares on goods is weakly negative. Households in the lowest income quintile spent 57% of their expenditure on goods, while those in the highest income quintile spent 52% on goods. However, not all goods were disproportionately consumed by lower-income households. Figure 7 plots, for each good in the UK CPI, the share of this good in total spending by bottom quintile households, minus the corresponding spending share for top income quintile households in 2001, and shows this against the growth in Chinese import penetration from 1999 to 2007. Most of the goods on which the low-income households spend a larger fraction of their expenditure compared with high-income households are food products such as meat, bread and dairy, which face no meaningful import competition from China. The high-income households instead outspend the poor on cars and motor fuels, which again have little Chinese trade exposure. Among the goods that face a significant growth in import competition, the poor spend relatively more on shoes and appliances, but the rich spend relatively more on a sizeable number of import-exposed products such as computers, furniture and garments. As a consequence, the regression slope in Figure 7 is weakly negative, and further calculation reveals that the average import exposure of the top income quintile's goods basket is about 16% larger than the exposure of the bottom quintile's

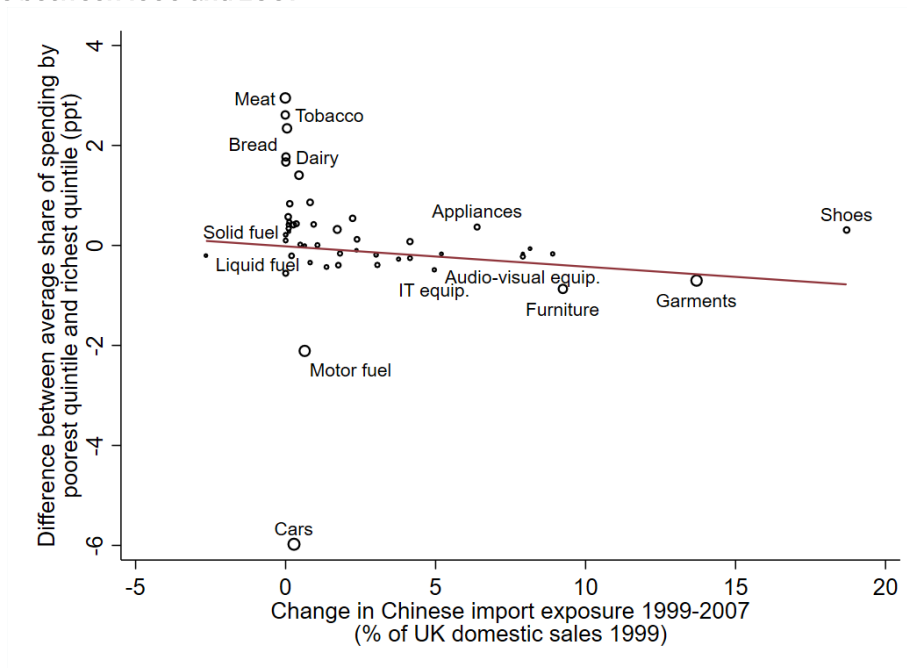
⁴² We calculate $\beta_{price} \times \sum_p (\Delta ChinaIP_p \times cons_p)$ where β_{price} is the coefficient on Chinese import penetration in the price regressions of Table 1 (taken from column 4 or 6), $\Delta ChinaIP_p$ is the change in Chinese import penetration to the UK from 1999 to 2007 for product p , and $cons_p$ is total household final consumption expenditure on product p in 2001, taken from the ONS Consumer Trends publication. The figures are expressed in 2001 prices..

⁴³ We use the number of families in 2001 for this calculation. There were 17.0 million families in the UK in 2001 (Office for National Statistics, 2019).

⁴⁴ We calculate benefits per displaced job as $\frac{\beta_{price}}{\beta_{emp}} \times \frac{\sum_p \Delta ChinaIP_p cons_p}{\sum_p \Delta ChinaIP_p emp_p}$, where emp_p is total employment of workers producing good p in 2001 and β_{emp} is the coefficient on Chinese import competition in the employment regressions in Table 1. This follows a similar calculation by Jaravel and Sager (2019), who obtain a much larger benefit for consumers of \$288,000 per displaced worker in the US when they use a comparable specification and instruments. In their US estimates, the effect of the import shock is larger for prices and smaller for employment than in the UK, such that the ratio $\frac{\beta_{price}}{\beta_{emp}}$ is two to four times larger in the US. Moreover, Jaravel and Sager scale the percentage change in consumer prices not with household consumption, but with domestic absorption which also includes the purchases by firms and government of goods whose prices may not be accurately captured in the CPI.

basket. While low-income households thus spend a larger fraction of their overall expenditure on goods, the high-income households spend relatively more on the import-competing goods that stand to benefit most from price declines. These two offsetting effects are nearly equally large in magnitude, such that the import exposure of the entire expenditure basket of goods and services is almost equivalent for both groups. Therefore, our analysis suggests that trade-induced price declines equally benefit low-income and high-income households, and thus have little impact on inequality between these groups.

Figure 7. Difference in spending by poor and rich in 2001 against the change in Chinese import exposure between 1999 and 2007



Note: Figure excludes services. Chinese imports include imports from Hong Kong.

Source: Authors' calculations using data from the CPI, UN Comtrade and the Business Structure Database. Employment data from the Office for National Statistics (2020).

One caveat of this simple analysis of trade's distributional impacts is that Figure 7 captures the rich and the poor's expenditure shares on goods regardless of whether these goods have been domestically produced or imported. If the low-income households were more likely to consume cheap imported products while affluent households more often buy domestic products whose prices change little, then our analysis may underestimate the relative benefit to the poor in terms of lower prices.⁴⁵ However, Levell, O'Connell and Smith (2017) show for the case of food products that UK households of different income levels do not systematically differ in their relative purchases of domestic versus imported goods. Borusyak and Jaravel (2018) provide broader evidence for the US, where the college-educated and those with lower educational attainment spend similar fractions of their overall expenditure on imported goods. This observation also holds when indirect spending on imports is taken into account, which occurs when consumers purchase domestic goods that have been produced using imported intermediate inputs. Three separate analyses by Borusyak and Jaravel (2018), Hottman and Monarch (2018) and Bai and

⁴⁵ The distinction between spending on domestically produced goods and spending on imported goods will be less relevant if import competition induces domestic producers to substantially reduce their prices, as suggested by Jaravel and Sager (2019).

Stumpner (2019) all find that rising Chinese imports to the US reduced consumer prices roughly evenly for households of different education groups or income strata.⁴⁶

In addition to the literature on the price effects of Chinese import competition, recent empirical research has also analysed the response of domestic prices in Europe and the US to sudden large changes in exchange rates or changes in tariffs.⁴⁷ Given the above observation that the expenditure shares on goods or imported goods do not vary greatly across income groups within the UK or the US, one might expect that changes in goods prices do not create substantial inflation inequality, unless a price change – for instance due to tariffs – differentially affects goods whose expenditure shares vary strongly across income groups. Breinlich et al. (2019) indeed estimate that the sudden depreciation of the British pound following the 2016 Brexit vote increased prices for consumers in the UK by an average of 2.9%, but had no differential impact on households of different income levels.

While Section 4 above emphasised the differential impact of trade shocks on labour market outcomes across regions, there is much less evidence on their regional price effects. It is generally assumed that the prices of traded goods do not vary greatly across space within a country. However, the price effects of an import shock could still vary across regions if there is variation in regional consumption bundles. Breinlich et al. (2019) provide some evidence for such spatial effects in their analysis of changes in UK consumer prices following the sterling depreciation of 2016. They estimate that the resulting increase in inflation was 0.7 percentage points lower in the London area, where housing costs account for a relatively large share of overall expenditure, than in Northern Ireland, where consumers spend a relatively high proportion of their income on such goods as food, clothing and fuel. In the case of the Chinese import competition shock in the US, Bai and Stumpner (2019) instead find no evidence for differential price effects across major regions of the country.

In sum, we conclude that the impact of trade shocks on prices appears to be quite uniform across income groups and geographic regions. While shocks such as rising import competition contributed to greater inequality in labour market outcomes, such inequality does not appear to be substantially offset or exacerbated by differential changes in prices.

6. Societal and political repercussions

Fissures in the fabric of society

Economic analysis usually evaluates the welfare effects of trade based on its impact on people's consumption possibilities. These are determined both by their labour earnings and by the price and variety of the goods that they can purchase. From this perspective, a loss of well-paid

⁴⁶ While the rich and poor have roughly equal spending shares for import-exposed products, it could be that for some reason, the goods that are more often purchased by one group may have prices that react more elastically to an import shock of a given magnitude. Jaravel and Sager (2019) conduct a split-sample analysis, in which prices of goods consumed more by the poor have stronger reactions to the trade shock. When we estimate price changes in the UK separately for the half of goods that are relatively more or less often consumed by the poor, then we find mixed results across different regression specifications. Coefficient estimates for the impact of import competition are more negative for the prices of goods consumed more by the rich when using the regression models in columns 1 and 2 of Table 1, while the converse holds for the models in columns 3, 4, 5 and 6.

⁴⁷ See, for example, Breinlich et al. (2019) on the depreciation of the British pound following the Brexit referendum, Auer, Burstein and Lein (2021) on the 2015 appreciation of the Swiss franc following the end of its peg to the euro, and Amiti, Redding and Weinstein (2019) and Fajgelbaum et al. (2020) on the import tariffs introduced by the US in 2018.

manufacturing jobs would be problematic primarily to the extent that it reduces workers' earnings.⁴⁸

However, the notion that a job simply serves as a source of income is incomplete. The broader societal implications of job loss are vividly portrayed in Vance's (2016) best-selling memoir that recounts the rise and decline of a manufacturing town in the US Midwest. When the local steel plant downsized during the 1980s, many workers lost not only their jobs but also some of their pride and purpose. Public facilities in the city deteriorated, substance abuse and crime increased, and families broke apart. Vance cites the work of sociologist William Julius Wilson (1996), who observed that 'A neighborhood in which people are poor but employed is different from a neighborhood in which people are poor and jobless. Many of today's problems in the inner-city ghetto neighborhoods—crime, family dissolution, welfare, low levels of social organization, and so on—are fundamentally a consequence of the disappearance of work'. Vance argues that these observations, which originally referred to inner-city ghettos, apply equally to decaying manufacturing towns.

Recent research brings more systematic support to the notion that localised impacts of import competition shocks had broader social repercussions beyond changes in individual earnings. Feler and Senses (2017) show that US local labour markets with greater exposure to Chinese competition experienced declines in local tax revenues which in turn led to declines in government expenditures for such purposes as education, parks and natural resources, and transportation. Moreover, they and Che, Xu and Zhang (2018) both report increased crime rates in these localities, especially regarding property crime.

Import competition shocks have also been linked to a range of adverse health behaviours and outcomes. Drawing on data from the British Household Panel Survey, Colantone, Crinò and Ogliari (2019) show that workers in the UK whose industries become exposed to greater Chinese import competition experience higher rates of anxiety and depression, social dysfunction and loss of confidence. These individuals also become more likely to report alcohol and drug consumption and heavy smoking. The magnitude of the estimated health impacts is large. Under the assumption that Chinese import competition had no impact on the health of individuals who work in industries with zero trade exposure, the authors estimate that the trade-induced deterioration in mental health reduced life quality of workers in the UK by a monetary equivalent of 0.35% of GDP in the year 2007.⁴⁹ In analyses of local labour markets in the US, Lang, McManus and Schaur (2018) similarly detect that greater exposure to Chinese import competition increased mental health problems in the local population. Moreover, a greater fraction of individuals in these localities report an inability to afford a doctor visit. In regions that simultaneously faced a large exposure to automation, the import shocks also contributed to a broad range of additional adverse health outcomes, such as diabetes, obesity and pain (Adda and Fawaz, 2020).⁵⁰ Perhaps most worrisome, local import exposure induced higher mortality rates,

⁴⁸ In theoretical models that include a basic labour–leisure trade-off, job loss and unemployment would have a negative effect on workers' utility due to the reduction of income, but greater leisure time of workers who are out of jobs would contribute positively to utility.

⁴⁹ Colantone, Crinò and Ogliari (2019) estimate how import exposure impacts a quality-of-life metric that is used for the computation of quality-adjusted life years. A worker in an industry with average growth of Chinese import competition experiences a reduction in quality of life by 0.6%. When a quality-adjusted life year is valued at £30,000, the average worker's reduction in quality of life due to deteriorated mental health has a monetary cost equivalent of £178, and the total cost summed over all workers equates to 0.35% of GDP.

⁵⁰ Adda and Fawaz (2020) follow Autor and Dorn (2013) in measuring local labour markets' exposure to automation based on their specialisation in routine-task-intensive occupations, which can potentially be substituted by computers and robots. Autor, Dorn and Hanson (2013b) show that the routine-intensity of US commuting zones is not correlated with

notably due to drug and alcohol poisoning (Autor, Dorn and Hanson, 2019; Pierce and Schott, 2020).

Trade shocks can also affect family and household structures, with shocks to female and male workers generating substantially different results. Keller and Utar (2018) show that Danish workers whose initial employers faced rising import competition from China during the period 2000–09 spent less time as employees at the initial firm than otherwise-comparable workers whose industries were not exposed to import competition. While the trade-induced decline of employment at the initial firm had a similar magnitude for both women and men, the subsequent career trajectories differed substantially across genders. Men's reduced employment at the initial firm was compensated by correspondingly longer employment spells at other firms, but women's reduced employment at the initial firm was associated with longer periods of non-employment. Women instead became more likely to marry and to have children, and the import shock thus raised fertility and marriage rates overall. These Danish results partly echo findings for the US. Autor, Dorn and Hanson (2019) split the aggregate import exposure of local labour markets into gender-specific shocks based on the initial gender composition of trade-exposed local industries, and find that an adverse shock to females' labour market opportunities increases marriage rates and fertility. However, shocks that reduce employment and earnings primarily among men have the opposite effects of reducing marriage and childbirth. Since the US manufacturing sector employs substantially more men than women, the adverse effects for men dominate in the aggregate, which means that local labour markets with greater overall import exposure experience larger employment and earnings declines among men than among women, and reductions in fertility, marriage and cohabitation. Moreover, children in these localities become more likely to grow up in poor and single-parent-headed households.⁵¹ Complementing this evidence, the UK study by Colantone, Crinò and Ogliari (2019) finds evidence that children experience adverse outcomes as a consequence of import shocks in their father's industry, while there are no effects of shocks to their mother's industry. In particular, children aged 11–15 whose father's industry faced greater trade shocks were less likely to speak to parents about issues the youngsters cared about, spent longer hours watching TV, had lower self-esteem, and felt greater unhappiness with life.

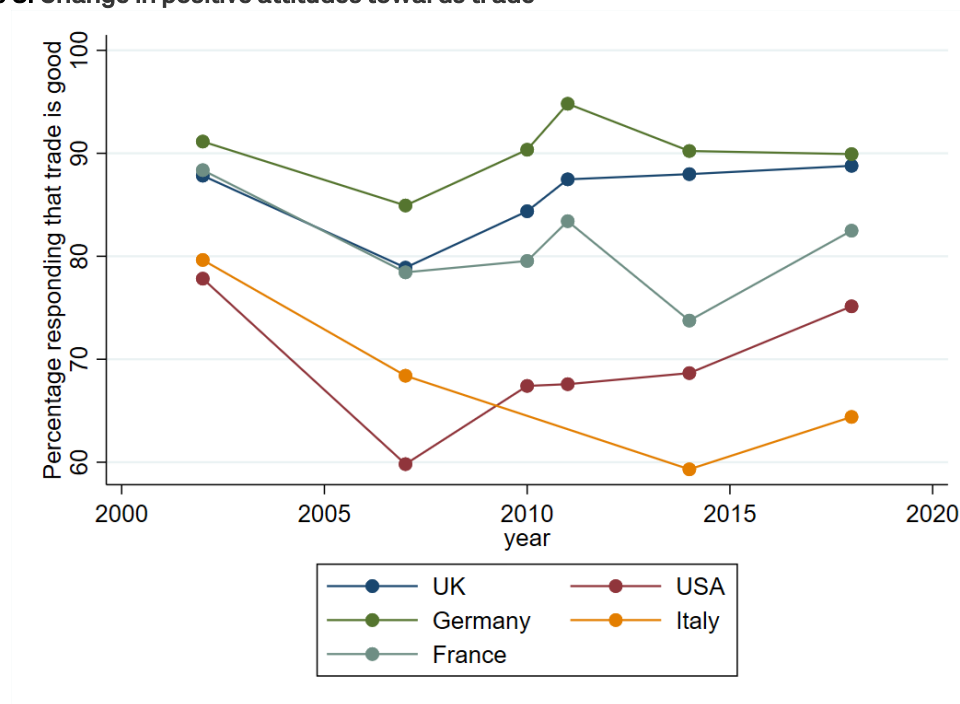
It is noteworthy that the adverse impacts of trade shocks on public goods provision, crime, health and family structures affect the residents of the same locations, and probably often the same individuals, who also suffer the most negative economic consequences from these shocks. Traditional economic analyses that study the effect of trade on inequality through the lens of income and consumption only may thus severely underestimate the full extent of trade's impact on inequality in society.

Public attitudes towards trade and electoral outcomes

One might expect the negative consequences of increased import competition for certain groups and regions to be reflected in public attitudes towards trade, electoral outcomes and ultimately countries' willingness to pursue open trade policies.

their exposure to Chinese import competition, which allows separate identification of the impacts of automation and trade on local labour markets (Autor, Dorn and Hanson, 2015).

⁵¹ The notion that an adverse local labour market shock may lead not only to economic but also to social decline does not apply to recent trade shocks only. For instance, Black, McKinnish and Sanders (2003) document that the rapid decline of the US coal and steel industries during the 1980s caused an increase in single-parent households, as employment opportunities for men deteriorated in heavily affected areas.

Figure 8. Change in positive attitudes towards trade

Note: Calculations by Davenport, Dorn and Levell (2020) based on Pew Global Attitudes Surveys conducted in Summer 2002 and Spring 2007, 2010, 2011, 2014 and 2018. Italy was not included in the surveys for Spring 2010 and 2011. The vertical axis shows the percentage of respondents agreeing that trade with other countries is 'very good' or 'somewhat good'. Shares exclude those who refused to answer.

Davenport, Dorn and Levell (2020) analyse recent international data from the PEW Global Attitudes Survey, which asked respondents about their general attitudes towards trade. Figure 8 shows the share of respondents in five large high-income countries who stated that international trade was either 'good' or 'very good' for their country in successive surveys from 2002 to 2018. Public attitudes towards trade indeed deteriorated in the 2000s when globalisation and Chinese import competition were accelerating most rapidly. Averaged over the five indicated countries, the share of survey respondents with favourable attitudes towards trade fell from 85% in 2002 to 74% in 2007. In the US, the share of positive views on trade even declined by a remarkable 18 percentage points over this five-year period. However, the deterioration in attitudes towards trade during the 2000s was not permanent. As seen in Figure 1, growth in international goods trade levelled off after 2007, and Figure 8 indicates that favourable attitudes towards trade rebounded during that period. By 2018, the earlier declines in positive attitudes towards trade had largely reversed in all indicated countries except Italy.⁵²

While the survey evidence indicates that a majority of the general public have favourable views on trade, additional results in Davenport, Dorn and Levell (2020) show that those without a college education are more likely to hold sceptical attitudes towards trade in all surveyed OECD countries. Moreover, public views on trade are more ambivalent than those of academic

⁵² The rebound in positive attitudes towards trade is confirmed by other sources. For example, surveys by Gallup have regularly asked Americans whether they viewed trade as 'an opportunity for economic growth through increased U.S. exports' or 'a threat to the economy from foreign imports'. In 2008, 41% of adults saw trade as an opportunity for growth and 52% thought it was a threat to the economy. By contrast in 2019, 74% regarded it as an opportunity and just 21% viewed it as a threat (Saad, 2019). In the UK, a 2019 survey by the Department for International Trade indicates that two-thirds of respondents reported a positive attitude towards free trade agreements (Department for International Trade, 2020).

economists, who tend to be almost unequivocal in their support of open trade policies even if they acknowledge that trade may make some workers worse off.⁵³

Davenport, Dorn and Levell (2020) also note that despite the generally favourable attitudes towards trade, survey respondents hold more mixed views on trade's impact on jobs, wages and prices. In particular, in all surveyed OECD countries other than Israel and Sweden (where attitudes were more favourable), only 20–40% of survey respondents stated that trade reduces prices. This result stands in stark contrast to empirical analyses such as in Section 5 above, which find sizeable benefits from trade in the form of lower prices. It is plausible that many people either do not notice trade-induced price declines, or fail to identify increased trade as a cause of observed price reductions. The fraction of respondents perceiving a positive impact of trade on jobs is larger and ranges from about 30% to 60% in most countries, while fewer survey responses perceive a positive effect on wages.

Research in both economics and political science has explored whether import competition shocks in the 2000s also affected electoral outcomes specifically in those local labour markets that were most exposed to trade.⁵⁴ Colantone and Stanig (2018a) relate the Chinese import competition faced by large geographic regions in 15 Western European countries to outcomes in parliamentary elections. They find that rising import competition was associated with electoral gains for far-right parties between 1988 and 2007, while Milner (2021) shows that these effects persist through 2018. This aggregate result receives support from more detailed local labour market studies in individual countries, which showed an impact of import competition on growing electoral success of far-right fringe parties in Germany parliamentary elections between 1987 and 2009 (Dippel et al., 2021) and of France's National Front party in presidential elections from 1995 to 2012 (Malgouyres, 2017b). Moreover, residents of UK regions that faced a larger growth of import competition during the 1990s and 2000s became more likely to voice nationalist sentiments and lower support for EU membership in the British Household Panel Survey (Harms and Steiner, 2018), and these regions were more likely to vote for Brexit in 2016 (Colantone and Stanig, 2018b).

For the US, Autor, Dorn, Hanson and Majlesi (2020) observe various outcomes that suggest an ideological and electoral shift to the right in local labour markets with greater exposure to Chinese import competition over the period 2000–16. These outcomes include a rising market share of the pro-Republican TV channel Fox News, a greater growth of campaign contributions by conservative donors, a larger probability of electing politicians from the right wing of the Republican party in congressional elections, and greater vote shares for the candidates of the Republican party in presidential elections. These outcomes, however, do not reflect a monotone shift towards more conservatism. Import-exposed locations also saw increased campaign contributions by left-wing donors, and candidates from the left wing of the Democratic party became more likely to win election to Congress in regions where non-Hispanic whites account for

⁵³ The University of Chicago's Initiative on Global Markets (IGM) has repeatedly surveyed its panels of leading economics professors on trade issues. In 2012, 35 of 37 US economists agreed that US citizens are on average better off thanks to the North American Free Trade Agreement (NAFTA), and 34 of 34 said that trade with China makes most Americans better off. In 2016, 46 of 47 European economists agreed that the average Western European citizen is better off thanks to trade within the EU; and in 2018, 38 of 39 said that trade with China makes most Europeans better off. Most of the survey respondents (33 of 34 in the US and 33 of 39 in Europe) also agree that trade has made some American and European workers worse off who work in sectors, such as clothing or furniture production, that face heavy competition from Chinese imports. In all cases, the economists who did not agree with the statements were either uncertain or had no opinion, while no one disagreed. See <http://www.igmchicago.org/>.

⁵⁴ See Walter (2021) for a review of the political science literature on the perceived backlash against trade and other forms of globalisation.

a minority of the population. Instead, electoral losses largely concentrated among moderate members of the Democratic party, thus contributing to political polarisation. The trade-induced shifts in electoral outcomes were largely complete by the year 2010 when Chinese import growth started to slow down and public attitudes toward trade were improving, but the electoral gains persisted in subsequent years.

It is not immediately obvious why import competition would lead to electoral gains for populist right-wing parties and politicians.⁵⁵ Using a mediation analysis, Dippel et al. (2021) show that the effect of the import shock on vote shares for far-right parties in Germany can be fully explained by the shock's adverse impact on local labour market outcomes. However, this leaves open the question of why a deterioration in local labour market conditions due to trade would favour primarily nationalist right-wing parties, and not left-wing parties that promote greater financial redistribution.

One interpretation is that nationalist right-wing politicians promote protectionist trade policies that shield domestic workers from the effects of import competition. The 2016 election of Donald Trump as president of the US stands out because he spoke far more about trade during campaign events and took more protectionist stances than any other major-party candidate for the US presidency from 2008 to 2016 (Cerrato, Ferrara and Ruggieri, 2018). Supporters of Trump were disproportionately likely to state that trade had hurt their families, both compared with supporters of other Republican politicians and compared with the supporters of Democrats who ran in the 2016 presidential primaries (Pew Research Center, 2016).⁵⁶ Once elected, Trump followed up on his campaign promise to introduce new import tariffs, especially on goods from China.⁵⁷ In Europe, many far-right parties share a scepticism about the European Union and demand greater national sovereignty, but trade protectionism is not necessarily a salient issue.⁵⁸

Another interpretation is that the lasting economic decline of local labour markets due to import competition contributed to a cultural backlash of rising nationalism and support for right-wing parties' anti-immigration stances. This more general backlash may have then persisted even as general attitudes towards trade recovered. Colantone and Stanig (2018b) provide evidence for a connection between trade shocks and anti-immigrant sentiment based on survey data from the 2016 British Election Study. They show that the residents of import-competing regions of the UK were less likely to perceive immigration as good for Britain's economy or cultural life, and were less likely to advocate greater immigration. Cerrato, Ferrara and Ruggieri (2018) document in pooled US survey data for the years 2008 to 2016 that the residents of local labour markets facing greater import competition have more negative attitudes towards Muslims, Hispanics and Asians, and are more likely to state that immigrants take away jobs from natives. Economic

⁵⁵ See Rodrik (2020) for a discussion of additional factors beyond trade that contributed to the rise of right-wing populism.

⁵⁶ Survey data collected by Di Tella and Rodrik (2020) show that support for trade protection rises especially strongly when respondents are confronted with a scenario of job loss due to outsourcing to a developing country, but also to a lower extent when job loss is due to other labour market shocks such as technological change.

⁵⁷ Trade policy has not always been a strongly partisan topic in the US. In 2009, a survey by the Pew Research Center found that the fraction of registered voters who stated that trade agreements between the US and other countries were bad for the US was about one-third both among self-identified supporters of the Republican party and of the Democratic party (Jones, 2018). By 2018, the fraction of respondents who thought trade agreements were bad had increased to 46% among Republicans, and declined to 19% among Democrats. Feigenbaum and Hall (2015) note that both Republican and Democratic politicians who represent US congressional districts with high exposure to Chinese import competition have become more likely to vote against trade liberalisation.

⁵⁸ Survey data indicate that voters who supported the UK's 2016 Brexit referendum saw Britain's exit from the European Union as an opportunity to achieve greater sovereignty and reduced immigration, but also to achieve greater trade openness through new trade agreements (Owen and Walter, 2017).

theory provides several explanations for such an impact of adverse economic shocks on nationalism and anti-immigration sentiment. Grossman and Helpman (2018) argue that economic decline can increase people's identification with their own social group, while Gennaioli and Tabellini (2019) note that shocks can shift group allegiance from economic classes (high- and low-income) to culture-based identity that pitches nationalists against cosmopolitans and immigrants.

Politicians may also strategically emphasise controversial issues in order to strengthen cultural identification and increase turnout among their supporters (Glaeser, Ponzetto and Shapiro, 2005). Indeed, the widely perceived backlash against globalisation, as reflected in many recent political outcomes, may be less a consequence of a swing in public opinion against globalisation than a result of its politicisation (Walter, 2021).

7. Policies to support globalisation's losers

The realisation that globalisation had adverse economic and social impacts on some segments of the population in high-income countries raises the question of how governments could best support such losers from trade. We discuss below evidence on compensation of earnings losses, programmes that facilitate labour market adjustment, place-based policies for the revival of economically depressed locations, and trade policies that seek to mitigate exposure to trade shocks. A common theme for all of these policy options is that even when they are effective in helping trade's losers, they tend to generate important trade-offs between equity and efficiency.

Compensating income losses

Economists have long realised that trade could be financially beneficial for everyone.⁵⁹ For this to be the case, however, it is necessary that the beneficiaries from trade use a part of their gains to provide compensation to trade's losers. In practice, such redistribution occurs primarily through general tax and transfer systems that shift resources from employed and high-income individuals towards unemployed and low-income individuals.

Evidence on government transfers triggered by trade shocks is scarce. Autor, Dorn and Hanson (2013a) show that US households in local labour markets with greater exposure to Chinese import competition report larger receipt of social security and welfare benefits. Comparing local labour markets at the 75th and 25th percentiles of import exposure over the 2000–07 period, the social security and welfare payments per working-age adult increased by 2.2% more in the former location. This elasticity is very similar to that of wage and salary incomes, which declined by a differential 2.3%. However, when measured in dollar rather than percentage terms, the estimated increase in social security and welfare income amounts to just an additional \$18 per adult and year, which falls far short of an estimated \$581 decline in wage and salary income.

In addition to analysing households' self-reported social security and welfare income, Autor, Dorn and Hanson (2013a) studied government data that cover a broader measure of transfer expenditures, which additionally includes unemployment benefits, medical benefits and educational assistance. Some of these transfers, such as the quantitatively important medical assistance, comprise in-kind benefits rather than financial payments to households. All of the aforementioned types of transfers differentially increased in more import-exposed locations. Again comparing local labour markets at the 75th and 25th percentiles of import exposure over

⁵⁹ This notion is often considered to be a fundamental tenet of economics. For instance, the widely used introductory economics textbook by Mankiw (2011) states as its fifth principle of economics: 'Trade can make everyone better off'.

the 2000–07 period, the former experienced an additional \$63 per-capita growth in annual transfer payments, with one-third of that effect coming from medical benefits alone. However, this increase in government transfers still only compensates for a modest portion of the trade-induced earnings decline.⁶⁰

The situation is different in countries with more extensive welfare systems. Utar (2018) finds that Danish workers in firms directly threatened by the expiration of the Multifibre Agreement experienced a 3.7% reduction in annual earnings, but 'personal income' – which includes government transfers, business and self-employment income – only fell by around 1%. However, even in Denmark, workers may not always be well insured against negative income shocks due to trade. Hummels et al. (2014) report that a doubling of Danish firms' offshoring reduced low-skilled workers' labour earnings by 1.5% in the following year, while a measure of 'gross earnings' that also includes unemployment insurance benefits and social assistance income declined only modestly less by 1.3%.

One reason for not implementing a full compensation is that a redistribution of income via taxes and transfers from trade's winners to the losers can generate a sizeable loss of economic efficiency (Antràs, de Gortari and Itskhoki, 2017). However, a lack of adequate income support can have grave consequences for workers whose jobs and communities are exposed to adverse trade shocks, such as the workers in import-competing US localities who report that they are unable to afford a doctor's visit (Lang, McManus and Schaur, 2018).

Lowering adjustment costs

Adverse labour market impacts of trade shocks such as rising import competition from China are differentially concentrated among the employees of the industries most exposed to such shocks and in the geographic regions where such industries are concentrated. Many workers do not quickly adjust to trade shocks through mobility across sectors and space.

Active labour market policies (ALMPs) seek to reduce adjustment costs in the labour market by facilitating workers' re-employment through such measures as job search counselling, retraining, or employment subsidies.⁶¹ Recognising trade's potential to disrupt labour markets, the US set up a trade-specific ALMP called Trade Adjustment Assistance (TAA) in 1962. President Kennedy explained that 'When considerations of national policy make it desirable to avoid higher tariffs, those injured by that competition should not be required to bear the full brunt of the impact. Rather, the burden of economic adjustment should be borne in part by the Federal Government' (Kennedy, 1962).⁶²

In its current form, the TAA programme primarily covers the costs of retraining unemployed individuals. The majority of workers in TAA-sponsored training enrol in occupational training programmes – for instance, for such activities as computer operators, office clerks, medical assistants or nursing aides (Hyman, 2018). During the TAA-sponsored training, programme

⁶⁰ Barrot et al. (2017) show that households in more import-competing local labour markets instead accumulate greater debt in the form of home equity extraction and credit card debt.

⁶¹ (Re)training can also be offered by firms to their employees. However, Costa, Dhingra and Machin (2019) find that UK firms that were adversely affected by higher costs of intermediate inputs following the pound's depreciation in 2016 reduced training activities for their workers.

⁶² More generous support for workers displaced by trade may also increase support for free trade in the electorate. Hays, Ehrlich and Peinhardt (2005) observe that survey respondents in Europe and North America were less likely to advocate protectionist policies if their country provided more generous ALMPs, unemployment benefits and social security schemes.

participants are entitled to receive unemployment benefits for up to three years, instead of the standard eligibility period of 26 weeks that applies in most US states. To facilitate labour market adjustment across space, the TAA programme additionally pays relocation allowances to workers who obtain long-term employment outside their current commuting area. To obtain TAA benefits, groups of three or more workers, or their representatives such as labour unions, former employers or state career centres, have to file a petition with the US Department of Labor. This agency then determines whether the workers were laid off by a firm that experienced declines in sales or production due to trade. Such trade exposure can either be import competition or outsourcing that affected a firm directly, or that occurred at the firm's suppliers or customers. In the years 2015 to 2019, the Department of Labor accepted about 830 TAA petitions per year, and nearly 90,000 workers gained access to TAA benefits annually (US Department of Labor, 2020).

Hyman (2018) evaluates the impact of TAA receipt on workers' adjustment to trade shocks using data on approved and rejected TAA petitions from 24 US states during the period 1974–2016. In the two years following the TAA petition, individuals whose petition was approved accumulated about \$10,000 less in earnings than comparable workers whose petition was rejected, because retraining slowed the former group's return to the labour market.⁶³ However, over the following eight years, the TAA workers earned about \$60,000 more than non-TAA workers, in part thanks to a greater probability of being employed. The net financial gain for TAA workers of about \$50,000 over ten years is large given that the worker population under study was earning only about \$23,000 annually prior to the layoff that prompted the petition for TAA support. If one takes these gains for workers as the programme's benefit, and computes its costs based on varying assumptions for the economic distortions that are created by the taxation required to fund the programme, as well as moral hazard induced by extended unemployment benefit durations, then the social return of TAA is estimated to lie in a range of 0% to 9%.⁶⁴ However, another recent evaluation of TAA, which focuses on a provision of the programme that provides wage subsidies to workers over the age of 50 who are willing to accept a lower-wage job, finds little evidence for a favourable effect of such subsidies on workers' labour market outcomes following job displacement (Hyman et al., 2021).

Across local labour markets, TAA expenditures grow particularly rapidly in locations that face a greater growth of Chinese import competition (Autor, Dorn and Hanson, 2013a) and that experience greater employment declines (Kondo, 2018). However, the TAA programme is small compared with many other transfer programmes that target the unemployed or low-income households. As a consequence, TAA accounts for less than 1% of the increase in total government transfer spending that results from a local labour market's exposure to import competition (Autor, Dorn and Hanson, 2013a).

Given the small scale of trade-specific programmes such as TAA or the EU's European Globalisation Adjustment Fund (EGF), it is likely that many workers who are displaced by trade

⁶³ Overall, 63% of all petitions are approved. A simple comparison between all accepted and rejected petitioners is complicated by the fact that underlying economic circumstances systematically differ across the two groups, as successful petitioners apparently were able to better document that layoffs occurred due to large trade shocks. However, petitions are judged by individual case investigators who vary in their approval leniency, which creates a source of randomness in the evaluation process where a marginal petition is more likely to be approved when it is assessed by a more lenient investigator. Hyman's (2018) analysis exploits this institutional feature in an instrumental variables design that compares workers with marginal petitions whose acceptance probability was influenced by the discretion of the case investigator.

⁶⁴ Hyman (2018) assumes that the economic deadweight loss that results from taxation could be anywhere between \$0.25 and \$0.75 per dollar of tax revenue, which yields an estimated internal rate of return of 9% for the former and 0% for the latter case.

shocks will be supported by general ALMPs that are available to all unemployed workers, rather than the ones directly connected to trade.⁶⁵ Indeed, the UK never applied for any EGF funds and instead preferred to fully rely on its own domestic programmes to support redundant workers (UK Parliament, 2016). A recent meta-analysis of several hundred mostly European ALMP evaluation studies shows a large dispersion in effectiveness across such programmes (Card, Kluve and Weber, 2015). About two-thirds of the analysed studies found statistically significant positive effects of ALMPs on employment probabilities two or three years after the end of a programme, with ALMPs supporting human capital accumulation yielding the best outcomes. Most of the programme evaluation studies did not report programme costs, and hence the meta-analysis does not report information on cost-benefit calculations.⁶⁶

Overall, the evidence on trade-specific and general ALMPs suggests that such programmes can be helpful at easing displaced workers' labour market adjustment. Different from transfer payments to the unemployed, programmes that help workers to find new jobs mitigate not only displaced workers' financial losses, but also the adverse social outcomes associated with persistent joblessness. However, not all ALMPs achieve their goals to help workers find good jobs, and even when programmes are effective, they do not always perform well in cost-benefit calculations.

Reviving local economic activity

An important result of the recent literature on local labour market effects of trade is that adverse shocks do not lead to large and rapid population adjustments. Instead, displaced workers are often spatially immobile, and adverse labour market outcomes such as low employment rates and depressed earnings remain heavily concentrated in the locations whose industries were most exposed to adverse trade shocks, even years after such shocks subside.

An alternative or complement to supporting displaced individuals with financial transfers or active labour market policy programmes is to direct support at depressed regions, cities or neighbourhoods via place-based policies. Such policies can take the form of place-based redistribution, where a system of taxes and transfers is conditioned on individuals' location rather than on their individual income level. Gaubert, Kline and Yagan (2021) show that place-based redistribution can be more efficient than income-based redistribution under some conditions, especially if the poor population is spatially concentrated and if the place-based redistribution does not induce strong migration from thriving to depressed locations. They also provide survey evidence which suggests that there is more popular support for targeting tax credits to poor people who live in distressed places, rather than poor people independent of location.

Instead of transferring funds to the residents of economically weak regions, many place-based policies seek to stimulate job creation in such locations through such measures as infrastructure investments or subsidies to firms. The European Union spends about a third of its budget on

⁶⁵ Since 2007, the EGF has paid for a fraction of member countries' ALMP expenditures that are targeted at trade-displaced workers. Applications for EGF support are submitted by member countries, and are usually restricted to large layoff episodes where at least 500 workers lose their job at the same firm. In an average year between 2015 and 2020, the EGF only accepted about four such applications covering around 4,000 trade-displaced workers per year (European Union, 2020). Close to half of the workers supported by the EGF during these years had lost their jobs in just five distinct events: the closures of a pair of assembly plants by Ford and Caterpillar in Belgium, two mass layoffs by Microsoft in Finland, and another large layoff by Air France in its home market. The EGF thus has a much smaller scope than TAA, which is likely due to its focus on large and politically visible mass layoff events (Claeys and Sapir, 2018).

⁶⁶ See Crépon and van den Berg (2016) for another recent review of the literature on ALMPs.

cohesion policy that seeks to reduce economic disparities across European regions. An important pillar of this policy is EU Structural Funds that are directed at poorer European regions whose per-capita income is below 75% of the EU average. These funds are often used to finance projects related to transportation and energy infrastructure. Becker, Egger and Ehrlich (2010) estimate that regions just below the 75% income threshold for eligibility experience a 1.6 percentage point greater growth of per-capita GDP over periods of about five years from the 1990s to the early 2000s, compared with regions just above the 75% threshold which are not eligible for this funding. However, funding did not lead to differential regional employment growth. Moreover, the Structural Funds stimulated greater GDP growth only in about a third of the eligible regions, and were ineffective particularly in regions with low human capital levels and poor political governance (Becker, Egger and Ehrlich, 2013).

Governments often use place-based policies that provide subsidies to specific firms in depressed areas. In the UK, the Regional Selective Assistance (RSA) programme provided discretionary grants to firms in regions with low income levels and high unemployment.⁶⁷ RSA financed up to 35% of the costs of investment projects that involve capital expenditure on property, plant or machinery, with most funding going to firms in the manufacturing sector. Approved projects were those expected to either generate new employment or protect jobs that might be lost otherwise. Criscuolo et al. (2019) investigate the consequences of a change in regional eligibility for RSA funding that was mandated by the periodic updating of the EU's list of economically disadvantaged regions. They find that locations that were more likely to become eligible for RSA based on their characteristics in the early 1990s experienced a significantly smaller decline in manufacturing employment and a larger decrease in unemployment during the early 2000s. The authors estimate that the direct costs of the RSA programme and its indirect costs via distortionary taxation amount to only about \$3,500 per manufacturing job that the programme managed to create or preserve.

Broader reviews of spatially targeted programmes (e.g. Kline and Moretti, 2014; Neumark and Simpson, 2015; Ehrlich and Overman, 2020) suggest that there is substantial heterogeneity in the effectiveness and efficiency of place-based policies, just as there is large variation in the success of active labour market policies. While some policies achieve their stated goals, others fail to produce the desired increases in incomes or employment, or manage to do so only at disproportionate costs or during transitory periods.

Protective trade policy

Transfer schemes, active labour market programmes and place-based policies often provide support to workers and regions only once trade shocks have occurred and job loss and income declines have already taken place. Protective trade measures such as the imposition of import tariffs and quotas instead seek to reduce the magnitude of the trade shocks itself. Such policies can thus prevent the adverse impacts of trade shocks from occurring, but they simultaneously tend to eliminate trade's desirable effects.

The rules of the World Trade Organization (WTO) allow its members to impose safeguard measures such as tariffs and quotas that provide emergency protection from import competition. Such safeguard measures must be justified by a sharp increase in imports that

⁶⁷ The name of the grant programme has changed several times. It is currently known as Grant for Business Investment in England, while the prior name of Regional Selective Assistance is still used in Scotland and Wales.

causes, or threatens to cause, serious injury to a domestic industry.⁶⁸ The measures must also be temporary, with the goal of giving an industry some breathing space to make the necessary adjustments to face the greater exposure to imports. Between 1995 and 2020, the WTO registered 196 instances where a country imposed safeguard measures, though the European Union (four cases) and the US (eight cases) rarely used them (World Trade Organization, 2020).

One prominent and controversial example of a safeguard measure is the 2002 US tariffs on steel. US steel prices were at a 20-year low in the early 2000s, and the industry suffered from an economic recession (Read, 2005). An investigation by the US government determined that imports of steel products, especially from the EU, were creating serious harm. As a consequence, the US imposed emergency tariffs of up to 30% on various steel products. The EU responded immediately by filing a complaint at the WTO, which in 2003 ruled that the steel tariffs did not fulfil the requirements for justified safeguard measures. While the WTO acknowledged that the US steel industry was negatively affected by imports, it argued that the evidence submitted by the US did not justify the magnitude and scope of the imposed tariffs. The US lifted the tariffs a few months after the WTO decision and claimed that this trade policy measure had been successful by then. However, the evidence surveyed in Read (2005) suggests that the tariffs brought only modest job gains in the steel sector, while job losses in industries that use steel as an input were larger by an order of magnitude.⁶⁹

The benefit that higher tariffs bring in terms of averted job loss in protected industries tends to trade off against lower job creation in downstream industries, higher consumer prices, and potential political conflict with foreign trading partners who may react with retaliatory tariffs. To realise greater gains from trade, developed countries instead lowered their average import tariffs from about 12% in the mid 1980s to less than 5% in 2016 (World Bank, 2019). They also ended the Multifibre Arrangement (MFA), which instituted import quotas to protect textile and apparel industries against competition from low-income countries. While freer trade indeed promises economic gains in the aggregate, the observation that workers and local labour markets struggle to adjust quickly to a rapid surge in import competition suggests that it may be advisable to reduce trade barriers gradually rather than through a sudden shock.⁷⁰

The trend towards ever-lower tariffs was broken in 2018 and 2019, when the US implemented wide-ranging tariff hikes, while affected trading partners of the US answered with retaliatory tariffs. Given that these tariffs came in a period when the US experienced neither a surge in import competition nor job loss in its manufacturing sector, they could not be justified as temporary safeguard tariffs. Instead, the US government argued that its new tariffs on steel and aluminium products protected national security interests, while a large set of new tariffs specifically directed at imports from China was justified with alleged unfair trade practices of the Chinese. From early 2018 to late 2019, the average US import tariffs levied on Chinese goods

⁶⁸ Different from anti-subsidy or anti-dumping measures, safeguards do not require unfair trade practices of the exporting countries.

⁶⁹ Jabbour et al. (2019) and Bown et al. (2020) show that the more widely used anti-dumping tariffs, which are justified by other countries' unfair pricing practices, had no positive aggregate effects on employment in France and the US, respectively. Such tariffs did little to shore up domestic employment in protected industries, but were associated with job losses and lower wages in downstream customer industries.

⁷⁰ The MFA, which was originally instituted in 1974, was gradually phased out from 1995 to 2005. However, the final removal of MFA quotas in 2005 still caused a major shock to the textile and apparel sectors in high-income countries. In the US, prices of previously quota-protected goods experienced a sudden drop of 38% (Harrigan and Barrows, 2009).

increased from 3% to 21%, while the average tariff that the Chinese applied to US goods rose from 8% to 22% (Bown, 2021).

The US tariff hikes were widely seen as part of President Trump's agenda to bring back jobs to America (Tankersley, 2019). Yet there is little evidence for employment gains. Flaaen and Pierce (2020) study the impact of the US–China 'trade war' on employment in broad US manufacturing industries, and find that the industries that were protected by higher import tariffs did not add significantly more jobs, while downstream customer industries faced job losses. An analysis of employment across all economic sectors in local labour markets also finds no evidence for substantial job gains in localities that were specialised in tariff-protected industries (Autor et al., 2021). Instead, employment fell in locations whose exporting industries were more exposed to other countries' retaliatory tariffs. In addition to the overall negative impact of the tariffs on US employment, the US import tariffs also contributed to an increase in prices faced by US firms and consumers (Amiti, Redding and Weinstein, 2019; Fajgelbaum et al., 2020; Flaaen, Hortaçsu and Tintelnot, 2020; Cavallo et al., 2021).

While tariffs and quotas are relatively easily measurable thanks to their quantitative nature, there exists less systematic information and thus less research on restrictions of trade through regulatory policies. Countries may, for instance, restrict imports through onerous and internationally incompatible product safety standards. Leonardi and Meschi (2020) show that since 1995, there has been a strong increase in 'specific trade concerns' that countries filed with the WTO to denounce regulatory barriers imposed by other WTO members. Their evidence indicates that a rising set of US industries is protected by such non-tariff measures, and that these industries experienced lower employment declines.

Overall, the evidence on the labour market impacts of protective trade policy provides a cautionary tale. Such policies can help to mitigate trade shocks that are so sudden and large that they overwhelm domestic industries' and workers' ability for economic adjustment. However, the imposition of new trade restrictions with the goal of protecting or bringing back jobs brings a new disruption to the labour market, and potential job gains in protected industries may trade off against higher prices for firms and consumers, employment declines in downstream customer industries, and adverse consequences resulting from other countries' retaliatory trade measures.

8. Conclusions

International trade expanded rapidly during a wave of globalisation in the 1990s and especially during the 2000s. This period witnessed the transition of a large bloc of countries from communist to capitalist economic systems, with China emerging as the world's largest exporter of manufactured goods. Trade was further facilitated by new information and communication technologies as well as falling tariffs. While some European countries such as Germany greatly expanded their exports during this period, other countries such as the UK and the US were primarily faced with a significant increase in import competition.

The rapid change in patterns of international trade had sizeable impacts on workers in high-income countries. Import competition caused many manufacturing firms to downsize or close. In contrast to the predictions of frictionless labour market models, many redundant workers did not rapidly move to other and similarly well-paid jobs. Instead, employees of import-competing firms accumulated significantly lower earnings over their careers than comparable workers in

industries with little trade exposure. Workers with low educational attainment and those in low-wage jobs experienced especially large earnings declines. The geographic local labour markets in which the import-competing industries cluster experienced not only larger declines in manufacturing employment, but in some cases also additional job loss outside the manufacturing sector, along with lower wages. Trade therefore contributed to greater *inequality across workers of different sectors, greater inequality across workers of different skill levels and greater inequality across workers of different geographic regions*.

While rising import competition from China was associated with job loss in many European countries and the US, not all labour market consequences of trade have been negative. Some high-income countries strongly benefited from improved opportunities for exports that created domestic jobs in export-oriented industries. Even rising offshoring by firms has sometimes been associated with employment and wage gains for the domestic employees of these firms, especially among highly skilled workers whose labour may be a complement in production to internationally sourced intermediate goods inputs. We show that levels of manufacturing employment were quite stable in countries that maintained a balanced trade relationship with China, while the manufacturing sectors of many countries that ran up a trade deficit saw dramatic job losses.

The import competition shocks faced by industries and local labour markets have also been connected to a range of outcomes that are less typically studied in analyses of international trade. Recent evidence shows that these shocks caused higher crime rates, a deterioration of health outcomes, a dissolution of traditional family structures, and greater support for far-right political parties. We present survey evidence which indicates that the general population in major European countries and the US became more sceptical towards trade during the 2000s, when many of the adverse consequences of import competition shocks materialised. However, attitudes towards international trade have been improving again over the last decade.

Trade can affect inequality not only through its impacts on earnings and employment in the labour market, but also through consumer prices. We conduct a novel analysis of the impact of rising imports from China on consumer prices in the UK. This analysis shows significant benefits for UK consumers as increased trade reduced consumer prices. However, the benefit of lower prices is relatively evenly distributed across rich and poor households, which implies that changes in prices neither exacerbated nor mitigated trade's impact on inequality.

The realisation that trade shocks can cause severe disruption in labour markets and rising income inequality in society raises the question of what policymakers can do to support the losers from globalisation. Protective trade policy in the form of new import tariffs that seeks to undo past globalisation tends to create more harm than benefit. A combination of income support and retraining can instead help displaced workers to avoid significant financial hardship and to find their way back into gainful employment. Moreover, place-based policies such as grants for firms that invest in depressed regions may rekindle economic activity in localities that suffer from persistently low employment rates following trade shocks. It remains a challenge, however, to identify which specific policies are effective at helping the losers from trade while not creating unfavourable trade-offs between equity and efficiency.

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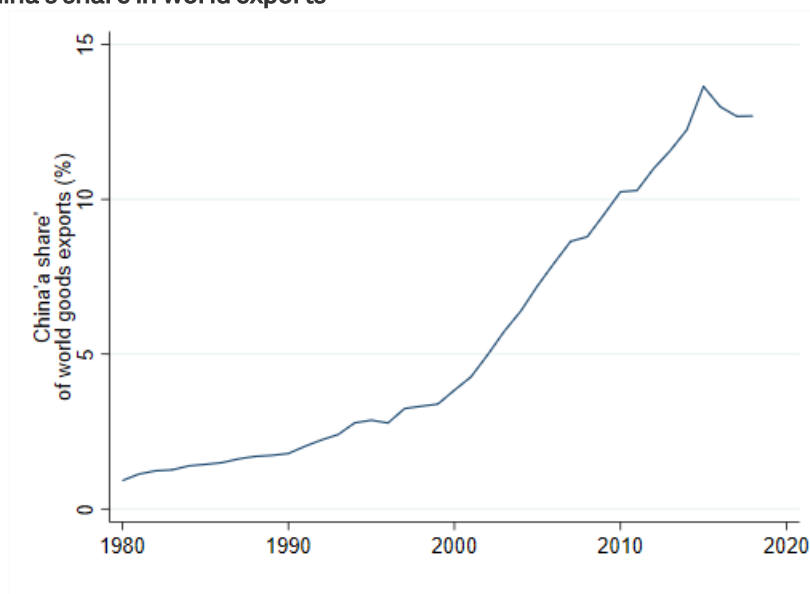
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Appendix

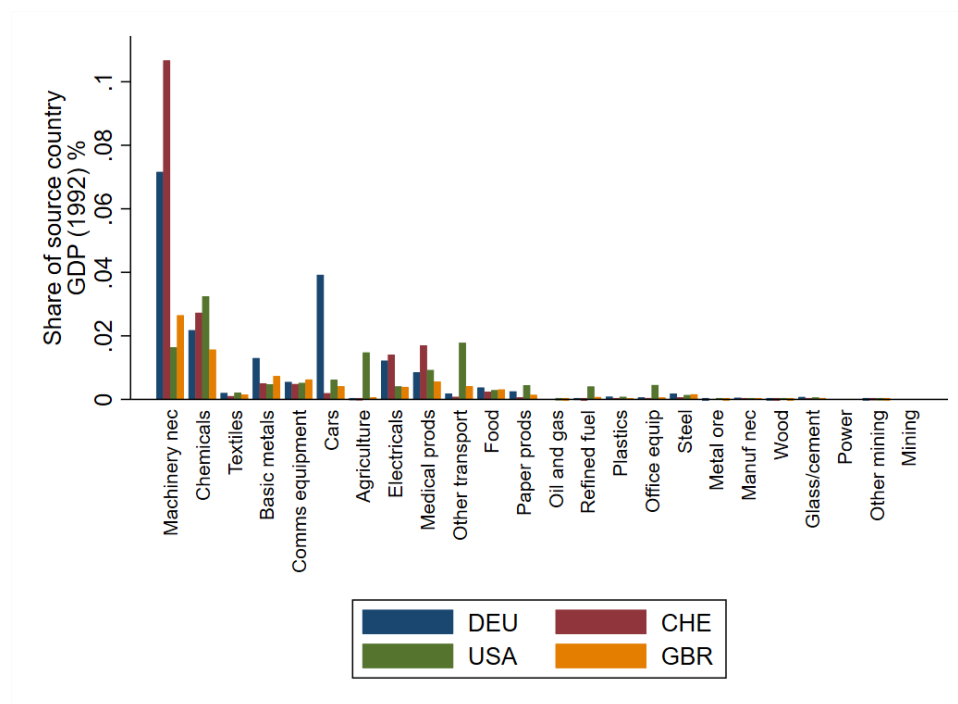
A. Appendix figures and tables

Figure A1. China's share in world exports

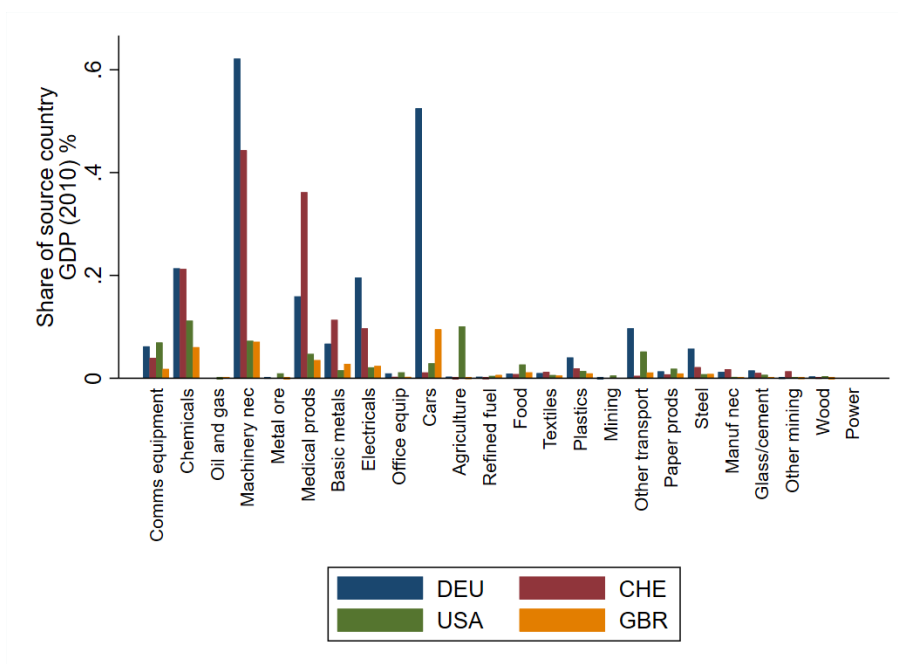


Source: World Bank (2021).

Figure A2. Chinese imports from different industries as a percentage of source country GDP, 1992



Source: Authors' calculations from OECD STAN database. Bars ordered according to the importance of each industry in overall Chinese imports in 1992.

Figure A3. Chinese imports from different industries as a percentage of source country GDP, 2010

Source: Authors' calculations from OECD STAN database. Bars ordered according to the importance of each industry in overall Chinese imports in 2010.

Table A1. Spending on active labour market policies (ALMPs) in selected countries

Country	Active labour market policy spending, % of GDP (2007)	Unemployment rate (2007)	ALMP spending relative to unemployment rate
US	0.12	4.6	0.026
UK	0.29	5.3	0.055
Germany	0.85	8.7	0.098
Norway	0.54	2.5	0.216
Spain	0.77	8.5	0.091
France	0.91	7.7	0.118
Italy	0.43	6.1	0.070

Source: OECD (2021).

B. Local labour market analyses of Chinese import competition

Autor, Dorn and Hanson (2013a) study the impact rising Chinese import exposure has on manufacturing's share of employment, using local variation in trade exposure across commuting zones in the US. They estimate the percentage point change in the manufacturing employment share among working-age adults due to a \$1,000 (2007) rise in Chinese import exposure per worker. Their approach has since been replicated in local labour market analyses for several European countries.

In this section, we attempt to put the estimates from the following countries into comparable terms:

- US (Autor, Dorn and Hanson, 2013a);
- UK (Foliano and Riley, 2017);
- Germany (Dauth, Findeisen and Suedekum, 2014);
- Norway (Balsvik, Jensen and Salvanes, 2015);
- Spain (Donoso, Martin and Minondo, 2015).

Additional studies for France (Malgouyres, 2017a) and Italy (Citino and Linarello, 2019) also pursue a similar empirical approach but use different measure of import exposure or labour market outcomes. We therefore include them only partially in our analysis below.

There are a number of methodological differences also between the papers included in our main comparison. In particular, different papers use different geographic units and sample periods for their analyses. Moreover, while all studies use an instrumental variables strategy that uses Chinese exports to other high-income countries as an instrument for Chinese exports to the country under analysis, the set of countries used to measure China's general export specialisation varies across studies. Finally, the preferred estimates of each paper use different vectors of control variables. We note the following differences:

- **Geographical unit of analysis for local labour market**

US: 722 US commuting zones with standard errors clustered by state.

UK: 243 UK travel-to-work areas.

Germany: 413 German counties with standard errors clustered by 50 labour market areas.

Norway: 160 labour market regions with standard errors clustered by 20 counties.

Spain: 50 Spanish provinces with standard errors clustered by 17 autonomous provinces.

- **Sample periods**

US: Stacked differences over periods 1990–2000 and 2000–07.

UK: One sample period, 2000–15.

Germany: Stacked differences over periods 1988–98 and 1998–2008.

Norway: Stacked differences over periods 1996–2002 and 2002–07.

Spain: Stacked differences over periods 1993–2003 and 2003–07.

- **Set of countries used to instrument for Chinese imports**

US: 8 high-income countries in Europe and Asia/Pacific.

UK: 9 high-income EU countries.

Germany: 8 high-income non-EU countries.

Norway: 17 OECD countries.

Spain: EU15 except Spain itself.

- **Variables included**

The German study of Dauth, Findeisen and Suedekum (2014) differs from the others in that it usually combines imports from Eastern Europe with those from China.⁷¹ All papers control for initial variation in the population and employment composition of a local labour market, and some also control for certain contemporaneous changes in a locality's economic environment.

⁷¹ The German study is also the only one that does not appear to weight the local labour market observations to account for size differences. All other studies weight geographic units by population size.

Table B1 documents the specific estimates from each study that we highlight. Each of the reported coefficients indicates the effect of a \$1,000 growth of imports per worker on the percentage of working-age adults who are employed in the manufacturing sector. Since the original papers report results for different local currencies, we converted results to common currency units (US\$ 2007) where possible.⁷² The coefficient from the US study of Autor, Dorn and Hanson (2013a) says that for each \$1,000 (2007) increase in Chinese imports per worker, manufacturing employment as a share of working-age population declines by 0.596 percentage points. Results for Norway and Germany are much smaller than this, while results for the UK and especially for Spain are larger.

Table B1 also reports the different control variables that are used for the main estimates of each study. To probe the sensitivity of estimates to different control variables, we also compare reported estimates from specifications that use minimal controls in Table B2. The general pattern of results is similar to those reported in Table B1.

Table B3 translates the estimated effects of a unit increase in import competition into implied losses in manufacturing employment. We obtain these by multiplying the coefficients in Table B1 by the average change in Chinese imports per worker in each country. We are also able to include in this comparison results for Italy, which are based on a different measure for import competition. The final column of Table B3 indicates the annualised change in the percentage of working-age population working in manufacturing given the product of average import growth in a country and employment change per unit of import growth. The pattern of manufacturing decline across countries remains similar to that in Table B1, with the smallest negative employment effect in Norway and the largest one in Spain. The impact of Chinese import competition on manufacturing employment is similar in the UK and the US, where the US faced a larger growth in Chinese import competition than the UK, while the UK experienced a larger decline of manufacturing per unit of import exposure.

Results for additional local labour market outcomes in Table B4 indicate negative effects of import shocks on overall employment and wages. In this broader set of labour market effects, we are able to include France, where the impact on the log count of manufacturing workers of a \$1,000 increase in Chinese imports is slightly larger than in the US, but smaller than in Spain.

⁷² Results in these papers are reported for local currencies in different years – for instance, in € 2005 in the case of Dauth, Findeisen and Suedekum (2014). To convert these to 2007 dollars, we could either (i) deflate/inflate import values to 2007 terms using local price deflators and then convert to US\$ using a 2007 exchange rate or (ii) convert to US\$ terms using an exchange rate for the appropriate year and then inflate/deflate the results to 2007 terms using a US price deflator. Since there is no strong reason to favour one of these approaches over the other, we do both and take the geometric means of the resulting conversion factors. To avoid these conversions being driven by end-of-period exchange rates, we also convert currencies ‘via’ the start year over which import growth is measured and the end year. For instance, in the German case (where import growth is measured from 1988 to 2008), we use local price deflators to convert values to both 1988 and 2008 terms, then use dollar exchange rates for these two years to convert values to US\$, and finally apply US price deflators to put these values in 2007 terms. The currency conversion factor we use for the German results is then the geometric mean of the conversion factors implied by these two approaches. Note that Donoso, Martin and Minondo (2015) report results based on nominal rather than real currency units.

Table B1. Comparison of the effects of a \$1,000 per worker increase in Chinese import competition on manufacturing employment in different countries

Country	Coefficient	Table no.	Years	Controls
US	−0.596 (0.099)	3 col. 6	1990–2007	initial manufacturing employment share, foreign born, college education, female employment shares, offshoring/tech change susceptibility, 9 regional dummies
UK	−0.983 (0.230)	4 col. 4	2000–2015	initial manufacturing employment share, low-skilled, foreign born, female employment shares, change in share foreign born
Germany (China)	−0.104 (0.056)	3A col. 2	1988–2008	initial manufacturing employment share, high-skilled, foreign born, female employment shares, offshoring susceptibility, 4 regional dummies, export exposure to China*
Germany ('the East') [†]	−0.104 (0.049)	1 col. 3	1988–2008	As for 'Germany (China)' with export exposure to 'the East' instead of China plus employment share in tradable goods/cars
Norway	−0.088 (0.035)	2 col. 3	1996–2007	initial manufacturing employment share, 1996 college education shares, change in total exports per worker from region (excluding exports to China), 5 regional dummies
Spain [^]	−2.054 (0.441)	2 col. 8	1999–2007	initial manufacturing employment share, foreign, college education, female, youth, construction employment share, change in working-age population, 5 regional dummies, 4-year house price growth, ICT, R&D, capital to labour ratio, patents of local manufacturing industries

Note: Results are taken from Autor, Dorn and Hanson (2013a) (US), Foliano and Riley (2017) (UK), Dauth, Findeisen and Suedekum (2014) (Germany), Balsvik, Jensen and Salvanes (2015) (Norway) and Donoso, Martin and Minondo (2015) (Spain), and are scaled to units of \$1,000 (2007) per worker (except for Spain). Regressions using stacked differences (in the US, Germany, Spain and Norway) also control for period-specific fixed effects.

* Export exposure is defined analogously to import exposure.

[†] 'The East' refers to China and Eastern Europe.

[^] Spanish estimates are in current dollars.

Table B2. Comparison of the effects of a \$1,000 per worker increase in Chinese import competition on manufacturing employment in different countries (for specifications with minimal controls)

Country	Coefficient	Table no.	Years	Controls
US	-0.746 (0.068)	3 col. 1	1990–2007	None
UK*	-1.823 (0.205)	4 col. 1	2000–2015	None
Germany (‘the East’) [†]	-0.024 (0.063)	1 col. 1	1988–2008	1988 manufacturing employment share
Norway	-0.086 (0.034)	2 col. 1	1996–2007	None
Spain [^]	-1.695 (0.351)	2 col. 5	1999–2007	1999 manufacturing employment share

Note: Results are taken from Autor, Dorn and Hanson (2013a) (US), Foliano and Riley (2017) (UK), Dauth, Findeisen and Suedekum (2014) (Germany), Balsvik, Jensen and Salvanes (2015) (Norway) and Donoso, Martin and Minondo (2015) (Spain), and are scaled to units of \$1,000 (2007) per worker (except for Spain). Regressions using stacked differences (in the US, Germany, Spain and Norway) also control for period-specific fixed effects.

* Foliano and Riley (2017) do not report two-stage least squares results without controls. Results here are estimated by ordinary least squares.

[†] Dauth, Findeisen and Suedekum (2014) do not report separate results for Chinese import exposure without control variables. ‘The East’ refers to China and Eastern Europe.

[^] Spanish estimates are in current dollars.

Table B3. Chinese import changes and implied job losses in manufacturing in different countries

Country	(1) Coefficient	(2) Import change (US\$ 2007)	(3) Manuf./pop. change (ppt)	(4) Implied manuf. change (col. 1 x col. 2)	(5) Implied manuf. change p.a.
US 1990–2007	–0.596 (0.099)	2,979	–4.07	–1.78	–0.104
UK 2000–2015	–0.983 (0.230)	1,614	–4.20	–1.59	–0.106
Germany (the East) [†] 1988–2008	–0.104 (0.049)	8,784	–4.00	–0.92	–0.046
Norway 1996–2007	–0.088 (0.035)	2,146	–1.53	–0.19	–0.017
Spain* 1999–2007	–2.055 (0.441)	1,006	–0.30	–2.07	–0.258
Italy [^] 1991–2007	[–0.146 (0.043)]	[4.20]		–0.61	–0.038

Note: Results are taken from Autor, Dorn and Hanson (2013a) (US), Foliano and Riley (2017) (UK), Dauth, Findeisen and Suedekum (2014) (Germany), Balsvik, Jensen and Salvanes (2015) (Norway), Donoso, Martin and Minondo (2015) (Spain) and Citino and Linarello (2019) (Italy), and are scaled to units of \$1,000 (2007) (except for Spain). Column 2 represents the average change in imports across local labour markets, while column 3 indicates the change in the share of working-age adults who are employed in manufacturing. These averages are weighted by regional populations in Spain, Italy and the US. The UK, German and Norwegian figures are unweighted averages.

[†] German estimates are for the combined imports competition from Eastern Europe and China.

* Spanish estimates and import figures are in current dollars.

[^] Figures for Italy in columns 1 and 2 are not comparable to the other countries, since the Italian estimates measure growing import competition as an increase in the import penetration ratio (relative to 1991), rather than imports per worker.

Table B4. Comparison of the effects of a \$1,000 per worker increase in Chinese import competition on other wage and employment outcomes in different countries

Outcome	Measure	US	UK	Germany [†]	Norway	Spain [*]	France
Wages	log change	-0.759 (0.253)		-0.0001 (0.0001)	-0.003 (0.001)	-0.012 (0.009)	
Manufac. employment	100 x log change	-4.231 (1.047)			-0.465 (0.267)	-8.290 (3.610)	-5.247 (1.405)
	pop. share change	-0.596 (0.099)	-0.983 (0.230)	-0.104 (0.049)	-0.088 (0.035)	-2.054 (0.441)	
Non- manufac. employment	100 x log change	-0.274 (0.651)			0.274 (0.098)	5.380 (2.710)	-3.073 (0.717)
	pop. share change	-0.178 (0.137)		-0.092 (0.056)			
Unemploy- ment	100 x log change	4.921 (1.128)			0.950 (0.560)	-13.770 (11.360)	
	pop. share change	0.221 (0.058)		0.006 (0.014)			
Not in labour force	100 x log change	2.058 (1.080)			0.075 (0.103)	1.800 (2.710)	
	pop. share change	0.553 (0.150)					
Total employment	pop. share change			-0.224 (0.091)			
Table no.		5 col. 1-4	4 col. 4	5 col. 2-5	4 col. 1, 3-5	8 col. 1-4 C, 9 col. 3 D	2+3 col. 5

Note: Results are taken from Autor, Dorn and Hanson (2013a) (US), Foliano and Riley (2017) (UK), Dauth, Findeisen and Suedekum (2014) (Germany), Balsvik, Jensen and Salvanes (2015) (Norway), Donoso, Martin and Minondo (2015) (Spain) and Malgouyres (2017a) (France), and are scaled to units of \$1,000 (2007) per worker (except for Spain).

Controls for US, UK, Germany, Norway and Spain are the same as outlined in Table B1. For France, they are the initial share of college-educated residents, of women in the employed population, foreigners, and production workers in the workforce as well as 22 regional fixed effects, period effects and the log of initial total employment. Non-manufacturing employment for Norway excludes public sector employment. Wage changes are defined differently in different countries: for the US, it is the average log weekly wage; for Germany, it is the log change in regional median wage; for Norway, it is average log earnings; and for Spain, it is the change in the log average wage. Malgouyres (2017a) reports effects on average log hourly wage separately for the manufacturing sector and the non-tradable sector. Expressed per \$1,000 increase in imports, these effects are -1.355 (standard error 0.673) and -0.332 (0.250).

[†] German estimates are for the combined imports competition from Eastern Europe and China.

^{*} Spanish estimates are in current dollars.

C. Analysis of the impact of Chinese import competition on UK consumer prices

Measuring import penetration and employment changes for different products

Our price analysis makes use of data on imports and exports of commodities, employment in different industries (taken from Office for National Statistics (2020)) and the prices of consumer products (taken from the Consumer Prices Index).

We take our import and export data from the UN Comtrade database at the level of six-digit Harmonised System product codes. We map these to 836 Classification of Product by Activity (CPA) codes using a concordance taken from the EU RAMON database and then to 109 three-digit Classification of Individual Consumption by Purpose (COICOP) codes using a proportional crosswalk provided by the Office for National Statistics (2017a). This final crosswalk gives the proportion of consumption spending on each COICOP code made up by each CPA code in 2013. We use this crosswalk to proportionately allocate imports to each COICOP category and also allocate workers from each industry to each COICOP product the industry produces. The allocation of UK domestic output to these industries might differ from the allocation of UK domestic consumption (which includes spending on imports) but it is the former that would be most relevant for assigning employment across COICOP categories. For this reason, when allocating workers to COICOP categories, we adjust the allocation of CPA codes to COICOP codes according to the import intensity of each COICOP group (though this does not have a large effect on the results). Figures on import intensities of each group are taken from Office for National Statistics (2017b).

We define the growth of import penetration for a product between year τ and year t as

$$\frac{M_{p,t}^{China \rightarrow UK} - M_{p,\tau}^{China \rightarrow UK}}{T_{p,1999} + M_{p,1999} - X_{p,1999}}$$

where $T_{p,1999}$ is turnover in 1999 for UK industries producing good p , $M_{p,1999}$ is total UK imports of product p , $X_{p,1999}$ is total UK exports and $M_{p,t}^{China \rightarrow UK}$ are Chinese imports into the UK in year t (all valued in 2016 £). In the regression analysis below, we instrument this with

$$\frac{M_{p,t}^{China \rightarrow Other} - M_{p,\tau}^{China \rightarrow Other}}{T_{p,1999} + M_{p,1999} - X_{p,1999}}$$

where $M_{p,t}^{China \rightarrow Other}$ is Chinese imports into other developed countries in year t . These countries are Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Spain, Switzerland and the US. $T_{p,1999}$ is calculated from the Business Structure Database under the assumption that the firms in each industry produce products with the same CPA code as their reported Standard Industrial Classification (SIC) code.

Regression sample

We exclude services, including the category telephone equipment and services as this is predominantly spending on services. Our price data distinguish 49 goods products, which is more aggregated than the 58 distinct COICOP groups for which we have data on import penetration. For those nine goods where the price data are more aggregated than the import data, we calculate the weighted average of import exposure for industries using spending shares from the Living Costs and Food Survey as weights. Due to data limitations, we also exclude recreational

durables during the 1994–98 and 1999–2007 periods, and cars and sports equipment for 1994–98, as price data for these goods do not go back to 1994. This leaves us with a sample of 46 goods for which we have import penetration, price and employment data for the whole period, and 48 goods with complete data from 1999 onwards.

In our regression analysis, we also make use of the change in import penetration across two periods, 1994–98 and 1999–2007. Since the two periods are not of equal length, we use annual average changes in prices, employment and import penetration. There is a rapid and sustained increase in reported UK imports from China between 1999 and 2000, which most likely reflects a change in the treatment of imports from Hong Kong which originated in China (Baranga, 2018). For this reason, we include imports from Hong Kong in our measure of Chinese import penetration for the UK (but not in our measures of Chinese imports into other countries, as they are not affected by this issue).

Alternative employment regressions

An alternative way to estimate the impact of Chinese import competition on different industries is to use more tightly defined SIC industry codes, instead of the product groups for which we also have price data. Panel a of Table C1 shows results for the effect of Chinese import competition estimated in the same way as we did in Table 1 but using 362 industries defined at either the four- or three-digit level (depending on whether it is feasible to map commodity codes to four-digit or only to three-digit industries) rather than at the level of COICOP industries. The employment impacts are in general smaller than those in Table 1, and indicate employment losses of between 0.8% and 1.6% per percentage point increase in import penetration once we control for two-digit industry fixed effects. These figures are similar to those reported by Acemoglu et al. (2016) and Jaravel and Sager (2019) for industry-level employment regressions in the US.

Panel b of Table C1 reports results when we conduct the employment analysis at the level of more aggregate two-digit SIC industries. The employment impacts are considerably larger, suggesting that the level of aggregation can affect the estimated effects. This may partly reflect attenuation biases as it can be difficult to exactly allocate imports to detailed industries that produce similar outputs. In the main text, we report impacts at a level consistent with our consumer goods categories. These estimates lie between the estimates shown in panels a and b of Table C1 once we control for industry fixed effects.

Table C1. Effect of Chinese import competition on UK consumer prices and employment, 1994–2007: four-digit SIC versus two-digit SIC

	(1)	(2)	(3)	(4)	(5)	(6)
a. Δ Employment (ppt) (4/3-digit SIC)						
Δ Chinese import exposure	–1.331** (0.461)	–1.291** (0.461)	–1.187** (0.453)	–1.628** (0.525)	–1.045* (0.449)	–0.836* (0.395)
N	362	349	341	362	349	341
b. Δ Employment (ppt) (2-digit SIC)						
Δ Chinese import exposure	–2.425** (0.876)	–2.250** (0.856)	–2.121* (0.866)	–6.283* (2.447)	–6.033* (2.428)	–4.264+ (2.203)
N	60	52	48	60	52	48
Product/Industry FE (2-digit)				X	X	X
Excl. fuel and tobacco		X	X		X	X
Excl. tech. goods			X			X

Source: Data taken from the Quarterly Labour Force Survey. Results are weighted by employment counts in 1999. Standard errors in parentheses. Chinese import exposure is measured as the annual average change in the real value of Chinese imports between 1999 and 2007 and between 1994 and 1998 relative to UK domestic sales in 1999. Regressions include time period fixed effects. Instruments are the change in Chinese imports in each industry entering Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Spain, Switzerland and the US. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.