

D Impact of trade on labour market outcomes

This section looks at the empirical evidence on the effect of trade on wages and employment and addresses the following key questions: what is the evidence of the impact of import competition and offshoring on the level of wages and employment? What is the impact of increased market access for exports and the availability of cheaper imported inputs on employment? How can varied empirical evidence across countries be reconciled? How does the functioning of the labour market affect outcomes? How large are trade-induced adjustment costs? This section focuses particularly on wages and employment because research on other dimensions of labour markets, such as employment stability and security, is much less developed due to lack of cross-country data and thus does not allow for a comparison of how trade and technology play out on these other variables.



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Some key facts and findings

- Globally, millions of jobs depend on international trade. Imports support jobs by improving the competitiveness of firms, while exports allow firms to reach larger markets. The share of export-related jobs in domestic employment can reach up to 30 per cent in some countries.
- Importers and exporters pay higher wages than firms focusing on the domestic market. Indeed, firms that both export and import pay workers around 30 per cent more than firms not engaged in international trade.
- Trade opening tends to increase wages and employment, but not all workers benefit, as regional and individual differences determine how widely gains are shared. Domestic policies, macroeconomic conditions and barriers to worker mobility play an important role in shaping how the benefits are shared.
- Trade increases the demand for skills and can accelerate structural change. This is the case even in economies with a comparative advantage in low-skill activities because trade leads to the upgrading and wider use of technology.
- Trade has supported the participation of women in the workforce in developing countries thanks to the expansion of sectors and services which generally employ a higher share of women.
- By creating opportunities for skilled workers, trade can increase incentives for schooling. This can be especially beneficial for women in some developing countries where they traditionally receive less education.

1. Introduction

The discussion in Section B on labour markets highlights that employment and wages are affected by many different factors, of which trade is only one. Section B shows that in a theoretical model where wages are flexible and workers are mobile, balanced trade does not affect aggregate employment levels of an economy. However, in the real world there are considerable wage and job search rigidities. Trade imbalances and obstacles to labour mobility and thus to trade can affect the aggregate number of jobs in an economy. Since trade comes in many forms, it is not clear whether the upfront expectation about the sign of the impact should be positive or negative. An empirical analysis of the effects of trade on employment and wages is therefore key to understanding what factors play a role in shaping the impact of trade on employment and wages.

The effects of technology discussed in Section C and the effects on trade on employment that we will discuss in this section are often similar and difficult to disentangle. Much in the same way that there are gains from innovation, so there are gains from trade (see Box D.1). With increased productivity, a country can produce more using the resources available to it, gross domestic product (GDP) increases, and the prices of consumer goods fall, improving consumers' welfare. Trade allows each economy to specialize and export goods and services that it can produce more cheaply and to import those it cannot. This fosters the growth of the most competitive sectors and firms in the economy, while at the same time allowing consumers more choice at cheaper prices. These gains from trade are significant. Some estimations have indicated that they can be as high as one-third of a country's GDP compared to autarky (Ossa, 2015). Trade can also enhance growth and productivity by allowing firms to import more technologically advanced inputs and exploit greater economies of scale, and it can provide incentives to innovate. In such cases, the effects of trade mirror even more closely the effects of technological change.

As with skill-biased or routine-biased technological change, if gains from trade are to materialize, workers must adjust to change. Imported inputs may be used by local business to increase their productivity and become more competitive in international markets. These imports, however, may be in competition with goods produced by local producers. Hence, trade results not only in the growth of some domestic firms that take advantage of the access to new markets but also the decline of other domestic firms that shrink and go out of business. As firms adjust, so do workers that may leave less productive firms to seek

employment in more productive ones. In the presence of frictions in such reallocation of workers, workers may experience temporary or permanent spells of unemployment.

This section is organized as follows: Section D.2 provides some facts and figures about jobs supported by trade, and about wages in trade-related versus non-trade-related occupations. Section D.3 reviews the impact of international trade on the level of employment and wages, and discusses the factors that affect this relationship. Section D.4 looks at the effects of trade on the long-term structure of employment for skilled and unskilled worker in manufacturing and services jobs. It also examines the impact of trade on women's employment opportunities.

2. Jobs supported by trade

Many people work on trade-related activities. Jobs are created not only to fulfil an economy's domestic demand, but also to produce goods and services that are directly exported across economies, or inputs that are used to produce goods and services that will be exported. Not only export, but also import-related activities produce jobs. If trade is disrupted, these jobs are put at risk and workers need to look for alternative occupations.

(a) Both imports and exports support employment

Figure D.2 represents the share of jobs that were supported by exports in 2011. The figures take into account not only the number of people employed in exporting firms, but also those that are employed to produce inputs that will be sold domestically and processed for exports by other firms in the country. In 2011, jobs supported by export production amounted to almost 15 million in the United States, 66 million in the EU and 121 million in China.¹ In terms of total employment, the importance of jobs supported by exports varies from 10 per cent in the United States or Japan up to 28 per cent in the European Union, the Republic of Korea or New Zealand.

In the context of global value chains (GVCs), in which goods and services are produced by combining inputs from different countries, access to the cheapest and best quality inputs is essential to achieve export competitiveness and also to produce goods and services for the domestic market at affordable prices. Both exporting and non-exporting firms benefit from increased import opportunities that lower their costs and help them to expand. Protectionism in the form of higher domestic tariffs

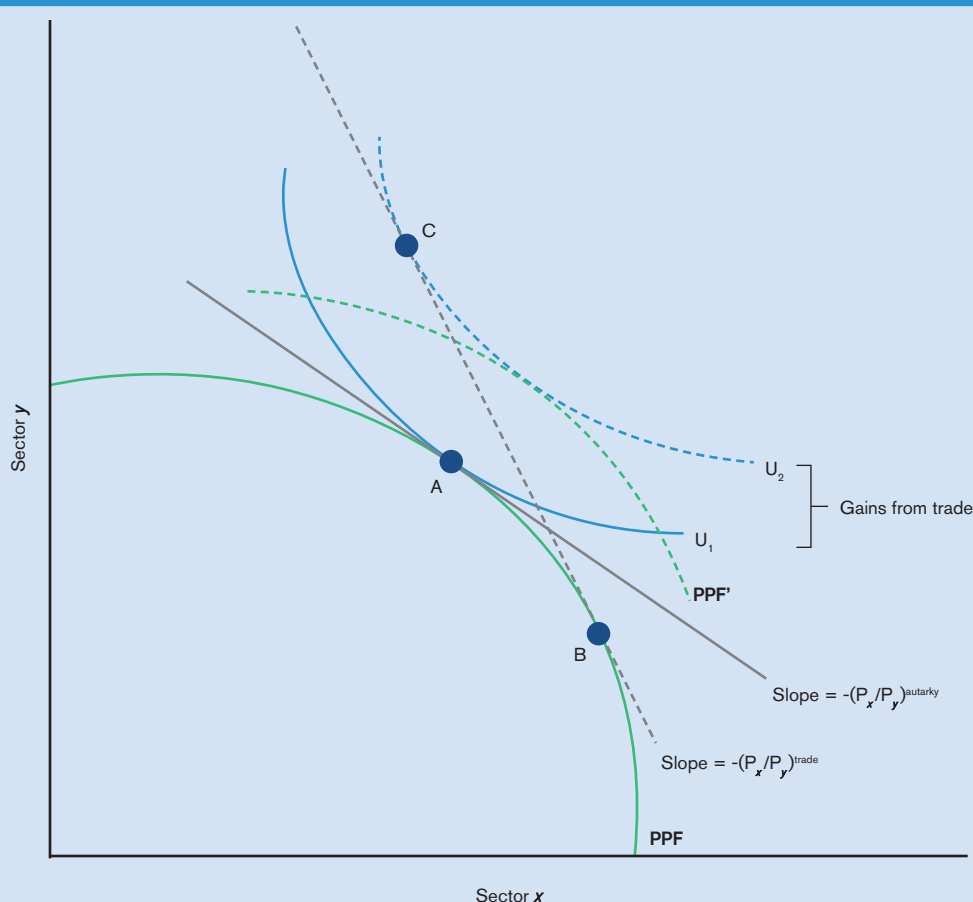
Box D.1: Welfare equivalence between technological change and international trade

As described in Box C.1, the production possibility frontier (PPF), represented by curves PPF and PPF' in Figure D.1, shows the quantity of good x and good y that can be produced in an economy with a given endowment of labour. The slope of the PPF at a given point represents the amount of good y that can be redirected through the reallocation of productive resources into the production of one more unit of good x given a certain level of technology. If the productivity of labour increases (when there is a technological innovation for example), the PPF shifts outwards.

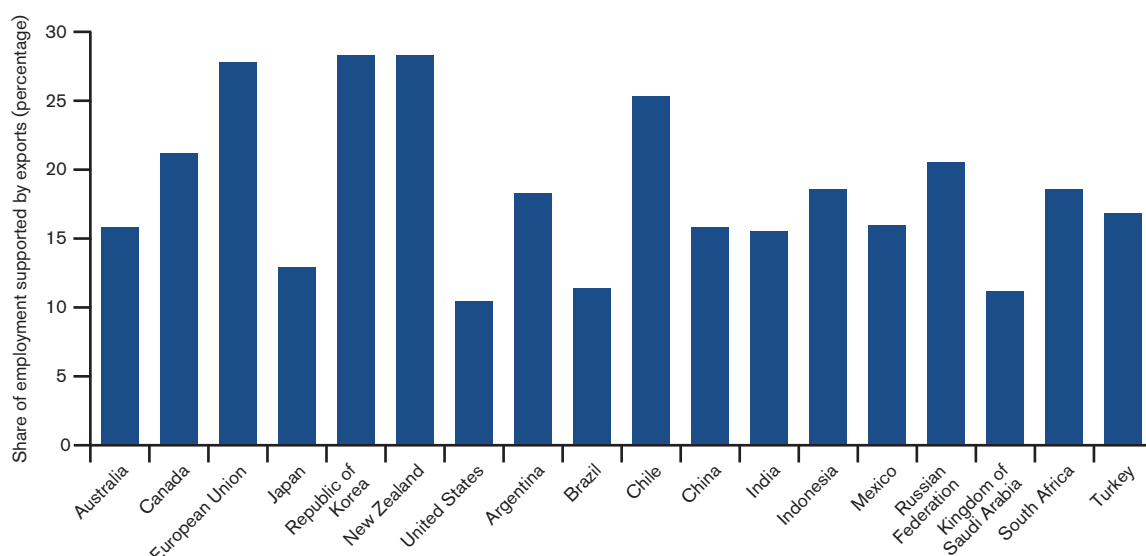
According to economic theory, the quantity of good x and y that an economy will actually produce depends on consumers' preferences. A way to represent consumer preferences is by drawing indifference curves (curves U_1 and U_2 in the figure below). Each indifference curve represents the various combinations of quantity of goods x and y consumed that give consumers the same level of utility. Higher indifference curves represent higher level of utility for the consumers. In the absence of trade, the PPF acts as a budget constraint for the country. Under perfect competition, the economy will produce at the point of maximum utility for the country, that is, at the point where the highest indifference curve is tangent to the PPF, represented by point A in Figure D.1. The tangent to the indifference curve in point A is the relative price of good x in terms of good y in autarky: $(P_x/P_y)_{\text{autarky}}$.

When the country opens to trade, relative prices of good x and y will change (represented by $(P_x/P_y)_{\text{trade}}$) because the country will be able to produce more of the good for which it has a relative comparative advantage and to import and consume more of the goods for which consumers have a relative greater preference. In such a situation, the economy is able to produce at point B and consume at point C. The increase in the utility from the indifference curve U_1 to the indifference curve U_2 represents a measure of the gains from trade. An equivalent increase in the level of consumers' utility can only be reached if the PPF expands outwards to a higher level PPF', following for instance technological change.

Figure D.1: Trade openness and technological change in a production possibility frontier



Source: WTO Secretariat.

Figure D.2: Share of total employment supported by exports (2011)

Source: WTO calculations based on Trade in Value Added Database (TiVA)

Note: The numbers take into account jobs supported by exports directly, i.e. jobs in the exporting industry, and jobs supported indirectly in the upstream industries that provide intermediate inputs to the exporting industries. Increased revenue from the export sector can also support domestic jobs through increased spending, but this channel is not captured.

or other forms of non-tariff barriers tends to decrease the competitiveness of domestic firms both at home and abroad. By enhancing firms' competitiveness in foreign markets, imports therefore sustain domestic jobs too. Antràs et al. (2017), focusing on the United States, illustrate this point by showing that firms that import intermediate inputs from several foreign countries at high intensity have lower input costs and sell more than firms in which all inputs are domestic. Specifically, a firm that imports 47 per cent of its input purchases presents cost savings of 30 per cent and has 176 per cent higher sales due to global sourcing. Similarly, Colantone and Crinò (2014) find for the European Union that new imported inputs have a strong positive effect on product creation and give a substantial boost to output growth in manufacturing. Other studies also support similar findings for developing countries, for example Kasahara and Rodrigue (2008) for Chile and Goldberg et al. (2010) for India. Furthermore, Antràs et al. (2014) find evidence from the United States suggesting that firms that increase their imports of intermediate inputs also start sourcing more from domestic suppliers and thus may support more employment in those firms.

(b) Both exporters and importers pay higher wages

Workers generally earn higher wages in exporting firms. Data on firm-level wages show that there is

considerable variation across firms even in the same industry. A large body of work has provided evidence that exporting manufacturing firms are different in a number of ways compared to firms that sell only domestically: they are larger, more productive and more capital-intensive and they pay higher wages. In a pioneering study, Bernard and Jensen (1997) found that average wages are between 5 and 7 per cent higher in exporting plants compared to non-exporting plants of the same size and skill composition. Other studies have supported the existence of this exporters' wage premium for other countries, including China, Denmark, Germany, the Republic of Korea, Spain, Sweden and the United Kingdom.² More recently, the availability of data on worker-level wages allows taking into account worker characteristics such as age, gender and education when estimating the exporter's wage premium. The results confirm that workers with similar characteristics earn higher wages when working for an exporting, rather than a non-exporting, firm (Dai and Xu, 2017; Irarrazabal et al., 2013).

Importing firms also pay higher wages. Using highly detailed firm-level data for the Indonesian manufacturing sector in the period 1991 to 2000, Amiti and Davis (2012) find that exporters pay wages that are higher by 8 per cent, importers pay wages that are higher by 15 per cent, and firms that both import and export pay wages up to 25 per cent higher than firms that are not engaged in international trade.³

3. The impact of trade on employment and wages

A careful assessment of the research on trade and labour market outcomes suggests that the impact of trade is likely to be positive for overall employment and real wages in an economy, at least after a period of transition. Like technology, trade affects individuals, firms, regions and sectors unevenly, and while some regions may benefit, others may lose. Depending on the specific characteristics of an individual and if no adequate accompanying policies are in place, some workers may not gain from trade even when the welfare of the majority increases.

(a) Trade's overall effects on employment and wages

The main question in any assessment of the labour market effects of trade is how trade affects a country's overall employment rate and average wages. In particular, are there net labour market gains from increased trade openness when all sectors are considered?

It is important to clarify here that even if there were net labour market losses from trade, this would not imply that the net overall effect of trade is negative, because the effect on wages and employment is only one way in which trade affects an economy's welfare. Trade also affects welfare through its effect on other markets. For instance, trade reduces prices in product markets, thus increasing real wages and lowering the prices of inputs. Amiti et al. (2017) show that imports from China have decreased the manufacturing price index in the United States by almost 8 per cent between 2000 and 2006. According to Handley and Limao (2017), the additional policy certainty alone that China's WTO accession has given to US investors is responsible for a price drop equivalent to a 13 per cent tariff decrease. In line with this, Box D.2 discusses evidence showing that when all channels are considered, the welfare gains from trade considerably outweigh adjustment costs from trade.

When looking at the issue of the impact of trade on wages and employment, ideally, one should consider both direct and indirect effects of trade on these two labour market outcomes. On the one hand, there is a direct negative substitution effect of import competition on employment. On the other hand, there are many, often positive, indirect effects.

One of these effects relates to the impact of trade on the prices of imported intermediate inputs used by domestic firms. When these inputs become

cheaper, domestic firms can increase production and hire more domestic workers. The importance of these international production linkages has increased considerably over the recent decades and should thus be included in any assessment of the labour market effects of trade (e.g. Hummels et al., 2001). Another important indirect effect involves disposable income. Cheaper imports can increase the disposable income of consumers and, thus, increase spending on domestically produced goods. These indirect effects are usually referred to as general equilibrium channels while the direct effects are so called partial equilibrium channels.

A large body of the literature, however, does not account for these indirect effects. Studies that analyse the effects of trade using units of analysis below the national level often miss certain general equilibrium effects and are unable to capture the full impact of trade because of their fairly specific focus on regions, industries, firms or individuals (see Box D.3). It is important to keep this in mind to properly interpret the evidence on the impact of trade on the labour market.

Recent studies on the effects of trade at the country level that take into account general equilibrium channels paint a positive picture for trade. Independent of the exact identification strategy behind the estimates, an increase in openness to trade tends to decrease (although only slightly) the national unemployment rate.

For instance, cross-country studies that estimate econometrically the effect of changes in tariffs or trade openness on changes in employment suggest that, while unemployment can initially increase after a trade shock, it then decreases below its initial level. For tariffs it is estimated that a 1 per cent decrease lowers unemployment by about 0.35 per cent, while for trade openness a 10 percentage point increase reduces aggregate unemployment by about three-quarters of a percentage point (Dutt et al., 2009; Felbermayr et al., 2011).

This is in line with Figure D.3, which correlates changes in trade openness with changes in unemployment and shows that the correlation at the aggregate level is close to zero. Regarding the trade-related adjustment period, various studies suggest that a time-frame of seven to ten years is necessary for economies to return to their new steady states (Arias et al., 2013; Artuç et al., 2010).

The evidence that trade decreases unemployment has recently been confirmed by studies that use an alternative approach to capture the indirect effects of

Box D.2: The benefits of trade outweigh the costs

Most of the literature on the gains from trade does not take into account the costs of adjustment to opening up to trade, i.e., the costs borne by those workers who have to change jobs and may be temporarily unemployed. Typically, economic literature assumes that such adjustment is smooth and costless. However, various factors can slow down the reallocation of resources following a trade shock. As discussed in Section B, key determinants of the ease and speed of adjustment to trade are obstacles to labour mobility, often called “frictions” in the economic literature. Economic theory and quantifications that include these obstacles and their implications for unemployment or wages therefore allow for a more complete cost-benefit analysis of trade.

While this work is still in its early stages due to severe data limitations, initial results suggest that the gains from trade are considerably larger than the adjustment costs. With an estimated cost of 80 per cent of the gains from trade, Davidson and Matusz (2009) provide an upper bound of the share of the benefits that trade costs may represent. But they also show that this share can be as low as 5 per cent when retraining costs are low and the import-competing sector is small.

Other works have generalized the determinants of adjustment costs beyond retraining costs and the size of the import-competing sector, and typically estimate adjustment costs to be between 15 per cent and 40 per cent of the gains from trade. For instance, Kambourov (2009) finds that Mexico's gains from trade opening were reduced by 30 per cent due to inflexible labour market laws, and Dix-Carneiro (2014) finds that, depending on the additional mobility of capital, adjustment costs amount to not more than between 16 and 32 per cent of the gains from trade in Brazil.

An alternative approach to estimating the welfare effects of trade net of adjustment costs is to consider the impact of raising trade barriers instead of the effects of trade opening. Just like opening up to trade, higher trade barriers are likely to trigger adjustment costs. Firms that rely on imported inputs tend to shrink, although additional protection may allow some less productive domestic firms to survive. Estimates suggest that the costs per saved job are usually highly disproportionate and that downstream job losses outweigh the number of saved jobs.

For instance, while Hufbauer and Lowry (2012) put the costs of US safeguard tariffs on Chinese tyres at around US\$ 900,000 per saved job in 2011, they also argue that while 1,200 jobs in the tyre industry might have been saved, they cost 3,700 jobs in downstream sectors. This is broadly in line with earlier estimates by Hufbauer et al. (1986) from 31 US case studies, which put the average cost per job saved at above US\$ 500,000.

This literature thus points almost unanimously to the fact that there are net overall gains from trade when all aspects are considered. However, it is important to keep in mind that as long as there are no actual data on key variables like aggregate retraining costs or geographical mobility costs, these numbers can only be treated as indications.

trade. The approach relies on structural estimation by explicitly spelling out the different channels through which trade affects the labour market, including indirect effects, and then simulates the overall impact based on actual observed changes in trade flows. In this way, a wide variety of obstacles to goods and labour mobility may be accounted for, and researchers can capture general equilibrium effects stemming from input-output linkages, geographic factors or other mechanisms.

A recent study by Caliendo et al. (2015) based on this alternative approach (simulations rather than econometric analysis) finds that aggregate US employment and real wages have benefitted from the

increased trade exposure to imports from China since the 1990s. However, the study also stresses that the distribution of these gains within the United States was very uneven, with some manufacturing sectors, like electronics or textiles, contracting while others expanded, including services or food and beverages. This will be discussed in more detail in the next subsection.

In a similar study, preliminary results suggest that the net United States-wide labour market effect extends to the manufacturing sector and is even more positive. The main difference is that this work incorporates a potential positive response of the labour supply to the increased real wage. That is, trade increases wages

Box D.3: Pros and cons of partial versus general equilibrium analysis of trade and employment links

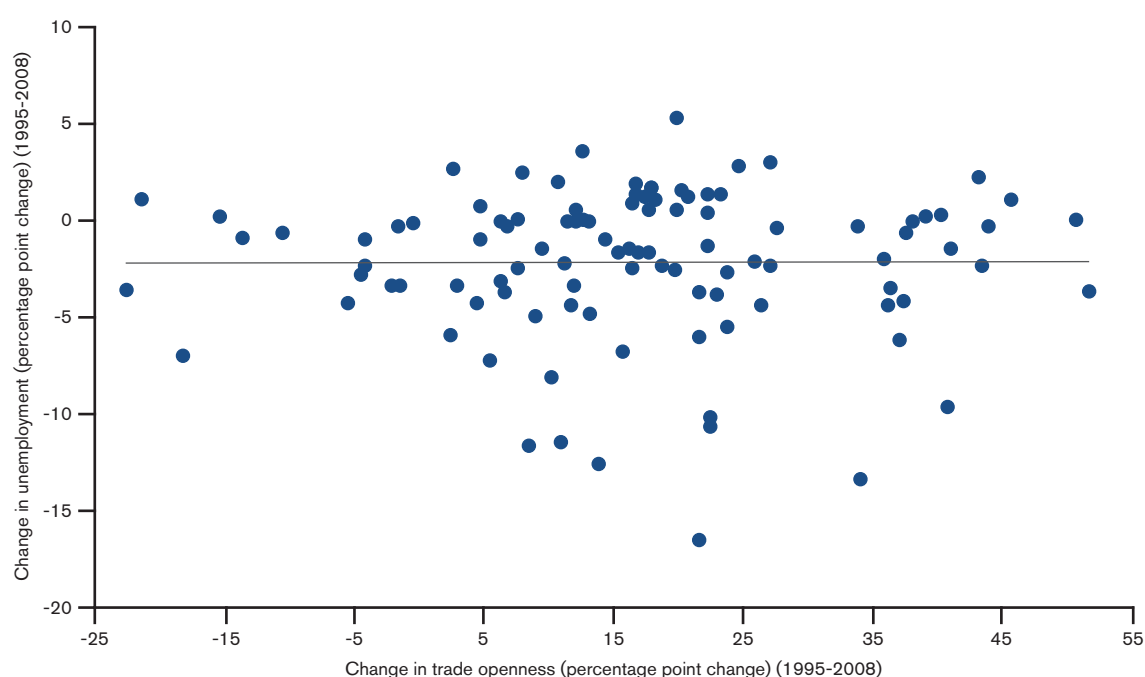
Estimates of the effects of trade on employment have been made in the context of both partial and general equilibrium analysis – in other words, in terms of the direct and indirect effects of trade. The methodology used to assess the impact of trade on employment determines the way in which results can be interpreted and how they can be used.

Studies of the effects of import competition on employment based on partial equilibrium (PE) analysis generally explore the effect at the level of a sector or geographical area (e.g. a community zone or state) within a country. This approach has the advantage of requiring a more limited amount of data than a general equilibrium (GE) analysis and can therefore be used to identify individuals who are likely to lose their jobs to import competition. Hence, these results can be used to put in place policies that can ease adjustment and address costs.

However, PE analyses miss a part of the story of resources reallocation. PE studies do not take into account that when imports displace domestic production in a certain sector, the capital and the labour formerly used in the production of that good are freed and can shift to another sector. Similarly, if the unit of analysis is a certain geographical area, partial equilibrium analysis does not account for the possibility that resources freed in one area can flow to another area and increase production there. Therefore, they can only provide us with a sense of the overall effects under stringent assumptions.

Structural empirical studies that look at the links between trade openness and labour market outcomes in general equilibrium overcome this limitation and provide overall welfare analysis. These models can also account for relevant input-output relationships between industries and across borders, using data on global input-output tables. However, the results of a GE approach depend on the completeness of the model and the set of parameters used for the estimations. For example, in the context of labour market outcomes, important aspects to account for in a GE model are how people's decisions to relocate depend on the benefits and costs of relocation, how workers react to changes in earnings (labour supply), and how the process of matching workers and employers operates.

Figure D.3: Trade openness and unemployment (1995 to 2008)



Source: World Development Indicators.

Note: Change from 1995 to 2008 expressed in percentage points where trade openness is measured as the sum of exports and imports of goods and services as a share of gross domestic product. Outliers are excluded.

and this triggers more workers to enter the labour market. The study shows that when the reaction of labour supply to changes in real wages is taken into account, trade has unanimously positive effects on employment and real wages across different sectors. The key mechanism is that when trade raises either nominal wages or decreases prices, individuals have a stronger incentive to work. The increased incentive then implies an increase in labour supply and higher employment (Adao et al., 2017).

In such simulation-based evidence, the specific estimated figure of the effect of trade on wages and employment will always be sensitive to the specifications of the model used for the estimation. However, including trade's indirect effects, such as the response of the labour supply to increased real wages or increases in disposable income, in the analysis of the effects of trade on labour markets is important when one wants to assess country-level effects.

In recent years, there has been a series of studies that have looked at the impact of China's trade expansion on local labour markets within the United States, as well as Brazil, France, Germany, Norway and Spain (see e.g. Autor et al., 2016; Malgouyres, 2016; Dauth et al., 2014). These studies identify how employment in regions more exposed to import competition has developed compared to other regions that are less exposed to import competition. Some of these studies use their results on relative regional effects to deduce absolute nationwide effects. Contrary to the simulation and cross-country evidence, they report reductions in national employment caused by increased Chinese imports. For instance, in the case of the United States, one study suggests that up to 2.4 million jobs were lost from 1999 to 2011, of which 1 million were in the manufacturing sector (Acemoglu et al., 2016).

However, it is important to note that a set of strong assumptions is necessary to deduce national-level effects from relative regional effects. For instance, as outlined by Muendler (2017), such estimates require that employment in the least exposed local labour market does not react to trade. Typically, these studies compare regions within a country and relate their performance to their exposure to import competition (difference-in-difference analysis). That is, regions in California with a focus on computer and electronics manufacturing are more exposed to Chinese import competition than regions in Wisconsin specialized in food and beverages. Based on the results that employment in less exposed regions developed favourably compared to employment in more exposed regions, these studies infer that overall employment

must have declined as a result of trade with China. This inference implies that the negative relative effect found by these studies – i.e. less exposed relative to more exposed regions – translates into a negative absolute effect of the same magnitude. For this to hold, the underlying assumption must be that employment in less exposed regions does in fact not react at all. Coming back to the example, this means that employment in Wisconsin did not change as a result of higher Chinese imports while employment in California reacted a lot.⁴

The intuition is that we cannot deduce from a change in the difference of employment between two local labour markets after an increase in imports whether employment benefitted from this increase or not. Muendler (2017) explains this with an illustrative example:

“Setting aside the mathematics, a common image to describe the consequences of trade [...] is that of boats being lifted or lowered. Does the China shock lift or lower the boats in the United States? It is impossible to tell from DD [difference-in-difference] estimation. The DD estimator shows conclusively whether the difference in altitude between two typical boats grew or shrank [...] By its methodological design, however, the DD estimator does not allow us to infer whether all boats were lifted (just some less than others), or all boats were lowered (just some more than others), or some boats were lifted (little) and others lowered (much). In short, the DD estimator can precisely answer the question how regional disparities between communities in the United States changed. But the DD estimator is, by construction, incapable of showing how the U.S. economy as a whole (the average U.S. boat) was affected (unless we know from conclusive independent analysis of some local community that was immune)”.

Even if one were to believe that these studies have correctly identified an immune local labour market, the result that the impact of trade on the overall level of employment may have been positive, or only slightly negative, is also confirmed by alternative local labour market studies of the same type. A key distinguishing factor in this context is once again that imports affect labour market outcomes through more channels than direct substitution (i.e. the partial versus general equilibrium problem, see Box D.3). For instance, a preliminary study by Wang et al. (2017) finds that when the exposure measure additionally captures the expansion of downstream non-manufacturing firms that have benefitted from cheaper inputs

sourced from China, more exposure implies regional employment gains.

Another study, by Magyari (2017), moves the unit of analysis from regions to firms. It finds that firms moved jobs across their different plants as a response to the surge in imports from China, in order to specialize in their most competitive products. This actually led to an increase in the total number of jobs within the firms but since these plants are often in different regions this is consistent with the results of both the local labour market and the national studies.

To conclude, the research that establishes a link between trade and national employment and real wages suggests that trade benefits these two labour market outcomes, but not necessarily equally within countries. Therefore, the next section discusses how the overall labour market gains are shared at a more disaggregated level.

(b) How trade's overall effects on employment and wages map out within a country

The second key question for an assessment of the labour market effects of trade is how the overall effects map into outcomes at finer levels of disaggregation within countries. Trade shifts resources from less productive sectors to more productive ones and from less productive firms to more productive ones (see Box D.4 for an overview of the different effects of trade). Since firms and particular sectors are concentrated in certain regions, these shifts usually translate into regional disparities.

Similarly, since many workers are not fully mobile across firms or regions, trade – much like technological change – can affect individuals differently depending on their characteristics. As discussed in Section D.2(a), the empirical evidence on the impact of trade on labour markets that assesses relative effects cannot be used to infer level effects. This caveat applies to the literature that we review in this subsection. Recalling the example of the boats from above, this subsection looks at how the distance between the boats develops due to trade, but not at whether the boats are lifted or not. In particular, this subsection will look at disparities across sectors, firms, regions and individuals within an economy.

Starting with sectoral disparity, several studies have shown that after a trade shock, employment in import-competing industries suffers relative to employment in export-oriented sectors.⁵ Focusing on import competition, early evidence has shown that

through its impact on trade flows, the appreciation of the dollar between 1980 and 1985 affected wages and employment negatively in a sample of tradeable industries in the United States when compared to less affected industries (Revenga, 1992).

Similar evidence on relatively detrimental impacts in import-competing industries exists for tariff reductions in various developing economies including Argentina, Mexico and Morocco (Castro et al., 2007; Revenga, 1997; Currie and Harrison, 1997). In addition, a recent study by Pierce and Schott (2016a) confirms similar effects on employment in manufacturing in the United States arising from the elimination of tariff uncertainty rather than tariff reduction. Pierce and Schott argue that while the WTO accession of China had no implications for actual tariffs, which had been low since the United States granted China most-favoured-nation (MFN) status in 1980, it removed uncertainty because the MFN status had to be renewed periodically before the accession. They then show that employment was detrimentally affected in industries in which the difference between non-MFN and MFN tariffs was largest relative to employment in industries in which the difference was small. In addition, the work by Acemoglu et al. (2016) shows that upstream industries that supply the directly competing industries were also hit since input demand was affected.

Along the same lines, studies that also account for export opportunities provided by opening up to trade find a positive effect of trade on employment through this channel when compared to employment in import-competing sectors. A study on Germany shows that, following the rise of China and Eastern Europe, export-oriented industries created new job opportunities (Dauth et al., 2014). Along the same lines, increased US market access following the United States-Viet Nam regional trade agreement signed in 2001 allowed workers in Viet Nam to move from agriculture to more productive and better-paid jobs in manufacturing firms newly able to export to the United States (McCaig and Pavcnik, 2017).

There is also evidence of growing disparities across firms. Gains from trade materialize not only through the reallocation of resources across sectors, but also through the reallocation of resources from the least to the most productive firms within a sector. Just like sectoral reallocation, this can increase disparities in labour market outcomes of firms within the same sector. Amiti and Davis (2012) find that, in Indonesia, for instance, a reduction in industry-level input and output tariffs decreased wages in firms oriented only towards the domestic economy but increased wages in firms that import and export.

Box D.4: How does trade affect workers? Insights from economic theory*Distributional effects*

Trade theory usually studies how trade affects the demand for different types of workers (skilled versus unskilled) under full employment. That is, it does not take into account the level of employment and focuses on how resources reallocate within an economy. What are its theoretical predictions?

The classical analysis of winners and losers of trade opening is based on the traditional Heckscher-Ohlin (HO) model. This model predicts that when an economy opens up to trade, it will export the good or service, the production of which intensively uses a factor in which that economy is relatively abundant. In this set-up, developing countries that are typically well endowed with low-skill labour will tend to specialize and export low-skill intensive goods, say textiles. Low-skill intensive industries will expand and the demand for low-skill workers in developing country will increase. In developed countries, on the contrary, the production of high-skill-intensive goods or services will increase and so the demand for high skill workers. As a consequence, wages for low-skill workers will increase in developing countries and decrease in developed countries independently of the sector (exporting or importing) or the firm in which they are employed.

The HO model assumes that workers move freely from one sector to another one. This is realistic in the long run, but not in the short run. Firms require time to invest in the production of a new product and workers often require time and effort invested in training before they can transition from one job to another one. The Ricardo-Viner (RV) model provides a framework to analyse the effects of mobility frictions. In this model, workers in import-competing sectors, who cannot move easily to the expanding sector (i.e. they are sector-specific factors) may lose out from trade reforms. Workers in the export-growing sector instead gain, independently of whether they are high-skilled or low-skilled.

The “new-new” trade theory challenges the prediction that winners and losers from trade reforms depend in the short-run on the sector of employment and in the long run on their factor endowment. Rather, it predicts that high-productivity firms will expand and low-productivity firms will shrink. Individuals working in high-productivity firms will gain and those working in low-productivity firms may lose either temporarily or permanently (Bernard et al., 2007). In these models, when a country opens up to trade, the highest-skilled workers end up working in the exporting firms, because they self-select or because more productive firms screen more intensively. Hence trade opening leads to higher wages for skilled workers in all countries (Yeaple, 2005; Sampson, 2014; Helpman et al., 2010; Antràs et al., 2006).

There are also other elements that affect workers’ gains from trade. These are technological change (Aghion et al., 2005), the type of trade opening (Amiti and Davis, 2012), and whether or not a firm offshores parts of its production (see Feenstra and Hanson, 1995).

Long-run unemployment

Turning to the impact of trade on long-run unemployment, research has emphasised several mechanisms through which trade can affect the overall level of employment rather than the redistribution of jobs across workers. One mechanism is through sector-specific frictions in the labour market (for example, because requirements as to job-specific skills differ or because sectors face different minimum wages). Sectors facing higher frictions tend to have longer unemployment spells. By shifting resources across sectors, trade can increase or decrease long-run rates of unemployment, depending on whether a country’s comparative advantage lies in sectors characterized by high or low frictions (Davidson et al., 1999; Helpman and Itskhoki, 2010; Moore and Ranjan, 2005).

Frictions can also be firm-specific. Firms can have differing abilities to monitor workers’ efforts or they may adopt different mechanisms to hire workers. In this set-up, trade may have an impact on unemployment because it affects different firms differently (Davis and Harrigan (2011) and Felbermayr et al. (2011). Egger and Kreickemeier (2009) present a similar argument based on fair wages).

Although trade can theoretically affect overall employment, it is worth pointing out that empirically, according to a recent study by Carrère et al. (2015), the impact of trade on overall unemployment is relatively minor. Labour market institutions and technical change play a more relevant role in explaining employment than trade (Berger and Frey, 2016; Blanchard, 2006).

As labour markets adjust to trade and resources move from import-competing to exporting firms and across sectors, a country may experience growing regional disparity. This is because the industrial structure in a country is often regionally concentrated. That is, regions tend to depend on a certain sector or even firm rather than being diversified across import-competing and export-oriented sectors or firms, and trade shocks can thereby lead to detrimental impacts in regions in which, for example, the production structure depends on import-competing sectors/firms, compared to regions in which export-oriented sectors/firms may be concentrated. This mechanism is identical to that discussed in Section C, in which the increased use of industrial robots in a number of US industries led to a rise in cross-regional disparities (Acemoglu and Restrepo, 2017).

The result that trade has widened regional disparities in terms of wages and employment is quite general. It is a finding of both partial and general equilibrium studies and holds for regional trade agreements (RTAs) and unilateral trade opening, as well as for studies that focus on import competition from China.⁶ Similar results have also been found in developing economies like Brazil, India, and Viet Nam (Dix-Carneiro and Kovak, 2017; Topalova, 2010; McCaig, 2011), as well as in developed economies like Germany or the United States (Dauth et al., 2014; Caliendo et al., 2015; Autor et al., 2013).

It is important to note that trade affects both tradeable and non-tradeable sectors in the same local labour markets. While only certain tradeable sectors are directly affected by increased import competition or increased market access, non-tradeable sectors, like retail, health or hospitality, in the same region are also typically affected because of indirect effects. Autor et al. (2013) find, for instance, that wages in non-tradeable sectors of areas most exposed to Chinese imports decreased while, conversely, preliminary evidence by Wang et al. (2017) suggests that these sectors expanded employment. Dauth et al. (2014) also report wage gains in the services sector of export-oriented regions in Germany, while Menezes-Filho and Muendler (2011) show that, in Brazil, the services sector and the less trade-exposed informal sector absorbed initially displaced workers after Brazil's trade liberalization.

The combination of these effects on firms, sectors and regions trickles down further to individuals working in differently affected sectors and firms, or living in different areas. As discussed in Section B, this is because moving across sectors, firms or regions is costly for workers, and particularly so for workers with certain skills or in certain occupations.

Therefore, the impact of trade on individual labour market outcomes will depend on a combination of five factors: the individual's employer, occupation, skills, sector of employment, and the region in which he/she lives.

Evidence on the effects of NAFTA on US labour market suggests, for instance, that despite average nominal wages and overall employment remaining largely unaffected, certain workers who lived in more exposed areas or worked in more exposed sectors incurred earnings losses relative to less exposed peers (Hakobyan and McLaren, 2016). For instance, the combined role of location and industry exposure implied that a blue-collar footwear worker without a high school degree in a town specializing in footwear production was hit across several dimensions (import-competing region and sector). Specifically, Hakobyan and McLaren report that in the most vulnerable regions and industries, high-school dropouts experienced a decrease in wage growth over the decade of respectively 4 and 17 percentage points compared to similar workers that were less exposed.⁷

Similarly, evidence for the US labour market shows that relative earning losses appear to be larger for low-wage workers, especially in manufacturing, while high-wage workers experience only minimal earning losses, as they are able to move across employers and outside manufacturing more easily (Autor et al., 2014; Krishna and Senses, 2014). On the other hand, evidence for exporting firms and sectors indicates that rising exports increase relative employment stability, in particular in smaller establishments (Kurz and Senses, 2016; Dauth et al., 2014).

However, the evidence for Germany shows that the expansion of export-oriented sectors did not benefit workers displaced from import competition. Instead, gains in these industries accrued primarily to workers from the same sector, new labour market entrants, or previously unemployed workers (Dauth et al., 2016). This is confirmed by Danish data (Keller and Utar, 2016), which suggests that many displaced mid-wage manufacturing workers moved into low-wage services jobs.

Furthermore, evidence suggests that occupation matters in addition to industry. Ebenstein et al. (2014), looking at total US trade, find that a 10 per cent increase in occupational-level import competition and offshoring to low-income countries brought about a relative decline in real wages, especially for occupations intensive in routine tasks. The study equally finds that an increase in export growth and offshoring to high-income countries

implies a relative increase in wages. Ebenstein et al. argue that the earning losses of workers faced with import competition are mainly those of workers who moved outside manufacturing, in line with the previous evidence that sector-specific training is crucial for the trade adjustment of individuals who have had to change jobs as a result of import competition.

Finally, evidence from Finland and Denmark (Hakkala and Huttunen, 2016; Utar, 2016; Hummels et al., 2014) confirms that both offshoring and import competition are likely to bring about lower employment probabilities and wages for workers in exposed firms when compared to workers in exporting firms. This effect is borne predominantly by low and medium-skilled production workers, who tend to move into the services sector rather than export-oriented manufacturing. Exporting on the other hand increased the wages across all skill types.

In conclusion, empirical evidence shows that without intervention by governments and other institutions, labour market gains from trade are not distributed evenly. Import-competing sectors, regions, firms or workers tend to fare worse in relative terms than their export-oriented counterparts. At the worker level, this is particularly problematic for less educated workers in manufacturing, who face the largest obstacles to labour mobility and therefore bear a larger part of the relative adjustment costs. This finding mirrors the results from Section C on technology. Note, however, that as discussed in Section D.2(a), these relative losses do not mean that these individuals are worse off in absolute terms.

(c) Which factors determine how easily countries adjust to trade?

A smooth and quick adjustment to trade shocks can reduce the trickle-down effect on workers discussed in section D.2(b). If workers can move fairly freely across firms, occupations, sectors or regions, the trade-induced disparity across these dimensions does not translate into heightened disparity for individuals. Typically, the ease of adjustment is affected by various external factors. Section B has highlighted the prominent role of macroeconomic conditions and obstacles to labour mobility. The section has shown that adjustment to economic shocks tends to be slower during recessions and that various frictions that affect the movement of capital and labour, such as information asymmetries, job market regulations or moving costs, prevent workers from capitalizing on the gains from trade. While these two factors can affect the adjustment to any type of shock, whether they are due to trade, technological

change, or commodity prices, certain factors are particularly important in a trade context.

This subsection discusses three factors for which the trade context is important, namely trade balances, the pattern of trade opening, and the degree of regional diversification. While the evidence on responses to trade shocks so far been fairly homogeneous across economies, certain differences do exist, such as the differing responses of Germany and the United States to rising Chinese import competition. These differences can shed some light on the three factors that either smoothen or aggravate how national labour market gains from trade are shared within countries, thus allowing a better understanding of what is within the scope of policy when it comes to reducing these disparities.

First, trade balances matter for the ease of adjustment. A central difference between Germany and a set of other advanced economies when compared to the United States is the aggregate savings and investment behaviour, which has led to a large and persistent trade deficit in the United States. While the causes of this are usually not to be found in trade policy but rather in other areas such as taxation or monetary policy, the deficit can change the role of trade shocks for relative outcomes because it leads to an expansion of the non-tradeable sector *vis-à-vis* the tradeable sector (Krugman, 2016). The absorptive capacity of the tradeable sector for displaced workers becomes in this case limited and, as a consequence, these workers move into the non-tradeable sector, which implies a loss of sector-specific human capital,⁸ or out of the labour force.

Another important factor is the industrial structure and pattern of liberalization. It matters how important the comparative advantage sectors of partner economies are for the economy that incurs the trade shock. For instance, the total manufacturing share in the United States of the textile sector in 1995 was around twice as high as the corresponding share in Germany, which had lost parts of this sector to other European countries during the European integration process. Since in 1995 China's biggest comparative advantage was in textiles, the differential impact on Germany and the United States can be partly explained by this.

Several studies suggest that the initial industrial level of tariff protection is a major determinant of how trade shocks play out within countries. Naturally, in many cases employment in industries that enjoy high levels of protection prior to a trade opening faces higher adjustment costs than employment in less protected industries that have already adjusted to increased

competition (e.g. Hakobyan and McLaren, 2016; Hanson and Harrison, 1999). Jakubik and Kummritz (2017) show that it was not until 2015 that the US labour market largely adjusted to increased Chinese import competition.

Finally, how easily workers in import-competing sectors can adjust to the effects of rising imports depends on how diversified their local labour markets are. This is caused by the interplay of sector-specific skills and the cost of moving. When export-oriented industries within the same sector are in the same local labour market as the import-competing industries, workers can switch relatively easily because there are no moving costs and they can retain their sector-specific know-how. Evidence on the importance of diversification was presented recently in a study by Yi et al. (2017), who find that earning disparities in less diversified regions of Germany were three times as high as in highly diversified regions.

This section highlights that factors other than trade policy are also responsible for the distributional implications of changes in trade flows. In addition, individually addressing the three factors described above does not guarantee smooth adjustment since the condition of other factors might still prevent it. For example, recent work by Baldarrago and Salinas (2017) on Peru suggests that high labour mobility alone is insufficient for costless labour market adjustment after trade opening.

4. Trade and the structure of employment

Country-wide employment levels are largely affected by macroeconomic factors (see Section B). However, trade induces changes in countries' employment structure at the level of tasks, occupations, firms or sectors due to its reallocation effects. In other words, some jobs may disappear while other jobs are created. The previous subsection shows that such new jobs may differ from the old ones in the skillsets they require, their industry or their location, which may hamper the adjustment. This subsection discusses how these reallocation effects have affected the composition of the labour force in terms of skilled and unskilled workers, manufacturing and services jobs, and how they have affected job opportunities for women.

(a) Trade has increased the demand for skills

International trade and offshoring, like technology, can change the employment structure across skill

levels by changing the demand for skills. As explained in Box D.4, the traditional factor-endowment theory of comparative advantage predicts that trade would increase the relative demand for skills in an advanced economy that is relatively skill-abundant, while in a low-income economy, where skills tend to be relatively scarce, trade could lead to an increased relative demand for low-skilled labour.

Recent theories nevertheless point out several channels through which trade can lead to an increasing demand for skills not only in developed, but also in developing countries.

As offshoring costs fall, a developed economy can relocate more production stages to a developing economy. This leads the former to specialize in a narrower set of stages that are relatively skill-intensive, while the latter attracts a wider set of stages. In the developing country, the new stages would be relatively more skill-intensive than the stages it used to host. As a consequence, the relative demand for skilled labour may increase in both economies.

Furthermore, an increase in the relative demand for high-skill workers can come from a trade-induced change in the firm composition. When trade liberalization opens new trading opportunities, the most productive firms try to seize them and expand their production. At the same time, international trade stiffens competition in the domestic market, leading the least efficient firms to reduce their sales or close down. High-productivity expanding firms tend to be more skill-intensive than low-productivity downsizing firms, and therefore this change in firm composition may translate into an increase in the relative demand for high-skill workers irrespective of the industry specialization.⁹

Finally, as mentioned in Box D.4, to the extent that trade brings about innovation and technology diffusion, it may also indirectly boost the demand for high-skill labour globally.

In the short term, the supply of workers with a given skillset tends to be fixed and an increased demand for skills translates into increases in the skill premium, i.e. the ratio of wages commanded by high-skill and low-skill workers. This higher skill premium acts as a signal for workers to increase their skill levels and/or acquire the appropriate type of skills. When skill supply responds to the market changes, the increased demand results in a higher share of high-skilled workers without long term repercussions for the skill premium. It can therefore be an important mechanism in upskilling the labour force and consequently in advancing economic development.

While the following paragraphs show that there is abundant evidence of upskilling following trade opening, there is also evidence that the skill premium tends to be higher for several years which suggests that the adjustment of skill supply can be sluggish (Goldberg and Pavcnik, 2007; Goldberg, 2015; Helpman, 2016). This is supported by empirical evidence which shows that while high-skill workers can adjust to changes in skill demand promptly, upskilling or re-skilling of low-skill workers is costly and takes time (Keller and Utar, 2016; Autor et al., 2014; Artuç and McLaren, 2015). Skills development policies therefore play an important role in shaping the impact of increased demand for skills on labour market outcomes, as discussed in Section E.¹⁰

Empirical evidence supports the view that international trade increases the relative employment of skilled workers both in developed and developing countries. The early literature focused on the period of the 1970s and 1980s in the United States. In this period, the share of non-production workers¹¹ in the manufacturing labour value added increased, suggesting that the demand for skills shifted towards high-skill workers. This is because the proportion of high-skill workers tends to be larger in activities that are not directly related to the production process, such as marketing or logistics, than in routine production activities. The early empirical analysis nevertheless showed that while international trade contributed to the observed trends, investment in computers and research and development (R&D) was the most important driver (Berman et al., 1994).

Other studies focusing on the impact of increased offshoring from the United States to Mexico also found that offshoring contributed to the increasing relative demand for non-production manufacturing workers, but that its impact was small relative to that of technology upgrading. The respective contributions were estimated to be around 15 per cent for trade and around 30 per cent for technology (Feenstra and Hanson, 1999).

More recently, empirical evidence from the United States and Belgium shows that imports of intermediate inputs from China mildly increased the relative employment of non-production workers compared to production workers (Wright, 2014). The estimates by Wright suggest that the effect accounted for around 6 per cent of the average decline in US production worker employment during the period 2001 to 2007. Moreover, Wright estimates that this decline was outweighed by a positive impact on the non-production employment, leading to a small but positive increase in aggregate employment.

Firm-level evidence from France supports findings that offshoring is associated with a lower relative demand for production workers and especially for the less skilled ones. Between 1986 and 1992, French manufacturing firms which increased their imports of final goods, and which were therefore likely to engage in offshoring of the assembly stage, changed their labour force composition towards non-production activities such as marketing or distribution (Biscourp and Kramarz, 2007). Evidence from the same study also shows that all types of offshoring, whether foreign sourcing of final goods or intermediate inputs, are associated with an increase in the share of skilled workers such as engineers or technicians among the remaining production workers. Interestingly, the employment changes in this study were due to offshoring to other OECD countries, suggesting that skills upgrading within firms from high-income countries is not necessarily linked to offshoring to low-wage countries. Rather, it appears to be associated with increases in sourcing from foreign markets in general.¹²

Newly available data on occupational characteristics allow researchers to characterize better the recent changes in the nature of work and the tasks required in each occupation. The types of tasks performed by a worker at the workplace also determine whether a job is suitable to be offshored and whether it is susceptible to import competition from low-wage countries. Occupations which require repetitive, easily codifiable tasks are not only easy to automate, as mentioned in Section C, but also to relocate. Non-routine occupations that require abstract thinking and face-to-face communication are much less tradeable.

This literature also emphasizes that the low- versus high-skill dichotomy is not sufficient to capture fully the labour market evolution in the past decade. The jobs that require the lowest level of skills are predominantly non-routine services jobs, such as cleaning or security services, and thus are not directly affected by offshoring or automation (at least so far). Consequently, trade and technology tend to increase the demand for high-skilled workers compared to mid- or low-skilled ones as well as to decrease the demand for mid-skill workers performing routine tasks compared to both high- and low-skill categories. This phenomenon, referred to as job polarization, has been documented for many developed countries since the late 1990s and recently also for some developing countries such as Brazil, Mexico and Turkey (OECD, 2017; Reijnders and de Vries, 2017).

Firm- and worker-level evidence shows that offshoring and import competition have a small positive impact on the demand for non-routine occupations and

thus on job polarization. Becker et al. (2013) show that offshoring by German multinational enterprises is associated with an increase in non-routine and interactive tasks performed in the onshore plants, and a higher share of high-skill workers. Still, Becker et al. estimate that offshoring accounts for only 10 to 15 per cent of these changes. Another recent study investigates the impact of import competition from low-wage countries on workers in Denmark (Keller and Utar, 2016). The study shows that import competition has led to a decline in routine, mid-skill manufacturing occupations, and has therefore contributed to an overall shift in employment towards both high- and low-skill occupations. Evidence from the United States and Western Europe suggests that services offshoring also increases the relative demand for high-skill workers in non-routine occupations, but that the effect is economically small (Crinò, 2010; Crinò, 2012).

Skills play an important role in shaping the impact of import competition on individual workers. The study by Keller and Utar (2016) finds that workers' ability to move up or down depends on several factors. First, workers in occupations that require cognitive skills either stay in mid-wage jobs or move upwards, and therefore are unaffected or benefit from import competition. Second, vocational training with a manufacturing focus makes mid-wage workers less vulnerable to wage declines if they stay in their job but it does not shield them from being obliged to move into low-wage jobs. Finally, third-level education and vocational training with an information technology focus prevents workers from having to move to low-wage jobs and strongly increases their chances of moving to high-wage jobs if they face import competition from a low-wage country.

Economists have pointed to different channels through which trade affects the demand for skills. One factor is simply that trade is a skills-intensive activity. There is evidence that increased trade may push up the relative demand for skills because exporting firms employ more skilled labour than non-exporters (Bernard and Jensen, 1995; Bustos, 2011a; Brambilla et al., 2011). Using a dataset which provides detailed information on the skill structure within French manufacturing firms, Maurin et al. (2002) find that firms employ relatively more skilled workers in marketing and development when they sell their products outside of France. At the same time, the skill intensity does not depend on whether they export to developed or to developing countries, which suggests that it is not the type of products that determines the skill intensity. It appears that the very act of exporting requires a skilled labour force. In the same spirit, Matsuyama (2007) emphasizes

that exporting requires services like distribution, transportation, and advertising, which are intensive in certain skills.

Another way in which trade increases the demand for skills is by triggering skill-biased technical change. Trade opening provides more incentives and opportunities to increase productivity and product quality, which generally necessitates more investment in R&D and technology upgrading (Bustos, 2011a; Bloom et al., 2016). This in turn leads to an increased relative demand for skilled workers.

Empirical evidence shows that import competition leads to skill upgrading through its impact on product and process innovation. Using firm-level data for twelve European countries over the period 1996 to 2007, Bloom et al. (2016) estimate that increased trade with China accounted for about 15 per cent of the technology upgrading in Europe between 2000 and 2007. The explanation is that import competition triggers so called defensive innovation whereby low-productivity firms escape increased market competition by focusing on higher-quality and/or more high-tech segments of their product markets. This involves more investment in R&D and higher requirements of the skills of their workforce. The study indeed shows that technology upgrading has had a significant impact on the relative employment of skilled workers.

Supporting this evidence, an analysis of Belgian firms in the same period, 1996 to 2007, shows that import competition from China led to skill upgrading in low-tech industries (Mion and Zhu, 2013). The findings suggest that the response to imports from China accounted for 27 per cent of the increase in the share of non-production workers, and for almost half of the increase in the share of highly educated workers in the low-tech industries. Similarly, Attanasio et al. (2004) show that the substantial tariff reduction which took place in Colombia during the 1980s and 1990s induced skill-biased technical change. Attanasio et al. document how industries that experienced larger tariff cuts increased the share of more skilled workers into their workforce and argue that this change points towards skill-biased technical change due to increased competitive pressure brought about by a decrease in tariffs.

Bustos (2011a) provides a complementary mechanism in which exporters have more incentive to upgrade their technology when trade costs decrease. This is because their sales in foreign markets become more profitable, which in turn gives them an incentive to invest in more advanced technologies to increase their productivity. Since advanced

technologies often substitute for low-skilled workers and require servicing and operation by relatively high-skilled workers, the relative demand for skills by exporters increases. Examining how the elimination of import tariffs between the signatory members of the MERCOSUR (i.e. Southern Common Market) agreement affected Argentinean firms between 1992 and 1996, Bustos (2011b) finds that after trade opening, exporters upgraded their technology faster than non-exporting firms.¹³ The technology upgrading was in turn accompanied by skills upgrading as exporters increased the share of high-skill workers in their workforce.

Furthermore, exporters from developing economies have an incentive to upgrade the quality of their product when they get better access to rich markets. This argument, proposed by Verhoogen (2008), is based on the assumption that firms can produce output of different qualities, depending on whether they sell in the export market (higher quality good) or in the domestic market (lower quality good). As trade costs decrease, more firms are able to enter the export market, and existing exporters can sell more to foreign producers. Because they only sell high quality to the foreign consumers, the average quality that they produce rises. The production of a high-quality product in turn requires more skilled workers than the low-quality one. Trade opening leads the high productivity firms to increase their sales in the export market (with the high-quality good) and to raise their relative demand for skilled workers. Supporting this argument, Brambilla et al. (2012) find that Argentinean firms exporting to high-income countries hire more skilled workers than exporters to middle-income countries or than purely domestic firms.

Finally, imported technological change may be an important driver of demand for skills in developing countries that rely on imports for most of their capital equipment (Burstein et al., 2013). The adoption of new technologies and building of incremental new-to-firm innovations and know-how around them, rather than deep innovation, are the main drivers of technical change in developing countries.¹⁴ When imports of capital equipment become cheaper due to lower trade costs, new technologies embedded in such equipment become more accessible and thus more profitable to adopt.

The complementarity between advanced technology and skilled workers leads to an increase in the demand for skills. Lee and Wie (2015) find that the adoption in Indonesia of foreign technologies through imports and foreign direct investment was associated with an increased share of non-production workers in

the labour value added of manufacturing firms. Similar evidence is available for Mexico and shows that Mexican firms that import machinery and equipment are more likely to employ more skilled workers (Hanson and Harrison, 1999).

On the other hand, evidence from Chile does not suggest that imported material and foreign technical assistance had any significant impact on the labour share of non-production workers by Chilean firms in the 1980s (Pavcnik, 2003). However, this finding may be due to the fact that not all imported materials are technology-intensive, which can blur the results. Using data from 21 developing countries over the period 1983 to 2000, Raveh and Reshef (2016) show that it is indeed the adoption of new technologies through imported capital goods¹⁵ that is associated with a higher demand for skilled workers in developing countries.¹⁶

(b) Trade also benefits unskilled workers and the poor

Most of the studies on the effects of trade and trade policy on labour market outcomes do not consider the poverty implications directly.¹⁷ However, those which examine the effect of trade on the skill premium and more generally on the relative demand for skilled workers provide some insight into the poverty implications, given that the poor are often low-skilled. When interpreting these results, it is important to bear in mind that an increase in the skill premium does not need to be associated with an increase in poverty. In many cases, the increase in the skill premium reflects a situation where both high-skill and low-skill wages increase, with the latter increasing at a faster pace.

For example, using Chilean plant-level data for the period 1995-2007, Pellandra (2013) finds that exporting had no effect on plant average low-skill wages, but it did have a significant positive effect on high-skill average wages. She also finds that exporting led to an increase in employment of low-skilled workers. In a study on Mexico, Verhoogen (2008) finds that an increase in the export share of sales was associated with a larger difference between white-collar and blue-collar wages, and both white-collar and blue-collar wages were found to increase in absolute terms. Focusing on Indonesia, Amiti and Cameron (2012) estimate that a decrease in tariffs on imported inputs in Indonesia decreased the skill premium in firms that import their intermediate inputs. They suggest that trade liberalization induced firms to substitute in-house input production for cheaper imported inputs. Since final goods production in Indonesia is relatively less skill-intensive than inputs

production, this led to a decrease in the relative demand for skilled labour.

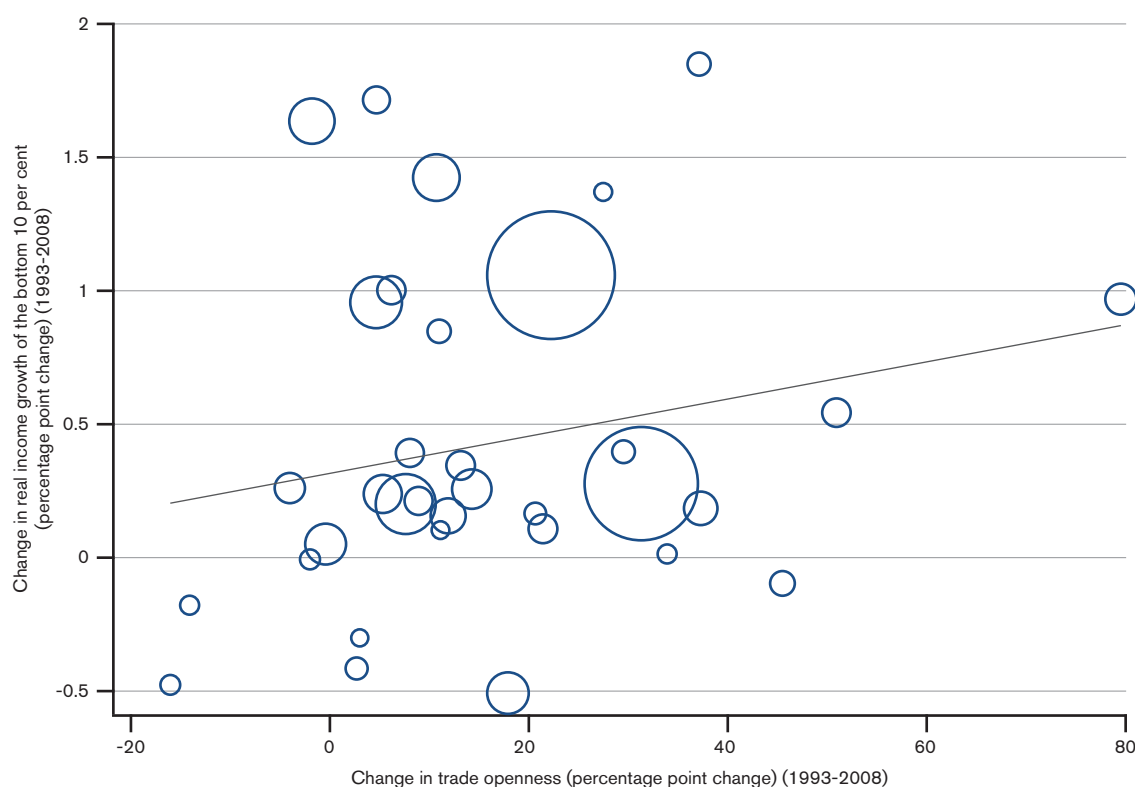
While more research into the impact of trade on low-skilled workers is needed, a simple correlation between the change in real income in the bottom 10 per cent of the population over the period 1993 to 2008 and the change in trade openness in the same period show a clear positive relationship (see Figure D.4).

The specific consequences of trade opening on poverty depend, among other factors, on what the poor consume, what they produce and on patterns of trade opening, as well as on the impact of trade on the formal and informal sectors. Evidence on the effects of trade opening on the poor via a study of consumption shows that, on average, for 40 countries, the gains from opening up to trade are 63 per cent for the bottom 10 per cent of the income distribution and 28 per cent for the top 90 per cent. Trade opening

favours relatively more poor consumers, because they spend relatively more on sectors that are more traded, while high-income individuals consume relatively more services, which are less traded (Fajgelbaum and Khandelwal, 2016).

Recent economic research stresses the importance of looking at the effects of trade on the poor through both the earning and the consumption channel. When these two channels are active, trade opening reduces the consumption price index, thus increasing real wages. This income effect, however, also shifts the composition of the consumption basket in favour of goods consumed at a higher level of income. Since production of these goods tends to be more skill-intensive, the income effect reduces the relative demand for low-skilled workers and thus pushes nominal wages down for the poor. Ultimately, the overall effect is a matter of empirical evidence. Existing empirical studies that look at the impact of trade opening through both the earning and the

Figure D.4: Change in trade openness and real income growth of the bottom 10 per cent of the income distribution (1993 to 2008)



Source: Lakner-Milanovic (2016), World Panel Income Distribution and World Bank, World Development Indicators.

Note: Figure D.4 shows the relationship between the real income growth of the bottom 10 per cent and the change in trade openness (in percentage points) in large countries with populations above 40 million. Trade openness is defined as exports plus imports over GDP. The size of a circle indicates the size of a country's population.

consumption channel do find positive effects on the poor resulting from trade opening in Argentina (Porto, 2006), India (Porto, 2006; Nicita, 2009; Marchand, 2012) and Mercosur (Nicita, 2009).

Furthermore, there is evidence that increases in job and wages opportunities in sectors where an economy can export competitively can benefit the poor. Focusing on the 2001 United States-Viet Nam Bilateral Trade Agreement, McCaig (2011) shows that between 2002 and 2004, provinces that had a higher pre-reform concentration of industries which ultimately experienced the largest tariff cuts in access to the US market also experienced greater decreases in poverty. Later research (McCaig and Pavcnik, 2014) shows that the agreement brought about a reallocation of workers from the informal to the formal sector. However, there is evidence that relative poverty declined less in areas with a high concentration of industries that lost tariff protection (Topalova (2010) for India and Kovak (2013) for Brazil).

Low geographical mobility for people at the bottom of the income distribution and inflexible labour laws appear to play a key role in reducing the benefits for the poor. The challenge is to accompany trade policy with policies that allow the poor to take advantage of the opportunities that are created by trade. For example, a reduction in tariffs will reduce the price paid at the border for the good by the importer. However, the transmission of this border price change to the price paid by local producers and consumers may be significantly affected by internal transport costs, thus limiting the benefits of trade opening on poor living in remote rural areas.

Similarly, trade opening provides workers with the opportunity to move from low-paid jobs in import-competing sectors to higher-paid jobs in exporting firms. However, labour rigidity (such as low mobility of workers) may lead to temporary unemployment, with potentially severe consequences for the poor.

(c) Trade has contributed to the shift of employment towards services in advanced economies

As trade brings about change in industrial structure, it also leads to shifts between broad sectors. Developed economies typically have a comparative advantage in tradeable services such as business services, R&D, design or financial services.¹⁸ Increased trade may therefore lead these countries to specialize in the tradeable services sector. At the same time, economic progress in these countries in the past decades has been characterized by an increasing importance of

the services sector as a source of employment and labour income (see Figure D.5). Trade is expected to contribute, among other factors, to this shift towards a services-based economy because disappearing jobs are predominantly in the manufacturing sector (see, for example, Box D.5), while new jobs are increasingly created in services (Spence and Hlatshwayo, 2012).

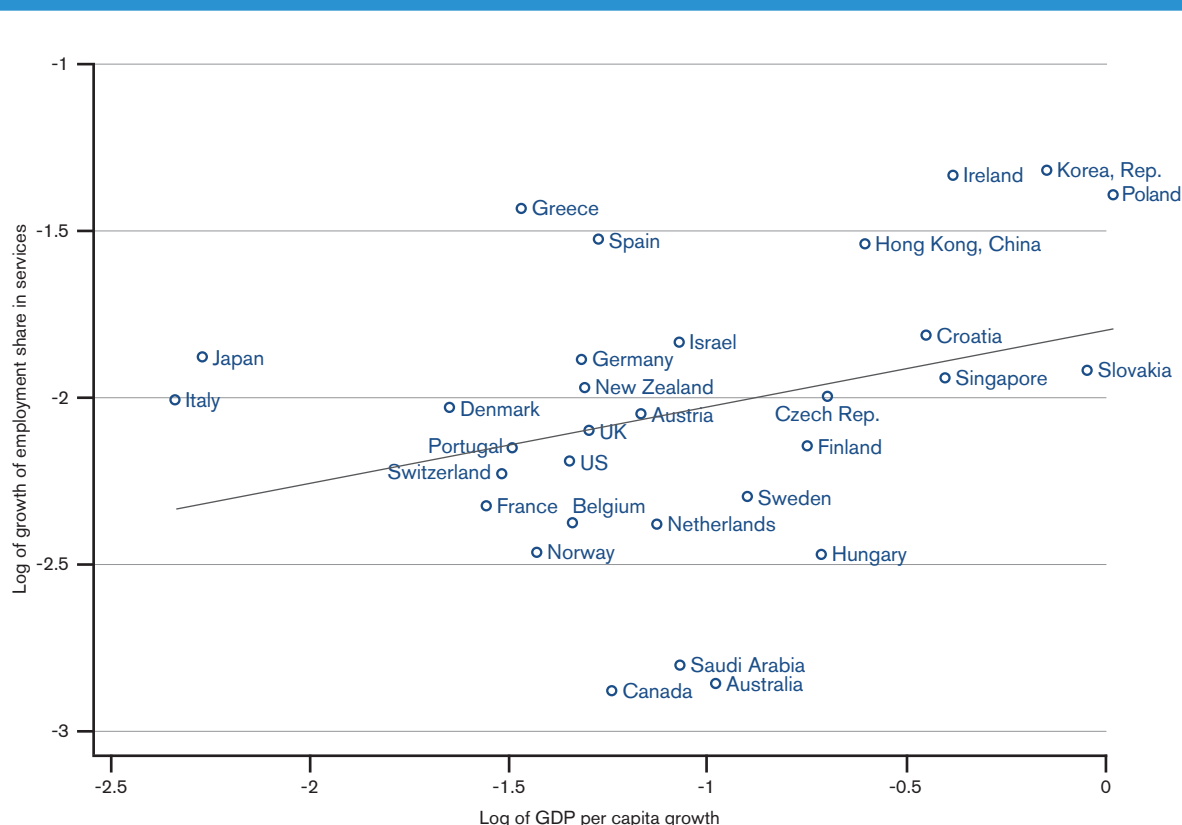
Empirical evidence from the United States and several European countries points towards the role of trade in faster transitions to services-based economies (Autor et al., 2013; Keller and Utar, 2016; Malgouyres, 2016; Balsvik et al., 2015). An exception is a recent study of Germany that suggests that German trade with China and Eastern Europe has slowed the decline of manufacturing employment (Dauth et al., 2014).

This suggests that one element that determines the impact of trade on sectoral composition can be the trade balance. When a country is running a trade deficit it consumes more foreign tradeable goods than it produces for consumption abroad. This leads employment to shift out of the tradeable sector towards the non-tradeable sector and thus also towards non-tradeable services. If, on the other hand, the country has a trade surplus, it concentrates its employment more in the tradeable sector than would be the case if its trade was balanced. The experience of the United States illustrates the former case, while Germany illustrates the latter.

In developing countries, economic progress is characterized by the shrinking of subsistence farming and transitions to the industry and services sectors (Figure D.6). Even China, which has become a manufacturing powerhouse, has experienced a faster increase in services than in manufacturing employment. International trade is therefore expected, in combination with other factors, to accelerate the shift of employment out of the primary, often informal, sector in these countries.

(d) Impact on women's employment and wages

Increasing women's participation in employment is crucial for achieving more gender equality, as well as being instrumental in achieving other development goals, such as reducing child mortality. Duflo (2012), for example, offers significant evidence that empowering women and enabling them to gain access to independent sources of income lead to better health outcomes for children.¹⁹ Women's participation in the labour market has increased significantly in developing countries; according to the World Bank (2012) in Bangladesh, for example, the labour participation of young women (aged 20–24)

Figure D.5: GDP growth and growth of the services' share of employment (1995 to 2011)

Source: ILO (2014a): supporting datasets and World Bank, World Development Indicators.

Note: Figure D.5 shows the relationship between the growth of employment share in services (in logarithm) and the GDP per capita growth (in logarithm) in high-income countries with populations above 4 million. The income classification is based on the World Bank Country and Lending Groups 2011.

increased almost two and a half times over the period 1995 to 2000. The growth of job opportunities for women in this period has been principally linked to the expansion of export sectors such as the textiles industry and services such as tourism and data processing (Mehra and Gammage, 1999).

Several studies support the view that trade has played a key role in opening employment up to women and find a positive correlation between export orientation and female participation in manufacturing employment (Özler, 2007; Seguino, 2000). Furthermore, across developing countries, exporting firms generally employ a significantly higher share of women than non-exporters. For example, in export-processing zones studied by Boyenge (2007), women constituted an average 70 per cent of the labour force in 2005 to 2006, ranging from a low of 10 per cent in Bahrain to 90 per cent in Jamaica and Nicaragua.

Despite the fact that the gender gap in labour force participation and the wage gap have narrowed since

1990, women's participation rate remains well below that of men, and women are still paid less than men for the same work and skills. On average in the OECD, the gender gap of the full-time equivalent employment ratio is 32 per cent and women are paid 16 per cent less than men (OECD, 2011b).

This sub-section explores the ways in which trade affects women's employment and highlights some of the obstacles that women face in capturing a higher share of the opportunities that trade offers.

(i) How does trade affect women's participation in the labour market and their wages?

Trade and trade policies have different impacts on men and women in a given economy because of the existence of gender, social and cultural structures.

Women have, on average, lower access to education, finance and information and, in some countries, limited ownership of land. Moreover, women face

Box D.5: The role of trade in the recent decline in US manufacturing employment

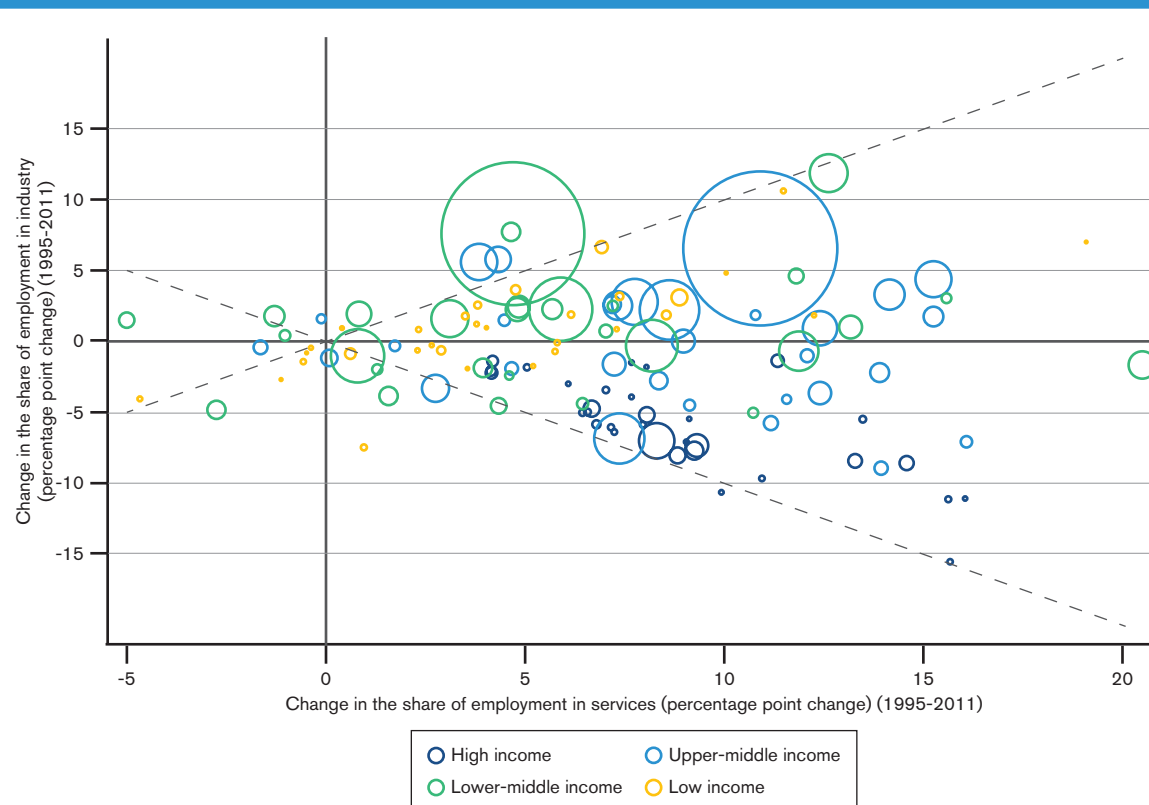
Recent research on the impact of rising Chinese import competition on US labour markets has sparked a heated debate around the role of trade in manufacturing jobs. “Back-of-the-envelope” calculations in popular media outlets, blogs and policy briefs have provided policymakers with a wide range of estimates. De Long (2017), for example, estimates that trade agreements contributed less than 5 per cent or even as little as 1 per cent to the manufacturing jobs lost in the United States after 2000. De Long’s estimate is supported by various other estimates which are slightly larger but usually do not exceed 15 to 20 per cent (Krugman, 2016; Hicks and Devaraj, 2015). At the other extreme, Scott (2015) goes as far as to claim that the growing manufacturing trade deficit of the United States can explain almost all of the manufacturing jobs lost in the period between 2000 and 2007.

While back-of-the-envelope calculations can give a useful first idea of an effect, they are likely to miss important indirect effects of growing trade deficits or trade agreements. In addition, they usually do not adequately take into account weaknesses of underlying data or reverse causality. For instance, a trade deficit is an outcome itself usually caused by factors that might equally affect employment. Moreover, trade deficit analyses are usually based on gross trade data instead of on the appropriate value-added trade data. To illustrate this, we can use the trade between China and the United States as an example. Many Chinese gross exports to the United States contain US value-added. In the case of the iPhone, which is assembled in China and sent to the United States, the total value of the product is counted as Chinese despite the fact that much of its value is created in California. Value-added trade data subtract the US contribution from Chinese gross exports and are therefore more apt for job market outcome inference, since US value added in Chinese exports does not reduce numbers of US jobs. In 2011, for example, the US trade deficit with China was 50 per cent larger in gross terms than in value-added terms, according to OECD-WTO statistics (TiVA 2016 database).

Economic research that has more rigorously dealt with some of these issues can shed additional light on this question and potentially help to extract a more reliable number even if it does not address all of the aforementioned problems. Seminal work in this area by Acemoglu et al. (2016) and Autor et al. (2013) examines the increase in Chinese import competition by comparing more and less exposed local labour markets in the United States. It finds that it can explain around 20 per cent or 25 per cent of the manufacturing decline. Studies that take into account a larger set of indirect effects of trade more generally (i.e. not just trade with China) either confirm this or put the number lower, due to the fact that trade may even have stabilized manufacturing, as discussed in Section D.2 (Adao et al., 2017). This suggests that, at the very most, trade can explain one-fifth or one-quarter of the recent decline of US manufacturing employment, with the true number likely to be lower.

A view of the long-term trend can help to illustrate the virtues of this more careful estimate. Figure C.2 (Section C) depicts the decline of the share of US manufacturing employment and shows that the rise of China starting around 1990 does not seem to have changed this development much. China’s WTO accession in 2001 seems to overlap with a slightly sharper drop but such declines seem to have occurred regularly over time if one looks at the early 1980s or mid-1970s. This regularity suggests that other factors could have played a role, such as the oil shock in the 1970s, the dollar appreciation in the 1980s, the dot-com and housing booms in the 2000s and the high domestic aggregate demand (Hlatshwayo and Spence, 2014),²⁰ all of which contributed to a relative increase of the non-tradeable sector.

All of this re-emphasizes the discussion in Section B, which has highlighted that many factors other than trade have been boosting the non-tradeable sector in the United States over time. For instance, changing demand patterns caused by demographic change and increased incomes favour services over manufacturing. Section C discusses at length the fact that technological change has increased productivity in manufacturing faster than in services and business cycles may be behind short-term deviations of the general trend like the one in the early 2000s. Moreover, Bernard and Fort (2017) suggest that part of the manufacturing decline is due to a statistical misconception, because certain US firms are counted as wholesalers despite the fact that they are increasingly involved in the production of goods, with Apple Inc. serving as a prime example. By re-classifying these firms as manufacturers, up to two million jobs can be shown to have switched from services to manufacturing in 2007.

Figure D.6: Change in the share of employment in industry and services (1995 to 2011)

Source: ILO (2014a): supporting datasets.

Note: Figure D.6 shows the change in the share of employment in industry (in percentage points) and the change in the share of employment in services (in percentage points) in countries with populations above 4 million. The size of a circle indicates the size of country's population. The income classification is based on the World Bank Country and Lending Groups 2011. Industry includes manufacturing, construction, mining and quarrying, and electricity, gas and water supply. Most data points are concentrated in between the dashed 45-degree lines, which indicate that the change in industry employment was smaller than the change in services employment.

more time constraints than men due to the uneven distribution of work in the household. Therefore, in many economies, women are still employed in low-skill intensive sectors, such as the textiles industry. They are more likely to be employed part-time than men, and, if they own a business, it is more likely to be a small business. These characteristics affect the supply of labour by women and women's participation in the labour market (WTO-WBG, 2015).

There are several ways in which opening up an economy to trade can affect women's participation in the labour market and their remuneration.

First, the traditional trade theory of comparative advantage predicts that opening up to trade increases job opportunities for women and reduces gender wage gaps in developing countries. Given that female workers predominate in less-skilled jobs in developing economies, the traditional Heckscher-

Ohlin model predicts employment gains for women in export sectors of developing countries, as countries abundant in low-skill workers specialize in low-skill intensive sectors. Women's participation in the labour force is likely to increase because women represent an important share of the unskilled labour force.

Trade driven by comparative advantage is probably the driving force behind the increase in women's participation in developing countries in the early period of GVCs in the 1980s and the beginning of the 1990s. Trade expansion and the increasing specialization of some developing economies in the textiles industry led to an increased demand for low-skill workers, opening up job opportunities for women. In the Republic of Korea, the share of women employed in manufacturing grew from 6 per cent in 1970 to around 30 per cent in the 1980s and early 1990s. The importance of manufacturing as an employer of female labour in the Republic of Korea

has since declined (to 14 per cent in 2007), but the sector still employs 10 times more women today than in the 1960s (Berik, 2011).

However, to the extent that comparative advantage drives women's empowerment, individual country experiences may differ. Female workers may lose jobs elsewhere in export industries that have experienced an erosion of competitiveness.²¹

Second, economic theory has suggested that trade reduces the incentive to discriminate through its competition effect. Gender discrimination is costly and inefficient. Intensified competition resulting from more open trade reduces the ability of firms to practise wage discrimination against disadvantaged groups (Becker, 1957). There is evidence compatible with this argument. For example, Black and Brainerd (2004) find that the gender wage gap in US manufacturing narrowed rapidly between 1976 to 1993 in initially more concentrated industries that experienced larger increases in competition with trade reform. Other studies support this interpretation (e.g. CEA (2015) for the period 1989 to 2009 in the United States and Klein et al. (2010) for Germany between 1993 and 2007). In a recent study on Norway, Bøler et al. (2015) find that exporting firms have a larger share of female employees and a lower gender wage gap.

However, other studies point to other potential explanations for this trend. One is a composition effect, i.e. a reduction of the wage gap due not to a genuine closure of the gap for the same skill and occupation, but rather due to low-skill female workers exiting the labour force.²² Other studies point to other confounding factors. For example, in their study on Norway, Bøler et al. (2015) show that women with a third-level education earn higher wages at exporting firms than at non-exporters, but that they are underpaid given their level of skill in comparison to men.

One counter-argument raised to Becker's theory that trade reduces the incentive to discriminate through its competition effect is that longer working hours and the increased need for flexibility required in more competitive environments put women at a disadvantage in exporting firms. Bøler et al. (2015) show for Norway that increasing the length of parental leave available to fathers, thus narrowing the employer's perceived time flexibility gap between genders, has led to a fall in the initially higher wage gap observed in exporting firms relative to non-exporters. This exemplifies how policies can be put in place to maximize the positive effects of trade and manage potentially negative effects on the gender gap.

A third way in which trade can help increase women's participation in trade and share more evenly the benefits of trade is through electronic commerce (e-commerce) and participation in GVCs. Information and communication technologies and e-commerce facilitate access to global markets, including for women, by reducing the transaction costs associated with time and mobility constraints. To the extent that time and mobility constraints are more binding for women, particularly those who have children, e-commerce has the potential to affect the trade gender gap.

E-commerce and GVC participation can also affect the gender gap because they favour small and medium-sized enterprises (WTO, 2016). Female entrepreneurs in developing economies typically run small businesses (ITC, 2016). Therefore, they suffer disproportionately from trade-related fixed costs. E-commerce and GVC participation can help small and medium-sized enterprises to overcome some of the barriers to accessing foreign markets by allowing them access to foreign consumers and distribution networks and enabling them to exploit certain economies of scale they could not otherwise access.

Fourth, trade can affect gender inequality by providing a bigger incentive for schooling. One of the aforementioned features of trade is that it is a skills-intensive activity and thereby increases demand for skills (see Section D.3(a)). By creating higher-skilled job opportunities, trade increases the incentive to acquire education. This can foster women's educational attainment in developing countries. For example, there is evidence that in Indian villages where outsourcing increased employment among women, girls were more likely to attend school than girls in other villages. The expectation that they would get a job in the future worked as an incentive for their current education. In contrast, the probability that boys would attend school was unaffected by trade linkages (World Bank, 2012; WTO-WBG, 2015).

The importance of domestic policies that are complementary to trade liberalization is also apparent; for example, if trade increases the demand for skills, it cannot, for example, increase the likelihood of women receiving education in environments where they do not have access to education.

Trade also provides an incentive to upgrade technologies (see section D.3(a)), and trade-induced technological change can provide opportunities for the empowerment of women. New technologies involve computerized production processes and lower the need for physically demanding skills, which can benefit women. Yet evidence of the effects

of technology upgrading on women's wages and participation in employment is mixed and appears to depend on whether technology affects routine-type occupations (which, according to Autor et al. (2015), affect women negatively) or increased robotization (for which Acemoglu and Restrepo (2017) do not find any significant impact on women) or purchases of computerized machinery and equipment (for which Juhn et al. (2013; 2014) find a positive effect for women).

Overall, there appears to be convincing evidence that trade has so far helped increase women's participation in the labour force and that these new job opportunities are a factor in women's empowerment. However, the evidence of the impact of trade on wage discrimination is less compelling, as some studies point to an increase in wage discrimination brought about by more competition generated by trade.

(ii) What are the specific obstacles that women face?

Women face significant obstacles to trade, resulting in lost opportunities to benefit from trade. The previous subsections have suggested that limited access to education can limit women's access to new employment opportunities offered by trade. Limited access to finance and legislations that may provide incentives to discriminate against women are other factors that limit the ability of women to benefit from increased market access (see Section D.2(c)).

Trade facilitation measures negotiated at the WTO may have a big effect on the gender gap. Women face particular time constraints due to the uneven distribution of work in the household. Therefore, time delays and non-transparent rules and regulations can be particularly burdensome for them, and the transparency fostered by the WTO's trade facilitation can help them to overcome these obstacles. In addition, trade facilitation measures particularly favour small-scale enterprises of the type run by women in certain developing economies (Fontagné et al., 2016).

Given the sectoral structure of their employment, women may also face higher tariff barriers to export. Existing evidence on India shows that women tend to work in sectors that face higher barriers to export in the destination country.

Table D.1 provides an example of tariffs faced in the export markets by women and men in India for different income categories. Table D.1 shows that for the same income category, women in general face higher tariffs than men if they have to export the product they produce, i.e. women tend to work in sectors that face higher tariffs. Although more research is needed to analyse the extent to which this tariff structure is common across countries, existing research on the impact of increased market access on wage and employment (see Section D.2) suggests that addressing these issues may help women to capture a higher share of the gains from trade.

Table D.1: Weekly wage and tariff faced on exports by men and women by decile, India

Wage decile	Weekly wage (Rupees)		Tariff faced (%)	
	Men	Women	Men	Women
1	208	206	20.4	21.7
2	386	382	22.2	22.6
3	529	522	19.9	21.5
4	666	663	19.9	20.2
5	767	744	18.1	21.7
6	934	920	15.8	18.2
7	1,113	1,091	14.7	19.7
8	1,419	1,401	12.0	15.1
9	2,190	2,254	7.8	8.6
10	8,268	8,508	4.6	3.6
Overall	1,675	720	14.4	20.4

Source: Mendoza, Nayyar and Piermartini (2017)

5. Conclusions

Trade increases welfare because each economy's consumers thereby gain access to relatively scarce products that are relatively abundant in another economy. Trade also spurs growth because it pushes countries to specialize. Economic resources are reallocated toward their most efficient utilization. While providing benefits, this reallocation of resources also engenders adjustment costs.

This adjustment can be costly and prolonged due to the presence of labour mobility frictions (such as the costs for workers to switch occupations, industries or regions but also job security legislation), capital mobility frictions or poor macroeconomic conditions.

Furthermore, domestic constraints, such as poor institutions or underdeveloped infrastructure and credit markets, can prevent the expansion of exports. These obstacles make it more difficult for displaced workers to find jobs in the export sector and are likely to have negative repercussions for wages and employment, thereby exacerbating the distributional effects of trade. When market adjustment is impeded, the negative effects of import competition on certain individuals and communities can be large and long-lasting, and workers may experience long periods of unemployment.

There are five key messages to retain from the review of the evidence provided in this section.

First, evidence consistently shows that the welfare gains from trade are considerably larger than the costs. Effects on aggregate employment are minor and tend to be positive. The net effect on welfare depends on the magnitude of adjustment costs and trade gains. But existing evidence evaluates costs to be just a fraction of the gains.

Second, the debate over the labour market effects of import competition needs to be qualified. While some manufacturing jobs may be lost in some local labour markets, other jobs may be created in other zones or in the services sector. When researchers take these effects into account their findings suggest a positive overall effect of trade on employment. Similar results are found when input-output linkages are taken into account or when the response of the labour supply to increased real wages is accounted for. Clearly, those who lose jobs because of import competition are not necessarily the same workers who get new jobs in exporting firms, because they are likely to have different skillsets or limited labour mobility. These adjustment costs need to be taken into account, but without losing sight of the overall picture.

Third, there is evidence that export opportunities are associated with employment growth. In developing countries, improved access to foreign markets has contributed to the movement of workers away from agriculture and towards services and manufacturing, as well as away from household businesses toward firms in the enterprise sector, and away from state-owned firms toward private domestic and foreign-owned firms. Although more should be done to understand how labour markets in least-developed countries (LDCs) are affected by trade opening, there is evidence that the involvement of LDCs in GVCs has been a vehicle for developing employment opportunities.

Fourth, trade offers opportunities for better-paid jobs. A significant share of jobs is related to trade, either through exports or imports, and both exporters and importers pay higher wages. This is because trading is a skills-intensive activity. International trade requires the services of skilled workers, who can ensure compliance with international standards, manage international marketing and distribution, and meet the demanding standards of customers from high-income countries; and trade leads to the selection of more productive firms and provides firms with an incentive to upgrade their technology. There is evidence that better access to foreign markets benefits exporting firms and thus their workers. This in turn positively affects regions where these firms are located, as well as occupations that are intensively used by these firms.

As regards the evidence on the impact of trade on wage dispersion, there is evidence that by increasing the demand for skills, trade contributes to wage differences between high- and low-skilled workers. This change in relative wages can motivate more workers to acquire the required skills, increasing the skill supply and thus making the increase in wage differences only temporary. Access to relevant education and active labour market policies that include the upskilling and reskilling of workers have an important role to play in ensuring a fast adjustment. It is also worth noting that most of the existing analysis fails to account for the fact that most of the gains from trade opening come through a reduction in prices. Workers are also consumers. Trade impacts their wellbeing not only through changes in the wage received, but also through changes in the price of the goods that they consume. Given that most of the gains from trade opening through the consumption channel accrue to lower-income groups, failing to account for the income-group specific price changes overestimates the impact on wage disparity.

Fifth, trade has played a significant role in creating jobs for women in many countries. This has proved

essential to achieve some of the United Nations' sustainable development goals, such as the reduction of child mortality and universal education. But trade has also increased competitive pressure in the job market and this has sometimes been reflected in increased wage gaps between the genders, due to the disadvantages women face in many societies.

In conclusion, trade opening need not produce net losers, if individuals are compensated. The next section will look at what policies can be adopted to ensure that the opportunities that trade provide are distributed more widely.

Endnotes

- 1 The share of jobs supported by exports in total employment is strongly related to the ratio of exports to GDP but it also depends on the labour intensity of exporting industries. Therefore, an economy with a relatively low exports-to-GDP ratio and labour-intensive exports can have the same share of export-supported jobs in total employment as an economy with a relatively high exports-to-GDP ratio that is specialized in capital-intensive industries.
- 2 See Schank et al. (2007) for a survey of the existing literature; also see Dai and Xu (2017) for China, Munch and Skaksen (2008) and Hummels et al. (2014) for Denmark, Bernard and Wagner (1997), Arnold and Hussinger (2005) and Schank et al. (2010) for Germany, Hahn (2005) for the Republic of Korea, Fariñas and Martín-Marcos (2007) for Spain, Hansson and Lundin (2004) for Sweden, and Greenaway and Yu (2004) for the United Kingdom.
- 3 This is compared to firms in the same industry, with the same number of employees and the same share of white-collar workers.
- 4 Note that the actual results would in fact equally be consistent with an increase of 2.4 million jobs in the United States. For instance, it is possible that employment in regions that are not in direct competition with Chinese imports, like Wisconsin, benefits from increased Chinese imports because they reduce average prices and thus raise disposable income, which translates into higher demand. While this channel is equally present in more exposed areas, it might be counteracted there by the closure of firms due to import competition, leading to a zero net effect on the local number of jobs. The interpolation from relative regional effects to absolute nationwide effects depends completely on the underlying assumption of how the least exposed labour market has reacted.
- 5 A relatively detrimental effect does not tell us anything about level effects. The evidence discussed here does not indicate whether both import-competing and exporting sectors expanded (but the exporting sector more), contracted (but the exporting sector less), or whether one expanded (exporting) and one contracted (importing). Moreover, a relatively detrimental employment impact in import competing sectors does not mean that imports hurt the economy or even overall employment. For instance, imports are solely responsible for the price-decreasing effect of trade which benefits everyone and, in particular, poorer individuals. It also allows input-importing firms to expand and thus might increase overall employment.
- 6 It is important to re-emphasize here the findings of our discussion in Section D.2(a), i.e. that while most of the local labour market studies cannot inform us on nationwide effects, they are well-equipped to provide evidence on the cross-regional disparities that we discuss here.
- 7 Note that the most exposed industries are usually industries that enjoyed the highest rates of protection before liberalization, which suggests that sectors that are protected for too long fail to develop adjustment mechanisms. This phenomenon is discussed in more detail in Section D.3(c).
- 8 This is because skills acquired in the tradeable sector may not match with the skills required in the non-tradeable sector.
- 9 A similar mechanism is proposed as an explanation for the decreasing labour share related to trade openness. High-productivity firms tend to be not only more skill-intensive but also more capital-intensive. Expansion of these firms at the expense of low-productivity firms then can lead to increased capital intensity at the industry level and consequently into a decrease in the labour share of income (Autor et al., 2017).
- 10 See ILO and WTO (2017) for a detailed exposition of the interaction between trade, skills demand and skills supply.
- 11 Non-production (or white-collar) manufacturing workers are those employed in activities that are not directly related to manufacturing production.
- 12 For a more detailed exposition of the literature that estimates the impact of offshoring on workers, see Hummels et al. (2016).
- 13 The MERCOSUR Agreement was signed in 1991 by Argentina, Brazil, Paraguay, Uruguay and the Bolivarian Republic of Venezuela.
- 14 Caselli and Wilson (2004) report that OECD countries account for over 90 per cent of the worldwide total expenditures on research and development (R&D) which illustrates the point that less developed economies engage in deep innovation only marginally.
- 15 They focus on imports of R&D-intensive capital goods that are likely to embed advanced technologies.
- 16 The intuition behind this is that high-tech capital often substitutes less-skilled workers and that, at the same time, the operation and service of such capital requires relatively high-skilled workers.
- 17 For a recent review on trade and poverty, see the report by the World Bank Group and World Trade Organization (WBG-WTO, 2015). This report also discusses the obstacles faced by the poor when attempting to capture a larger share of the gains from trade.
- 18 Based on the revealed comparative advantage index calculated using the TiVA database.
- 19 One explanation for this correlation is, for example, that when women have the opportunity to work, they may also get higher education and better healthcare for their children.
- 20 If the economy is near full employment, an elevated demand crowds out tradeable sectors. This is because tradeable goods and services can be sourced from abroad, while non-tradeable goods and services cannot (Hlatshtwayo and Spence, 2014).
- 21 Kucera and Milberg (2000) found that over the period from 1978 to 1995, women in OECD countries working in import-competing industries such as textiles, garments, footwear and leather goods, suffered disproportionate job losses.

22 In Mexico, over the period between 1990 and 1995, higher export orientation was associated with a narrowing of the gender wage gap, but results differ by period and export sector under consideration (World Bank, 2012). In the Republic of Korea, greater openness had little impact on or

even widened the gender gap (World Bank, 2012). Kongar (2007) shows for the United States that the reduction in the gender wage gap was due to the departure of low-skilled female workers rather than to a decline in wage discrimination against female workers.