

Trade, Technology and Jobs: A WTO Contribution to the Debate

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This paper is part of the Growth and Reducing Inequality Working Paper Series, which is a joint effort of the G-24 and Friedrich-Ebert-Stiftung New York to gather and disseminate a diverse range of perspectives and research on trends, drivers and policy responses relevant to developing country efforts to boost growth and reduce inequality. The series comprises selected policy-oriented research papers contributed by presenters at a Special Workshop the G-24 held in Geneva (September 2017) in collaboration with the International Labour Organization and the Friedrich-Ebert-Stiftung, as well as relevant sessions in G-24 Technical Group Meetings.

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Abstract

This paper, which summarizes the main findings of the World Trade Organization's World Trade Report 2017, examines how technology and trade affect employment and wages. It looks in particular into the part played by technology and trade in the shift of employment from manufacturing to services; the decreasing share of middle-skilled jobs; and the growing demand for skilled workers. It analyzes the challenges faced by workers in adjusting to changes in labor markets and how governments can facilitate such adjustment to ensure that trade and technology are inclusive.

Evidence presented in the paper shows that labor markets have evolved in many different ways across countries, suggesting that country-specific factors play a pivotal role. Although technological advances and trade have yielded important benefits for economies overall, certain types of workers and/or regions may sometimes be adversely affected. Overall trade is found to raise total employment, even if it is not by much. While technology and trade are interrelated, it is technology more than trade that appears to be responsible for the recent decline in manufacturing jobs and for the declining number of middle-skill jobs relative to low- and high-skill jobs. The paper concludes that helping workers adjust to changes in the labor market and ensuring that benefits are spread more widely can increase the positive impact of open trade and technological progress.

A. INTRODUCTION

Over the last quarter of a century, the dramatic opening of the world economy combined with the rapid pace of technological change have improved the welfare and living standards of billions of people around the world, including its poorest citizens. However, this process has been accompanied by economic change and upheaval in the labor market as workers have shifted from declining industries to rising ones, and more generally from lower to higher productivity activities.

Technological progress and openness to trade – the two most important drivers of economic advances and change today – are inextricably linked. The integration of the global economy has accelerated the spread of innovation, information and know-how, and has spurred cross-border collaboration and competition, all of which have helped fuel technological advances. At the same time, these technological advances – from containerization (i.e. shipping merchandise in large standardized containers) to improvements in air-travel, to the internet – have helped bring about today’s increasingly integrated global economy. The result tends to be a virtuous circle in which advances in technology lead to more openness to trade, and economic openness spurs technological advances, all helping underpin deepening growth and greater integration of developing countries into the global economy.

Continued economic progress hinges on the ability of societies to adjust, adapt and encourage inclusiveness. The ability of workers to move from lower- to higher-productivity jobs, and from declining sectors to rising ones, is the essential mechanism by which trade and technological progress increase overall economic efficiency, promote development and improve living standards. Although total labor market adjustment costs are typically much smaller than the total benefits of trade and technological change, these costs are often disproportionately borne by certain groups or communities in the form of declining incomes or job losses.

The fact that some countries seem to be adapting to technological change and globalization better than others, particularly by reducing obstacles to labor mobility and, more broadly, by more equitably and actively sharing the costs and benefits of change, suggests that government policy can play an important role in helping economies and societies adjust to a changing world.

This paper pulls together some of the main findings of the World Trade Organization (WTO)’s World Trade Report 2017, which examines the similarities and differences in the way technology and trade are impacting labor markets today. Although technology and trade are related and affect labor markets through similar mechanisms, they also have distinct effects that warrant separate analysis. More broadly, the current debate about the impact of globalization, and whether it is technology or trade that is “responsible” for today’s labor disruptions, raises important questions about how both are affecting the level and composition of employment. These questions deserve further examination if policymakers are to provide informed responses to the labor market challenges we face. Indeed, in light of the confluence and intertwining of these twin challenges, the report contributed to the debate around the need for 21st-century adjustment policies, education systems and social support networks to ensure trade and technology can drive economic progress for the benefit of all.

This paper starts with Section B presenting a number of major trends in labor market outcomes, distinguishing between trends in the levels of real wages, unemployment and labor force participation, and trends in the composition of employment or in relative wages. Section C looks at how technological change impacts labor market outcomes. It explains that while technology increases productivity by allowing firms to produce more output with less labor, it can have an ambiguous impact on aggregate labor market outcomes. It also discusses the various effects of technological change on workers, depending on their skills and on the work tasks they perform. Section D examines how international trade influences labor market outcomes. It shows that the effect of trade on aggregate employment and real

wages tends to be positive but varies within economies and across regions and individuals because of different skills requirements and/or limited labor mobility. Beyond the number of jobs, the section discusses how trade affects the composition of employment. It shows that trade often favors high-skilled workers more than others, and that trade plays a significant role in creating jobs for women in many countries. Finally, Section E discusses how the costs of technological progress and trade can be reduced, how to better distribute the benefits from economic change and compensate those who are adversely affected and how domestic policies and institutions fundamentally affect this distribution. Overall, this paper suggests that globalization can be made more beneficial and inclusive for all, by making labor markets work more efficiently and by better compensating those adversely affected – either indirectly, in the form of retraining and education, or directly, in the form of income redistribution.

B. LABOR MARKET TRENDS

Labor markets are highly complex and multifaceted systems shaped by demographic, economic, social and institutional factors. They are quite different from ordinary markets for goods and services. Labor services are demanded by employers and supplied by workers. The coexistence of excess supply (i.e. unemployment) and excess demand (i.e. vacancies) reveals the high segmentation of the labor market by industry, worker characteristics, skills and regions, as well as the important role of wage rigidities, imperfect information and other frictions. These specific features make it quite challenging to identify common trends in labor markets across countries.

1. Major Trends in Labor Markets

A broad range of indicators have been developed in the literature to measure the multi-faceted nature of labor markets. However, in general, labor market data tends to be more available for high-income countries than for developing economies. In addition, where data are available for developing countries, the time periods covered are often shorter. Detailed breakdowns by age, gender, economic sector and form of employment may also not be available.

The proportions of the working-age population willing to work (i.e. labor force participation rate) and employed (i.e. employment-to-population ratio) have, on average, decreased in middle-income economies, but remained relatively constant in high- and low-income economies over the past 25 years. These broad trends, however, mask important differences across economies, including between countries in the same region or with a similar level of economic development. Part of these country specificities reflects differences in output growth responses to business cycle fluctuations, as well as differences in population growth and in the relative increase in female participation in the labor force.

Similarly, the unemployment rate does not exhibit any long-term trends. The incidence of unemployment varies significantly across and within regions. The probability of unemployment is also often higher for young and/or female workers. The unemployment rate increased sharply in most high-income countries post the 2007 recession and decreased only gradually thereafter.

The overall annual number of hours worked has, on average, increased in both developed and developing countries. The growth rate of total annual hours worked has been, however, much higher in low- and lower middle-income economies. The total of hours worked seems to have grown at a slower pace in high-income countries since the trough of the Great Recession. Real wages have also been growing in recent years but at a slower pace than before the financial crisis. Besides business cycles and price inflation, part of the evolution of real wages is linked to the growing share of non-standard employment, such as part-time and temporary employment, which is often associated with lower wages.

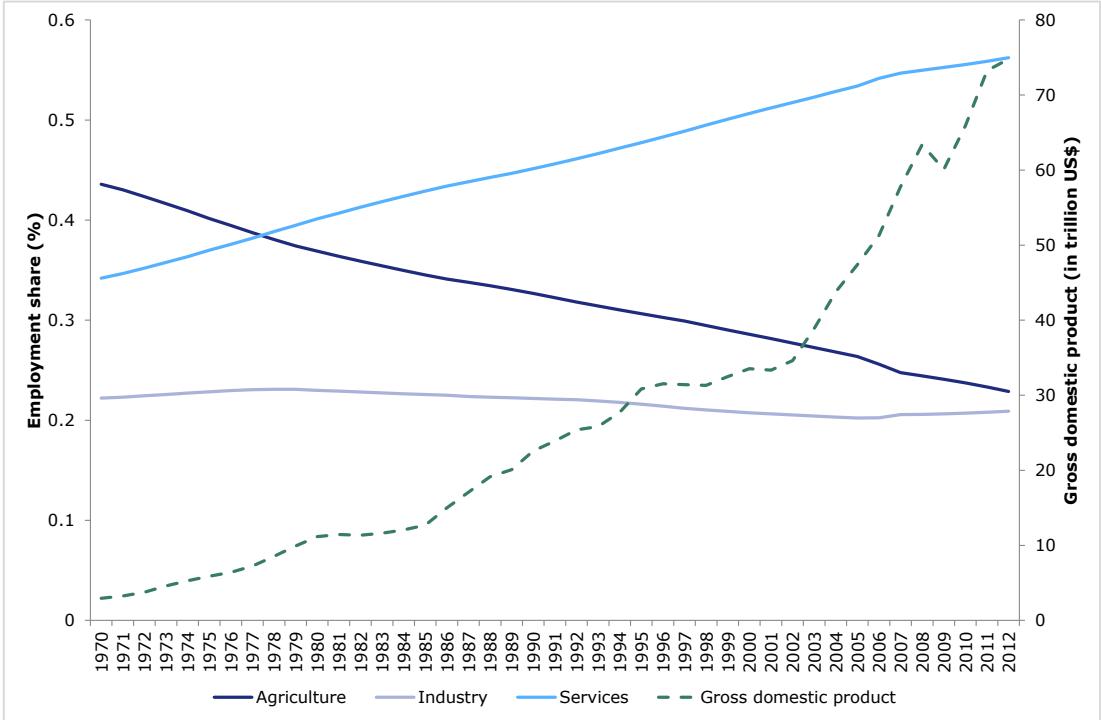
Even though the Great Recession hit high-income economies harder, it also had an impact on a large number of developing countries. It did so particularly through an increase in their large informal economy, where the employment relationship is, in law or in practice, not subject to labor legislation, income taxation, social protection or certain employment benefits. While measuring the size of the informal sector and tracking the trends in informal employment are particularly challenging, available data suggest that informal employment rates tend to decline with economic development but remain highly persistent in most developing countries. In many developing and least-developed countries, informal self-employment and unpaid family work continue to be important forms of employment. Informal employment also tends to be less remunerative than formal employment.

2. Structural Changes in Labor Markets

Two important transformations in the sectoral and occupational structure of employment have occurred in a large number of economies over the past 25 years. First, the role of the agricultural, industry and services sectors in terms of job numbers has changed significantly in most countries over the past few decades. While the employment shares of agriculture and manufacturing in total employment have declined or stagnated in developed countries and an increasing number of developing countries, the services employment share has steadily increased in most countries, as highlighted in Figure 1.

However, this general structural trend masks important differences between countries with different income levels or in different regions. Similarly, informal employment, self-employment and unpaid family work tend to be overrepresented in some sectors, such as the agricultural sector in many developing and least developed countries. Women also tend to be over-represented in some agricultural and services industries in many economies.

Figure 1: Evolution of employment share by sector (1970 to 2012)

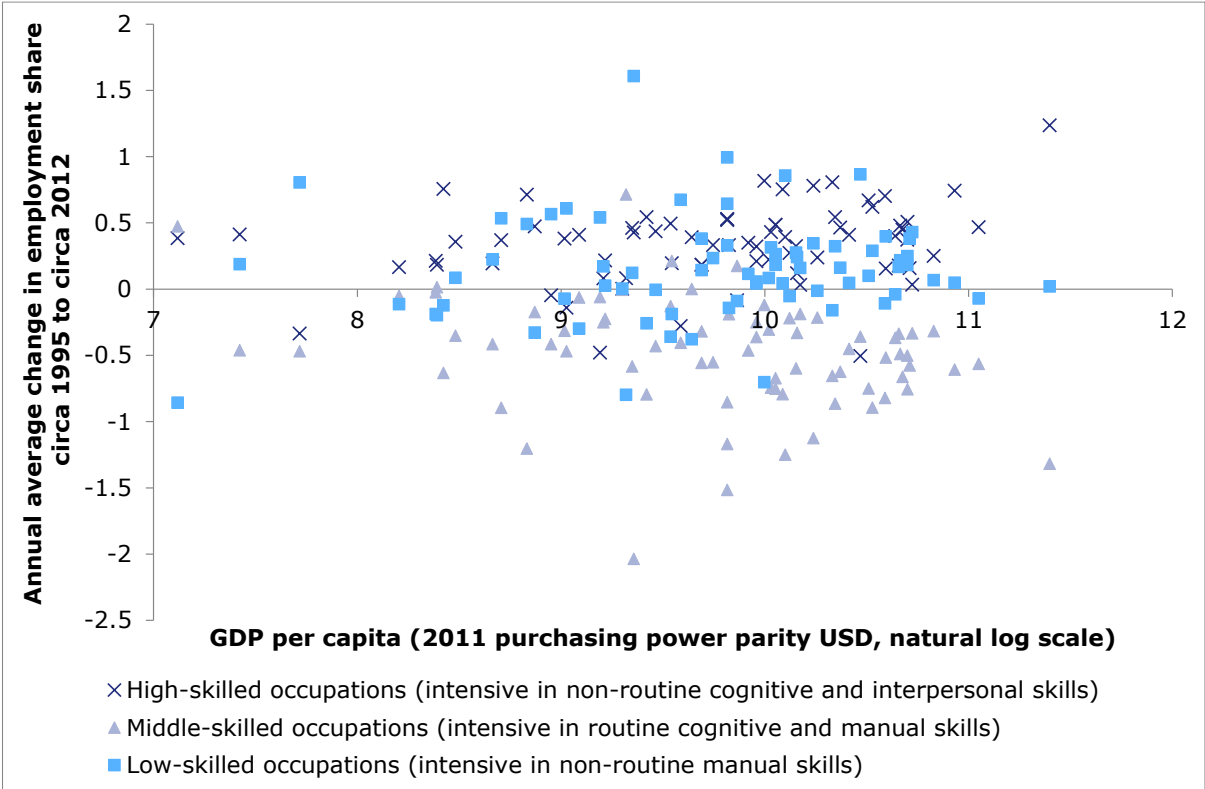


Source: Timmer, de Vries and de Vries (2015); World Development Indicators (July 2017).
 Note: The five-year moving average of the employment share by sector in total employment covers 40 economies: 10 developed and 30 developing. The agriculture sector includes activities in agriculture, hunting, forestry and fishing. The industry sector includes mining and quarrying, manufacturing, construction and public utilities (electricity, gas and water). The services sector includes trade and transport services, business services, government services and personal services.

Second, important changes in terms of skill requirements at the occupation level have been occurring in many countries. Skills refer to job-relevant knowledge, expertise, personal attributes and competencies required to perform a job's specific tasks. Each job and related tasks require a specific combination of skills. The labor market of many developed countries and several developing countries has become polarized with the relative decline in the number of middle-skill jobs compared to the relative increase in the number of low-skill and high-skill jobs, as shown in Figure 2. Similarly, the skill premium, defined as the ratio between the wages of skilled and unskilled workers, has increased across several developed and developing countries but remained constant or decreased in others.

While job polarization seems to be pervasive across high income countries, including across manufacturing and services industries, many developing countries with large natural resource endowments and commodity exporters have, for the time being, not been affected by job polarization. Similarly, recent empirical research suggests that women and men may not necessarily be equally affected by job polarization. This seems to be the case for the labor market in the United States between 1980 and 2008, where female workers experienced job polarization, while male workers did not (Cerina et al., 2017). More generally, the exposure to job polarization often tends to change over time, highlighting its dynamic nature.

Figure 2: Evolution of the skill composition in employment (circa 1995 to circa 2012)



Source: World Bank (2016).
 Note: The figure displays change in percentage points of employment shares between circa 1995 and circa 2012. The occupation classification is based on Autor (2015). High-skill occupations include legislators, senior officials and managers, professionals, technicians and associate professionals. Middle-skill occupations comprise clerks, workers in crafts and related trades, and plant and machine operators and assemblers. Low-skill occupations refer to service and sales workers and elementary occupations, e.g. cleaners and helpers, agricultural laborer, food preparation assistants and street sales workers.

Both important structural changes have been and continue to be disruptive for many workers, who face a higher risk of job loss and of having to switch to a job in a different type of occupation or sector. In such a broader context, and as discussed below, the complex interplay between factors shaping supply and demand for labor and different external factors or structural changes including trade and technological progress is at the heart of labor market outcomes and the distribution of economic gains across workers and regions.

C. IMPACT OF TECHNOLOGY ON LABOR MARKET OUTCOMES

Throughout history, technological change has been a source of anxiety for many workers whether in the agriculture, manufacturing or services sectors. While technological progress is the main source of economic growth, it is also the main source of labor market change. Technological progress expands economic output and increases welfare by improving productivity – allowing more output to be produced with the same resources – and by enabling further innovation and development. However, by making some products or production processes obsolete, creating new products or expanding demand for products subject to innovation, technological change is associated with the reallocation of labor across and within sectors and firms.

1. Impact on the Level of Employment

A common theme in the literature is that in both developed and developing countries alike, the most relevant effects of technology are on the structure, rather than the level, of employment.

Technological progress can assist workers or replace them. Autopilot technology on planes, for instance, assists the work of pilots, greatly increasing their overall performance. As for automation technologies, they allow machines to complete cognitive or manual tasks without human intervention. The corking of wine bottles in a winery, for instance, if undertaken by a machine, makes human labor input redundant.

The overall effects of technological progress on the demand for labor however, may be positive or negative. This is because technological change involves both substitution and compensation mechanisms. If technological change takes the form of a new product that substitutes for an older one, for example, it lowers the demand for the old product while it raises the demand for the new product. This tends to raise the demand for labor to produce the new product and to lower the demand for workers to produce the old product. In this case, the substitution mechanism at work operates via product displacement. While the resulting adjustment (with some jobs disappearing and others being created) may not be without frictions, in this context, it is worth noting that higher labor demand in the growing sector can partially or fully offset lower labor demand in the declining sector, a compensation mechanism that can produce ambiguous effects on overall labor demand.

Similarly, the overall effect of labor-replacing automation on labor demand is ambiguous. Labor-replacing technological change induces firms to substitute capital for labor, reducing the demand for labor. At the same time, however, several compensation mechanisms tend to counterbalance the substitution mechanisms. First, while workers are displaced in those industries that introduce the new technology, additional workers are needed in the industries that produce the new machinery. Second, automation reduces average costs and stimulates production in the innovating industry and in all other industries, which in turn tends to increase labor demand. Third, local demand spillovers (i.e., when new jobs generate additional demand in the local economy) may also contribute to raise overall labor demand. Finally, by lowering the cost of producing with labor, automation may discourage further automation. The extent to which the compensation mechanisms can counterbalance the labor saving impacts of technological change depends on several underlying assumptions and conditions. This means that

whether technological change ultimately increases or decreases overall employment and wages is an empirical question.

The empirical literature has generally found small and possibly even positive effects of technological change on aggregate labor demand and employment. Case study evidence focusing on particular sectors and occupations shows that even after the introduction of labor-replacing technologies employment increased when those technological changes led to significant scale effects (Bessen, 2015). There is also abundant econometric evidence on the overall employment effects of technological change. The studies in this field can be classified according to the type of technological change considered (i.e. product innovation, process innovation, routine-biased technological change, computerization or exposure to industrial robots), the income level of an economy (developed or developing) and the unit of analysis (firm, industry or local labor markets). The general conclusion from this literature is that technology has affected the structure of employment, but has had small (and mostly positive) effects on the overall level of employment, including in developing countries (Vivarelli, 2014; Arntz et al., 2016; Ugur and Mitra 2017).

There are, however, a few relevant exceptions, with some studies showing the negative effects on labor demand generated by technological change. Acemoglu and Restrepo (2017), for example, consider how exposure to industrial robots affected employment and wages in local labor markets in the United States between 1990 and 2007, and they estimate large and robust negative effects of robots on employment and wages across commuting zones.

2. Impact on the Composition of Employment

While technological change does not seem to reduce overall employment, it does affect the relative earnings of workers with different skills and/or the skill composition of employment. The reason for this is that technological progress tends to be skill-biased, in the sense that it increases the relative demand for skills, and routine-biased, in the sense that it decreases the demand for routine tasks.

The rapid diffusion of information and communication technologies (ICTs) in the work place is consistent with an increase in the (relative) demand for skilled workers because ICTs and skills are complementary. A consensus seems to emerge from the empirical literature that technological change has been skill-biased over the past few decades in developed and in developing countries. Sector-, firm- and plant-level studies as well as cross-country studies confirm the validity of the hypothesis that technological change has been skill-biased for the United States as well as for other OECD countries (Autor et al., 1998; Bartel et al., 2007; Spitz-Oener, 2006; Machin and Van Reenen, 1998). These studies typically find a positive link between some measure of technology intensity and the share of skilled employment or the skill premium. For developing countries, in addition to studies similar to those available for developed countries, a number of studies provide evidence of relative skill bias emerging through technological change associated with imports of embodied technologies.² For the United States, it has recently been estimated that computerization is the central force driving changes in the levels of wages between different education groups, accounting for 60 percent of the rise in the skill premium (Burstein et al., 2015). Such quantification exercises however, are subject to the caveats that the results highly depend on the definition of technology and vary significantly across studies.

As highlighted above, an important recent labor market development in many developed and some developing countries has been job polarization defined as an increase in the number of high- and low-skill and paid jobs associated with a decrease of the number of middle-skill and paid jobs. Theory suggests

² See for example the studies of Brazil and Mexico by Fajnzylber and Fernandes (2009), of Ghana by Görg and Strobl (2002), of Turkey by Srouf et al. (2013) and Meschi et al. (2016) and of the Middle East and North Africa region by Mnif (2016).

that technology can lead to employment polarization because it tends to replace routine tasks and to complement cognitive skills (Autor et al., 2003; Autor et al., 2006; 2008). Technology improves the relative employment prospects of skilled workers performing non-routine tasks, which are not easily automated, and tasks involving cognitive skills, which are complemented by ICT technologies. Conversely, technology worsens the relative employment prospects of middle-skilled workers performing routine tasks (which are easily automated) and has little direct effects on employment prospects of low-skilled workers performing non-routine manual tasks (which are neither easily automated nor subject to ICT-skill complementarity). With few exceptions, the empirical literature confirms the idea that technological change has been a major driver of the decline in routine occupations, and of the consequent employment polarization in developed economies. In the case of developing countries, the evidence that technological change is biased against routine employment is mixed.

3. Technology and the Future of Work

The upcoming wave of technological advances, in particular artificial intelligence and robotics, raises a number of issues, including their impact on the future of jobs. Some experts argue that history will repeat itself and the next wave of technological advances will replace many existing jobs but create new ones. Other experts disagree, arguing that the new wave of technologies is different in terms of speed, scale and force, and will replace human jobs at a massive scale, leading to a "jobless future."

Several studies and reports have attempted to estimate the share of jobs that are at high risk of automation. Different methodologies and underlying assumptions lead to substantially different estimated shares of jobs vulnerable to automation. The estimated share of jobs at risk of automation tends to be larger in developing countries than in developed countries because of the relatively larger share of workers specialized in routine jobs that are easier to automate. However, the estimated probability of automation does not, in any event, equal future unemployment, because the development, adoption and diffusion of future technologies will hinge on a number of factors, including feasibility, affordability, and the managerial culture within firms, as well as legal and regulatory frameworks and public acceptance. Accordingly, the adoption and diffusion of automation could be slower and more limited in developing countries given the higher prevalence of barriers to technology, lower wages and the number of jobs based on manual dexterity that are more difficult to automate (at least for the time being).

While the debate remains unsettled and controversial, the upcoming technological progress is likely to continue being disruptive through its impact on skills development by making some skills obsolete but enhancing others, and creating a need for new skills. As discussed below, one of the challenges for workers is to be able to cope and adjust to these changes.

D. IMPACT OF TRADE ON LABOR MARKET OUTCOMES

Labor market outcomes, including employment and wages, are affected by many factors, such as, in some cases, international trade (see Section B). The effects of technology and of trade on employment are often similar in nature and particularly difficult to disentangle. Much in the same way that there are gains from technological progress, there are also gains from trade. International trade increases productivity and welfare. Opening up to trade increases a country's welfare in a number of ways: through static gains – for example, by reallocating productive resources more efficiently to allow for greater specialization – and through dynamic gains – for example, by encouraging the exchange of ideas that in turn accelerates innovation. The static gains from trade alone can be significant. Some estimates indicate that they can be as high as one-third of a country's GDP compared to autarky (Ossa, 2015). However, by enabling the most competitive domestic firms to take advantage of the access to new markets and expand, and by

accelerating the decline of other less competitive domestic firms, international trade is necessarily associated with the reallocation of labor across and within sectors and firms.

1. Impact on the Level of Employment

The literature suggests that like technological change, trade mostly affects the structure, rather than the level, of employment in both developed and developing countries.

Similarly, the impact of trade on labor market outcomes, in particular on employment, may be positive or negative depending on the extent to which the negative substitution effect of import competition is offset or not by other positive compensation effects. Different indirect compensation effects have been identified in the literature. For instance, trade can have an indirect positive effect on employment through cheaper imported intermediate inputs that can enable domestic firms who use them to increase production and hire more domestic workers (Hummels et al., 2001). Another important indirect effect relates to the positive impact of cheaper imports on consumers' disposable income, who can increase spending on goods and services produced by domestic firms. In turn, these domestic firms may expand their production and hire additional workers to meet the increased demand. Similarly, when trade either raises nominal wages or decreases prices, individuals have a stronger incentive to enter the labor market and work. Overall, failing to take into account these indirect and often complex effects leads to an incomplete assessment of the impact of trade on labor outcomes at country level.

The literature generally tends to find positive effects of trade on overall employment (Caliendo et al., 2015; Wang et al., 2017). An increase in trade openness also tends to slightly decrease the national unemployment rate (Felbermayr et al., 2011). The literature however finds that trade tends to affect individuals, firms, sectors and regions unevenly. While regions with more productive sectors and firms benefit from trade opportunities, other regions with less productive sectors and firms are likely to be adversely affected. Similarly, some workers – depending on their specific characteristics, including mobility – may not necessarily benefit directly from trade even when the society as a whole experiences a welfare increase.

In recent years, there has been a lot of debate around the impact of China's economic rise on the labor market of its trading partners. In that context, several studies have assessed the impact of China's trade expansion on local labor markets within the United States, Brazil, France, Germany, Norway and Spain. Using the same econometric approach, these studies find that employment tends to be more adversely affected in regions more exposed to import competition than in regions less exposed to import competition (Autor et al., 2016; Malgouyres, 2017; Dauth et al., 2014). While these findings are valuable in understanding how trade affects regional employment disparities, this type of empirical studies cannot be used to infer the overall national-level effects on employment, unless a set of strong and restrictive assumptions are considered.

While empirical evidence suggests that trade has widened regional disparities, other factors have also contributed to rising disparities across regions. Automation is a key factor, as illustrated by the increased use of industrial robots. The available empirical evidence suggests that trade can explain up to 20 to 25 percent of the recent decline in manufacturing jobs in the United States (De Long, 2017; Krugman, 2016; Hicks and Devaraj, 2015). This implies that factors other than trade, such as technological change, may explain up to 80 percent or more of the decline in U.S. manufacturing jobs.

2. Impact on the Composition of Employment

As explained above, like technological change, trade does not reduce overall employment but affects the relative composition of employment in terms of tasks, occupations, firms or sectors as well as relative earnings. As a result, certain regions, sectors, and individuals benefit considerably from trade, while others can be left worse off in the absence of adequate policy responses.

Empirical evidence suggests that in advanced economies, trade increases the relative demand for high-skilled workers, especially in non-routine occupations. It thus behaves in a similar manner to skill-biased technological change. The main channels appear to be specialization in skill-intensive activities, the offshoring of routine tasks and increased innovative activity as a response to competition from low-cost exporters. Trade also leads to a higher demand for high-skilled workers in developing economies, mainly because of technology diffusion through imports of capital goods, intermediate inputs and know how. The increased demand for skills often translates not only into an increased share of skilled workers in employment, but also into a higher skill premium, that is, an increase in the nominal wages of high-skilled workers relative to low-skilled workers.

Similarly, trade gains also accrue to less skilled workers and poorer individuals. In particular, both skilled and unskilled workers in developing countries that are more exposed to trade tend to experience an increase in their respective wages. Furthermore, trade increases the purchasing power of poor, low-skilled workers by enabling them to purchase more affordable imported products, and therefore its impact on the relative real wage can be favourable to the poorer.

As explained above, labor markets in a large number of developed and developing countries have experienced important structural changes with a lasting shift of employment from agriculture and manufacturing towards services. Part of the transition from middle-class manufacturing jobs to services jobs in many advanced economies is due to trade, because of their strong comparative advantage in the tradable services sector. Similarly, trade, in combination with other factors, has accelerated the shift of employment out of the primary, often informal, sector to both the industry and services sectors in developing countries.

Trade has also been found to have supported employment opportunities for women in some countries. Trade expansion and increasing specialization in the textile sector have opened up job opportunities for women in certain countries, such as Jamaica, Nicaragua and the Republic of Korea. Yet, there is evidence that women, particularly those with children, face higher time and mobility constraints than men when it comes to accessing foreign markets. In that context, technological developments like e-commerce can have an important positive impact on work for women. In parallel, trade increases the incentive of women, who have traditionally received less education than men, particularly in developing countries, to undertake schooling because it creates job opportunities for skilled workers.

3. Jobs Supported by Trade

As hinted above, an increasing number of people work on trade-related activities. Jobs are created not only to serve the economy's domestic demand, but also to produce goods and services for international markets, or inputs used to produce goods and services that will be exported. In 2011, jobs supported by exports amounted to almost 15 million in the United States, 66 million in the European Union and 121 million in China. The importance of jobs supported by exports further varies from 10 percent of total employment in the United States to 28 percent in the European Union, the Republic of Korea or New Zealand.

Access to the cheapest and best quality inputs, including through imports, is key to produce affordable goods and services and enhance export competitiveness. Therefore, imports of intermediate inputs, including in the context of global value chains (GVCs), also sustain domestic jobs. Several empirical studies confirm that firms importing more inputs incur lower input costs and sell more than firms using only domestic inputs.

More generally, firms engaged in international trade through exports and/or imports, tend to be larger, more productive and more capital-intensive than firms operating only in their respective domestic markets. In that context, exporting and importing firms generally pay higher wages.

E. POLICY RESPONSES TO LABOR MARKET ADJUSTMENTS

As explained in detail above, technological change and trade help improve economic efficiency either by enhancing the productivity of certain firms or by allowing for more specialization. At the same time, they require workers to adjust, as they are associated with the reallocation of labor from less productive to more productive activities, firms or sectors in each country. The costs of these adjustments may be significant at the individual level and may require a policy response. Through a mix of adjustment, competitiveness and compensation policies, governments can help workers manage the cost of adjusting to technological change and trade, while making sure that the economy captures as much as possible the benefits from these changes.

Adjustment policy refers broadly to measures taken to lower the cost of reallocating resources, in particular labor, in response to technological change or greater trade competition. Various frictions (arising from skill mismatches, lack of geographical mobility, etc.) may impede the ability of the economy, and in particular that of the labor market, to transition swiftly and smoothly to a new equilibrium. A lack of information about job opportunities can also hamper adjustment. The costs that arise from these problems of adjustment reduce the benefits that a society obtains from technological progress or more open trade. Adjustment policies aim to make the labor market and the economy in general respond more efficiently to economic changes (Magee, 2001). Beyond improving economic efficiency, adjustment policy offers a way to compensate those who lose out from the dislocation caused by economic change and/or to maintain political support for innovation and trade openness.

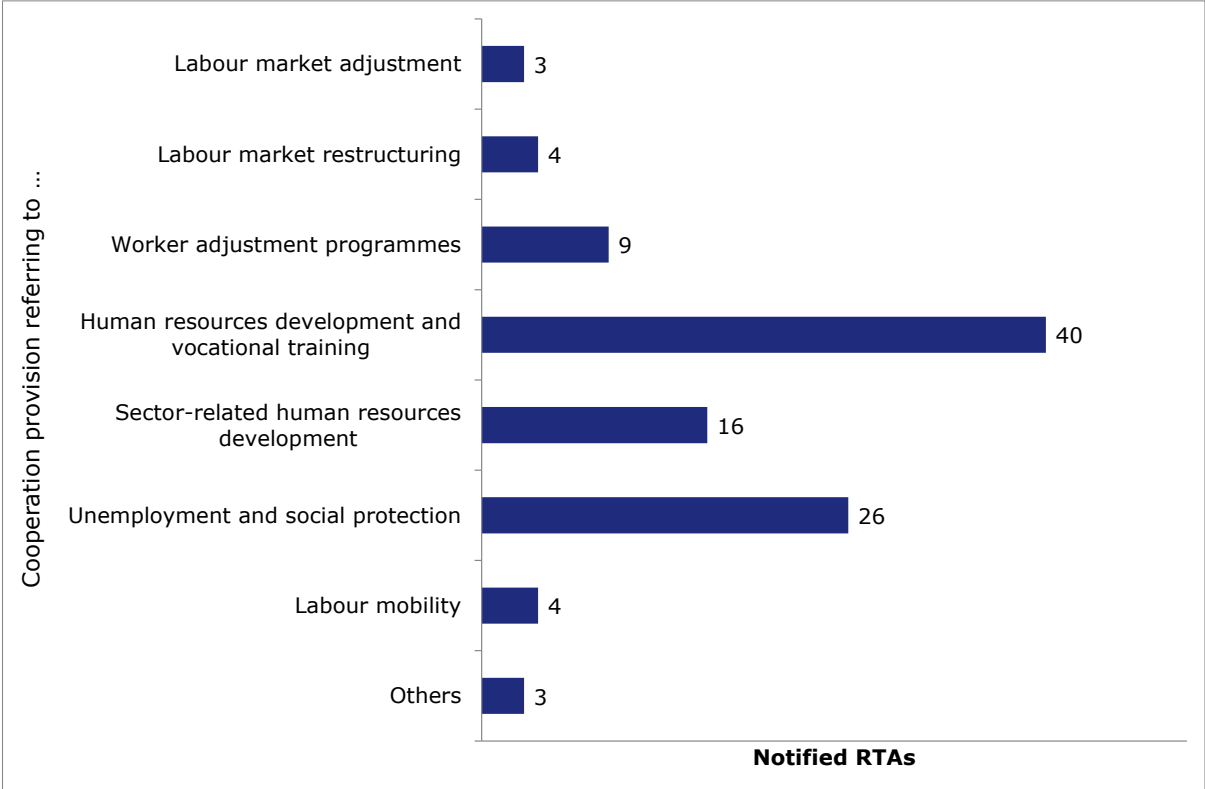
1. Labor Market Adjustment Policies

Adjustment policies can take different forms. First, they may be general – labor market, training and social policies, for example, are generally designed to help workers adjust to economic change, no matter what its initial cause may have been – or specific, as with trade adjustment programs. Second, adjustment policies may involve active or passive labor market policies. Active labor market policies aim to increase the likelihood of unemployed workers finding new jobs, through training or job-search assistance, for example. Passive labor market policies, on the other hand, help by providing financial support to workers who have lost their jobs. Third, adjustment programs may be activated in advance of economic dislocation, or in response to dislocation. Fourth, when the labor impacts of trade are concentrated in particular regions, one possible policy response is to enhance labor mobility. If, however, some workers cannot or do not want to move, and/or mobility may worsen the situation of those who stay, regional development policies or so-called "place-based" policies may have a role to play.

Often, it is important to consider the wider social and political context in which adjustment policies operate. Research suggests that the degree of trust and confidence that the various sectors of society, such as business, labor and government, have in one another contributes to successful adjustment programs (Blanchard et al., 2013). Also, since the use of adjustment measures can have an impact on

other countries through trade, trade agreements sometimes include provisions on adjustment measures. Regional trade agreements (RTAs) are sometimes considered as a laboratory in which countries establish new provisions and address new trade-related issues and challenges. A review of the 280 RTAs currently in force and notified to the WTO as of June 2017 suggests that only a limited number of agreements incorporate explicit provisions referring to labor market adjustment, as shown in Figure 3. Although the language differs between agreements, all of these provisions, which are typically found in the labor chapter of RTAs, identify labor market adjustment as an area of cooperation.

Figure 3: Cooperation provisions related to labor market adjustment in RTAs



Source: WTO Secretariat based on WTO RTA database.

The economic literature offers some suggestions on how to make adjustment programs work more effectively. These are mostly based on experiences in industrial countries. Since adjustment programs are meant to principally, but not exclusively, reduce the costs of reallocating resources in response to trade or technological change, they have been evaluated based on the re-employment rates of workers, the change in wage upon re-employment, the financial costs of running the program and whether the programs meet social cost-benefit criteria. However, since there may be equity and political economy rationales behind these programs, the programs’ success may also be judged by how much they cushion workers from economic losses or blunt calls for restrictions on trade or technological progress.

General programs tend to show marginally better results in terms of re-employment rates, wage change on re-employment, net financial costs and social benefits, and they can deal with a wider range of economic changes. The Danish flexicurity model for example involves three main pillars (Andersen et al., 2007): (i) a comprehensive welfare state with an emphasis on transfers to households and publicly-provided social services financed by high taxes; (ii) generous public and/or private spending on investment in human capital, including child care and education as well as research and development (R&D); and (iii) a set of labor market institutions that include strong labor unions and employer

associations, significant elements of wage coordination, relatively generous unemployment benefits and a prominent role for active labor market policies. These three elements are expected to work together to create: (i) a flexible labor market with employers able to hire and fire workers quickly depending on economic circumstances; (ii) unemployment security in the form of a guarantee for a specified level of unemployment benefits to workers who lose their jobs; and (iii) a system of active labor market policies to help unemployed workers get guidance, education and ultimately a new job. While the Danish model, and more broadly the Nordic model, is held up as a success story in dealing with the effects of trade opening, its effectiveness is often attributed to societal idiosyncrasies, i.e. a feeling of trust and sense of fairness prevalent in society (Andersen et al., 2007).

Trade-targeted programs can be cheaper than those that cover all types of shocks and they may have some advantages from a political economy perspective. However, the size and coverage of specific programs are often very small. For instance, the U.S. Trade Adjustment Assistance (TAA) and European Globalization Adjustment Fund (EGF) had budgets of US\$ 800 million in 2015 and US\$ 153 million in 2014 respectively. Workers are often unaware of the existence of these programs (Cernat and Mustilli, 2017; European Commission, 2011). A study of the US TAA's effectiveness by the U.S. Department of Labor found that: (i) the participants significantly increased their receipt of re-employment services, education and training services; (ii) the participants were engaged in some form of productive activity at about the same rate as the comparison group; (iii) there was heterogeneity in outcomes depending on the characteristics of the participants (younger workers who received training fared better than older workers and workers who did not receive training); and (iv) participants experienced a decline in total income during the four-year follow-up period (D'Amico and Schochet, 2012).

While research into the effectiveness of adjustment programs is limited, it seems that a number of lessons can be drawn from experiences of implementing these programs in developed countries. First, more effective adjustment programs are required, but also much better financed ones. The recent joint International Monetary Fund (IMF)-World Bank and WTO report calls for well targeted and adequately financed trade adjustment assistance (IMF et al., 2017). Second, programs tailored to worker and country specifications appear to perform better. Theoretical (Cosar, 2010) and empirical work (Schochet et al., 2012) suggests that consideration of differential worker characteristics is extremely important when designing adjustment schemes to increase efficiency and equity. Third, it is important to strike a balance between employment protection, levels of compensation and active labor market policies, knowing that there is some divergence in views about the effectiveness of the latter.

These lessons also broadly apply to developing countries, but one needs to take into account a number of features in developing economies that differ from those of developed economies. First, resources to fund adjustment programs are limited and there is a greater role for the state, whether in the use it makes of public employment or the presence of state-owned enterprises (SOEs) in the economy. Second, both the agricultural and informal sectors tend to constitute a large share of total employment. These could lead to important differences in adjustment costs and strategies, including a greater emphasis on agricultural, state-owned enterprises and the informal sector. The informal sector can provide a crucial adjustment channel in developing countries. It is not necessarily an inferior employment option since it may be sought by those who prefer flexible hours (Goldberg and Pavcnik, 2003). In many developing countries, policymakers have to be sensitive about the role the agricultural sector and the public sector (including SOEs) play in the labor market and the consequences this has on adjustment after trade reform and/or liberalization. Also, a recent survey of evaluations done on developing countries claims that many of their active labor market policies are much less effective than hoped for, as it finds no significant impacts on either employment or earnings (McKenzie, 2017). One explanation for this may be that urban labor markets in developing countries work reasonably well in many cases, with fewer market failures than is often assumed.

2. Competitiveness-related Policies

Policies that increase the competitiveness of the economy can make it more responsive to the opportunities created by innovation and trade. First, given that both technological change and trade tend to increase demand for skilled workers, greater investment in education and training will allow workers to respond better to economic change. Second, the quality, cost and reliability of infrastructure have a far-reaching impact on competitiveness. Among the key sectors in this regard are transport, power, telecommunications, and housing. These are crucial not only to production, but also for moving goods, services and people within and across national borders, and also for communicating and acquiring information. Third, improving the functioning of the credit market can improve the competitiveness of domestic firms by lowering the cost of borrowing and making it easier for enterprises to finance their expansion. Fourth, trade measures can be used to increase the competitiveness of a country's producers. Negotiating greater market access in foreign markets reduces the trade barriers faced by a country's producers and allows them to sell more to foreign consumers. If a country is integrated into global value chains, reducing its own import barriers, and particularly those affecting intermediate inputs, may also increase its competitiveness in global markets, since imports of intermediate goods are essential to exports in GVCs. Fifth, trade facilitation reform, through implementation of the WTO Trade Facilitation Agreement, lowers trade costs and offers another way to increase a country's competitiveness.

3. Redistributive Policies

Governments can take measures to address possible adverse distributional consequences of technological change and increased trade competition. The adjustment process through which an economy realizes the efficiency gains of increased trade and technological change may result in permanent income losses for some displaced workers. Two main rationales for governments to take redistributive measures to compensate such permanent adverse distributional consequences, in addition to efficiency-based adjustment measures, have been discussed in the economic literature. One possible rationale involves the notion of compensation as it is used in the welfare economic analysis of trade, which reflects the Pareto criterion according to which a change enhances the overall welfare of a society if it makes at least someone better off and does not harm anyone. Another possible justification often advanced in favour of redistributive measures for trade-displaced workers is based on considerations of equity in the sense that when society as a whole benefits from a policy change, it is unfair that the costs of that change be borne disproportionately by a subset of its members. One question that has been raised in relation to this second argument is whether there is any reason to treat trade-displaced workers differently from workers adversely affected by other, non-trade-related changes.

Another question that has been raised is whether growing international economic openness increases the public demand for governments to adopt social protection and redistribution measures to address labor market risks, and whether it affects governments' ability to adopt such measures. Overall, based on research focusing on developed countries, it would seem that any effects of economic globalization through trade and capital mobility on welfare state development in advanced economies are outweighed by the importance of domestic factors. This suggests that the extent to which governments act to compensate and redistribute in order to mitigate any adverse distributional consequences of trade is determined in the first place by countries' internal conditions. Findings from several recent studies on this relationship in the case of developing countries would seem to provide more support for the "efficiency" hypothesis. That is that increased internationalization results in a retrenchment of the welfare state in developing economies more than in the case of developed economies. Other research reports' findings, however, are consistent with the compensation hypothesis, in which international economic openness causes an expansion of the welfare state.

F. CONCLUSIONS

Technological advance and trade-opening continue to yield important benefits for economies overall, but these benefits come with sometimes important adjustments in the labor markets. Specific groups of workers and regions can be adversely affected – a problem which a number of countries are currently struggling to address. A key source of adjustment costs for workers and regions are frictions that impede workers who lose their job from smoothly transitioning to another job. Mobility frictions can be geographical when they impede the reallocation of workers between regions or they can be related to labor-market regulations. Skill mismatches between the new skills demanded by an increasingly information-driven global economy and the older skill set of many workers constitute another barrier to labor mobility.

While available evidence suggests that technology is responsible for more manufacturing job losses than trade, the two are interrelated. The question of whether job losses are the result of trade or technology risks missing the point that people need more creative and effective help to adjust to economic change, irrespective of its specific causes. Evidence also shows that some economies seem to be adjusting better than others to the challenges, as well as to the opportunities, offered by trade and technology. Domestic policies and institutions seem to play a key role in helping economies to prepare for economic change by facilitating labor adjustment and sharing benefits more widely.

One of the keys to successful adjustment seems to be finding an appropriate balance between labor market flexibility, on the one hand, and employment security, on the other. Active labor market policies aimed at retraining workers, helping them find new job openings, and assisting them with relocation, can usefully complement flexibility and security by providing workers with the necessary support and incentives to transition into new opportunities. More comprehensive, wide-ranging investments in education and infrastructure, as well as financial market policies, are also critical to prepare individuals to cope with economic change and to take advantage of a more skills- and technology-rich economy. Finally, redistributive policies aimed at compensating those who suffer long term losses from economic change may be necessary to sustain political support for further technological advance and economic openness.

Even if many of today's labor market problems are linked to domestic policy shortcomings, history has shown that if they are not addressed properly, they may have global ramifications that affect all countries. By providing a forum where governments meet, talk, and negotiate, the WTO – in cooperation with other relevant international organizations – offers an indispensable platform where governments can discuss how to maximize the contributions of trade and technology to economic progress, and how to ensure that this progress benefits everyone.

BIBLIOGRAPHY

Acemoglu, D. and Restrepo, P. (2017), "Robots and Jobs: Evidence from US Labor Markets", NBER Working Paper No. 23285, Cambridge, MA: National Bureau of Economic Research (NBER).

Andersen, T. M., Holmström, B., Honkapohja, S., Korkman, S., Tson, S. H. and Vartiainen, J. (2007), *The Nordic Model: Embracing Globalization and Sharing Risks*. Helsinki, ETLA B 232: Taloustieto Oy.

Arntz, M., Gregory, T. and Zierahn, U. (2016), "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis", OECD Social, Employment, and Migration Working Paper No. 189, Paris: Organisation for Economic Co-operation and Development (OECD).

Autor, D. H., Dorn, D. and Hanson, G. H. (2016), "The China Shock: Learning From Labor Market Adjustment to Large Changes in Trade", *Annual Review of Economics* 8: 205-240.

Autor, D. H., Katz, L. F. and Kearney, M. S. (2008), "Trends in US wage inequality: Revising the revisionists", *Review of Economics and Statistics* 90(2): 300-323.

Autor, D. H., Katz, L. F. and Kearney, M. S. (2006), "The Polarization of the U.S. Labor Market", *American Economic Review* 96: 189-194.

Autor, D. H., Levy, F. and Murnane, R. J. (2003), "The Skill Content of Recent Technological Change: An Empirical Exploration", *Quarterly Journal of Economics* 118(4): 1279-1333.

Autor, D. H., Katz, L. F. and Krueger, A. B. (1998), "Computing Inequality: Have Computers Changed the Labor Market?", *Quarterly Journal of Economics* 113(4): 1169-1213.

Bartel, A., Ichniowski, C. and Shaw, K. (2007), "How Does Information Technology Affect Productivity? Plant-level Comparisons of Product Innovation, Process Improvement, and Worker Skills", *Quarterly Journal of Economics* 122(4): 1721-1758.

Bessen, J. E. (2015) *Learning by Doing: The Real Connection between Innovation, Wages, and Wealth*, New Haven, CT: Yale University Press.

Blanchard, O., Jaumotte, F. and Loungani, P. (2013), "Labor Market Policies and IMF Advice in Advanced Economies During the Great Recession", *IZA Journal of Labor Policy* 3(1): 2.

Burstein, A., Morales, E. and Vogel, J. (2015), "Accounting for Changes in Between-group Inequality", NBER Working Paper No. 20855, Cambridge, MA: National Bureau of Economic Research (NBER).

Caliendo, L., Dvorkin, M. and Parro, F. (2015), "The Impact of Trade on Labor Market Dynamics", NBER Working Paper No. 21149, Cambridge, MA: National Bureau of Economic Research (NBER).

Cerina, F., Moro, A. and Petersen Rendall, M. (2017), "The Role of Gender in Employment Polarization", Department of Economics Working Paper No. 250, Zurich: University of Zurich.

Cernat, L. and Mustilli, F. (2017), "Trade and Labour Adjustment in Europe: What Role for the European Globalization Adjustment Fund?", Directorate-General for Trade Chief Economist Notes No. 2017-2, Brussels: European Commission.

Cosar, A. K. (2010), "Adjusting to Trade Liberalization: Reallocation and Labor Market Policies", Chicago: University of Chicago Booth School of Business, mimeo.

D'Amico, R. and Schochet, P. Z. (2012), *The Evaluation of the Trade Adjustment Assistance Program: A Synthesis of Major Findings*, Washington, D.C.: Social Policy Research Associates and Mathematica Policy Research.

Dauth, W., Findeisen, S. and Suedekum, J. (2014), "The Rise of the East and the Far East: German Labor Markets and Trade Integration", *Journal of the European Economic Association* 12(6): 1643-1675.

De Long, J. B. (2017), "NAFTA and Other Trade Deals Have Not Guttled American Manufacturing — Period", *Vox The Big Idea*. Available at <https://www.vox.com/>

European Commission (2011), *Activities of the European Globalization Fund in 2010*, Brussels: European Commission.

Fajnzylber, P. and Fernandes, A. M. (2009), "International Economic Activities and the Demand for Skilled Labor: Evidence From Brazil and China", *Applied Economics* 41(5): 563-577.

Felbermayr, G., Prat, J. and Schmerer, H.-J. (2011), "Trade and Unemployment: What Do the Data Say?", *European Economic Review* 55(6): 741-758.

Goldberg, P. K. and Pavcnik, N. (2003), "The Response of the Informal Sector to Trade Liberalization", *Journal of Development Economics* 72(2): 463-496.

Görg, H. and Strobl, E. (2002), "Relative Wages, Openness and Skill-Biased Technological Change", IZA Discussion Paper No. 596, Bonn: Institute of Labor Economics (IZA).

Hicks, M. and Devaraj, S. (2015), "The Myth and the Reality of Manufacturing in America", Center for Business and Economic Research Report, Muncie, IN: Ball State University.

Hummels, D., Ishii, J. and Yi, K.-M. (2001), "The Nature and Growth of Vertical Specialization in World Trade", *Journal of International Economics* 54(1): 75-96.

International Monetary Fund, World Bank, and World Trade Organization (2017), "Making Trade An Engine of Growth for All: The Case for Trade and for Policies to Facilitate Adjustment", Policy Papers Prepared by Staff of the IMF, the World Bank Group and the WTO, Washington, D.C.: World Bank.

Krugman, P. (2016), "Analytics of Trade Deficits and Manufacturing Employment (Very Wonkish)", *The New York Times*, The Opinion Pages 26-12-2016.

Machin, S. and Van Reenen, J. (1998), "Technology and Changes in Skill Structure: Evidence from Seven OECD Countries", *The Quarterly Journal of Economics* 113(4): 1215-1244.

Magee, C. (2001), "Administered Protection for Workers: An Analysis of the Trade Adjustment Assistance Program", *Journal of International Economics* 53(1): 105-125.

Malgouyres, C. (2017), "The Impact of Chinese Import Competition on the Local Structure of Employment and Wages: Evidence From France", *Journal of Regional Science* 57(3): 411-441.

McKenzie, D. J. (2017), "How Effective Are Active Labor Market Policies in Developing Countries? A Critical Review of Recent Evidence", Policy Research Working Paper No. 8011, Washington, D.C.: World Bank.

Meschi, E., Taymaz, E. and Vivarelli, M. (2016), "Globalization, Technological Change and Labor Demand: a Firm-level Analysis for Turkey", *Review of World Economics* 4(152): 655-680.

Mnif, S. (2016), "Skill Biased Technological Changes: Case of the MENA Region", *Theoretical and Applied Economics* XXIII(3(608)): 339-350.

Ossa, R. (2015), "Why Trade Matters After All", *Journal of International Economics* 97(2): 266-277.

Schochet, P. Z., D'Amico, R., Berk, J., Dolfin, S. and Wozny, N. (2012), *Estimated Impacts for Participants in the Trade Adjustment Assistance (TAA) Program Under the 2002 Amendments*, Princeton, NJ: Mathematica Policy Research.

Spitz-Oener, A. (2006), "Technical Change, Job Tasks, and Rising Educational Demands: Looking Outside the Wage Structure", *Journal of Labor Economics* 24(2): 235-270.

Srouf, I., Taymaz, E. and Vivarelli, M. (2013), "Skill-Biased Technological Change and Skill-Enhancing Trade in Turkey: Evidence from Longitudinal Microdata", IZA Discussion Paper No. 7320, Bonn: Institute of Labor Economics (IZA).

Timmer, M. P., de Vries, G. and de Vries, K. (2015), "Patterns of Structural Change in Developing Countries", in Weiss, J. and Tribe, M. (eds), *Routledge Handbook of Industry and Development*, Abingdon: Routledge: 65-83.

Ugur, M. and Mitra, A. (2017), "Technology Adoption and Employment in Less Developed Countries: a Mixed-method Systematic Review", *World Development* (forthcoming).

Vivarelli, M. (2014), "Innovation, Employment and Skills in Advanced and Developing Countries: A Survey of Economic Literature", *Journal of Economic Issues* 48(1): 123-154.

Wang, Z., Wei, S. J., Yu, X. and Zhu, K. (2017), "Rethinking the Impact of the China Trade Shock on the US Labor Market: A Production-Chain Perspective", Beijing: Research Institute on Global Value Chains, University of International Business and Economics, mimeo.

World Bank (2016), *World Development Report 2016: Digital Dividends*, Washington, D.C.: World Bank.