

# Global Value Chains, Offshoring and Wages\*

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## Abstract

Global value chains (GVCs) have proliferated mainly because of their efficiency, in that GVCs enable their participants to specialize in the activity in which they have comparative advantage. In addition, participation in GVCs can lead to increased job creation, increase in the economy's income and helps further economic growth and development. Naturally, however, there tends to be heightened concerns when it comes to offshoring activities, especially in the source economies. This study attempts to analyze the relationship between offshoring and wages among the 40 countries and 35 industries covered by the World Input-Output Database (WIOD), by measuring both narrow and broad offshoring. Data indicate that the majority of both narrow and broad offshoring occurs in the manufacturing sector. However, both narrow and broad offshoring in the services sector have also been rising. In addition, the dispersion in both wages and hours worked among workers of different skill groups can be seen quite clearly. Results show that the trend in the negative change in low-skill wage exists regardless of the degrees of offshoring activities. Medium-skill wages seem to be affected much more by offshoring. Education, financial intermediary and post and telecommunications services all experienced the biggest decline in low-skill wages, an increase in narrow offshoring and a decrease in broad offshoring. This suggests there might be a substitution effect of offshoring for low-skill labor. Medium-skill wages in education, financial intermediary and renting of machinery and equipment services show a similar trend.

JEL: F14 · F15 · F16

**Keywords:** global value chains (GVCs), offshoring, labor market

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## 1. Introduction

As production processes became more and more fragmented and international, trade in intermediate goods and services have accelerated. These global value chains (GVCs) proliferated mainly because of their efficiency, in that GVCs enable their participants to specialize in the activity in which they have comparative advantage. In addition, participation in GVCs can lead to increased job creation, increase in the economy's income and helps further economic growth and development.<sup>1</sup> In order to ensure reaping the gains from GVC participation, countries must put in place the right kind of trade and investment policies.

The rapid globalization process since the early 1990s has had diverse effects on individuals and households. Theoretically and empirically, it is now common knowledge that trade liberalization is associated with both job destruction and job creation. However, the debate continues regarding to what extent trade liberalization has impact on the labor market, and what complementary policies may be effective to implement along with trade liberalization in order to maximize (minimize) the benefits (costs). It is becoming increasingly important to measure the effects of trade liberalization on the labor market, in particular, wage and employment.

When firms choose to move some of its production activities to lower-wage host countries or purchase more intermediate inputs from such countries, it often leads to heated discussions in the source country. Organisation for Economic Cooperation and Development (OECD) (2007) explains three reasons behind these heightened concerns. First, although offshoring has had an impact only on traditional industries of the manufacturing sector in many countries for some time, now it is increasingly affecting the services sector as well. The rapid advances in information and communications technology (ICT) and infrastructure growth have increased the tradability of many service activities, thereby facilitating the sourcing of different categories of services from abroad. Furthermore, the COVID-19 pandemic, along with other rising risks, has also accelerated digitalization of trade. The response to coping with heightened uncertainty was formed based on compelling incentives to increase investment in making GVCs more resilient, especially through digitalization.<sup>2</sup> According to UNCTAD (2021), the pandemic contributed to drive a 6% increase in worldwide exports of ICT services. Since digitalization can overcome the cost of physical distance, it has the potential to bring together more diverse countries and people to work together.

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1. For a recent discussion, see World Bank (2020).

2. For more on the potential of digitalization of trade, see Asian Development Bank et al. (2021).

Second, more highly skilled jobs have recently been affected by offshoring, in addition to the low-skill jobs that used to be affected by traditional offshoring. Traditionally, the offshorability of jobs was discussed mainly based on the skills required for the tasks, between jobs that require high levels of education and jobs that do not. Recently, however, evidence suggests that the more critical distinction may be the divide between personal and impersonal jobs.

Third, there are increased concerns with regard to the two great emerging Asian economies, China and India. A big example for this is the ICT industry. Due to the wage-cost advantage and the large pool of English-speaking skilled labor, India has become a prime location for ICT services offshoring. OECD (2017) suggests that China also has the right economic conditions and pre-requisites to grow as a supplier of offshored ICT services, including a large and rapidly growing highly skilled labor supply, a large stock of ICT infrastructure, rapidly increasing engagement with multinational firms and a supportive policy environment, but it has not yet developed the specialized firms and human resources, including foreign language resources, or the stock of inward services investment to supply these services globally.

The term “offshoring” is here based on Hatzichronoglou (2006)’s definition; that is, outsourcing abroad or more generally, imports of intermediate inputs by domestic firms. There are two forms of offshoring: one where a domestic firm transfers some of its activities to its foreign affiliates; and another, a transfer of the production of goods or services abroad to a non-affiliated enterprise.

By examining findings on the relationship between offshoring and wages by skill type, this study seeks to set a direction for future research on this topic that will establish the labor implications of offshoring and trade reform. Section 2 first gives a brief overview of the development in trade and labor literature. Section 3 will then go on to descriptively analyzing the data on offshoring and wages in order to grasp the current situation and consequences of offshoring. Section 4 concludes.

## **2. Literature Review**

This section sets out by examining the available theoretical arguments and empirical evidence on the possible employment effects of trade and offshoring. I will first give a brief overview of the developments in the theoretical trade literature.

As mentioned, despite the fact that there is considerable agreement among economists that offshoring of production stages does affect wages and employment

across countries and industries, to date there has been little agreement on the expected direction of these potential effects. On the one hand, if offshoring mainly involves tasks carried out by low-skill labor, as we have long seen, then theoretically, the relative demand for high skills would increase and contribute to a widening wage gap between skilled and unskilled labor (Feenstra and Hanson, 1996). On the other hand, however, if the associated cost reductions are particularly strong in low-skill labor intensive industries, offshoring may reduce the wage gap between skilled and unskilled labor as resources are reallocated towards low-skill intensive industries (Jones and Kierzkowski, 1990).

There has been some development in international trade theory towards linking liberalization with unemployment and production fragmentation. The new movement was made possible when trade theory evolved into incorporating models with increasing returns to scale and imperfect competition (Krugman, 1980); and more recently, inter-firm differences in productivity (Melitz, 2003) and propensity to export within industries (Roberts and Tybout, 1997; Bernard and Jensen, 2004). Among the theorists exploring the connection between trade and employment is Matusz (1996), who embedded theories of efficiency wages and job search into trade models. In addition, Kasahara and Lapham (2013) extends Melitz (2003)'s model to incorporate imported intermediate goods.

Following these works, Helpman et al. (2012) developed a model with heterogeneity in fixed exporting costs and costs of screening worker abilities across firms. Estimating this extended model, they find that overall wage inequality arises within sectors and occupations across workers with similar observable characteristics. This within component is driven by wage dispersion between firms, and wage dispersion between firms is related to firm employment size and trade participation.

Costinot and Vogel (2010) implemented a model that focuses on heterogeneous workers. By taking different skill intensities into account, they examine the relationship between trade liberalization and wage premium. They analyze the impact of North-South trade, which results in an increased wage gap in the North, and a decrease in relative wages in the South. They present this as an explanation for the shrinking of the middle-class due to workers leaving the medium-skill industries in developed countries.

As for offshoring, Grossman and Rossi-Hansberg (2008) focus on the wage effects of offshoring. They show that the equilibrium wage of low-skill domestic workers may go up or down due to offshoring, depending on three factors: relative sizes of the productivity gains, the extent of displacement of workers and the size

of the country in world markets.

With the ongoing development in international trade, empirical literature considering the relationship between offshoring and relative wages has been increasing. However, empirical research to date has yet to offer any conclusive evidence on the effects of trade liberalization on employment and wages. Hoekman and Winters (2005) suggest that this is in part due to the potential endogeneity problem when dealing with trade policy. Trade policies can have a significant impact on the level and structure of employment, wages, income inequality, labor market institutions and policies, and labor and social policies can also influence the outcomes of trade policies in terms of growth of output, employment and the distribution of income. This makes it difficult to isolate the effects of trade from other policies implemented simultaneously with trade reform.

Empirical works that focus on offshoring tend to examine its effects on the skill structure of labor demand. They analyze relative demand for labor by estimating a translog cost function, which gives the variable costs in the respective industries, and through conditional and unconditional labor demand functions, which are derived through cost minimization and profit maximization for a given output respectively.

One of the studies that investigate how production offshoring affects skill structure and wage inequalities is by Hijzen et al. (2005). They use a translog cost function to study the impact of offshoring on the different types of workers in the United Kingdom. They divide the education groups into three: high-, semi- and low-skill workers by occupation. Using data on United Kingdom's manufacturing industries over the period 1982-1996, they estimate a system of equations, one for each type of variable cost (the three different types of labor and materials). Results indicate that increased intra-industry offshoring has a negative impact on the demand for all three occupation groups. The magnitude of the effects, however, is different; the lower the level of skills, the stronger the impact of offshoring becomes. The paper concludes that offshoring as well as technological change through research and development are important factors in explaining the changing skill structure which the United Kingdom has experienced.

Similarly, Feenstra and Hanson (1996), Falk and Koebel (2002) and Strauss-Kahn (2003) examine the impact of offshoring on the demand for skilled labor in the United States, Germany and France, respectively. Their results also tend to indicate that offshoring has had a negative impact on the demand for unskilled labor. An exception is Falk and Koebel (2002)'s study, whose results indicate that the increase in imported materials is driven by higher output growth rather than

input substitution for different types of labor.

Hijzen and Swaim (2010) analyze the impact of offshoring on the price elasticity of labor demand by analyzing partial equilibrium elasticities defined over a single sector. They use industry-level data for 17 OECD countries. Their results suggest that there is a cross-sectional association (which is likely to capture deeper long-term technological developments related to offshoring) between higher average offshoring intensity and higher elasticity of labor demand during the second half of the 1990s. Their findings underline the heterogeneity of these impacts, by implying that the impact of offshoring is likely to be quite different from that of trade in final goods.

More recently, Foster-McGregor et al. (2013) follow Hijzen et al. (2005) and estimate the relationship between offshoring and the skill structure of labor demand using the World Input-Output Database (WIOD) for 40 countries over the period 1995-2009. They estimate a system of variable factor demand equations, and their results indicate that while offshoring has had a negative effect on all skill (low, medium and high) levels, the largest impacts have been observed for medium-skill workers. This is notable in a sense that it is consistent with the aforementioned recent trend towards the shrinking of the middle class (see Costinot and Vogel, 2010).

Results from Yane (2019) reveal that participating in GVCs has both positive and negative effects on demand for different skill types of labor. On one hand, there is a positive trend for high-skill workers, regardless of the region or GDP per capita of the country. On the other hand, results show a decrease in low-skill labor demand. This indicates a widening gap between high- and low-skill labor, suggesting an increase in inequality, especially in low-income countries.

Based on these literature, the consensus view is that trade has played a role in observed changes in relative labor demand. However, the conclusion is still mixed with regard to the major reasons for rising wage inequality. The following section presents descriptive statistics on the offshoring activities and wage inequality during the past two decades.

### 3. Descriptive Analysis

The literature distinguishes between two different types of offshoring: narrow offshoring (or intra-industry offshoring) and broad offshoring (or inter-industry offshoring). This distinction between offshoring measurements was first introduced by Feenstra and Hanson (1999). Both measures will be used in the present paper to capture the differences between them.

The standard measure in the literature is to measure offshoring intensity by taking the share of imported intermediate inputs in value-added (Hijzen et al., 2005). Thus, narrow offshoring for industry  $i$ ,  $O_i^N$ , can be measured by:

$$O_i^N = \frac{IIM_{j=i}}{VA_i}$$

where  $IIM_{j=i}$  refers to imported intermediate purchases from industry  $j = i$  by industry  $i$ , and VA denotes value-added. Similarly, broad offshoring for industry  $i$ ,  $O_i^B$ , can be calculated as:

$$O_i^B = \frac{\sum_{j=1}^J IIM_{j \neq i}}{VA_i}$$

where  $\sum_{j=1}^J IIM_{j \neq i}$  refers to sum of imported inputs by industry  $i$  from all industries  $j$  but itself  $i$ .

Using data from the World Input-Output Database (WIOD)<sup>3</sup>, I construct the two measures of offshoring described above for 40 countries and 35 industries for each year from 1995 to 2011. Industries are aggregated into three sectors: agriculture, manufacturing and services. The 35 industries and their corresponding sectors are listed in Appendix A.1.

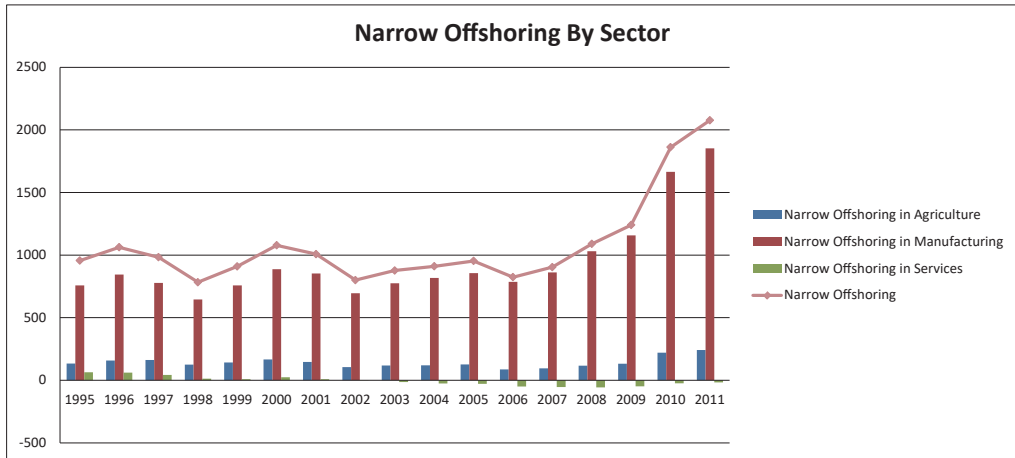
First, Figure 1 shows the increasing trend in narrow offshoring since 1995, by sector. Narrow offshoring only considers imported intermediates in a given industry from the same industry. Hijzen et al. (2005) use this definition of offshoring because imported intermediate inputs from the same industry are more likely to reflect substitution opportunities associated with the international fragmentation of production. Not surprisingly, the majority of narrow offshoring occurs in the

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3. The WIOD is available at <https://www.rug.nl/ggdc/valuechain/wiod/> and <https://web.archive.org/web/20211102093630/http://www.wiod.org/home>.

The core of the database is a set of harmonized national supply and use tables, linked together with bilateral trade data in goods and services. These two sets of data are then integrated into a world input-output table. See Timmer (2012) for the detailed framework and calculations.

**Figure 1**

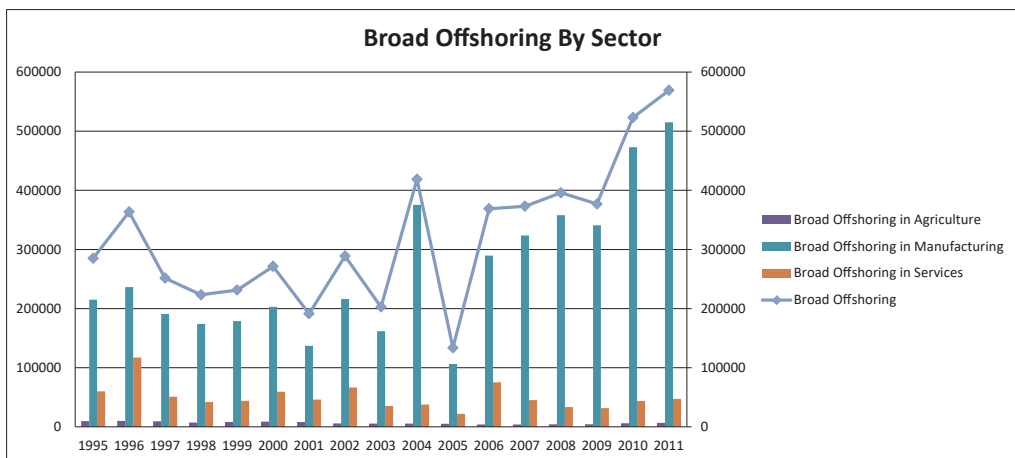


Source: Author's calculations based on WIOD.

manufacturing sector. Further, narrow offshoring in the services sector has been rising since 2006.

Second, Figure 2 depicts how broad offshoring has evolved since 1995, by sector. Similar to narrow offshoring, broad offshoring is large in manufacturing sectors. Led by a big drop in manufacturing offshoring in 2005, broad offshoring declined that year, but has been increasing since. Services offshoring dipped in 2008 and 2009, most likely due to the decrease in financial intermediation services

**Figure 2**



Source: Author's calculations based on WIOD.

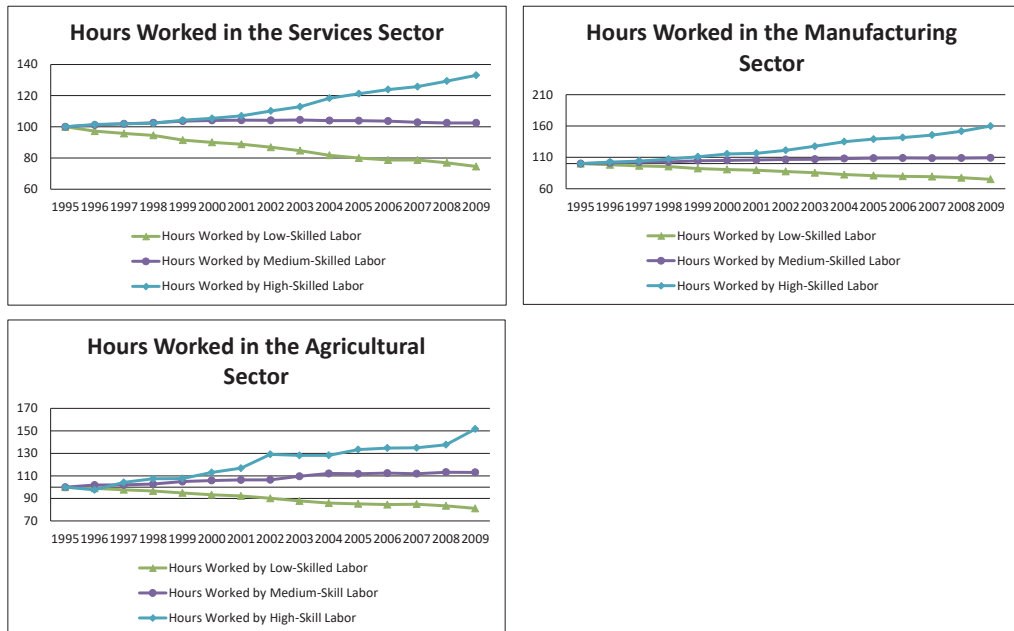


during the financial crisis.

The WIOD also includes Socio-Economic Accounts (SEAs) that cover high-, medium- and low-skill labor compensation as well as hours worked for the period 1995 to 2009. In Figure 3, it is clearly shown that during the period 1995-2009, hours worked by high-skill workers have increased relative to hours worked by medium- and low-skill workers. Although hours worked by medium-skill workers does not show that much fluctuation, the decline in hours worked by low-skill workers is striking.

Next, Figure 4 attempts to present the relationship between offshoring and wage dispersion by country. Here, I calculate the period 1995-2009, which includes the years 2008 and 2009 of the financial crisis.<sup>4</sup> Interestingly, the trend in the negative change in low-skill wage exists regardless of the degrees of offshoring activities. Medium-skill wages seem to be affected much more by offshoring. However, from this analysis only, it is difficult to tell in which direction high degrees of offshoring impacts medium-skill labor.

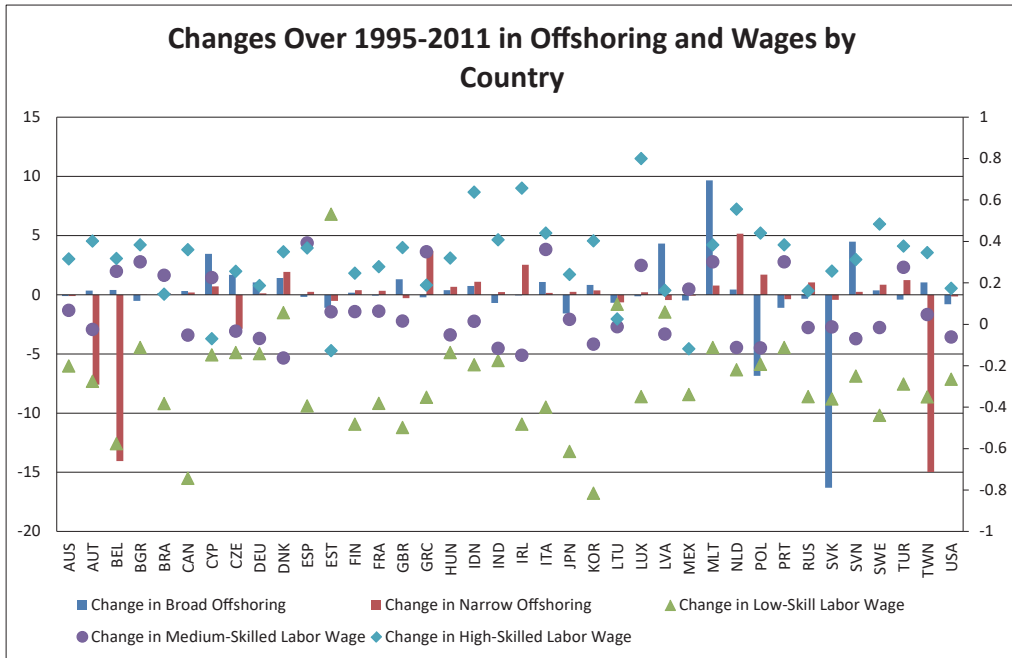
**Figure 3 Hours worked by sector (year 1995=100)**



Source: Author's calculations based on WIOD.

4. This is because when comparing the alternative graphs for the period 1995-2007, besides the magnitude, the direction and relative positions of the depicted points were similar.

**Figure 4**



Source: Author’s calculations based on WIOD.

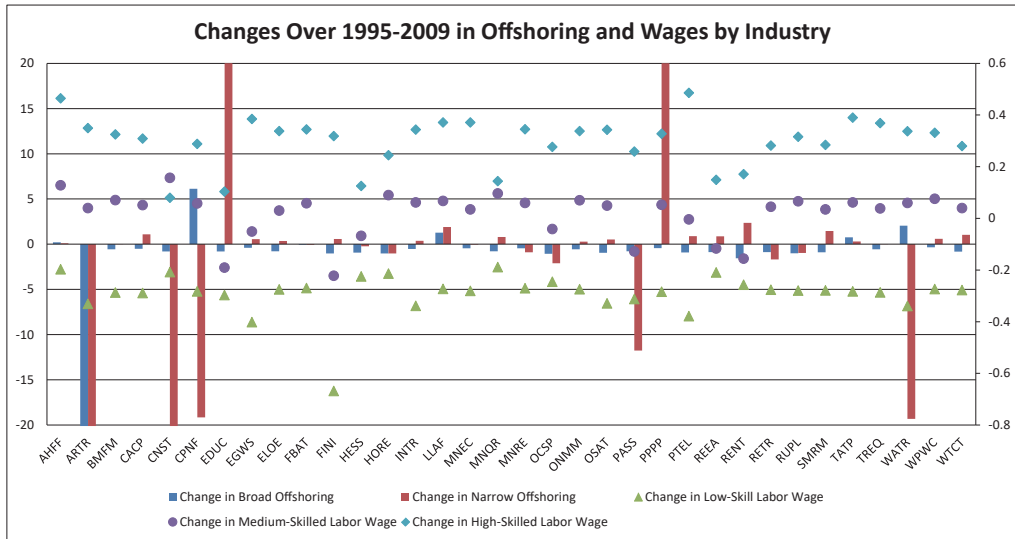
Notes: Refer to Appendix Table A.2 for the codes and their corresponding countries.

Figure 5 depicts the relationship between offshoring and wage dispersion by industry. Education, financial intermediary and post and telecommunications services all experienced the biggest decline in low-skill wages, an increase in narrow offshoring and a decrease in broad offshoring. This suggests there might be a substitution effect of offshoring for low-skill labor. Medium-skill wages in education, financial intermediary and renting of machinery and equipment services show a similar trend. This confirms the recent rise in concerns regarding services offshoring. With this data, however, we cannot trace the effects of call-center and computer programming activities which are often offshored to lower-wage countries.

#### 4. Concluding Remarks

Naturally, there tends to be heightened concerns when it comes to offshoring activities, especially in the source economies. This study attempts to analyze the relationship between offshoring and wages among the 40 countries and 35 industries covered by the WIOD, by measuring both narrow and broad offshoring based

Figure 5



Source: Author's calculations based on WIOD.

Notes: Refer to Appendix Table A.1 for the codes and their corresponding industries.

on Feenstra and Hanson (1999).

Data indicate that the majority of both narrow and broad offshoring occurs in the manufacturing sector. However, both narrow and broad offshoring in the services sector have been rising since 2006 and 2009, respectively. In addition, the dispersion in both wages and hours worked among workers of different skill groups can be seen quite clearly. Hours worked by high-skill workers have increased relative to hours worked by medium- and low-skill workers, whose decline in hours worked is striking.

Results show that the trend in the negative change in low-skill wage exists regardless of the degrees of offshoring activities. Medium-skill wages seem to be affected much more by offshoring. Education, financial intermediary and post and telecommunications services all experienced the biggest decline in low-skill wages, an increase in narrow offshoring and a decrease in broad offshoring. This suggests there might be a substitution effect of offshoring for low-skill labor. Medium-skill wages in education, financial intermediary and renting of machinery and equipment services show a similar trend.

Despite the recent increase in both theoretical and empirical studies regarding offshoring and wage dispersion, our work here is far from done. This section concludes this study by raising five research questions:

First, research on GVCs faces new challenges in light of the COVID-19 pandemic and the state of the world in its wake. Overall, the pandemic caused the volume of trade in the world to plummet. It revealed the vulnerability of GVCs by showing the world that one small disruption in the value chain can cause great disruption in the supply due to the lack of access to intermediate goods and services.

The pandemic also accelerated digitalization of trade. Digitalization has also changed what nations view as important when it comes to free trade. Not only is the number of free trade partners a country has important, but also the quality of free trade agreements. Since digitalization can overcome the cost of physical distance, it has the potential to bring together more diverse countries and people to work together.

Before the pandemic, protectionist trade policies arose mainly for the purpose to protect domestic labor and industries, however, pandemic brought about a different purpose for these kinds of closed policies, which are for security and political reasons. We saw many countries restrict their exports for essential goods when the pandemic started. International trade inevitably tends to be strongly affected by security and political issues. Since witnessing the disruption of the GVCs, there has been more support for the reshoring of production.

Second, due to the spread of the coronavirus, the dynamics of GVCs have changed. When examining the effects of GVCs, it is necessary to use a measure that can account for the increased interconnectivity of production networks. This could only be possible in the framework of input-output models. Redefining the measurement of the degree of participation in GVCs should enable us to grasp the impact in this changing world more accurately. Another movement we need to reflect in our research is the consideration for human rights and environment. Including these elements in the model is crucial to reflect the situations in the real world.

Third, there is also a question of whether the way nations, firms and people participate in GVCs matter. It is important to specify what role each actor has in the GVC and how that differentiates the effects on the labor market from each other. Following Hijzen and Swaim (2010), it is of interest to explore the heterogeneity of trade's impacts on labor demand. Differentiating between imports of intermediate inputs and final goods and services may reveal how offshoring and trade in final products vary in their effects on the labor market.

Fourth, regarding empirical research, incorporating technological change into the system of regressions will be important, given the fact that skill-biased technological change is regarded as the main determinant of the demand for skilled

workers. Deeper investigation into the effects of technological change such as ICT on offshoring and wage dispersion has become imminent.

Fifth, Krugman (2008) suggests that trade has become much more important in driving the demand for skilled workers in recent years due to the fast growth in imports from low-skill abundant developing and emerging economies, notably China. Considering this, examining whether the source countries are experiencing similar effects of offshoring as the host countries might shed some more light on the effects of offshoring. Since there obviously is heterogeneity in the source countries, we can investigate whether the effects differ by country as well.

Domestic production has been increasingly relying on foreign intermediate inputs in order to enhance efficiency. Hopefully, future research will identify the relocation effects on workers that occur when firms choose to offshore some of its production activities. Based on these results, we will be able to accurately address what complementary policies and systems are needed to help those that must bear the costs of globalization and ensure that the benefits from globalization can reach as many people as possible.

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## Appendix Tables

**Appendix Table A.1 List of industries and their corresponding sector classifications**

<b>Abbrev.</b>	<b>Industry</b>	<b>Sector</b>	<b>Abbrev.</b>	<b>Industry</b>	<b>Sector</b>
AHFF	Agriculture, Hunting, Forestry and Fishing	Agriculture	SMRM	Sale, Maintenance and Repair of Motor Vehicles Retail Sale of Fuel	Services
MNQR	Mining and Quarrying	Agriculture	WTCT	Wholesale Trade and Commission Trade, Except of Motor Vehicles	Services
FBAT	Food, Beverages and Tobacco	Manufacturing	RETR	Retail Trade, Except of Motor Vehicles ; Repair of Household Goods	Services
TATP	Textiles and Textile Products	Manufacturing	HORE	Hotels and Restaurants	Services
LLAF	Leather, Leather and Footwear	Manufacturing	INTR	Inland Transport	Services
WPWC	Wood and Products of Wood and Cork	Manufacturing	WATR	Water Transport	Services
PPPP	Pulp, Paper, Paper , Printing and Publishing	Manufacturing	ARTR	Air Transport	Services
CPNF	Coke, Refined Petroleum and Nuclear Fuel	Manufacturing	OSAT	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies	Services
CACP	Chemicals and Chemical Products	Manufacturing	PTEL	Post and Telecommunications	Services
RUPL	Rubber and Plastics	Manufacturing	FINI	Financial Intermediation	Services
ONMM	Other Non-Metallic Mineral	Manufacturing	REEA	Real Estate Activities	Services
BMFM	Basic Metals and Fabricated Metal	Manufacturing	RENT	Renting of M&Eq and Other Business Activities	Services
MNEC	Machinery, Nec	Manufacturing	PASS	Public Admin and Defense; Compulsory Social Security	Services
ELOE	Electrical and Optical Equipment	Manufacturing	EDUC	Education	Services
TREQ	Transport Equipment	Manufacturing	HESS	Health and Social Work	Services
MNRE	Manufacturing, Nec; Recycling	Manufacturing	OCSP	Other Community, Social and Personal Services	Services
EGWS	Electricity, Gas and Water Supply	Services	PHEP	Private Households with Employed Persons	Services
CNST	Construction	Services			

**Appendix Table A.2 Alphabetical country codes and countries**

<b>Code</b>	<b>Country</b>	<b>Code</b>	<b>Country</b>	<b>Code</b>	<b>Country</b>	<b>Code</b>	<b>Country</b>
AUS	Australia	EST	Estonia	JPN	Japan	RUS	Russia
AUT	Austria	FIN	Finland	LVA	Latvia	SVK	Slovak Republic
BEL	Belgium	FRA	France	LTU	Lithuania	SVN	Slovenia
BRA	Brazil	DEU	Germany	LUX	Luxembourg	KOR	South Korea
BGR	Bulgaria	GRC	Greece	MLT	Malta	ESP	Spain
CAN	Canada	HUN	Hungary	MEX	Mexico	SWE	Sweden
CHN	China	IND	India	NLD	Netherlands	TWN	Taiwan
CYP	Cyprus	IDN	Indonesia	POL	Poland	TUR	Turkey
CZE	Czech Republic	IRL	Ireland	PRT	Portugal	GBR	United Kingdom
DNK	Denmark	ITA	Italy	ROU	Romania	USA	United States