Global Value Chains and the Skill Structure of Labor Demand

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Abstract

Distinguishing among different types of trade flows, this study conducts empirical analysis on the role of global value chains in the skill structure of labor demand. This study uses data on labor compensation from the Socio-Economic Accounts (SEA) along with industry-level international trade data for the period 1995 to 2009, covering 40 countries from the World Input-Output Database. Preliminary results from the estimation of a system of factor demands do not show any statistically significant relation between foreign value added in a country's exports and its domestic labor demand. A different take on the analysis reveals that although trade in intermediate inputs have a negative effect on low- and medium-skilled workers, the positive effect from trade in final products on these workers outweighs this negative effect. Similarly, increase in trade in final products has an adverse impact on high-skill labor, but the effect from an increase in intermediates imports offsets this, contributing to an overall positive effect. The extent and direction of the impact from increase in intermediates and final products trade on the skill composition of labor demand vary depending on the sector, region and whether the goods and services being traded are low, medium or high technology. In order to alleviate the negative effects, workers from each skill group should be able to move along the value chain smoothly.

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In recent years we have witnessed the world economy rapidly integrating through international trade. Behind this phenomenon is the increasing prominence of trade in intermediates and trade in services during the past two decades. The international fragmentation of production in global value chains has been motivated by sourcing intermediate inputs from more cost-efficient producers in order to enhance efficiency. As a result, domestic production has been increasingly relying on foreign intermediate inputs. Further, rapid advances in information and communications technology (ICT) and infrastructure growth have increased the tradability of many service activities, thereby facilitating the sourcing of services from abroad.

This rapid globalization process has had diverse effects on individuals, households and firms. 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 wages and employment.

Global value chains have rapidly emerged as production processes have become more geographically fragmented since the 1990s. International trade and production are increasingly structured around these global value chains. A value chain can be simply defined as the full range of activities that firms and workers carry out in order to bring a product from its conception to its end use and beyond (see Gereffi and Fernandez-Stark, 2011). The term global comes from the fact that these activities are more and more spread over multiple countries. There has been a rising trend in the world's ratio of foreign to domestic inputs, indicating that firms have been expanding their purchase and usage of intermediate inputs from abroad.

The share of world's intermediates trade in total trade has been increasing, in contrast with the stagnant share of world's final products trade in total trade, as depicted in Figure 1. It also shows how intermediates trade share in total trade in East Asia is exceptionally high, leading the rising trend in trade in intermediate products.

Figure 1: Trade in Intermediates and Final Products as a Share of Total Imports
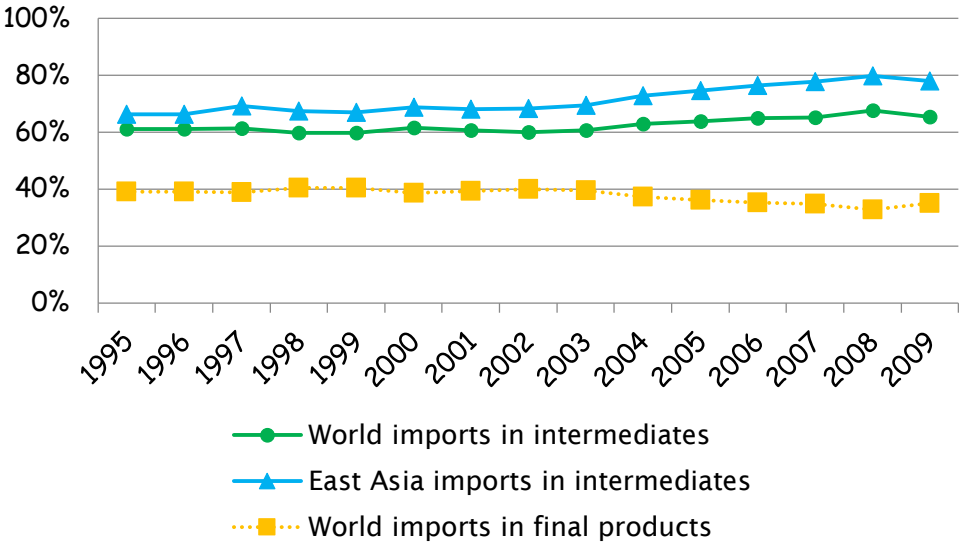
Source: Author's calculation based on WIOD.

Moreover, services trade liberalization has reduced regulatory barriers in key sectors of the global logistics chain, such as transport, finance and telecommunications. Business services, for example, are now an integral part of the global value chain. Naturally, people worry that if their country's imports from their partner country increase due to a newly-signed free trade agreement (FTA), the unemployment rate might rise and/or their wages may decrease. There are concerns that globalization leads to a greater wage gap and would worsen inequality, with people in the source country losing their jobs (quantitatively) or having to work in worse conditions (qualitatively).

Using trade data from the World Input-Output Database (WIOD)[1], this study attempts to reveal the relationship between participation in the global value chain and change in domestic labor

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[1] This new World Input-Output Database is available at http://www.wiod.org/database/index.htm.

demand. In measuring the foreign value added content in exports (FVAiX), this study follows Amador, Cappariello and Stehrer (2015). The ratio of value added to gross output in country s is denoted by v^s, a $1 \times NC$ vector, where N is the number of sectors and C the number of countries. The Leontief inverse of the global input-output matrix is expressed as $L = (I - A)^{-1}$, with dimension $NC \times NC$, where A denotes the global coefficients matrix. Country r's exports is denoted by a vector e^r with dimension $NC \times 1$. Pre-multiplying the Leontief inverse by the vector of value added coefficients and post-multiplying with exports vector gives us the FVAiX:

$$FVAiX^{sr} = v^s L^{sr} e^r \tag{1}$$

Hence, this indicator captures the value added content in country r's exports in which imported intermediates are used. Using this as a measurement for global value chain prevalence, this study assesses the effect global value chains have on the skill structure of labor demand. Based on recent 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.

Foster-McGregor et al. (2013) estimate the relationship between offshoring and the skill structure of labor demand using the 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-skilled workers. This is notable in a sense that it is consistent with the recent trend towards the shrinking of the middle class in the North (see Costinot and Vogel, 2010).

Table 1 shows preliminary results from an analysis on how Japan's neighboring countries' contribution to value added have had an impact on its wage shares by skill type. In this simple model, there are two sectors: manufacturing and services. It is assumed that the cost functions can

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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.

be approximated by a translog function and is twice differentiable, linearly homogenous and concave in factor prices. Time subscripts are omitted for simplicity.

$$lnC_i(w, x, z) = \alpha_0 + \sum_{j=1}^{J} \alpha_j lnw_{ij} + \sum_{l=1}^{L} \beta_l lnx_{il} + \sum_{r=1}^{R} \gamma_r z_{ir} +$$
$$\frac{1}{2}\sum_{j=1}^{J}\sum_{k=1}^{J} \alpha_{jk} lnw_{ij}lnw_{ik} + \frac{1}{2}\sum_{l=1}^{L}\sum_{m=1}^{L} \beta_{lm} lnx_{il}lnx_{im} + \frac{1}{2}\sum_{r=1}^{R}\sum_{s=1}^{R} \gamma_{rs} z_{ir}z_{is} +$$
$$\frac{1}{2}\sum_{j=1}^{J}\sum_{l=1}^{L} \delta_{jl} ln w_{ij}lnx_{il} + \frac{1}{2}\sum_{j=1}^{J}\sum_{r=1}^{R} \delta_{jr} lnw_{ij}z_{ir} + \frac{1}{2}\sum_{l=1}^{L}\sum_{r=1}^{R} \delta_{lr} lnx_{il}z_{ir} \qquad (2)$$

Where C_i depicts the total variable cost in sector $i = 1, ..., N$; w_{ij} denotes factor prices for factor $j = 1, ..., k, ..., J$; x_{il} denotes fixed inputs and outputs for $l = 1, ..., m, ... L$; and z_{ir} is the technological change or the demand shifters for $r = 1, ..., s, ... R$. The variable factors are low-skilled, middle-skilled and high-skilled labor and intermediate inputs. The five necessary restrictions for the aforementioned assumptions to hold are:

$$\sum_{j=1}^{J} \alpha_j = 1 \text{ and } \sum_{j=1}^{J} \alpha_{jk} = \sum_{k=1}^{J} \alpha_{kj} = \sum_{j=1}^{J} \delta_{jl} = \sum_{j=1}^{J} \delta_{jr} \qquad (3)$$

First derivatives of the translog cost function with respect to factor prices yields the cost share of factor j in total variable costs. Rather than estimating a single cost share equation, this study estimates a system of demand equations by iterating Zellner's method (ISUR), and controlling for time-invariant sector-specific fixed effects. Constructing a panel dataset for period 1995-2009, this study focuses on the relationship between the Asian production network and Japan's domestic labor demand. As shown in the preliminary results, the variable of interest, $FVAiX$, is not statistically significant at the 10% level. There is, however, a hint of a crowding out of the middle-skilled group, compared to low- and high-skilled workers, which is consistent with the recent literature.

The WIOD's Socio-Economic Accounts (SEAs) that cover high-, medium- and low-skilled labor compensation, that were used for this analysis, as well as hours worked are worth looking into. In Figure 2, it is clearly shown that during the period 1995-2009, hours worked by high-skilled workers have increased relative to hours worked by medium- and low-skilled workers. Although hours worked by medium-skilled workers do not show that much fluctuation, the decline in hours worked by low-skilled workers is striking. This set of graphs signifies a possible replacement of low-skilled labor by either high-skilled labor or the traditional foreign offshoring of less-skilled activities.

Figure 2: Hours worked by sector (year 1995=100)

Agriculture

Manufacturing

Services
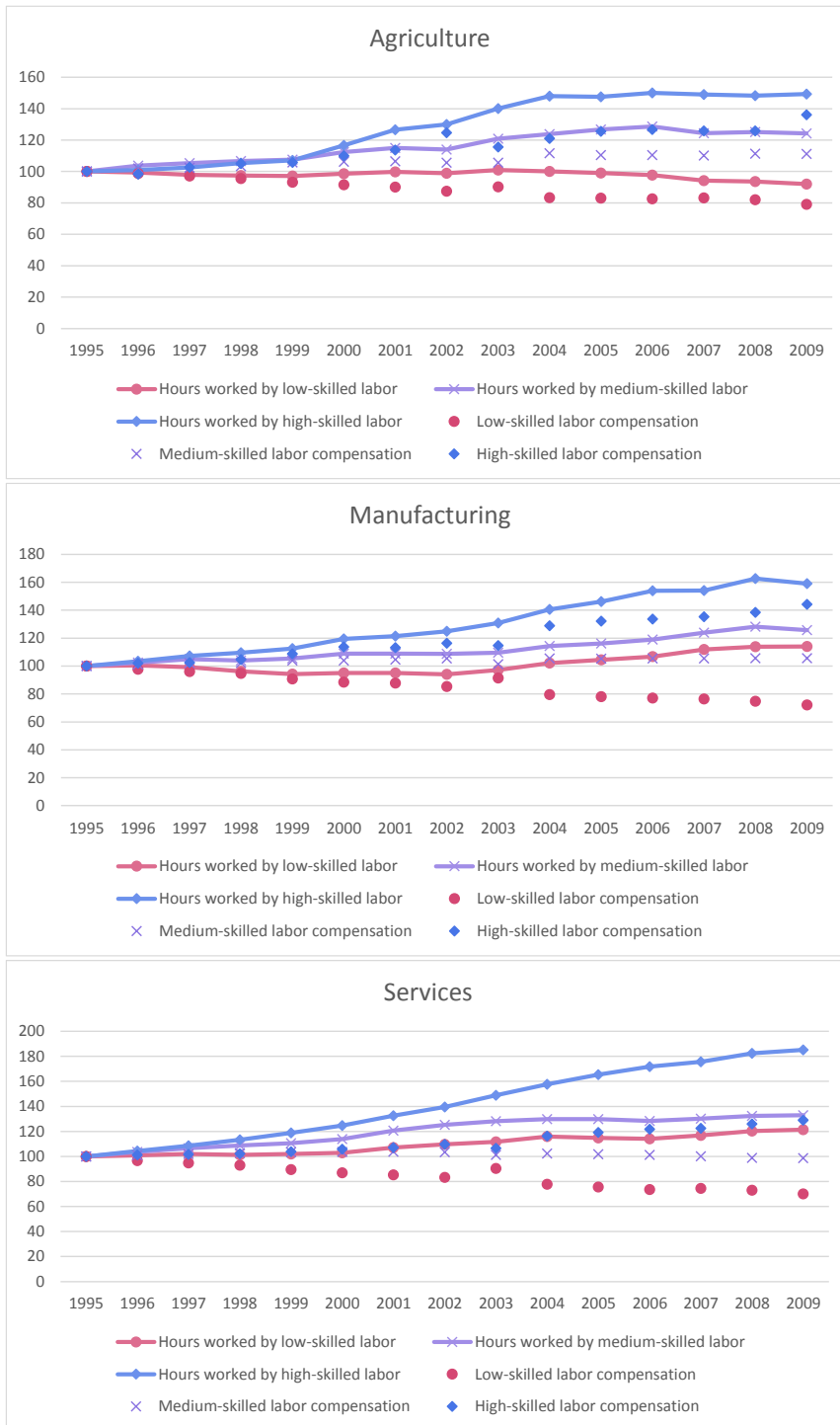
Source: Author's calculation based on WIOD SEA.

Table 1 : SUR estimation results

	(1) S_{LS}	(2) S_{MS}	(3) S_{HS}
w_{LS}	0.032812***	-0.0084803***	0.0079017***
	(0.0006433)	(0.0007472)	(0.0012364)
w_{MS}	-0.0351033***	0.1413692***	-0.1086694***
	(0.0030015)	(0.0034867)	(0.0057611)
w_{HS}	0.0147123***	-0.0210669***	0.1438633***
	(0.0017689)	(0.0020548)	(0.0033931)
w_{II}	-0.0137395***	-0.10375***	-0.047401***
	(0.0017062)	(0.0019824)	(0.0033448)
K	-0.0023595***	-0.0129762***	-0.0177739***
	(0.0005648)	(0.0006562)	(0.0010953)
GO	0.0036245***	0.0029765***	0.0185238***
	(0.0009065)	(0.0010532)	(0.0017731)
$FVAiX$	0.0014706	-0.0000998	0.001089
	(0.000635)	(0.0007378)	(0.0012473)
Obs.	140	140	140

Notes: The set of equations are estimated by ISUR. Standard errors are reported in parentheses.
Full set of time and sector dummies are included in the estimation.
***,**,* Significant at the 1, 5 and 10 percent level respectfully.

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