ERIA Discussion Paper Series

No. 331

Analysis of Global Value Chain Participation and the Labour Market in Thailand: A Micro-level Analysis

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May 2020

Abstract: *This study assesses the links between global value chain (GVC) participation and the labour market to examine the relatively unexplored employment-related distribution effects of GVC integration. Based on the Mincer wage model, we examine the relationship between GVC participation and worker productivity and wages at the individual level. Our main estimation method is a simple ordinary least squares estimation using pooled cross-sectional data from the Thai Labour Force Survey for the period 1995–2011. We also separately examine the effects of forward and backward GVC participation on wages and wage distributions. Our results show that GVC participation induces higher monthly wages for individuals and increases productivity in the labour market through either the forward linkage or backward linkage. We even find that GVC participation can help mitigate inequality. Our findings show that GVC participation promotes inclusive job creation and provides more job opportunities for rural, female, and low-skilled workers. Policies to support leveraging the existing strong industries through upgrading, smoothing labour movements while improving agricultural productivity, and preparing to move towards a services economy can help prepare Thailand, and other developing countries in general, to upgrade to higher value chains. Although GVC participation may be a catalyst for higher wages, greater labour productivity, and more inclusive job creation, its employment effects are complicated. An unbalanced policy framework might contribute to uneven income distributions and exclusive job creation as participating in GVCs through different linkages can benefit different stakeholders in varying ways. Therefore, a policy framework that balances the benefits among stakeholders in terms of wage distributions and job inclusion is ideal.*

Keywords: Global value chain participation; wage distributions; job inclusion; labour productivity; labour market; Thailand

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1. Introduction

The spread of global value chains (GVCs) is changing the approach towards trade and development analysis. While traditionally imports were assumed to reflect a country's domestic demand for foreign goods and services, trade is becoming increasingly characterised by the fragmentation of production across borders, where individual countries along GVCs play specific and separate roles in the production process. This change has called for a specialised analysis of GVCs and new measures of trade, one of which is trade in value added (TiVA). Through the interactions between countries and the supply of final goods and services, TiVA can provide insights into the industry-specific effects of GVCs and, consequently, their influence on the labour market and labour conditions. These insights are of particular importance for developing countries, which, because of their typical labour abundance, must find the most effective ways of achieving successful and comprehensive GVC participation.

This study assesses the links between GVC participation and the labour market. We utilise data from Thailand's Labour Force Survey (LFS) to examine the relationship between GVC participation and worker productivity and wages at the individual level. From 1960, Thailand began to change from being an agricultural produce exporter, such as of rice, to being a manufactured goods exporter, starting with garments and parts and components. This export-oriented development strategy has promoted Thailand's participation in GVCs. By promoting trade liberalisation and attracting more foreign direct investment, the country has been able to increase its economic activity in terms of both total output and the total amount of exports, while at the same time depending on more foreign inputs to produce its exports. Consequently, the labour participation pattern has responded to the change in the

trading pattern. This has manifested as a decline in the number of workers in the agricultural sector and a rising number of workers in the manufacturing and services sectors over time.

However, the full employment-related distribution effects of GVC integration are still largely unknown, and evidence is mixed. Participation in value chains may enable firms to grow and stimulate demand for labour, but it may also cause uncompetitive firms to exit the market and, thus, lower employment in some industries. Participation may also affect different groups of workers in different ways, depending on their skill level, gender, or region, leading to changes in wage levels and wage distribution patterns. Analysis in this area will thus aid in greater understanding of the role of labour in the distribution of the benefits from increased GVC participation.

Onto explore the relationship between GVC participation and worker productivity and wages at the individual level in Thailand, our study uses the modern definition of GVCs, which refers to either backward GVC participation (backward linkage) measured by the share of foreign value added (FVA) in gross exports, or forward GVC participation (forward linkage) captured by the share of domestic value added incorporated in the third countries' exports (indirect value-added exports, or DVX) in gross exports. In summary, our findings demonstrate that participating in GVCs can induce higher monthly wages for workers and boost productivity in the labour market through either the forward linkage or backward linkage. In addition, GVC participation can mitigate inequality and bring inclusive job creation, including greater opportunities for rural, female, and low-skilled workers.

This study contributes to the more solid findings on the impact of GVC participation on the labour market and income distribution at the individual level. In terms of Thailand and developing countries in general, this study is an initial stepping

stone for providing policy recommendations that can help economies benefit from GVC integration in the short run and distribute income more equally in the long run. Our findings show that participation in GVCs promotes inclusive job creation while providing increased job opportunities for rural, female, and low-skilled workers. This means that policies to support the existing strong industries can help Thailand as well as other developing countries upgrade to higher value chains. However, the employment effects of GVC participation can be complex. Unsuitable policy frameworks could increase income inequality among certain demographics and cause exclusive job creation due to the differences in the ways linkages benefit different stakeholders. As such, policies must be carefully designed to balance the resulting benefits among stakeholders.

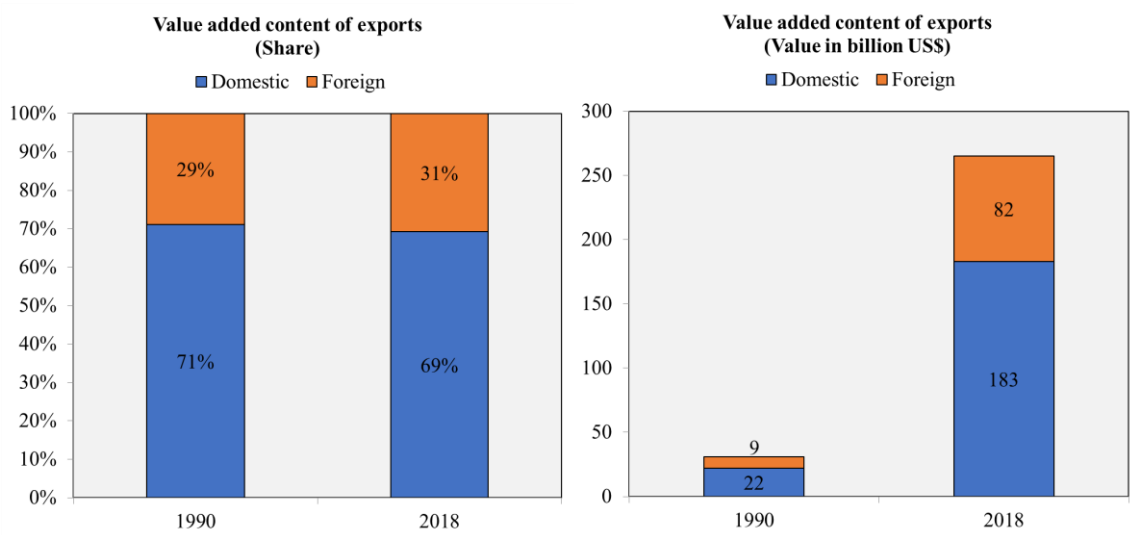
2. Global Values Chains and the Labour Market in Thailand

Since the 1980s, Thailand has enjoyed a small share of the larger GVC pie by promoting trade liberalisation and attracting more foreign direct investment (FDI) (Korwatanasakul, 2019). The country's export-oriented development strategy has promoted participation in GVCs. In fact, Thailand has predominantly entered GVCs at the assembly or production stages and, subsequently, sought to move towards higher value-added activities. Industries such as the parts and components, automobile, and electrical appliance industries have shown strong growth and contributed mainly to the fast growth of the Thai economy.

Thailand has raised the volume of its economic activity, both in terms of the total amount of exports and output, while depending on more foreign inputs to produce its exports. As shown in Figure 1, domestic value added (DVA) of exports, or the value

added attributable to the domestic economy, fell from 71% in 1990 to 69% in 2018. However, the decreased DVA ratio was followed by increases in gross exports (13% annually during 1990–2018), and the DVA also increased approximately nine-fold in absolute value.

Figure 1: Enjoying a Smaller Share of a Bigger Pie: Thailand's Exports in 2018



Source: Authors, based on Korwatanasakul, 2019.

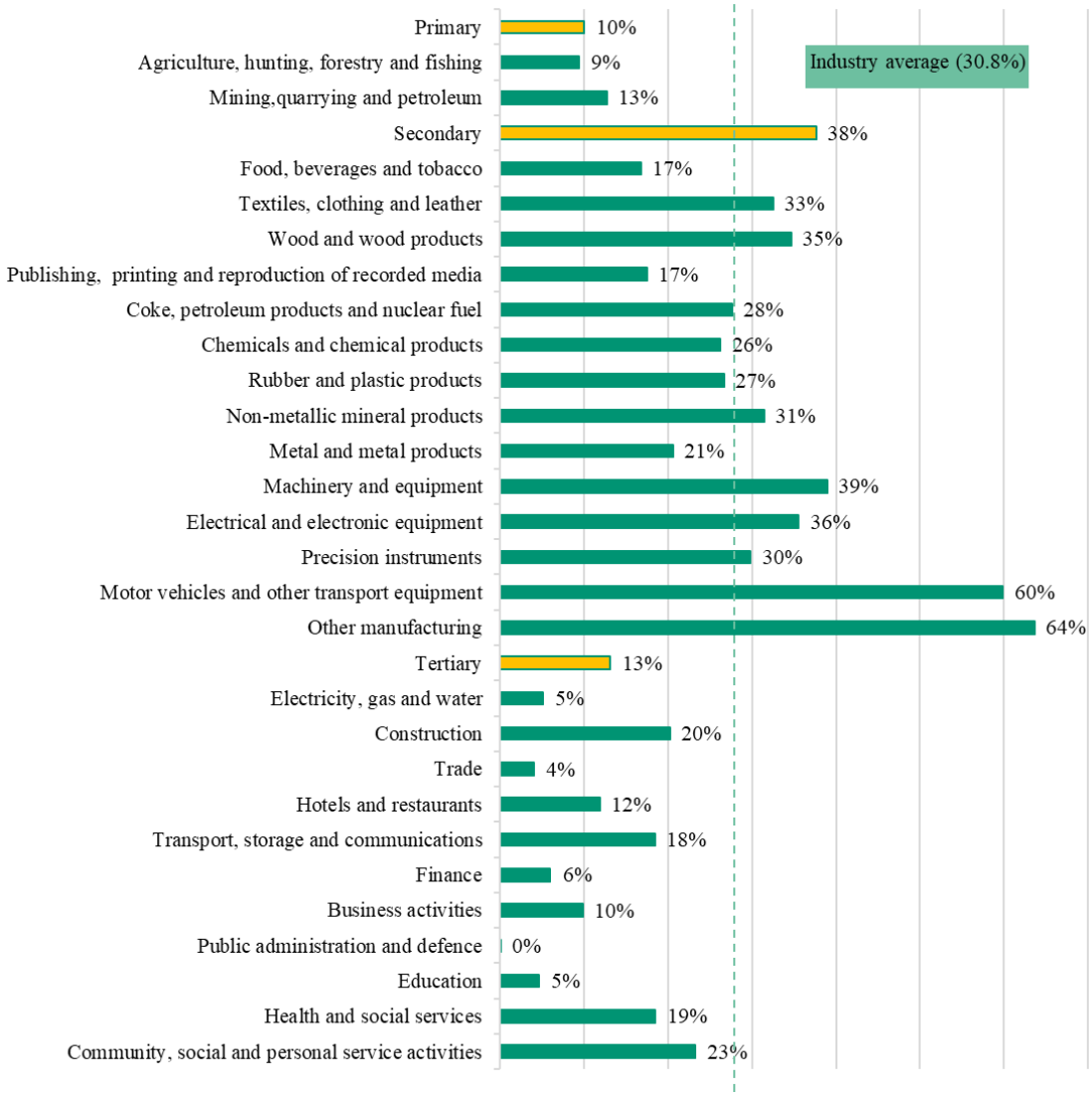
While promoting trade liberalisation and attracting more FDI increased the amount of exports dramatically, the value added contributed by foreign countries also rose at the same time and at an even higher growth rate. Hence, what matters is the amount of value added that the economic activities generate rather than the share of value added (Kowalski et al., 2015; Engel and Taglioni, 2017). Nonetheless, to maintain a satisfactory amount of value added in the long run, industrial and technology upgrading is needed since less technologically sophisticated activities can be replaced by countries with lower wages.

Figure 2 emphasises the fact that Thailand has relied heavily on foreign intermediate products (intensive backward GVC participation), especially in the motor

vehicles and other transport equipment industry and other manufacturing industries. Larger portions of foreign inputs are found in the secondary sector, such as electrical and electronic equipment, machinery and equipment, and motor vehicles and other transport equipment, compared to the primary and tertiary sectors, such as mining, quarrying and petroleum, construction, and trade.

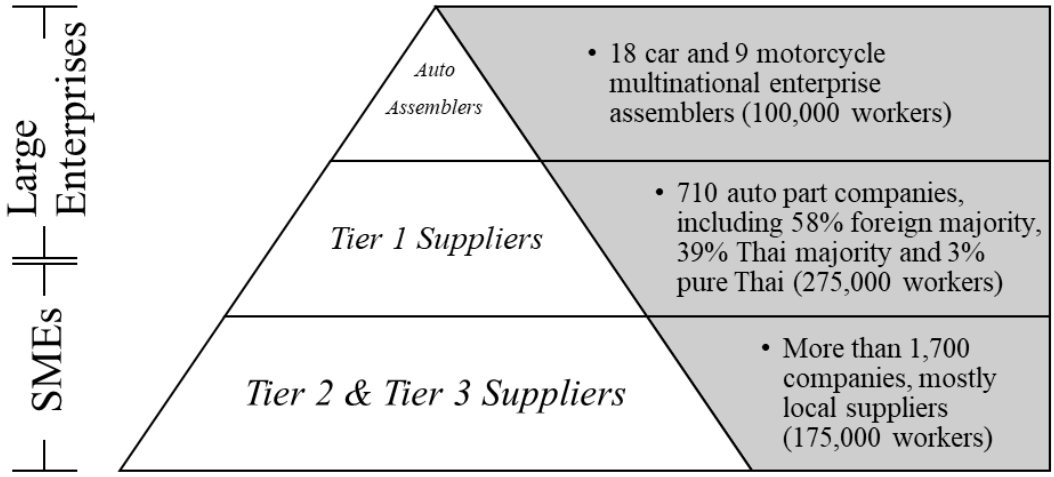
Thailand's strategy of export-led growth coupled with FDI attraction has allowed Thailand to successfully integrate into global markets and upgrade within GVCs with industry transformation from labour-intensive and low-tech industries (like garments and shoes) to skill-intensive and mid-tech industries (like automobiles). Figure 3 shows an example of the Thai industry structure with an intensive backward linkage, e.g. automotive industry. It shows that all assemblers and the majority of tier 1 suppliers are multinational companies that are a part of the offshoring scheme. They usually hire medium-to-high skilled local workers, such as clerks, engineers, and managers, to run their businesses. In contrast, local companies concentrated in tier 2 produce less sophisticated products to either feed to assembly plants or for export. These companies tend to employ low-to-medium skilled local workers to carry out less sophisticated tasks.

Figure 2: Thailand's Share of Foreign Value Added in Exports by Industry, 2015



Source: Authors, based on Korwatanasakul, 2019.

Figure 3: Structure of Thailand's Automotive Industry, 2017



SME = small and medium-sized enterprise.

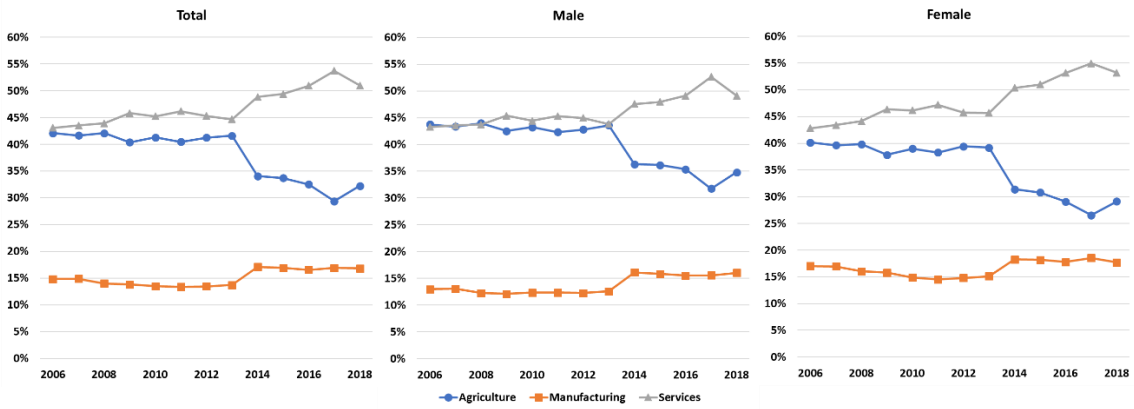
Source: Authors, based on Korwatanasakul, 2019.

At the same time, Thailand's labour market has also undergone substantial structural change. In terms of market share, from 2006 to 2018, the share of those employed in agriculture declined from around 42% to approximately 30%; those employed in services hovered around 10%; and those employed in manufacturing increased slightly from less than 15% to around 17% (Figure 4). This indicates some change in the composition of the labour market towards a focus on services. The labour market comprised 38.4 million workers in 2018. Of these, almost 12.6 million were engaged in the agriculture and fishery sectors; manufacturing – which requires intensive backward GVC participation – comprised just over 5.8 million workers; while 19 million people were working in services (Figure 5).

Table 1 shows the labour productivity index (LPI) for the whole economy and selected major economic activities from 2001 to 2018. The LPI for the whole economy increased at an average annual rate of 2.9%. However, the growth in labour productivity for the economy as a whole shows variations in performance amongst different major economic activities. Analysed by selected economic activities, the

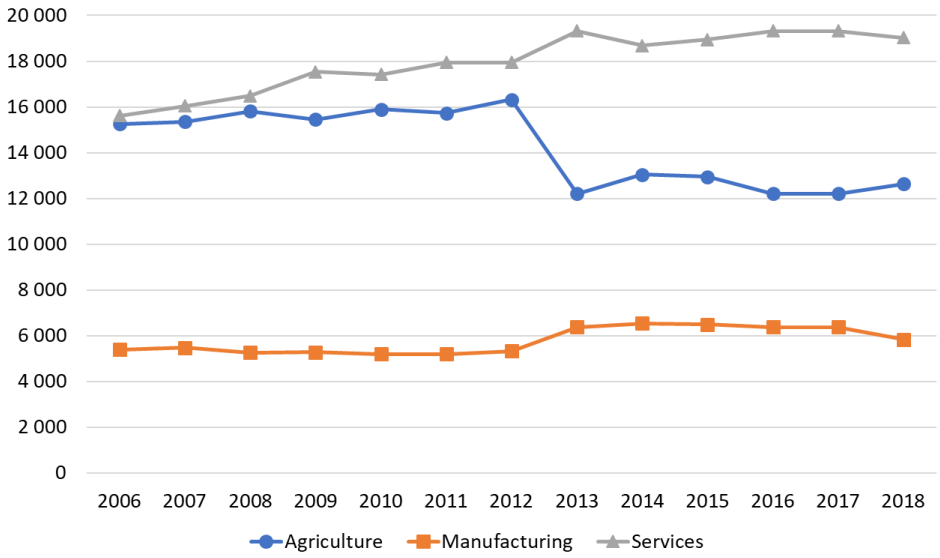
largest increase in LPI was recorded in manufacturing, with an average annual increase of 3.4%. During the same period, services recorded labour productivity growth at an average annual rate of 2.6%, while growth was the smallest in the agricultural sector at 1.3%.

Figure 4: Share of Employed Persons, By Sector, 2006–2018



Source: Authors, based on National Statistical Office (Thailand) data.

Figure 5: Employed Persons, By Sector, 2006–2018 ('000s)



Source: Authors, based on National Statistical Office (Thailand) data.

Table 1: Labour Productivity Index (LPIs) per Employed Person Classified by Economic Activity

Year	LPI (Year 2013 = 100)			
	Economic Activity			
	Total	Agriculture	Manufacturing	Services
2001	74	87	64	79
2002	76	85	67	84
2003	79	97	71	83
2004	82	96	74	84
2005	85	94	76	85
2006	88	95	82	88
2007	91	95	85	90
2008	91	97	91	89
2009	87	98	87	87
2010	93	97	99	90
2011	92	99	96	87
2012	97	99	101	94
2013	100	100	100	100
2014	102	102	98	100
2015	105	99	99	103
2016	110	102	104	106
2017	116	106	110	112
2018	119	108	111	121
Average annual percentage change of LPI	2.9%	1.3%	3.4%	2.6%

Source: Authors, based on data from the Bank of Thailand.

3. Literature Review

GVCs have gained momentum in the emerging international trade and development literature. However, little is known about the link between internationally fragmented production, i.e. GVCs, and productivity due to limited empirical research and the lack of comprehensive GVC data. A large body of research, however, has comprehensively examined the relationship between international trade and

productivity gains, especially under models of final goods, and has found that in general, trade can lead to productivity gains through multiple channels.

Before the era of GVCs, studies of internationally fragmented production focused mainly on the role of offshoring and productivity (Feenstra and Hanson, 1996; Egger and Egger, 2006; Amiti and Wei, 2009; Winkler, 2010). Offshoring countries, which are mainly developed countries, can benefit from increased productivity through the specialisation of production with comparative advantage (compositional change) and the gaining of access to new input varieties (structural change) (Mitra and Ranjan, 2007; Grossman and Rossi–Hansberg, 2007; Criscuolo, Timmis, and Jonestone, 2016). New production base countries, which are mainly developing countries, enjoy productivity gains from greater input varieties, knowledge and technology spillovers, and the pro-competitive effects of foreign competition (Li and Liu, 2012; Baldwin and Robert–Nicoud, 2014; Criscuolo, Timmis, and Jonestone, 2016; Constantinescu, Mattoo, and Ruta, 2017). However, analysis of offshoring has looked mostly at the benefits for the (mainly developed) countries that move their production bases to developing countries. In other words, the benefits of becoming part of a global production network that accrue in developing countries are less obvious. Moreover, the definition of offshoring is relatively limited as it is generally used to refer to specific and partial parts of production or production processes. On the other hand, GVCs relate to the entire production network (Criscuolo, Timmis, and Jonestone, 2016). Consequently, recent literature has emphasised the impact of vertical specialisation and GVCs on productivity (Winkler and Farole, 2015; Formai and Caffarelli, 2016; Kummritz, 2016; Taglioni and Winkler, 2016; Constantinescu, Mattoo, and Ruta, 2017) and argued that GVC participation (both backward and forward participation) leads to higher productivity, especially in terms of labour. More

recent studies have moved towards micro-level analysis, including analysis of wealth distributions at the task level within production chains (World Bank, 2017).

As discussed, the large-scale economic phenomena and microeconomic effects in terms of producer theory have been well studied. Previous studies have discussed the motivations of producers to engage in offshoring from the producer side and in terms of producer theory, and show that firms organise production based on efficiency and profitability criteria. As such, the relationship between GVC participation and the broad labour market outcomes is quite clear. However, evidence of the impact of GVC participation in terms of the labour market and income distribution at the individual level, especially in developing countries, remains obscure. Farole (2016) categorises the impacts of GVC participation into four aspects, namely job creation, skills development and working conditions, wages and wage distributions, and inclusion.

3.1. Job creation

While few studies have addressed job creation, we can observe two main trends. First, in general, the jobs embodied in exports are moving away from those with low-skilled labour content towards those with high-skilled and medium-skilled labour content (Timmer et al., 2014; Farole, 2016; OECD, 2016; World Bank, 2017; Jiang and Carabello, 2017). This result conforms with the standard Heckscher–Ohlin model and the empirical findings of Feenstra and Hanson (1995, 1996), which showed that outsourcing leads to an increase in the relative demand for skilled labour in both developed and developing countries. Second, in GVCs, there has also been a pattern in the form of a shift from employment in manufacturing to employment in services, such as activities related to marketing, R&D, logistics, and distribution (OECD, 2016; World Bank, 2017). However, Jiang and Carabello (2017) found that in developing

countries, the jobs embodied in exports remain concentrated in low-skilled jobs, and, through foreign trade, participating in GVCs leads to higher domestic employment than foreign employment. Based on the existing literature, it is still debatable whether the effects of GVC participation on employment in developing countries are positive (Kabeer and Mahmud, 2004; Humphrey, McCulloch, and Ota, 2004; Nadvi and Thoburn, 2004) or negative (Roberts and Thoburn, 2004; Nadvi and Thoburn, 2004).

3.2. Skills development and working conditions

Whether GVC participation leads to better skills development and working conditions remains an unsolved question. Farole (2016) argued that existing studies may suffer from two technical estimation problems, reverse causality and selection bias. However, there is the general impression that GVC participation leads to better working conditions in developed countries and worse conditions in developing countries.

3.3. Wages and wage distributions

From the macro perspective, studies have argued that GVC-oriented investment due to differences in relative wages across countries leads to large employment effects, both in developed countries (outsourcing countries) and developing countries (host countries) (Kabeer and Mahmud, 2004; Humphrey, McCulloch, and Ota, 2004; Nadvi and Thoburn, 2004). Most studies found that GVC-oriented investment results in within-country wage inequality, especially in developed countries (IMF, 2013). This can be explained by the shift towards high-skilled labour content (Katz and Autor, 1999; IMF, 2007) or as an effect of offshoring (Pavcnik, 2011; Amiti and Davis, 2012; Hummels et al., 2012; Lopez–Gonzalez, Kowalski, and Achard, 2015; Meng, Ye, and Wei, 2017). In other words, greater demand for high-skilled labour and/or lower

demand for domestic low-skilled labour results in wage inequality between low- and high-skilled workers.

However, from the previous discussion, the employment effects are unclear in developing countries, where GVC participation may lead to higher employment either of high-skilled and medium-skilled labour or low-skilled labour. Hence, it is also inconclusive whether GVC participation leads to increased wage inequality in developing countries.

There are three main groups of findings regarding GVC participation and wages and wage distributions. First, the findings in favour of GVC participation argue that it is not a major factor in the increase in wage inequality or that it can even help mitigate inequality in some cases (Lopez–Gonzalez, Kowalski, and Achard, 2015). This can be shown as countries that have a higher backward GVC participation also tend to have lower wage inequality. Income inequality can be mitigated through the transfer of knowledge and investment in training and skills, and participation in GVCs can reduce wage inequality, particularly when it relates to the participation of lower-skilled segments of the labour force. Second, the findings against GVC participation posit that the benefits from GVC participation, especially in terms of wages, largely accrue to a small number of high-skilled workers and to the owners of capital, including foreign investors (Goldberg and Pavcnik, 2007; Pavcnik, 2017; Das, Sen, and Srivastava, 2017; Meng, Ye, and Wei, 2017; Medeiros and Trebat, 2017). Meng, Ye, and Wei (2017) found for the case of China that factory wages are significantly larger than rural wages. Furthermore, Medeiros and Trebat (2017) argued that participation in GVCs can even result in a race to the bottom for wages and profits for labour-intensive workers and contract manufacturers. The last group of literature argues that the effect of GVC participation on wage inequality is inconclusive, highly case-specific, and

dependent on the nature of GVC participation, such as the type of activity or the position of workers within GVCs (McCulloch and Ota, 2002; Kabeer and Anh, 2003; Kabeer and Mahmud, 2004; Nadvi and Thoburn, 2004; Shepherd, 2013; Lopez–Gonzalez, Kowalski, and Achard, 2015).

3.4. Inclusion

GVC participation may result in wider disparities in developed countries and more advanced developing countries, where there is a demand for high-skilled and medium-skilled labour. High-skilled labour and medium-skilled labour tend to be biased towards urban residents and male workers. In developing countries, GVC participation may provide more job opportunities for youth, rural, female, and low-skilled workers as the demand for low-skilled labour rises (Dolan and Sutherland, 2003; Nguyen et al., 2003; Barrientos and Kritzinger, 2004; Farole, 2016). Although 'inclusive' job creation has been observed (Farole, 2016), inequalities in wages and employment conditions still persist, especially in terms of gender (Dolan and Sutherland, 2003; Nguyen, Sutherland, and Thoburn, 2003; Barrientos and Kritzinger, 2004; Tejani and Milberg, 2010).

To summarise, what we know so far is the following. (i) The microeconomic findings, such as in terms of producer theory and the relationship between GVC participation and the broad labour market outcomes, seem to be well studied, whereas evidence of the impact of GVC participation in terms of the labour market and income distribution, especially in developing countries, remains unclear. (ii) Recent studies are moving towards micro-level analysis. However, such studies have carried out their analysis at the industry or sector level. To the best of our knowledge, no studies have used data at the individual level. (iii) In developed countries, GVC-oriented investment

results in within-country wage inequality due to a shift towards high-skilled labour content or as an effect of offshoring. (iv) In developing countries, the results are highly case/industry specific and mixed among a limited number of literature. The past four decades have seen dramatic GVC proliferation, while within-country income inequality in many developed and developing countries has also risen. This highlights the need for analysis of the long-term effects of GVC participation on income inequality and the labour market to fill the gaps in the current literature. The gaps and limitations contributing to the mixed findings in developing countries are largely due to the lack of availability of GVC data, ambiguous and non-traditional definitions of GVC participation, restrictive levels of analysis, and heterogeneity in the nature of recent findings.

Data availability is often lacking in developing countries and considered a significant technical issue in the study of GVCs. Most studies have had no choice but to use the available aggregate data sources to examine the relationship between GVC participation and the broad labour market outcomes. Combining multiple data sources, both at the aggregate and individual levels, such as by using the LFS data, can provide a much richer, micro-level view for better understanding the impact of GVC participation on labour market outcomes, e.g. on wages, the wage distribution, and inclusion. In the early literature, the lack of availability of GVC data led to analytical limitations, including ambiguous and non-traditional definitions of GVC participation and restrictive levels of analysis. Given that the data limitations vary across different studies, GVC participation has also been quantified in multiple ways. Hence, it is difficult to compare and contrast the impacts of GVC participation across different studies without uniformity in its definition. Recent literature has adopted a more common definition of GVC participation, as elaborated on in the following section.

4. Data and Methodology

4.1. Data

The data used in this study is drawn from Thailand's LFS, conducted by the National Statistical Office (NSO), for the period 1995–2011 (due to limitations on the available GVC data). The LFS is collected quarterly on approximately 80,000 random households for a total of around 200,000 observations per quarter, comprising 0.1%–0.5% of the total Thai population. The LFS is the only national dataset for Thailand that comprehensively includes information both on demographic and labour-related characteristics.

The sample used for the estimation in this study is obtained by pooling the data for 17 consecutive years of the LFS from 1995 to 2011. We use only third-quarter data from the LFS to control for the seasonal migration of agricultural labour. In general, agricultural workers move back and forth between the urban manufacturing sector and the rural agricultural sector. However, they tend to migrate back to the rural agricultural sector during the rainy season (Sussangkarn and Chalamwong, 1996), i.e. the third quarter of the year. This study limits the sample to wage workers aged 15 or above in the year of interview. This age restriction is imposed because the minimum legal age that individuals can start working is 15 years old.

Table 2 shows the descriptive statistics for the dependent and independent variables. [4] The dependent variable is the log monthly wage. Following Korwatanasakul (2017), the monthly wages are calculated from the different types of wages reported by each individual observation. As this study pools multiple years of

[4] See Appendix for the descriptive statistics with different time periods (Tables A1 and A2).

data together, the data in nominal values, such as for monthly wages, requires adjustment for inflation. We deflate the nominal wage by the regional headline Consumer Price Index (CPI) using 2011 as the reference base year. Finally, the monthly wage adjusted for inflation is transformed into the log form. For the 'years of schooling' variable, in the LFS, the measure of school attainment is not the actual number of years spent at school but the highest degree attained by an individual. Hence, we recode the school attainment variable into years of schooling ranging from zero, for no education, to 21 years, for those with a doctoral degree. The average years of schooling in the sample is approximately 9 years, corresponding to the Thai compulsory education law of 9 years. 'Age' refers to the individual's age at the time of the survey. The average age is 37 years in our sample. This reflects the real situation of the labour market. In general, employees start working at the age of around 20, after secondary education or higher education, while the age of retirement is 60. The estimation model also includes other variables as control variables: year fixed effects (1995–2011), region fixed effects (five regions), industry fixed effects (34 industries), gender, area of residence (urban and rural), and labour skills (high- and low-skilled labour).

Table 2: Descriptive Statistics

Variable	Observation	Mean	Std. Dev.	Min	Max
Dependent Variable					
Log monthly wage	758,621	8.773463	0.82595	2.596956	15.91289
Independent variable					
Years of schooling	513,564	9.240692	4.875976	0	21
Age	758,621	36.60735	11.44879	15	98
GVC participation	652,786	0.712471	0.628842	0.136067	8.234579
Forward linkage	652,786	0.449016	0.68242	0.000067	8.142179
Backward linkage	652,786	0.263454	0.153482	0.020109	0.65252
Male	758,621	0.536125	0.498694	0	1
Urban	758,621	0.684829	0.464584	0	1
High-skilled labour	653,613	0.526504	0.499297	0	1
Manufacture	758,621	0.322976	0.467614	0	1
Control variable (Fixed effects)					
Year	758,621	2003.584	4.765829	1995	2011
Region	758,621	2.972994	1.246894	1	5
Industry	758,621	19.2433	10.94872	1	34

Source: Authors.

In this study, we match the industrial control variables with the 34 industrial sectors categorised in the Organisation for Economic Co-operation and Development's (OECD) TiVA data. In general, the main indicators in the database measure the value-added content of international trade flows and final demand. The TiVA database covers 63 economies – including OECD economies, the 28 European Union economies, G20 economies, most East Asian and Southeast Asian economies, and some South American countries – for 34 industries, 16 manufacturing sectors, and 14 services sectors. The data are available for 17 years, from 1995 to 2011.

4.2. Methodology

a) Participation in global value chains

Individual economies can participate in GVCs through either backward or forward participation, which reflect the upstream and downstream links in the chain. Typical GVC participation refers to backward GVC participation (backward linkage), where an individual economy imports foreign inputs to produce its intermediate or final goods and services to be exported. This, in part, covers the new production base countries in charge of downstream production processes in the studies of offshoring or internationally fragmented production. In studies of GVCs, the backward linkage is measured by the share of foreign value added (FVA) in gross exports, where the foreign value-added content of exports is analogous to vertical specialisation. On the other hand, forward GVC participation (forward linkage) occurs when exporting domestically produced intermediate goods or services to a first economy that then re-exports them through the value chain to third economies as embodied in other goods or services for further processing. The forward linkage is captured by the share of domestic value added incorporated in the third countries' exports (indirect value-added exports, or DVX) in gross exports. According to the World Trade Organization (2018), the forward linkage represents the seller-related measure or supply side in the GVC participation index, while the backward linkage shows the buyer perspective or sourcing side in GVCs.

b) Mincer wage model and GVC participation

To estimate the impacts of GVC participation on wages, we exploit the Mincer wage model and adjust the model by including the GVC participation index by industry. The GVC participation index is calculated as follows:

$$\text{GVC}_{\text{Participation}} = \frac{\text{DVX+FVA}}{\text{GE}} \quad (1)$$

where DVX is the domestic value added incorporated in the third countries' exports in gross exports, FVA is the foreign value added in gross exports, and GE is the gross exports.

The main estimation method is a simple ordinary least squares (OLS) estimation using the pooled cross-sectional LFS data from 1995–2011 (for which GVC data are available).

The Mincer wage equation (OLS regression) is the following:

$$\log y_i = \beta_0 + \beta_1 S_i + \beta_2 A_i + \beta_3 A_i^2 + \beta_4 G_i + \beta_5 C_i + e_i \quad (2)$$

where log y_i is the log of monthly wages of an individual, i; S_i refers to the number of years of education of individual i; A_i is the age of individual i as a proxy for working experience; and G_i indicates the GVC participation ratio of the industry to which individual i belongs. C_i represents the control variables included for year fixed effects, region fixed effects, industry fixed effects, gender, area of residence, and labour skills. e_i is the disturbance term.

We estimate various model specifications using different definitions of GVC participation, including forward and backward GVC participation, to check the robustness of the main specification. We also separately examine the effects of forward

and backward linkages on wages and wage distributions. Finally, control variables, e.g. gender and area of residence, are included in the estimation to examine the wage distribution and the issue of inclusion in the labour market. All independent variables related to GVC participation are derived from the TiVA database, and the trade values come from the OECD's Inter-Country Input–Output (ICIO) Tables, while the individual-level variables are mainly from the LFS.

5. Results and Discussion

Table 3 shows the estimation results for the effects of GVC participation on monthly wages. All GVC participation variables, on average, have a statistically significant positive impact on individuals' monthly wages. The forward linkage shows a positive impact on wages because as sectors and countries upgrade and shift towards high-skilled labour content, wages increase, particularly for skilled workers (Katz and Autor, 1999; IMF, 2007; Shepherd, 2013; Farole, 2016). We also observe a positive effect of the backward linkage since, on average, workers benefit from higher wages due to higher job opportunities from abroad.

As shown in Table 4, the results remain qualitatively and quantitatively the same when adding the control variables for industrial sector, gender, area of residence, and labour skill. The positive effect of GVC participation on monthly wages is robust to the inclusion of these controls. The results are also robust to alternative approaches to measuring GVC participation. The results remain qualitatively the same across different model specifications when using the forward and backward linkage participations to represent GVC participation, with the exception of the specification of the specification which includes a gender dummy variable for which the backward

linkage coefficient becomes insignificant.[5] Arguably, participating in GVCs through either the forward linkage or the backward linkage can benefit workers and increase productivity in the labour market.

Table 3: Effects of GVC Participation on Monthly Wages

	(1)	(2)	(3)	(4)
Schooling	0.105***	0.0933***	0.0945***	0.105***
	(0.00155)	(0.00184)	(0.00179)	(0.00173)
Age	0.0689***	0.0638***	0.0644***	0.0692***
	(0.00154)	(0.00144)	(0.00143)	(0.00148)
Age^2	-0.000603***	-0.000591***	-0.000596***	-0.000629***
	(0.0000219)	(0.0000178)	(0.0000180)	(0.0000201)
GVC participation		0.173***		
		(0.0153)		
Forward linkage			0.153***	
			(0.0138)	
Backward linkage				0.121**
				(0.0391)
Constant	6.146***	6.302***	6.318***	6.161***
	(0.0446)	(0.0478)	(0.0485)	(0.0468)
N	513,564	443,990	443,990	443,990
R-squared	0.579	0.586	0.584	0.573

Note: Cluster-robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All models control for year, region, and industry fixed effects. The GVC participation index is calculated as (DVX+FVA)/gross exports, where DVX and FVA are the quantities of domestic value added incorporated in other countries' exports and foreign value added embodied in exports, respectively. The forward linkage represents the share of FVA in gross exports, while the backward linkage refers to the share of DVX in gross exports.
Source: Authors.

[5] See Appendix for supplementary results (Tables A3 and A4).

Table 4: Robustness of the Effects of GVC Participation on Monthly Wages

	(1)	(2)	(3)	(4)	(5)	(6)
Schooling	0.0933***	0.1039***	0.0949***	0.0927***	0.0857***	0.0874***
	(0.00184)	(0.00188)	(0.00185)	(0.00186)	(0.00172)	(0.00167)
Age	0.0638***	0.0647***	0.0642***	0.0637***	0.0625***	0.0626***
	(0.00144)	(0.00144)	(0.00140)	(0.00145)	(0.00139)	(.00132)
Age^2	-0.000591***	-0.000606***	-0.000599***	-0.000591***	-0.000557***	-0.000571***
	(0.0000178)	(0.0000177)	(0.0000173)	(0.0000178)	(0.0000173)	(0.000016)
GVC participation index	0.173***	0.178***	0.167***	0.173***	0.157***	0.152***
	(0.0153)	(0.0104)	(0.0144)	(0.0155)	(0.0140)	(0.0120)
Manufacturing		0.0799***				0.132***
		(0.0104)				(0.0098)
Male			0.174***			0.208***
			(0.00585)			(0.0067)
Urban				0.0522***		0.073***
				(0.00597)		(0.0072)
High-skilled labour					0.164***	0.289***
					(0.00719)	(0.0118)
Constant	6.302***	6.527***	6.195***	6.272***	6.352***	6.352***
	(0.0478)	(0.0388)	(0.0465)	(0.0477)	(0.0476)	(0.0417)
N	443,990	443,990	443,990	443,990	391,768	391,768
R-squared	0.586	0.566	0.597	0.587	0.603	0.611

Note: Cluster-robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All models control for year, region, and industry fixed effects. The GVC participation index is calculated as (DVX+FVA)/gross exports, where DVX and FVA are the quantities of domestic value added incorporated in other countries' exports and foreign value added embodied in exports, respectively. The forward linkage represents the share of FVA in gross exports, while the backward linkage refers to the share of DVX in gross exports.
Source: Authors.

Next, we deepen our analysis by examining the differences between GVC participation through industries engaging with forward linkage activities and those engaging with backward linkage activities. The results are shown in Table 5. GVC participation, either through industries engaging more in forward linkage activities or backward linkage activities, benefits workers in manufacturing sectors more than those in non-manufacturing sectors. However, GVC participation through industries engaging more in backward linkage activities has a negative impact on the wages of workers in non-manufacturing sectors. A possible explanation could be that technology in non-manufacturing sectors, such as the agriculture and service sectors, tends to replace workers when productivity increases. Therefore, we observe lower demand for workers in non-manufacturing sectors, which leads to lower wages.

The results in Table 6 show that GVC participation through industries engaging in more forward linkage activities benefits both male and female workers equally. In other words, there is no effect on the wage gap between male and female workers as the interaction term between 'forward linkage' and 'male' is not statistically significant. In contrast, the coefficient of 'backward linkage' turns insignificant after adding gender dummy variable in the model. This result is quite puzzling to us but looking from the result of the forward linkage we might be able to conclude that gender is not a relevant variable in analysing the effect of GVC participations, both forward and backward linkages, on wages. GVC participation through industries engaging in more backward linkage activities narrows the wage gap between male and female workers as there are more opportunities for female employment in new downstream production bases.

Table 5: Manufacturing Estimation Results

	Forward Linkage			Backward Linkage		
	(1)	(2)	(3)	(4)	(5)	(6)
Schooling	0.0945***	0.105***	0.105***	0.115***	0.116***	0.115***
	(0.00179)	(0.00189)	(0.00191)	(0.00234)	(0.00234)	(0.00228)
Age	0.0644***	0.0653***	0.0655***	0.0701***	0.0703***	0.0704***
	(0.00143)	(0.00142)	(0.00144)	(0.00148)	(0.00145)	(0.00147)
Age^2	-0.000596***	-0.000612***	-0.000613***	-0.000646***	-0.000646***	-0.000648***
	(0.0000180)	(0.0000178)	(0.0000178)	(0.0000197)	(0.0000195)	(0.0000198)
Forward linkage	0.153***	0.159***	0.147***			
	(0.0138)	(0.0131)	(0.0146)			
Backward linkage				0.210***	0.0912*	-0.224***
				(0.0287)	(0.0379)	(0.0548)
Manufacturing		0.116***	0.101***		0.0513***	-0.0707**
		(0.0121)	(0.0142)		(0.0143)	(0.0251)
Forward linkage x Manufacturing			0.0617**			
			(0.0224)			

Backward linkage x Manufacturing						0.476***
						(0.0774)
Constant	6.318***	6.544***	6.545***	6.391***	6.394***	6.454***
	(0.0485)	(0.0394)	(0.0392)	(0.0442)	(0.0433)	(0.0420)
N	443,990	443,990	443,990	443,990	443,990	443,990
R-squared	0.584	0.565	0.565	0.552	0.553	0.554

Note: Cluster-robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All models control for year and region fixed effects. DVX and FVA are the quantities of domestic value added incorporated in other countries' exports and foreign value added embodied in exports, respectively. The forward linkage represents the share of FVA in gross exports, while the backward linkage refers to the share of DVX in gross exports.
Source: Authors.

Table 6: Gender Estimation Results

	Forward Linkage			Backward Linkage		
	(1)	(2)	(3)	(4)	(5)	(6)
Schooling	0.0945***	0.0959***	0.0959***	0.105***	0.106***	0.106***
	(0.00179)	(0.00181)	(0.00181)	(0.00173)	(0.00176)	(0.00176)
Age	0.0644***	0.0648***	0.0648***	0.0692***	0.0695***	0.0695***
	(0.00143)	(0.00139)	(0.00139)	(0.00148)	(0.00145)	(0.00145)
Age^2	-0.000596***	-0.000604***	-0.000604***	-0.000629***	-0.000636***	-0.000637***
	(0.0000180)	(0.0000174)	(0.0000174)	(0.0000201)	(0.0000194)	(0.0000194)
Forward linkage	0.153***	0.150***	0.150***			
	(0.0138)	(0.0129)	(0.0141)			
Backward linkage				0.121**	0.0459	0.0575
				(0.0391)	(0.0405)	(0.0476)
Male		0.177***	0.176***		0.179***	0.185***
		(0.00589)	(0.00722)		(0.00588)	(0.00845)
Forward linkage x Male			0.00127			
			(0.00651)			
Backward linkage x Male						-0.0207
						(0.0335)
Constant	6.318***	6.210***	6.210***	6.161***	6.069***	6.066***
	(0.0485)	(0.0471)	(0.0469)	(0.0468)	(0.0470)	(0.0463)
N	443,990	443,990	443,990	443,990	443,990	443,990
R-squared	0.584	0.596	0.596	0.573	0.585	0.585

Note: Cluster-robust standard errors are in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001. All models control for year, region, and industry fixed effects. DVX and FVA are the quantities of domestic value added incorporated in other countries' exports and foreign value added embodied in exports, respectively. The forward linkage represents the share of FVA in gross exports, while the backward linkage refers to the share of DVX in gross exports.

Source: Authors.

Table 7 shows the estimation results by area of residence. GVC participation through industries that engage more in forward linkage activities benefits workers in both urban and rural areas equally, as the interaction term between 'forward linkage' and 'urban' is not statistically significant. On the other hand, industries with backward linkage or downstream production activities, often related to offshoring, are usually located in special industrial areas, where foreign firms can enjoy tax and other benefits from the government. Special industrial areas are common in developing countries, including Thailand. In addition, GVC participation through industries engaging in more backward linkage activities narrows the wage gaps between urban and rural areas as there are more opportunities for rural employment. Demand for rural workers increases and, as such, the wages or rural workers rise faster than those of workers in urban areas.

Lastly, in terms of GVC participation through industries engaging with forward linkage activities or upstream production, intuitively, we would expect that high-skilled labour would benefit more than low-skilled labour does. Conversely, in terms of the backward linkage effect, low-skilled labour would benefit more from GVC participation than high-skilled labour does. However, our analysis gives somewhat contradictory results. Table 8 indicates that low-skilled labour benefits more in forward-linkage oriented industries compared to high-skilled labour, while high-skilled labour enjoys higher benefits from backward-linkage oriented industries.

Table 7: Area of Residence Estimation Results

	Forward Linkage			Backward Linkage		
	(1)	(2)	(3)	(4)	(5)	(6)
Schooling	0.0945***	0.0939***	0.0939***	0.105***	0.104***	0.104***
	(0.00179)	(0.00180)	(0.00181)	(0.00173)	(0.00170)	(0.00171)
Age	0.0644***	0.0644***	0.0644***	0.0692***	0.0691***	0.0691***
	(0.00143)	(0.00143)	(0.00143)	(0.00148)	(0.00148)	(0.00148)
Age^2	-0.000596***	-0.000596***	-0.000596***	-0.000629***	-0.000629***	-0.000629***
	(0.0000180)	(0.0000180)	(0.0000179)	(0.0000201)	(0.0000200)	(0.0000200)
Forward linkage	0.153***	0.154***	0.139***			
	(0.0138)	(0.0139)	(0.0103)			
Backward linkage				0.121**	0.118**	0.205***
				(0.0391)	(0.0386)	(0.0450)
Urban		0.0526***	0.0460***		0.0506***	0.0854***
		(0.00601)	(0.00796)		(0.00565)	(0.0100)
Forward linkage x Urban			0.0173			
			(0.0111)			
Backward linkage x Urban						-0.125***
						(0.0287)
Constant	6.318***	6.287***	6.293***	6.161***	6.132***	6.114***
	(0.0485)	(0.0485)	(0.0506)	(0.0468)	(0.0467)	(0.0460)
N	443,990	443,990	443,990	443,990	443,990	443,990
R-squared	0.584	0.585	0.585	0.573	0.574	0.574

Note: Cluster-robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All models control for year, region, and industry fixed effects. DVX and FVA are the quantities of domestic value added incorporated in other countries' exports and foreign value added embodied in exports, respectively. The forward linkage represents the share of FVA in gross exports, while the backward linkage refers to the share of DVX in gross exports.
Source: Authors.

Table 8: Labour Skill Estimation Results

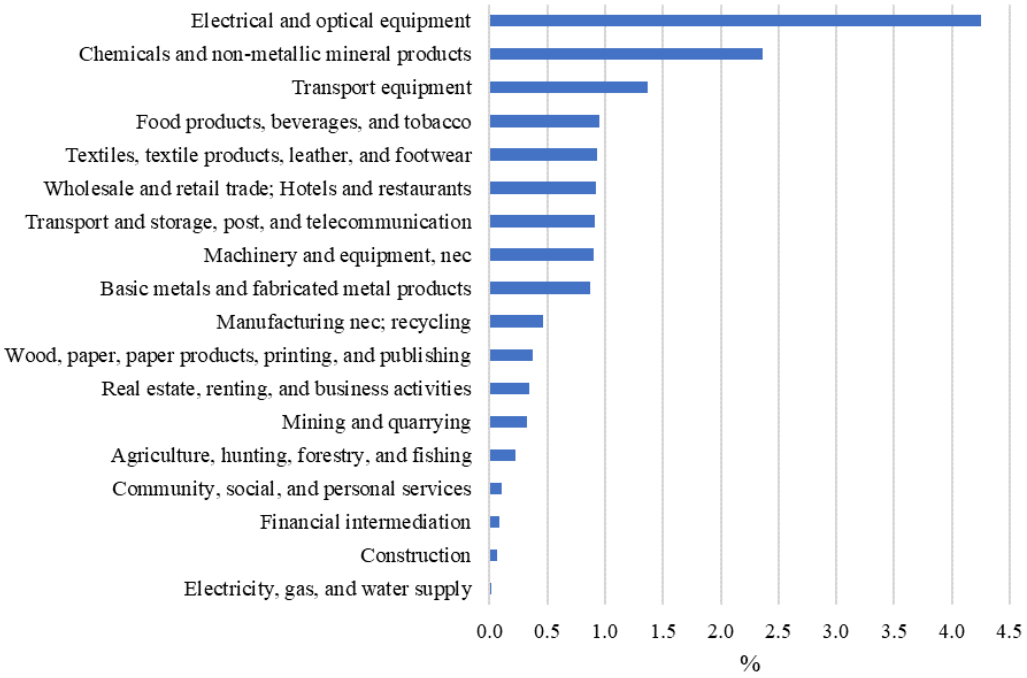
	Forward Linkage			Backward Linkage		
	(1)	(2)	(3)	(4)	(5)	(6)
Schooling	0.0945***	0.0869***	0.0873***	0.105***	0.0960***	0.0961***
	(0.00179)	(0.00167)	(0.00171)	(0.00173)	(0.00173)	(0.00172)
Age	0.0644***	0.0631***	0.0632***	0.0692***	0.0674***	0.0674***
	(0.00143)	(0.00137)	(0.00138)	(0.00148)	(0.00142)	(0.00142)
Age^2	-0.000596***	-0.000562***	-0.000562***	-0.000629***	-0.000590***	-0.000590***
	(0.0000180)	(0.0000174)	(0.0000175)	(0.0000201)	(0.0000193)	(0.0000194)
Forward linkage	0.153***	0.138***	0.185***			
	(0.0138)	(0.0125)	(0.0158)			
Backward linkage				0.121**	0.167***	0.155**
				(0.0391)	(0.0387)	(0.0461)
High-skilled labour		0.163***	0.180***		0.170***	0.162***
		(0.00721)	(0.00919)		(0.00732)	(0.0191)
Forward linkage x High-skilled labour			-0.0566**			
			(0.0168)			
Backward linkage x High-skilled labour						0.0316
						(0.0581)
Constant	6.318***	6.364***	6.342***	6.161***	6.208***	6.210***
	(0.0485)	(0.0481)	(0.0515)	(0.0468)	(0.0479)	(0.0476)
N	443,990	391,768	391,768	443,990	391,768	391,768
R-squared	0.584	0.601	0.601	0.573	0.592	0.592

Note: Cluster-robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All models control for year, region, and industry fixed effects. DVX and FVA are the quantities of domestic value added incorporated in other countries' exports and foreign value added embodied in exports, respectively. The forward linkage represents the share of FVA in gross exports, while the backward linkage refers to the share of DVX in gross exports.

Source: Authors

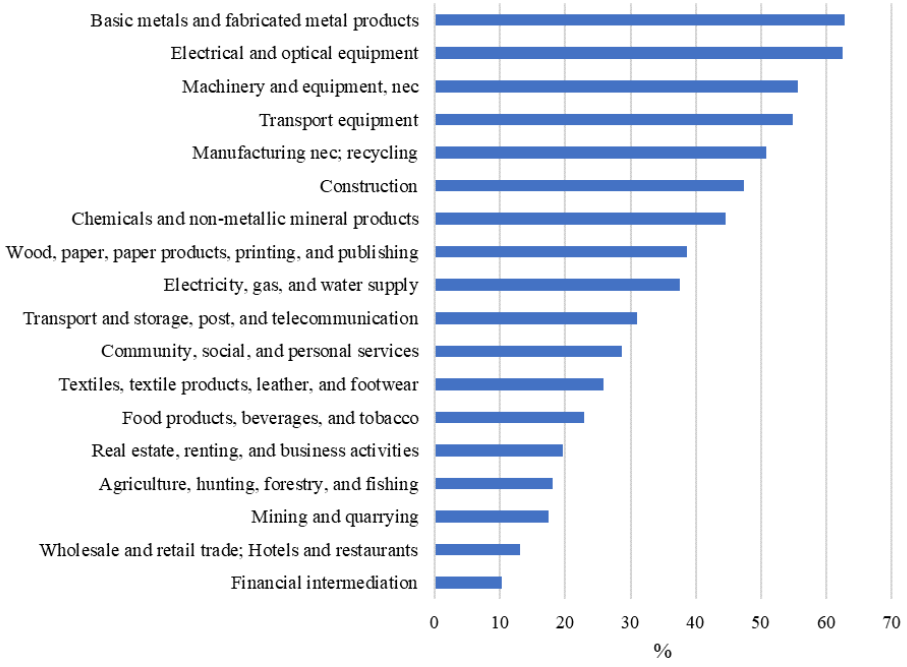
The reason is that the nature of GVC participation matters. As shown in Figure 6, Thailand's forward-linkage oriented industries mainly require less sophisticated technology and knowledge compared with typical upstream economies, such as Japan, the United States, and other advanced economies. Therefore, those forward linkage industries tend to utilise and benefit low-to-medium skilled labour. On the other hand, Figure 7 shows that the backward linkage activities are concentrated in industries requiring more sophisticated technology and knowledge, such as machinery and equipment, transport equipment, and electrical and optical equipment. These industries are often related to high-skilled tasks from offshoring countries, e.g. the automotive industry from Japan. As Thailand is placed in the middle of GVCs, it is more likely that backward-linkage oriented industries engage in medium- or high-skilled tasks. As a result, the backward linkage effect boosts demand for high-skilled workers, and the wages of high-skilled workers increase faster than those of lower-skilled workers. This leads to an increase in the wage gap between low- and high-skilled workers in industries engaging in the backward linkage. The general structure of Thai industry illustrates that the majority of tier 1 suppliers are multinational companies that usually hire medium-to-high skilled local workers, such as clerks, engineers, and managers, while local companies concentrated in tier 2 produce less sophisticated products. This supports our argument that even though the backward-linkage oriented industries are related to downstream production bases, they require higher-skilled labour than those local firms that may engage in forward linkage activities.

Figure 6: Domestic Value Added Incorporated in Third Countries' Exports as a Share of Gross Exports, by Industry, 2011



Source: Authors, based on OECD TiVA data.

Figure 7: Share of Foreign Value Added in Gross Exports, by Industry, 2011



Source: Authors, based on OECD TiVA data.

In general, our results show that GVC participation induces higher monthly wages for individuals and increases productivity in the labour market through either the forward linkage or backward linkage. This supports the previous studies that are in favour of GVC participation and argue that GVC participation is not a major factor in the increase in wage inequality (Lopez–Gonzalez, Kowalski, and Achard, 2015). Through our intensive analysis with different socio-economic controls, we do not find any evidence to show that the benefits from GVC participation, especially in terms of wages, largely accrue to a small number of high-skilled workers or to the owners of capital, including foreign investors, as suggested by several studies (Goldberg and Pavcnik, 2007; Pavcnik, 2017; Das, Sen, and Srivastavaet, 2017; Meng, Ye, and Wei, 2017; Medeiros and Trebat, 2017). Furthermore, we find that GVC participation can even help mitigate inequality in many cases, depending on gender, the industrial sector, area of residence, and labour skills. Our findings also show that GVC participation promotes inclusive job creation (Farole, 2016) and provides more job opportunities for rural, female, and low-skilled workers; this is consistent with the studies by Dolan and Sutherland (2003), Nguyen, Sutherland, and Thoburn (2003), Barrientos and Kritzinger (2004), and Farole (2016).

6. Policy Recommendations

As our findings suggest that participating in GVCs results in higher wages, a general policy recommendation would be to promote overall GVC participation. Policies to support leveraging the existing strong industries through upgrading, smoothing labour movements while improving agricultural productivity, and preparing to move towards a services economy can help prepare Thailand, and other developing countries in general, to upgrade to higher value chains. In addition, there is also an urgent need to improve sophistication in terms of the macroeconomic and institutional structures through inter- and intra-sectoral coordination among different actors in developing countries. Policies that support GVC participation can also help promote gender equality, especially through backward-linkage oriented industries. GVC participation narrows the wage gap between male and female workers by encouraging women to participate in the labour market through new opportunities for female employment in new downstream production bases.

Secondly, from our analysis, forward GVC participation and backward GVC participation yield different policy implications. On the one hand, the forward linkage tends to benefit low-skilled labour. Therefore, policies to develop domestic capacities, technology, and human capital would help strengthen local firms and, in turn, the forward linkage. On the other hand, backward GVC participation is likely to benefit both multinational and local firms that are involved in offshoring. As discussed in the previous section, these multinational firms are mainly located in rural areas so benefit rural workers and utilise high-skilled workers. Thus, policies for supporting supply-chain deepening, attracting foreign direct investment, facilitating overall offshoring

schemes, and exploiting technology spillovers, with a strong focus on skills development, are essential for reinforcing the backward linkage.

Lastly, although GVC participation may be a catalyst for higher wages, greater labour productivity, and more inclusive job creation, its employment effects are complicated and difficult to control domestically (Farole, 2016). Participating in GVCs through different linkages benefits different stakeholders. An unbalanced policy framework could contribute to uneven income distributions and exclusive job creation; therefore, a policy framework that balances the benefits among stakeholders in terms of wage distributions and job inclusion is ideal.

7. Concluding Remarks

This study addresses the gaps in the literature through empirical analysis of the distribution effects of GVC integration for the case of a developing country, Thailand. It investigates the presence of disparities in the accrual of the benefits from GVC participation that may appear in the labour market in the form of productivity or wage differentials or through differences in other socioeconomic characteristics, including, among others, the skill level, gender, or area of residence of workers. Based on the Mincer wage model, we examined the relationship between GVC participation and worker productivity and wages at the individual level using pooled cross-sectional data from the Thai LFS for the period 1995–2011. We also separately examined the effects of forward and backward GVC participation on wages and wage distributions.

Our results show that GVC participation induces higher monthly wages for individuals and increases productivity in the labour market through either the forward linkage or the backward linkage. We also found that GVC participation can help

mitigate inequality. The findings show that GVC participation promotes inclusive job creation and provides more job opportunities for rural, female, and low-skilled workers. Policies to support the existing strong industries can help Thailand and other developing countries to upgrade to higher value chains. However, the employment effects of GVC participation are complicated. An unbalanced policy framework could increase disparities in income distributions and cause exclusive job creation as the different linkages benefit stakeholders in different ways. As such, policy frameworks must be designed to balance benefits among stakeholders.

One of the caveats in our analysis is that our econometric model may face the problem of endogeneity, which is common to cross-sectional regression and analysis of the Mincer model. However, this study is an initial stepping stone for contributing to more solid findings on the impact of GVC participation on the labour market and income distribution at the individual level. Future research may improve on the methodology to deal with the endogeneity issue. Moreover, with the current econometric specification, it would be possible to study how wages in industries with different levels of GVC participation are evolving over time by interacting the GVC variables with year variables. This might provide interesting findings and patterns. As recent studies are moving towards micro-level analysis, firm-level data may be integrated to further deepen the analysis of the link between GVC participation and wages. This would possibly allow us to examine different implications for GVC participation on wages between local and multinational companies or among different socio-economic characteristics at the firm and individual levels.

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Appendix

Table A1: Descriptive Statistics (1995–2004)

Variable	Observation	Mean	Std. Dev.	Min	Max
Dependent Variable					
Log monthly wage	404,434	8.682311	0.8027746	2.596956	11.82081
Independent variable					
Years of schooling	403,426	9.092515	4.849229	0	21
Age	404,434	35.55324	11.18108	15	98
GVC participation	348,858	0.7258429	0.6425059	0.1360672	8.234579
Forward linkage	348,858	0.4647611	0.6963135	0.0000962	8.142179
Backward linkage	348,858	0.2610818	0.1513711	0.0296382	0.6525201
Male	404,434	0.5402315	0.4983794	0	1
Urban	404,434	0.708432	0.454485	0	1
High-skilled labour	367,299	0.4945943	0.4999715	0	1
Manufacture	404,434	0.3236968	0.4678865	0	1
Control variable (Fixed effects)					
Year	404,434	1999.803	2.921703	1995	2004
Region	404,434	3.002851	1.240538	1	5
Industry	403,906	19.3078	10.97272	1	34

Source: Authors.

Table A2: Descriptive Statistics (2005–2011)

Variable	Observation	Mean	Std. Dev.	Min	Max
Dependent Variable					
Log monthly wage	354,187	8.877547	0.8396287	3.138833	15.91289
Independent variable					
Years of schooling	110,138	9.783453	4.934892	0	21
Age	354,187	37.81099	11.63079	15	98
GVC participation	303,928	0.6971215	0.6124229	0.1548076	7.328684
Forward linkage	303,928	0.4309442	0.6656586	0.0000666	7.235367
Backward linkage	303,928	0.2661772	0.1558262	0.0201085	0.6525201
Male	354,187	0.5314368	0.4990115	0	1
Urban	354,187	0.6578785	0.4744207	0	1
High-skilled labour	286,314	0.5674399	0.4954318	0	1
Manufacture	354,187	0.3221519	0.4673015	0	1
Control variable (Fixed effects)					
Year	354,187	2007.901	1.98457	2005	2011
Region	354,187	2.938902	1.253244	1	5
Industry	348,642	19.16858	10.92039	1	34

Source: Authors.

Table A3: Robustness of the Effects of GVC Participation (Forward Linkage) on Monthly Wages

	(1)	(2)	(3)	(4)	(5)	(6)
Schooling	0.0945***	0.105***	0.0959***	0.0939***	0.0869***	0.0884***
	(0.00179)	(0.00189)	(0.00181)	(0.00180)	(0.00167)	(0.00166)
Age	0.0644***	0.0653***	0.0648***	0.0644***	0.0631***	0.0631***
	(0.00143)	(0.00142)	(0.00139)	(0.00143)	(0.00137)	(0.00131)
Age^2	-0.000596***	-0.000612***	-0.000604***	-0.000596***	-0.000562***	-0.000575***
	(1.80e-05)	(1.78e-05)	(1.74e-05)	(1.80e-05)	(1.74e-05)	(1.62e-05)
GVC participation (Forward linkage)	0.153***	0.159***	0.150***	0.154***	0.138***	0.135***
	(0.0138)	(0.0131)	(0.0129)	(0.0139)	(0.0125)	(0.0107)
Manufacturing		0.116***				0.163***
		(0.0121)				(0.0111)
Male			0.177***			0.211***
			(0.00589)			(0.00671)
Urban				0.0526***		0.0737***
				(0.00601)		(0.00723)
High-skilled labour					0.163***	0.289***
					(0.00721)	(0.0118)
Constant	6.318***	6.544***	6.210***	6.287***	6.364***	6.365***
	(0.0485)	(0.0394)	(0.0471)	(0.0485)	(0.0481)	(0.0423)
N	443,990	443,990	443,990	443,990	391,768	391,768
R-squared	0.584	0.565	0.596	0.585	0.601	0.610

Note: Cluster-robust standard errors are in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001. All models control for year, region, and industry fixed effects. The GVC participation is proxied by forward linkage participation that represents the share of FVA in gross exports.
Source: Authors.

Table A4: Robustness of the Effects of GVC Participation (Backward Linkage) on Monthly Wages

	(1)	(2)	(3)	(4)	(5)	(6)
Schooling	0.105***	0.116***	0.106***	0.104***	0.0960***	0.0974***
	(0.00173)	(0.00234)	(0.00176)	(0.00170)	(0.00173)	(0.00173)
Age	0.0692***	0.0703***	0.0695***	0.0691***	0.0674***	0.0673***
	(0.00148)	(0.00145)	(0.00145)	(0.00148)	(0.00142)	(0.00134)
Age^2	-0.000629***	-0.000646***	-0.000636***	-0.000629***	-0.000590***	-0.000604***
	(2.01e-05)	(1.95e-05)	(1.94e-05)	(2.00e-05)	(1.93e-05)	(1.77e-05)
GVC participation (Backward linkage)	0.121***	0.0912**	0.0459	0.118***	0.167***	0.0613
	(0.0391)	(0.0379)	(0.0405)	(0.0386)	(0.0387)	(0.0419)
Manufacturing		0.0513***				0.114***
		(0.0143)				(0.0143)
Male			0.179***			0.214***
			(0.00588)			(0.00709)
Urban				0.0506***		0.0725***
				(0.00565)		(0.00715)
High-skilled labour					0.170***	0.297***
					(0.00732)	(0.0133)
Constant	6.161***	6.394***	6.069***	6.132***	6.208***	6.233***
	(0.0468)	(0.0433)	(0.0470)	(0.0467)	(0.0479)	(0.0474)
N	443,990	443,990	443,990	443,990	391,768	391,768
R-squared	0.573	0.553	0.585	0.574	0.592	0.600

Note: Cluster-robust standard errors are in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001. All models control for year, region, and industry fixed effects. The GVC participation is proxied by backward linkage participation that represents the share of DVX in gross exports.

Source: Authors.

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