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# THE DETERMINANTS OF DOMESTIC VALUE-ADDED IN GROSS EXPORT FOR THAILAND BY FOCUSING ON THE ROLE OF OUTWARD FOREIGN DIRECT INVESTMENT

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**Abstract**

Thailand relies heavily on inward FDI as a mean of enhancing economic growth. However, several economic and political factors, including political instability, lack of operational workers, an aging population, and the rise of minimum wages, have increased the importance of outward FDI by Thai firms. This study has two aims. First, it attempts to conduct a decomposition analysis of gross export into domestic value-added between 2005 and 2015 using the method developed by Koopman et al. (2014). Secondly, it attempts to find the determinants of domestic value-added in gross export for Thailand by specifically examining outward FDI. Twenty-three countries of investment and six main manufacturing sectors were used to analyze the data. All regression included country, industry, and time fixed to the panel dataset. The result shows that outward FDI has played a significant role in creating domestic value-added in gross export through “Reverse Technology Spillover” However, the effect is heterogenous by country of investment. Furthermore, the results show that vertical specialization, defined as foreign value-added content in gross export, acts as a complement rather than a substitute in creating domestic value-added in gross export. Our result suggests that policymakers should keep promoting FDI outflow in order to increase domestic value-added in gross export.

***Keywords:*** Outward Foreign Direct Investment, Domestic value-added, Koopman’s Method, Manufacturing Sector, Thailand

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# ผลกระทบต่อการเพิ่มการส่งออกในรูปแบบของมูลค่าเพิ่มของประเทศไทยโดยให้ความสำคัญต่อการลงทุนทางตรงระหว่างประเทศขาออก

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**บทคัดย่อ**

ประเทศไทยพึ่งพาการลงทุนโดยตรงจากต่างประเทศ (Inward FDI) เพื่อใช้ในการพัฒนาเศรษฐกิจ แต่ในปัจจุบัน ความไม่มั่นคงของการเมือง ความขาดแคลนของพนักงานระดับปฏิบัติการ การก้าวสู่สังคมผู้สูงอายุและการขึ้นค่าแรงงานขั้นต่ำที่สูงขึ้นนั้น ทำให้เห็นความสำคัญของการลงทุนโดยตรงระหว่างประเทศขาออก (Outward FDI) เพิ่มมากขึ้นการศึกษาครั้งนี้มี 2 วัตถุประสงค์ วัตถุประสงค์แรก คือ การวิเคราะห์แยกองค์ประกอบของการส่งออกของประเทศไทยโดยใช้ทฤษฎีของ Koopman et al.(2014) ระหว่างปี พ.ศ. 2548 ถึง ปี พ.ศ. 2558 ส่วนวัตถุประสงค์ที่สอง คือ การศึกษาถึงปัจจัยที่ส่งผลกระทบต่อการเพิ่มจำนวนการส่งออกในรูปแบบของมูลค่าเพิ่มจากผู้ผลิตภายในประเทศ (Domestic value-added) โดยให้ความสำคัญต่อการลงทุนโดยตรงระหว่างประเทศขาออกเป็นหลัก การวิจัยครั้งนี้ใช้ข้อมูลภาคตัดขวาง (Panel dataset) ขอบเขตของการศึกษาคือ 23 ประเทศและ 6 อุตสาหกรรมหลักที่ประเทศไทยไปลงทุนและวิเคราะห์ข้อมูลโดยใช้การวิเคราะห์สมการถดถอยแบบ Fixed Effect

ผลการของศึกษาวิจัยสรุปว่า การลงทุนโดยตรงระหว่างประเทศขาออกมีส่วนสำคัญทำให้จำนวนการส่งออกในรูปแบบมูลค่าเพิ่มจากผู้ผลิตภายในประเทศนั้นเพิ่มมากขึ้นโดยผ่านการถ่ายทอดทางเทคโนโลยี (Reverse Technology Spillover) อย่างมีนัยสำคัญ อย่างไรก็ตามนั้นไม่ใช่ว่าการลงทุนในทุกประเทศจะทำให้จำนวนการส่งออกในรูปแบบมูลค่าเพิ่มนั้นเพิ่มมากขึ้น อนึ่งผลการศึกษาพบว่า จำนวนมูลค่าเพิ่มจากประเทศต้นน้ำ (Foreign value-added) เป็นปัจจัยสำคัญซึ่งทำให้จำนวนการส่งออกในรูปแบบมูลค่าเพิ่มนั้นเพิ่มมากขึ้นอีกด้วย ดังนั้นผู้กำหนดนโยบายควรสนับสนุนนโยบายการลงทุนโดยตรงระหว่างประเทศขาออกต่อไปเพื่อเพิ่มจำนวนการส่งออกในรูปแบบมูลค่าเพิ่มจากผู้ผลิตภายในประเทศ

***คำสำคัญ:*** การลงทุนโดยตรงระหว่างประเทศขาออก, การส่งออกในรูปแบบมูลค่าเพิ่มจากผู้ผลิตภายในประเทศ, Koopman's method, อุตสาหกรรมในประเทศไทย

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## 1. Introduction

The emergence of the Global Value Chain (GVC), in conjunction with deepened economic integration, has dramatically reshaped how world production has been organized over the past decade. The earliest theory of international trade championed the notion of horizontal specialization, implying that the entire production process, from start to finish, is performed in a single country and the factor content in final goods cross-national border only for consumption (Yamashita, 2010). However, in recent times, the dramatic reduction in trade barriers and widespread intra-industry specialization have allowed each stage of the production process to be undertaken in different countries, resulting in commodities composed of value-added from all around the globe (Aichele & Heiland, 2018). In the era of GVC, each country no longer trades on what it originally produces locally. Instead, the countries tend to specialize in specific activities to produce final goods at the lowest cost, leading to the notion of "trade in task" It is currently acceptable that participation in GVC can deliver greater benefits for developing countries by re-invigorating growth in the absence of innovation (Martínez-Galán & Fontoura, 2019).

As an export-oriented economy, Thailand is no exception in this regard. It stands to benefit from GVC participation in terms of boosting productivity and employment generation. However, one of the main drawbacks is that most of Thailand's exports are low-end products in the international value chain with low technological input from Thai manufacturing firm (Pangsopha, Manopiyaanand, Prachongkarn, & Wongwaisiriwat, 2018). Therefore, improving value-added activities is now viewed as a necessary condition to improve the employment rate. Otherwise, automation would replace labor in the supply chain (Leepipatpiboon & Thongsri, 2018). However, it is not clear what factors can help Thailand upgrade its exports to higher value-added activities.

Although gross exports play an important role in stimulating GDP in Thailand, policymakers are questionable if the country's involvement in international trade in the era of GVC will yield realistic benefits to Thai people in terms of employment and domestic content utilization. Scholars say that domestic value-added in export (DVA) provides a more realistic indicator of economic well-being and employment creation (i.e., Banga, 2014; Sasahara, 2019; United Nations Conference on Trade and Development [UNCTAD], 2013). Furthermore, value-added trade has become an important implication for the adjustment of the multilateral trade balance (Johnson, 2014). As mentioned by WTO Director-General Pascal Lamy (2011), "The statistical bias

created by attributing commercial value to the last country of origin perverts the true economic dimension of the bilateral trade imbalances. This affects the political debate, and leads to misguided perceptions". Gao, Cheng, and Yuan (2018) argue that the traditional trade statistics overestimate the trade deficit between China and the USA, resulting in trade friction between China and the USA. Gao et al. (2018) estimate that the China-USA trade deficit is reduced by more than 50% when measured in value-added terms, and has contributed 23.8% of the cumulative current account growth of the USA since 2000, not 46.2% as originally estimated on the gross value term.

In addition, domestic value-added in gross export helps generate employment. This argument is supported by Banga (2014) and Sasahara (2019). Banga (2014) mentions that exports from countries with lower value addition and high import content does not generate employment. Hence, countries should export high value-added products instead of focusing on higher exports. In addition, Sasahara (2019) demonstrates that a 1% increase in the share of domestic value-added leads to an increase in employment effect by 2.2%, 7.7%, and 1.5% in the USA, China, and Japan, respectively. Given the importance of domestic value-added in gross export in generating employment, a study of domestic value-added in export should not be neglected.

There are several reasons why this study considers Thailand as a sample for analysis. Firstly, Thailand has high processing trade. Koopman, Wang, and Wei (2014) claim that a country with high processing trade tends to have low domestic-value added in gross export. Secondly, emerging market economies like Thailand contribute approximately 60% of the global GDP, measured in purchasing power parity (Jangam & Rath, 2021). In addition, Thailand is an emerging market economy that have open up their economy to the global trade which is reflected through the growing proportion in the World trade. Moreover, Board of Investment of Thailand (2015) reports that while exports account for about 60% of Thailand's GDP on a gross basis, they only contribute 5% on a net basis. This suggests the need to accurately measure the contribution of export-led expansion gain to the Thai economy. At the moment, the quantitative measure of the effect and gain from conventional export-led growth strategy is inaccurate, as it only highlights the total amount of gross export without considering the export components.

Focusing on Thailand specifically, there is only one research that considers domestic value-added content in gross export in Thailand. However, this research does not examine the determinants of value-added in gross export. Sessomboon (2015) demonstrates that domestic value-added in export has contributed the most to Thailand's GDP growth of the four components based on the method developed by Koopman et al. (2014). Therefore, Thailand should increase domestic value-added in gross export as much as possible. This view is also supported by Asian Development Bank (ADB, 2015, p.8). The bank stated that "enhancing domestic value addition will have important implications for sustainability of economic growth and employment generation" for Thailand. In addition, increase share of domestic value-added content in export is viewed as necessary condition under "Thailand 4.0" program in order to increase their technology know-how (Organization for Economic Cooperation and Development [OECD], 2022). However, a literature review shows that while several researchers such as Jiranyakul and Brahmasrene (2002), Jongwanich (2010) and Tumbunlertchai (2009) have studied the determinants of export in gross terms for Thailand, no research focuses on the factors leading to increased domestic value-added in gross export for Thailand.

It can be said that Foreign Direct Investment (FDI) is the main driver of the economic development of emerging markets. Thailand has, in recent times, relied heavily on inward FDI as a means of enhancing economic growth. However, several economic and political factors, including political instability, an aging population, and the rise of minimum wages, have increased the importance of outward FDI (Cheewatrakoolpong & Boonprakaikawe, 2015). Additionally, outward FDI can contribute to domestic firms through industrial transformation and can encourage domestic firms to undertake higher value addition (Pananond, 2018). Unfortunately, the performance of outward FDI in Thailand remains low. Cheewatrakoolpong and Boonprakaikawe (2015) claim that the poor performance of outward FDI has a negative consequence on economic growth in Thailand, adding that outward FDI is a crucial factor that transforms newly industrialized economies (i.e., Thailand) into more developed countries (Ohno, 2009). Additionally, the Bank of Thailand estimates that a 10% increase in outward FDI will lead to a 1.56% increase in GDP in the long run and 1.03% in the short run (Kerdcheun, 2015). Given this importance, a study of Thai's outward FDI should not be ignored.

Given the limitations, this study aims to fill the gap in the research by conducting a decomposition analysis using longer time periods than Sessomboon (2015) did. This study will also explore factors that lead to an increase in value-added in gross export. Moreover, this study will

emphasize the role played by outward FDI and seek to identify "where" Thai firms should invest in order to increase domestic value-added in export. Studying factors affecting domestic value-added in gross export can assist policymakers in making appropriate policies to upgrade export into higher value-added activities. In section 1, we conduct a decomposition analysis of domestic value-added in gross export by using method developed by Koopman et al. (2014). In section 2, we will then investigate the determinants of gross export by considering particularly outward FDI by Thai firms.

## 2. Literature Review

### 2.1 Measurement of domestic value-added in gross export

The increasingly fragmented production network has led to growing awareness that traditional trade statistics mislead, and cannot objectively gauge the economic benefits a country enjoys through exports. This is because traditional statistics only record the final products crossing a border in gross terms without fully considering the value added by each country in the supply chain, leading to "double counting", referring that they record the same labor, the capital and the value of intermediate inputs bought and sold along the production chain at least two times. As a result, the final assembling country will capture the most of the valued good traded (Kam, 2017). To mitigate the "double counting" problem, a new indicator called the "domestic value-added" in gross export is introduced. It provides a better indicator of how trade contributes to economic growth and competitiveness since only the portion of domestic value-added in gross export contributes to national GDP (i.e., Banga, 2014; Sasahara, 2019; UNCTAD, 2013).

Studies on value-added trade are generally divided into two main groups; the decomposition analysis of value-added in gross export (i.e., Hummels, Ishii, & Yi, 2001; Johnson & Noguera, 2012; Koopman, Wang & Wei, 2008; Koopman et al., 2014; Wang, Wei & Zhu, 2013) and the factors affecting the growth of value-added in gross export (i.e., Kee & Tang, 2016; Olczyk & Koralska, 2017; Vrh, 2018; Yu & Lou, 2018). While many empirical studies have widely conducted decomposition analysis of value-added in exports, less attention has been paid to the factors driving it.

The first category of studies is on the decomposition analysis of value-added in gross export. Scholars such as Hummels et al. (2001), Johnson and Noguera (2012), Koopman et al. (2008, 2014), and Wang et al. (2013) have suggested various methodologies to decompose the value-added of export particularly in countries where processing trade is pervasive (i.e., China).

Representative studies of the decomposition analysis of value-added in gross export are as follows; Hummels et al. (2001) is one of the initial studies that introduced “vertical specialization” or the “HIY” model. It was subsequently refined and developed by several scholars such as Koopman et al. (2008, 2014), Johnson and Noguera (2012), and Wang et al. (2013). Hummels et al. (2001) decomposed gross export into the share of intermediate exports sent indirectly through other countries to the final destination and a share of the foreign input embedded in exports term and labeled them as “vertical specialization index.” Despite their notable work, they put many restrictive assumptions on foreign contents, i.e., for intensity in the use of foreign input, production for export and local sellers are the same. However, this assumption is violated when processing trade is pervasive, and all imported intermediate input contains 100% foreign content.

Koopman et al. (2008) did a similar decomposition analysis as the HIY model, but considered processing export in their analysis. Surprisingly, the estimation by Koopman et al. (2008) is more than double that implied by the HIY estimation. Another method of estimating value-added of export came from Johnson and Noguera (2012). They calculated the ratio of value-added export to gross export (VAX), and proposed ways to measure the share of a country’s GDP that is absorbed overseas.

However, none of the above-mentioned methods considered the place of “double counting” in trade balance and, therefore, mistakenly stated that gross export is equivalent to the value-added term. Koopman et al. (2014) and Wang et al. (2013) proposed a method that can fully decompose gross export into the foreign and domestic content of export, and that can further break down domestic value-added into three components; i.e., direct value-added, indirect value-added, and re-imported value-added export. More importantly, they considered the double counted term. However, numerous researchers, including Inomata (2017) and Man and Rui (2014) have claimed that Koopman’s method is considered to be the latest achievement method that reflects the real situation of global trade. Moreover, Koopman et al.’s method was the first to isolate the double-counting portion in gross export. Besides, Inomata (2017) has claimed that Koopman et al. (2014) has important implications for trade policies that channel domestic value-added first exported that return home.

### 2.2 Factor influencing domestic value-added in gross export

The second category of studies is based on determinations of value-added in gross export. Factors affecting domestic value-added in gross export can be classified into three broad categories; structural, policy and, quality of institution factors. Regarding structural factors, past literature such as Kee and Tang (2016) have found that imported substitution materials caused an increase from 65% to 70% in value-added in Chinese export between 2000 and 2007. Vrh (2018) discovered that an increase in the number of patent applications and more sophisticated products cause domestic value-added in export to rise in CEE-10 and EU-5 countries. Yu and Lou (2018) found that capital formation and improvement of research and development intensity cause domestic value-added in exports to increase in China.

Still focusing on structural factors, scholars such as Assamoi, Wang, Gnangoin, and Edjoukou (2019), Gonzalez (2016), and Yu and Lou (2018) use vertical specialization, defined as foreign value-added content in gross export, as an independent variable. However, the results are conflicting. For instance, Assamoi et al. (2019) and Gonzalez (2016) found that vertical specialization has a positive effect on the creation of domestic value-added in gross export in ASEAN and Latin America, meaning that export competitiveness is inextricably related to importing. On the other hand, Yu and Lou (2018) found that vertical specialization has a negative effect on the creation of domestic value-added in gross export in China.

In addition, based on the “new” new trade theory and especially in Melitz’s model (2003), Olczyk and Koralska (2017) used labor productivity as a factor affecting the domestic value- added in gross export for CEE countries and found labor productivity and highly skilled labor have a positive effect on the creation of domestic value-added in gross export. By contrast, Assamoi et al. (2019) found a negative relationship between labor productivity and domestic value-added in gross export for Latin America

Furthermore, several scholars have examined the role of policy factors affecting domestic value-added in gross export. Policy factors include tariffs, inward FDI, and the role of local content policy. Scholars such as Assamoi et al. (2019) and Gonzalez (2016) found a negative relationship between domestic value-added and tariff, since high tariffs will decrease access to more sophisticated input. However, Caraballo and Jiang (2016) found that high tariff positively affects domestic value-added. Caraballo and Jiang (2016) claimed that a country with weaker policies or a country with limited protections is likely to experience a reduction in

the domestic value-added in gross export. With regards to the study on inward FDI, Vrh (2018) found that inward FDI has a negative impact on the EU-15 because inward FDI can ensue from a higher volume of the destination country's imports from the country of origin of FDI. Adedeji, Sidique, Rahman, and Law (2016) found that local content policy is a significant factor in creating domestic value in extractive industries in African countries.

Lastly, regarding the quality of institutions factors, Assamoi et al. (2019) used the rule of law as a proxy for the quality of institutions and recorded positive results, because poor institutions can hinder the local production of intermediate products, causing local firms to rely more on foreign intermediates. In addition, Sahu (2016) considered Malaysian firms and found the government efficiency is a significant factor affecting domestic value-added in gross export for Malaysia.

To the researcher's best knowledge, there are only two studies considering the effect of outward FDI on domestic value-added in gross export. For instance, Vrh (2018) found outward FDI as a necessary condition for CEE-10 countries to upgrade their GVC but not a significant one for EU-5 countries. Another study is from the same researcher, but with a focus on Slovenian firms. Vrh (2019) found that outward FDI has a positive effect on domestic value-added in gross export as the majority of Slovenian firms engage in retail activity and not production. Thus, the outward FDI of Slovenia and its domestic value-added in export are found to be complementary.

### 2.3 Outward FDI and Reverse Technology Spillover

Not many scholars consider the determinants of outward FDI, even though it is an important driver of economic growth for Thailand. Scholars such as Javorcik (2004), Blalock and Gertler (2008), and Harding and Javorcik (2012) have investigated the effect of positive spillover from inward FDI. However, studies on outward FDI spillover are limited. According to Zhang and Chen (2020), outward FDI can generate positive spillover for domestic firms, thus upgrading to higher value-added in gross export. This is called "Reverse Technology Spillover." Outward FDI can promote the export of high value-added in home countries through several channels. For instance, when multinational firms invest in host nations, foreign affiliates can benefit from knowledge regarding demonstration or technology transfer from local firms in the host market, therefore improving the capacity of the home country and the export of more value-added products. Moreover, as technology is obtained from affiliates in the host nation, reverse

spillover is accompanied by internal transfer mechanisms through which the headquarters benefits through several channels, including personal exchanges between the parent company and affiliates. Furthermore, with the emergence of GVC, headquarters and their affiliates can focus on different parts of a certain product, trading intermediate or finished products internally. Headquarters can then receive technological know-how for manufacturing and improving their products (Javorcik, 2004). Moreover, they can share knowledge internally if outward FDI is made to set up R&D centers in developed countries.

### 2.4 Thailand's Policy

It can be concluded that a study on the impact of outward FDI on domestic value-added is very limited. However, for Thailand, a study of outward FDI should not be ignored, because one of the principal goals of the Board of Investment Thailand is to support Thailand's restructuring and quest to become a knowledge-based country with higher value-added activities. According to Pananond (2018), Thai firms should use international expansion to extend their value chain outside the national border. Even though the direct benefit is usually accrued to the investing enterprises, home countries also gain indirect spillover that increases their overall competitiveness. Moreover, more competitive Thai firms contribute to the industrial transformation of the home country, thus enabling the domestic economy to undertake higher-value-added activities.

## 3. Hypothesis Development

Theoretically speaking, many factors lead to increased domestic value-added in gross exports. These can be divided into structural, policy, and quality of institution factors. According to Kowalski, Gonzales, Ragoussis, and Ugarte (2015), there are no definite rules for investigating the determinants of domestic value-added in gross export. Therefore, this study will be based on theoretical prediction and past existing results.

**Hypothesis 1:** Outward FDI has a positive effect on domestic value-added in gross export since outward FDI can generate positive spillover for domestic firms through "Reverse Technology Spillover" thus resulting in an increase of domestic value-added in gross export. This is the main hypothesis of this study.

**Hypothesis 2:** Vertical specialization, as defined by Hummels et al. (2001) to be the summation of foreign value-added in export and pure double counting for foreign value-added, and as

considered by Yu and Lou (2018) to be a precondition when discussing how country gain from trade, has a negative effect on domestic value-added in gross export as it is referred to as foreign-value added content in gross export.

**Hypothesis 3:** Since gross capital formation, measured by nominal gross fixed capital formation (GFCF), will lead to a higher modern productive system, increases in gross capital formation will result in an increased domestic value-added in gross export.

**Hypothesis 4:** Labor productivity index per hour worked is a measure of output per input labor, calculated as the ratio of GDP at the constant price per hour worked. Higher labor productivity growth can reflect higher capital and increase labor efficiency. Therefore, it is hypothesized that high labor productivity will lead to an increase in domestic value-added in gross export.

**Hypothesis 5:** The number of patent applications has a positive effect on domestic value-added in gross export since it plays a significant role in technology catch-up and increases innovation.

**Hypothesis 6:** The rule of law underpins the way a national society is governed, and everyone in society is bound by and entitled to the benefits of the rule of law. The rule of law has a positive effect because it protects private assets from arbitrary appropriation, and therefore, it is hypothesized that the rule of law has a positive effect on domestic value-added in gross export.

## 4. Empirical Strategy

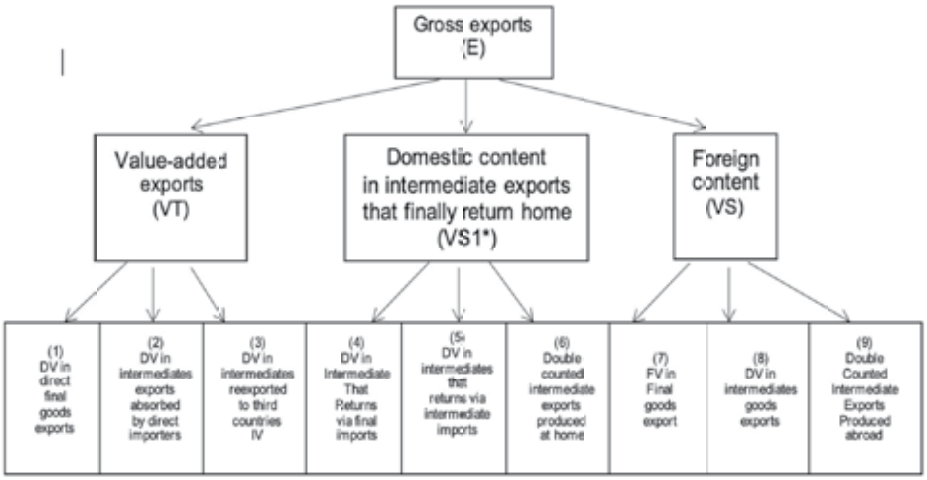
The panel data for 2005 – 2015 for six manufacturing sectors based on ISIC Rev 4 were analyzed. Twenty-three countries of investment were included in the data analysis. An input-output table developed by OECD was used to conduct a decomposition analysis. Six main sectors in which Thai enterprises experience outward FDI include textile, food and beverages, chemicals and pharmaceutical products, computer, electronic and optical equipment, electrical equipment and machinery and equipment. To obtain the domestic value-added from export, this study used the decomposition analysis method developed by Koopman et al. (2014), as it has been used by many recent studies (i.e., Olczyk & Koralska, 2017; Yu & Luo, 2018). In addition, Koopman's method is more precise and more accurate than the other methods, as it considers the double counting term (Inomata, 2017; Man & Rui, 2014).

Koopman et al. (2014) decomposes gross export into four main components, consisting of domestic value-added in gross export, domestic value-added first exported then returned home, foreign value-added, and pure double counting term. First, in order to distinguish domestic value-added from its gross export, this study employs decompr package in R studio, developed by Quast and Kummritz (2015) because this has been used by past scholars, such as Olczyka and Koralska (2017). Koopman et al. (2014) assumed a two-country-case model. In addition, it is assumed that there are G sectors in each country, and each country produces only one product that can be used directly for final consumption while the other one can be used as an intermediate input. Each country can export both final and intermediate goods. This can be written in the following equation;

$$e_{12} = v_1 b_{11} e_{12} + v_2 b_{12} e_{12} = [v_1 b_{11} y_{12} + v_1 b_{12} y_{22}] + [v_1 b_{12} y_{21} + v_1 b_{12} a_{21} (1 - a_{11})^{-1} y_{11}] + v_1 b_{12} a_{21} (1 - a_{11})^{-1} e_{12} + [v_2 b_{21} y_{12} + v_2 b_{21} a_{12} (1 - a_{22})^{-1} y_{22}] + v_2 b_{21} a_{12} (1 - a_{22})^{-1} e_{21}$$

According to the above equation, $[v_1 b_{11} y_{12} \; and \; v_1 b_{12} y_{22}]$ is the value-added in its export of final and intermediate goods for country R. The third item, ($[v_1 b_{12} y_{21}]$), represents the domestic value-added in the intermediate goods of export of country R of which return home is part of R's final goods import. The fourth item, ($[v_1 b_{12} a_{21} (1 - a_{11})^{-1} y_{11}]$ is the domestic value-added intermediate input in country R that is returned home as part of the import of intermediate goods used to manufacture final products that are absorbed in country R. The fifth item, ($[v_1 b_{12} a_{21} (1 - a_{11})^{-1} e_{12}]$ is called the pure double count term from the home country, occurring when country R and S both export intermediate product. The sum of the items (1) to (6) in figure 2 below is the domestic value-added content in gross export. The sixth item ($[v_2 b_{21} y_{12}]$) is the foreign value-added in gross export of final goods for country R. In addition, the seventh item ($[v_2 b_{21} a_{12} (1 - a_{22})^{-1} y_{22}]$ indicates foreign value-added in intermediate goods export out of country R. Finally, the eighth item ($[v_2 b_{21} a_{12} (1 - a_{22})^{-1} e_{21}]$) is another pure double counting for gross exports of country R that are produced in a foreign country. This only occurs when both countries export intermediate products. It is important to note that the third item in Figure 1 below only appears in three country case model. The summary is shown below;

**Figure 1: Accounting for Gross Export: Concept**




Source: Koopman's method (2014)

After conducting the decomposition analysis of the gross export for Thailand, this study then investigates the determinants of domestic value-added in gross export by specifically considering outward FDI between 2005 - 2015 In addition, panel data is used in this investigation because it allows researchers to consider on the variation within the country overtime. The regression model for testing the determinants of domestic value-added in gross export consists of time, industry and country fixed-effects. The industry fixed-effect controls for any unobservable industry-specific time-invariant heterogeneity across industries. In addition, the Hausman Test also confirms that the fixed-effect model is more appropriate than the random-effect model. The regression analysis is derived as below;

$$DVA_{k,j,t} = \beta_0 + \beta_1 OUTFLOW_{i,j,t-1} + \beta_2 VS_{i,j.t-1} + \beta_3 GFCF_{j,t-1} + \beta_4 LP_{k,t-1} + \beta_5 Patent_{k,t-1} + \beta_6 RL_{k,t-1} + \mu_i + \mu_j + \mu_t + \varepsilon_{ijt}$$

The dependent variable is domestic value-added in gross export (DVA). It denotes bilateral domestic value-added in export of country k with respect to country i in industry j in year t. The independent variables that are used to perform the regression analysis are as follows;

**Tables 1: The summary of the independent variables**

| Variables | Data Description | Data sources | Expected sign |
|---|---|---|---|
| FDI outflow | Bilateral direct investment from Thai enterprise to country i in industry j in year t. | Bank of Thailand | + |
| VS | Vertical specialization, which is the sum of foreign value-added and pure double counting | As calculated by Koopman's method | - |
| GFCF | Capital formation can be measured by nominal gross fixed capital formation | ICIO tables by OECD. | + |
| LP | calculated as the ratio of GDP at constant price per hour worked | Bank of Thailand | + |
| Patent | Number of patent applications in Thailand | World Bank | + |
| Rule of Law | Ranging from approximately -2.5 (weak) to 2.5 (strong) | World Governance Indicators | + |

### 5. Simultaneity Bias and Endogeneity Problem

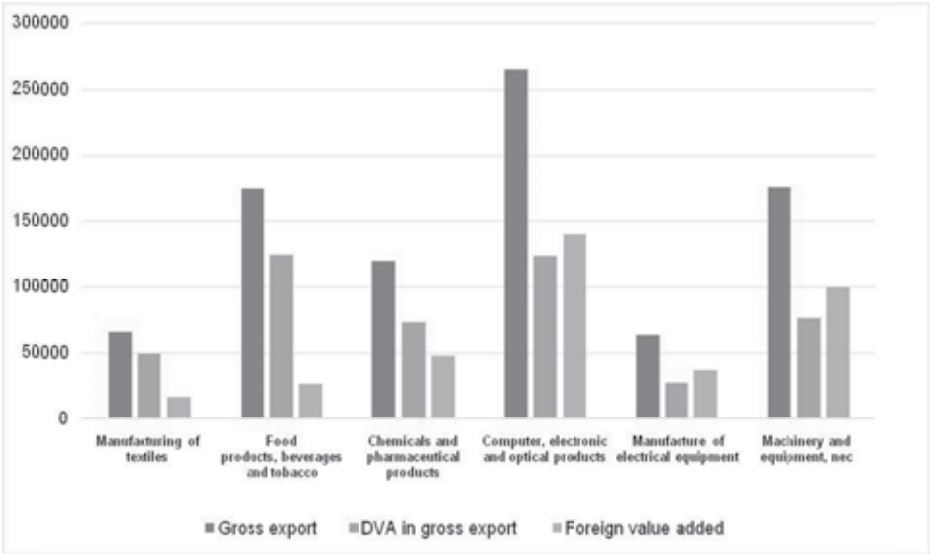
Simultaneity bias and endogeneity problem can become an issue in this study. For instance, outward FDI can cause an increase in domestic value-added in gross export. However, firms with higher domestic value-added in gross export can invest aboard. To minimize the simultaneous bias and endogeneity problem and allow for a deferred reaction of domestic value-added in gross export, we follow the past studies by Vrh (2018 & 2019) and Assamoi et al. (2019) by using the lagged variables by one year. In addition, fixed-effect was employed to mitigate the endogeneity issues. Moreover, Daniels and Minot (2020) state that using panel data set also mitigate the effect of endogeneity issue because panel data covers multiple units over multiple time period and these time differences can eliminate the endogeneity issue due to reverse causation. Furthermore, Wooldridge (2002) claims that panel data allows researchers to manage the omitted unobserved problem.

### 6. Empirical Evidence

Calculating using Koopman's method (2014), we compared domestic value-added in gross export by industry. According to Figure 2, traditional trade statistics has, to a large extent, exaggerated the size of Thailand's trade. Therefore, traditional trade statistics cannot accurately reflect Thailand's gains from its export. The manufacturing sector has huge differences in gross export and value-added in gross export. The electrical equipment manufacturing industry has the greatest difference in value-added in gross export in the sample period between 2005 and 2015. In terms of the absolute value of volume, the food,

beverages, and tobacco products industry has gained the largest value of domestic value-added in gross export with a value of US$ 124,448.30 million, followed by computer, electronic and optical products manufacturing with a value of US$ 123,704.4 million. In terms of the share of value-added in domestic value-added in gross export to gross export, the domestic value-added in gross export for the manufacture of textile accounts for 75% of gross export, followed by food, beverages, and tobacco product manufacturing, which contributes 71% of gross export, and chemicals and pharmaceutical product manufacturing, which contributes 60%. The least share of domestic value-added to gross export appears in electrical equipment manufacturing (43%). In addition, the volume of domestic value-added in gross export is much lower than the volume of foreign value-added in gross export in computer, electronic and optical products, and the manufacture of electrical equipment and machinery and equipment. By contrast, the volume of domestic value-added in gross export is higher than the volume of foreign value-added in gross export in the manufacturing of textiles, food products, beverages and tobacco and chemicals and pharmaceutical products. To sum up, it can be seen that the traditional trade statistics has, to a large extent, exaggerated the size of Thailand's trade due to the double counting problem. After the decomposition analysis had been conducted, the research attempts to find the determinants of domestic value added in gross export particularly the role played by outward FDI. The result of country-industry fixed effect is shown below.

**Figure 2: Comparison of Gross export, DVA, and FVA in gross export for Thailand's Manufacturing sector between 2005-2015 (in millions US$)**




Source: Author's own calculation based on Koopman's method (2014)

**Table 2: The Results**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| VARIABLES (DVA) | ALL | Developed countries | Developing countries | ASEAN | ASEAN+3 | Asian Tigers | Top 5 Exporters | Top 5 Importers |
| $OFDI_{t-1}$ | 0.236*** | 0.257*** | 0.534*** | -0.0260 | 0.240 | 0.0131 | 0.269** | 0.554*** |
| | (0.0536) | (0.0426) | (0.153) | (0.0918) | (0.156) | (0.0307) | (0.133) | (0.182) |
| $VS_{t-1}$ | 0.855*** | 0.720*** | 0.817*** | 0.490*** | 0.845*** | 0.491*** | 0.840*** | 0.829*** |
| | (0.0215) | (0.0499) | (0.0325) | (0.0776) | (0.0313) | (0.0826) | (0.0437) | (0.0440) |
| $GFCF_{t-1}$ | -0.00438* | -0.00450** | -0.00390 | 0.00118 | -0.00347 | -0.000246 | -0.0134 | -0.0126 |
| | (0.00234) | (0.00211) | (0.00535) | (0.00287) | (0.00510) | (0.00200) | (0.00944) | (0.00948) |
| $LP_{t-1}$ | -5.106*** | -3.560*** | -14.12*** | -6.316*** | -11.86*** | -3.491*** | -17.32*** | -19.35*** |
| | (1.468) | (1.378) | (3.415) | (1.864) | (3.262) | (1.257) | (6.119) | (6.051) |
| $Patent_{t-1}$ | -0.0118 | -0.00780 | -0.0810 | -0.0173 | -0.0624 | -0.0236 | -0.0896 | -0.0895 |
| | (0.0302) | (0.0281) | (0.0708) | (0.0375) | (0.0655) | (0.0270) | (0.127) | (0.122) |
| $RL_{t-1}$ | 3.554 | -30.90 | -13.02 | 75.80 | -56.64 | -79.96 | -34.23 | -119.1 |
| | (49.38) | (49.59) | (101.5) | (63.94) | (108.8) | (49.44) | (204.1) | (236.7) |
| Constant | 672.1*** | 556.2** | 1,751*** | 816.0*** | 1,525*** | 595.5*** | 2,322*** | 2,621*** |
| | (210.5) | (223.7) | (417.6) | (224.8) | (413.8) | (202.9) | (852.1) | (855.9) |
| Observations | 1,380 | 990 | 480 | 360 | 540 | 240 | 300 | 300 |
| R-squared | 0.609 | 0.299 | 0.697 | 0.356 | 0.709 | 0.282 | 0.677 | 0.681 |

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: Top 5 Export partners = Vietnam, China, Hong Kong, Japan and USA

Top 5 Import partners = Manlaysia, China, Japan, South Korea and USA

## 7. Discussion

Table 2 shows the result of the fixed-effect estimation. The statistical result indicates that the key hypothesis that Thailand's domestic value-added in gross export grows along with outward FDI is strongly supported but that the impact is different across countries of investment. According to Table 2, investment in all countries, except for Asian tigers, ASEAN region and ASEAN+3, generates higher domestic value-added in gross export. Furthermore, it can be implied that further ASEAN agreement with other countries does not help in the creation of domestic value-added in gross export. In addition, the coefficient is higher for developing countries than for developed countries, which stresses the important role of South-South FDI. Additionally, Pananond (2018) claims that local firms from emerging countries that are integrated from GVC through inward FDI by multinational firms from developed countries can later undertake their own expansion through outward FDI. According to Mudambi (2008), outward FDI can support the upgrade of export to high value-added activities because it allows the firms to consider their core competencies.

Pietrobelli and Rabellotti (2011) also stated that firms generally outsource previously internally managed activities while retaining activities that represent the source of their core competencies. In addition, the result confirms that outward FDI can increase domestic value addition through "Reverse Technology Spillover" in terms of demonstration and personal exchange of knowledge between parent companies and their affiliates which means that the domestic firms can improve their technology and management know-how, leading to an increase in the productivities due to the oversea investment activities (Zhang Chen, 2020). Furthermore, the result is consistent with the study from Vrh (2018) and Vrh (2019), who find a positive relationship between outward FDI and domestic value-added in gross exports in CEE-10 countries and Slovenian firms, respectively. However, the magnitude of the effect for Thailand is much stronger than for CEE-10 countries and Slovenian firms. For Thailand, a one-unit increase in outward FDI will result in between 0.236 to 0.554 unit increase in domestic value-added in gross export. However, for CEE-10 countries and Slovenian firms, a one-unit change in outward FDI will contribute only between 0.014 to 0.04 unit change in domestic value-added in gross export. This implies that the economic impact is stronger for Thailand than CEE-10 countries and Slovenian firms. To sum up, upgrading export to higher value-added activities by undertaking outward FDI is primarily important for Thailand.

Regarding the other variables,vertical specialization positively influences export performance for all countries, indicating that involvement in GVC benefits economies in the form of domestic value-added in gross export growth. The magnitude of the effect is highest for ASEAN+3 countries. Furthermore, it can be implied that vertical specialization or foreign value-added content in gross export is a complement rather than a substitute for the creation of domestic value-added in gross export, indicating that export competitiveness is substantial related to importing. The result is similar to the study by Gonzalez (2016) and Olczyk and Kordalska (2017) when focusing on ASEAN and CEE countries. However, the magnitude of the effect for Thailand is higher than for the ASEAN region and CEE countries. For Thailand, a one-unit increase in vertical specialization will result in an approximate increase of between 0.5 to 0.9 units in domestic value-added in gross export. In contrast, Gonzalez (2016) found that a one-unit increase in vertical specialization will cause an increase in domestic value-added in gross export by only 0.15 units for ASEAN, while Olczyk and Kordalska (2017) discovered that a one-unit change in vertical specialization results in 0.02 unit change in domestic value-added in gross export. However, the result is inconsistent with the study by Yu and Lou (2018), who found a negative relationship between China's vertical specialization and domestic value-added in gross export.

In addition, this study finds that capital formation, referred to as the acquisition of produced assets minus disposal, has a negative effect on the increase of domestic value-added in gross export for Thailand when investing in developed countries. The coefficient of capital formation is negative, suggesting that the higher the capital formation in Thailand, the lower the domestic value-added in gross export. In addition, a higher capital formation will contribute to a lower modern productive system. An explanation is that Thailand has a lower level of absorptive capability when investing in developed countries. However, as compared to the study from China, Yu and Lou (2018) found a positive relationship between capital formation and domestic value-added in gross export.

Surprisingly, we find that labor productivity has a negative effect on the rise of domestic value-added in gross export for all countries, suggesting that a higher output per worker will reduce domestic value-added in gross export. This result is similar to the findings from Assamoi et al. (2019), which focused on Latin American countries. This is because the variable, "labor productivity" fails to distinguish between skilled and unskilled labor. Therefore, labor productivity may be an inappropriate measure for the quality of human capital (Assamoi et al., 2019).

In. addition, Das and Chaudhuri (2018) state that labor productivity can increase if there are a competitive pressure of the firms. Other variables have also been investigated. For instance, this study finds no significant relationship between the number of patent applications on domestic value-added in gross export, meaning that the result is inconsistent with the study from Vrh (2018), who finds a positive relationship between the number of patent applications in CEE-10 and EU-5 countries. Moreover, a favorable business environment, such as the rule of law, does not matter in increasing domestic value-added in gross export for Thailand. This result is inconsistent with the study by Assamoi et al. (2019), who finds a positive effect of the rule of law on the creation of domestic value-added in gross export. Assamoi et al. (2019) mentions that bad rule of law can hinder domestic production causing the domestic firms to rely more foreign intermediate.

## 8. Conclusion

In summary, the paper attempts to fill the gap in the research by conducting a decomposition analysis of gross exports for Thailand, using a longer period than previous literature. The paper also investigates the determinants of domestic value-added in gross export for Thailand by considering outward FDI since it is crucial for Thailand's economic growth. Country-industry and time fixed-effects were applied to the panel data set for the 2005 to 2015 period. The results of this study confirm that outward FDI has led to the creation of domestic value-added in gross export for Thailand, but the effect is heterogeneous by the country of investment. Therefore, the government should emphasize a policy of promoting outward FDI in order to increase domestic value-added in gross export. However, there is a need to promote the right country because not all countries generate higher domestic value-added in gross export. Furthermore, this paper shows that Thailand has benefited from using vertical specialization to boost its domestic value-added in gross export performance. One limitation of this paper is limited coverage of value-added exports data for country of investment. We can improve the number of observations by using more countries of investment. Moreover, this research only uses manufacturing sectors as a sample for the analysis and hence, future research should incorporate the other sectors such as agricultural sectors, mining sectors as well as service sectors.

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