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Foreign Ownership and Productivity in ASEAN Manufacturing: The Moderating Role of Absorptive Capacity

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Abstract:- The globalization of markets and rising international trade have led to a dramatic increase in the international expansion of multinationals. In the process of internationalizing, multinational enterprises (MNEs)carry with them firm-specific advantages which allows them to attain higher productivity levels compared to domestic firms. Under its regional grouping, Association of Southeast Asian Nation (ASEAN), Southeast Asia is particularly interesting for the study of productivity differentials between domestic and foreign-owned firms. This is because there is still a lack of empirical evidence in the region and that in several ASEAN countries, there has been a recent trend of de-industrialization where the composition of GDP shift from manufacturing to service. The purpose of this paper is to explore whether foreign-owned ASEAN manufacturing firms experience higher productivity than their domestic counterparts. Additionally, it will also investigate how the relationship between foreign ownership and productivity is moderated by the firm's absorptive capacity. By applying a random-effect regression on a panel dataset consisting of 688 firms from Indonesia, Malaysia, and Vietnam covering the 2014-2018 period; this study provides partial support for the existence of productivity differentials between foreign-owned and domestic-owned firms in Southeast Asia and found that absorptive capacity negatively moderates this relationship. However, due to a lack of internal validity, the latter finding must be interpreted with caution.

Keywords:- *ASEAN, foreign ownership, absorptive capacity, productivity.*

I. INTRODUCTION

The globalization of markets and rising international trade have led to a dramatic increase in the international expansion of multinationals. In the process of internationalizing, multinational enterprises (MNEs) carry with them firm-specific advantages such as technological capacity, managerial expertise, and production knowledge to overcome the disadvantages associated with operating in an unfamiliar host country market (Dunning, 2009; Mallampally and Sauvant, 1999; Caves, 1996). The transfer of such knowledge across borders consequently translate to higher productivity levels exhibited by foreign firms relative to domestic firms (Benfratello and Sembellini, 2006). Previous studies have tried to establish the existence of productivity differentials between foreign and domestic firms as well as the factors that underlie them. The results concluded overall that foreign firms are indeed more productive than domestic firms due to higher technological intensity (Doms and Jensen, 1998; Driffield and Taylor, 2005), higher technical efficiency (De Backer, 2001; Griffith, 1999), and higher skill intensity (Griffith & Simpson, 2004; Globerman et al., 1994).

The study on productivity differentials forms an important assumption on the presence, scale, and scope of productivity spillovers arising from inward FDI.[1]In order for domestic firms to benefit from the presence of foreign firms in their industry, foreign firms must first be more productive than their domestic counterparts. While empirical studies generally confirm that foreign firms possess some form of productivity advantage, foreign ownership is not the sole reason that contributes to this phenomenon. Firm heterogeneity such as firm's size and age for example, may play an important role in determining its level of productivity (Girma et al., 2001; Griffith and Simpson, 2004). In addition, *composition effect* – the fact that foreign firms tend to cluster in industries with high productivity – partially explain why empirical studies generally find foreign firms to be more productive than domestic firms (Davies and Lyons, 1991; Howenstine and Zeile, 1992). To prevent the findings from being influenced by multiple unobserved factors, this study will control for industry composition, firm heterogeneity, and country-level factors. This ensures that any productivity differentials found in this study are purely because of ownership advantages.

The evidence of productivity differentials mostly come from developed countries such as the United Kingdom (Girma et al., 2001; Griffith, 1999; Harris, 2002; Harris and Robinson, 2003), Canada (Globerman et al., 1994), Belgium (De Backer, 2001), and the United States (Doms and Jensen, 1998). Evidence on developing countries or regions such as Southeast Asia remained scarce. The most notable studies on Southeast Asian countries pertaining to this issue are Ito (2002; 2004), which explored the Indonesian and Thailand automobile industry, respectively. It is important to note however that both studies only incorporate one country and industry, which might give a restricted perspective and less generalizable conclusion. This study aims to fill in this literature gap by incorporating multiple countries and

[1]For a review of the literature on spillovers from inward investment; see Gorg and Strobl (2001) or Gorg and Greenaway (2003).

manufacturing industries in Southeast Asia. Examining the manufacturing industry of Southeast Asia is particularly interesting for two reasons. First, the region is widely considered as an attractive destination for foreign direct investment (FDI) due to favorable policies such as investment liberalization, development of special economic zones, and the creation of free trade agreements. Under its regional grouping, the Association of Southeast Asian Nation (ASEAN), the region accounts for 21% of developing countries' FDI stock and 7% of global FDI stock (*ASEAN Secretariat*, 2017). Second, there has been a recent trend of premature de-industrialization by many ASEAN countries where the composition of GDP shifted from manufacturing to the service sector (Azis, 2018). This is evident if we look at the composition of ASEAN FDI stock, whereby an overwhelming 73% belongs to the service sector and only just 18% in manufacturing (*ASEAN Secretariat*, 2017). Traditionally, the manufacturing sector is considered as a source of sustained growth and productivity (McMillan and Rodrik, 2011; Nayyar, 2013); but this argument has been challenged by many who is in favor of the service sector. [2] By exploring the relationship between foreign ownership on manufacturing productivity in the ASEAN region, this paper might yield some important policy implications with respect to this differing point of view.

By using a panel data consisting of 688 firms originating from Indonesia, Malaysia, and Vietnam covering the 2014-2018 period; this study seeks to determine whether foreign ownership contributes to productivity differences in the ASEAN manufacturing sector. Moreover, this study will also investigate the moderating role of absorptive capacity in the foreign ownership-productivity nexus to demonstrate that the exploitation of firm-specific assets across borders depends largely on the learning capabilities of its subsidiaries. While the construct is rarely used in studies about productivity differentials, incorporating it will generate useful insights into how foreign subsidiaries absorb knowledge from its parent firm. The result of this study provides partial support for the existence of productivity differentials in ASEAN manufacturing firms after controlling for firm, industry, and country-level factors. Additionally, in contrast to expectation, absorptive capacity is empirically shown to be negatively moderating the impact of foreign ownership on productivity. However, this conclusion might be misleading due to a lack of internal validity in the second part of the analysis.

The remainder of the paper will be structured as follows. The second section will review existing literature on all the relevant topics pertaining to the research question. The third section will describe the data and methodology of the research. The fourth section will present the result of the analysis and evaluate the implications of the findings with respect to the research question. The fifth and last section will conclude the research by entailing a summary of the analysis, managerial and theoretical contributions, limitations of the study, as well as directions for future research.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

A. Foreign ownership and productivity differentials

Literatures have tried to empirically establish why foreign firms are generally more productive than domestic firms. Several studies for instance found that foreign firms have a higher skill intensity and pay workers higher wages compared to domestic firms (Griffith and Simpson, 2004; Globerman et al., 1994; Doms and Jensen, 1998; Griffith, 1999). The productivity advantage is therefore caused by foreign firms employing a larger proportion of skilled workers – which possess higher labour productivity than low-skilled workers – or the fact that they pay higher wages and obtain more efficiency out of their labour (Griffith, 1999). Additionally, foreign firms are also generally larger, exploit economies of scale better, and achieve higher technical efficiency (De Backer, 2001; Griffith, 1999). By studying Belgium firms over the period of 1990-1995 for instance, De Backer (2001) demonstrate using production frontiers – which measures the maximum attainable output for different bundles of input factors – that foreign firms tend to locate closer to the frontiers, indicating that they have higher technical efficiency and exploit economies of scale more optimally. Griffith (1999) provides further evidence through his study of UK establishments data from 1980-1992 and observed that foreign-owned establishments are almost six times larger and produce five times more output than domestic establishments. By referring to the "internalization" theory proposed by Caves (1996), which posits that foreign firms typically carry firm-specific advantages such as technological capacity, it can also be concluded that foreign firms are technologically more intensive than domestic firms. By using the number of technologies used in a plant as well as the extent to which employees use computer equipment, Doms and Jensen (1998) and Driffield and Taylor (2005) concluded that foreign-owned firms are more technologically intensive than domestic firms.

Similar findings on productivity differentials are also observed in Southeast Asia. Ito (2002; 2004) suggests that foreign establishments tend to be larger in size, pay higher wages, and experience higher labour productivity than domestic establishments. However, the author proceeds to mention that there is no significant evidence that the observed productivity differences are due to ownership-specific advantages. By decomposing total factor productivity – which refers to productivity of all inputs taken together – into several elements, Ito (2002) confirmed that production scale and capital utilization are the most important determinants of productivity. The findings here signify the importance of controlling for unobserved level factors such as firm-level characteristics and industry composition which might affect the relationship between foreign ownership and productivity. With that in mind, the following hypothesis is proposed:

[2]For a review of the literature in favor of the service sector; see Hauge and Chang (2019), Hallward-Driemeier and Nayyar (2017), and Ghani and Kharas (2010).

Hypothesis 1: Foreign-owned manufacturing firms experience higher labour productivity than domestic-owned manufacturing firms in Southeast Asia.

B. Determinants of productivity differentials

As previously mentioned, studies on productivity differentials should always be inseparable from the concept of firm heterogeneity. Firm heterogeneity refers to the fact that each firm may differ in terms of characteristics such as age, size, capital intensity, input, managerial quality; where these differences are potentially correlated with foreign ownership and can explain certain degree of productivity differentials (Benfratello and Sembellini, 2006). Early cross-sectional study on Canadian establishments conducted by Globerman et al. (1994) for instance, showed that the higher value-added per employee displayed by MNEs disappear after controlling for capital intensity, size, and workforce composition. Conversely, Doms and Jensen (1998) who studied U.S. firms conclude that the productivity advantage possessed by foreign establishments prevailed even after controlling for firm-level characteristics. To isolate the 'ownership' effect and ensure that findings are robust from observable firm-characteristics, newer studies have therefore incorporated variables such as age and size (Girma et al., 2001; Ito, 2002; Griffith and Simpson, 2004).

In addition to firm heterogeneity, many empirical studies also acknowledged that the observed differences in productivity between foreign and domestic firms may be caused by the fact that foreign firms tend to cluster in industries with higher productivity (Doms and Jensen, 1998; Griffith, 1999; Davies and Lyons, 1991). This phenomenon, also known as *composition or structural effect*, is examined comprehensively in the study by Davies and Lyons (1991) who used a two-tier decomposition method to distinguish the impact of structural and foreign ownership effect on the productivity of UK manufacturing firms over the period of 1971-1987. The study implied that foreign firms are on average 48.6% more productive than domestic firms but 20.3% of that productivity advantage is attributed to structural effect. Similar conclusion is reached in the study by Howenstine and Zeile (1992) who found that U.S. MNEs tend to concentrate in high productive industries such as chemicals, primary metals, and electronic equipment. As such, it is extremely important to control for variations across industry – *composition effect* – when assessing for productivity differences between foreign and domestic firms. Empirically, this is already done in studies performed by Girma et al. (2001) as well as Griffith and Simpson (2004).

Unlike previously mentioned empirical studies who generally focus on a single country, this study will incorporate multiple countries in the analysis. Therefore, country-level characteristics that might affect productivity levels should also be considered. These factors range from labour market regulations, financial markets, trade policies, institutional strengths, and human capital (Farole and Winkler, 2012). Countries adopting an open trade regime for instance will have higher level of productivity since they will attract more FDI (Crespo and Fontoura, 2007), be more globally integrated and technologically more advanced (Meyer and Sinani, 2009), and are more exposed to productivity-inducing competition (Farole and Winkler, 2012). Moreover, labour market regulations such as wage constraints, might affect skill-intensity of firms and consequently their productivity level (Hale and Long, 2011). While there are other important country-level characteristics, discussing each of them is beyond the purpose of this study. Therefore, this study will only acknowledge and control for them without making distinctions or specifying a particular country-level factor.

C. The role of absorptive capacity

Absorptive capacity is defined as "the ability to recognize the value of new external information, assimilate it, and apply it to commercial ends (Cohen and Levinthal, 1989). It is a fundamental concept that represents the firm's learning process and is critical to the long-term survival of the company due to its ability of reinforcing, complementing, and refocusing the firm's knowledge base. (Lane et al., 2006). The concept is widely studied in the FDI literature both as a country-level and firm-level factor that determines the extent to which knowledge and technologies are transferred across borders (Kneller et al., 2010). Moreover, in the FDI-spillover literature, Girma (2005) found through analysing a panel of UK firms covering the period of 1989-1999, that there is a minimum level of absorptive capacity that firms need to possess spillover benefits arising from FDI. A similar study by Girma et al. (2006) also concludes that absorptive capacity facilitates technology transfer through horizontal FDI for state-owned Chinese manufacturing firms.

In addition to explaining FDI-induced spillovers, absorptive capacity is also used by researchers to explain organizational phenomena that occur internally such as strategic alliances, knowledge transfer during an acquisition, and organizational learning (Lane et al., 2006). In the context of knowledge transfer, Deng (2010) conclude that absorptive capacity significantly determines the value-creation of two Chinese acquisitions. This is because the value-creation of an acquisition largely depends on the ability of the acquiring firms to absorb the knowledge and strategic assets of the acquired firm. Outside the realm of M&A, absorptive capacity also facilitates the transfer of technology in a strategic alliance. Mowery et al. (1996) through his study found that in an equity-based joint venture, the exploitation of technology does not occur automatically and requires firms within the alliance to have considerable amount of technological expertise, which represent absorptive capacity.

If we conceptualize MNE as interorganizational network consisting of "geographically dispersed and goal-disparate organization" (Bartlett and Ghoshal, 1990), then absorptive capacity may also facilitate the transfer of technologies or other capabilities at the firm-level between a parent and a subsidiary. The specialized knowledge of subsidiaries does not operate in a vacuum and can be shared to other units within the MNE network (Huber, 1991). However, since knowledge is often described as sticky and difficult to spread (Szulanski, 1996; Von Hippel, 1994), it requires internal capabilities in the form of absorptive

capacity to absorb this knowledge (Tsai, 2001). While this may sound theoretically plausible, the empirical evidence offers contradicting results (Kinoshita, 2000; Kneller, 2010). By using R&D intensity as a proxy for absorptive capacity for example, Kinoshita (2000) found no evidence in panel data of Czech manufacturing firms that the absorptive capacity of the affiliate helps it absorb technology from its MNE parent. Similarly, by using data from 25 transition countries in Eastern Europe, Kneller (2010) suggest that there is no evidence of a significant interaction effect between access to foreign technology and absorptive capacity. Given that foreign ownership involves the transfer of firm-specific assets such as technological capacity, the following hypothesis is proposed:

Hypothesis 2: Absorptive capacity positively moderates the influence of foreign ownership on the productivity of ASEAN manufacturing firms.

D. Theoretical Framework

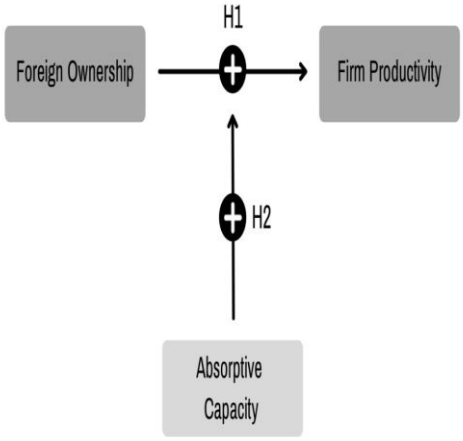

Fig. 1: Theoretical Model

The proposed theoretical model of the paper can be seen above in *Figure 1*. It consists of *foreign ownership*, *firm productivity*, and *absorptive capacity* to represent the independent variable, dependent variable, and the moderating variable, respectively. The arrow represents the direction of the effect, which can either be positive (+) or negative (-).

III. DATA AND METHODOLOGY

A. Sample and data

To test the proposed hypotheses, this research will use a panel dataset consisting of 688 manufacturing firms originating from Indonesia, Malaysia, and Vietnam, for the period 2014-2018. The three countries are selected because they represent 86% of manufacturing FDI inflows from 2012-2016 (*ASEAN Secretariat*, 2017). The sample is solely retrieved from the Orbis database, which contains company data and comprehensive financial information for over 125 million companies worldwide. Due to a lack of available data on several financial measures for private firms, the sample will only incorporate publicly listed companies spread across 20 industries according to NACE Rev.2 industry classification (see Table A1 in Appendix A). To improve the distribution of several variables and increase the reliability of the analysis, extreme outliers are deleted.[3] Due to missing data on several variables, the final sample size will vary from 229 to 2502 to maintain statistical power in certain models.

B. Variable measures

a) Dependent variable

Firm productivity will be proxied by *labour productivity*, which measures the ratio of output per labour input. Theoretically, total factor productivity (TFP) is preferable because it includes various inputs such as physical capital, material intensity, and labour. However, previous research on productivity showed that basic insights are not affected by using labour productivity instead of TFP (De Backer, 2001). In fact, many empirical studies have used labour productivity due to data limitation concerning the various inputs (Globerman et al., 1994; Doms and Jensen, 1998). Given similar constraint, this study will use *labour productivity* as the dependent variable, which are going to be measured using two proxies, namely: logarithm of sales per employee and logarithm of net income per employee. Two proxies are used instead of one to make the measure less sensitive to outliers and to generate a more robust result (Liu, Dutta, and Park, 2020).

The net income and sales number are obtained from *Orbis*, measured in thousands of USD, and adjusted to real terms using manufacturing price deflators derived from the *Economic Transformation Database.*[4] The manufacturing price deflator is calculated by dividing the nominal value-added by its corresponding real value-added for the manufacturing sector for a given country and year (using 2015 as the base year). The two proxies are then log-transformed to obtain a more normalized dataset and allow for a clear-cut interpretation (expressed in percentage). For the net income variable, since its log-transformed version is extremely skewed, negative net income values were deleted from the dataset.[5]

b) Independent variable

Foreign ownership will be measured using a dummy variable that takes a value of 1 if shares owned by foreign shareholders are equal or exceed a certain percentage amount and 0, otherwise. The ownership threshold varies across studies ranging from 10% or more (Blomstrom and

[3] Extreme outliers are detected using the ±3 standard deviation rule, which states that data points that lie beyond ±3 standard deviation away from the mean are considered as an extreme outlier and should therefore be deleted. A total of 3 firms are deleted from the sample; all of which originates from Indonesia.

[4] The Economic Transformation Database (ETD) contains comprehensive, long-term, and internationally comparable sectoral data on output and employment in Africa, Asia, and Latin America. The dataset covers the1990-2018 period and contains variables such as value-added constant, current prices, and persons employed across 12 different sectors. See de Vries et al. (2021) for the source.

[5] Even when the data series are scaled up by adding a constant, the variable remains extremely skewed after log-transformation.

Sjoholm, 1999), 50% or more (Kinoshita, 2000), to a complete 100% ownership (Takii, 2004). Some of these studies suggests that share of foreign ownership matters in determining the level of labour productivity (Takii, 2004; Blomstrom and Sjoholm, 1999). However, since the use of a continuous variable such as the firm's percentage of foreign shares is not possible,[6] this study will employ the 50% threshold to ensure that the effect of foreign ownership is indeed present.

c) Moderating variable

Much of the literature defines absorptive capacity as a knowledge base or the extent of prior knowledge within a firm. These studies follow the salient work of Cohen and Levinthal (1989) and used Research and Development (R&D) intensity as a proxy for absorptive capacity (Tsai, 2001; Mowery et al., 1996; Meeus et al., 2001). This is based on the conceptualization of R&D, which has two roles: to generate internal knowledge and to develop the firm's ability to assimilate outside knowledge (Cohen & Levinthal, 1989). However, due to inconsistent findings, multiple studies have used several alternative measures to operationalize absorptive capacity such as compensation policies, sharing routines, and competencies (Lane &Lubatkin, 1998; Lane, Salk, & Lyles, 2001; Meeus et al., 2001; Szulanski, 1996). Since *Orbis* database mostly contain financial information, this study will use R&D intensity as the most common measurement for absorptive capacity. This operationalization has a strong explanatory power and focuses on knowledge, especially in the context of technology and innovation (Cohen & Levinthal, 1989; Kinoshita, 2000; Liu et al., 2020). R&D intensity will be measured by the proportion of R&D expenses to total sales.

d) Control variables

To determine whether the productivity advantage of foreign firms is attributed to ownership-specific advantage as opposed to firm heterogeneity, industry composition, and country-level factors, several control variables are included in the analysis. The last two will be controlled by the creation of a dummy variable representing the industries and countries of the study, respectively. For firm heterogeneity, the following characteristics are specified and included in the analysis: size, age, liquidity, and leverage.

Size is an important source of productivity differentials between foreign and domestic firms because foreign firms are typically larger (De Backer, 2001; Griffith, 1999). Larger firms possess more intangible assets, exploit economies of scale more efficiently, and consequently are more productive (Kokko and Kravtsova, 2012). On the other hand, smaller size firms may also possess a more flexible management structure, resulting in a higher productivity level (Vujanovic et al., 2021). Firm size is measured by total assets (measured in thousands of USD).

Age is equally important in determining the productivity level of firms. Younger firms are typically less efficient than older firms and are pushed out of the industry before achieving true efficiency (Jovanovic, 1982). At the same time, newer firms may embody the latest technology and consequently attain higher productivity levels (De Backer, 2001). Firm age is measured as the number of years since establishment.

The effect of leverage on productivity can be described as non-linear. While higher leverage generally results in higher efficiency as it minimizes agency cost (Margaritis and Psillaki, 2010; Jensen and Meckling, 1976), an extremely high and low leverage can also have adverse impacts on the productivity of firms (Coricelli et al., 2012; Aghion et al., 2010). At low levels of leverage, leverage is associated with higher TFP growth since debt can be used to finance productive investments. As costs of leverage increases however, the cost of debt may overweigh the benefits and cause firms to suffer from a debt overhang problem (Coricelli et al., 2012). Firm leverage will be measured by the proportion of total debt and liabilities to total assets.

In the FDI-spillover literature, liquidity is required for firms to benefit from productivity spillovers (Alfaro et al., 2006). Moreover, as access to financing becomes widely available, local firms can start to supply multinationals and achieve spillover through backward linkages (Javorcik and Spatareanu, 2008). Using that logic, the more liquid a firm is, the more capable it is in undertaking projects that yield higher productivity. Firm liquidity is proxied by current ratio, which is measured by dividing current assets by current liabilities.

C. Methodology

a) Analytical approach

All of models in this study will be run using a random-effect GLS regression. Fixed-effect regression cannot be employed due to omission by collinearity between the fixed-effect dummy and time-invariant variables such as *foreign ownership* and *age*.[7] The use of a random-effect model can make the analysis particularly susceptible to omitted variable bias. However, since important firm-level characteristics are specified and controlled for in the analysis, this should not be a major issue. To ensure that random effects are indeed present, a Lagrange multiplier test is conducted, which results in the null hypothesis being rejected (p=0.00). This signifies that variation across entities exists and that random effect regression should be used instead of pooled OLS.

b) Model specification

This study will incorporate two models to test the first hypothesis and second hypothesis, respectively. As previously mentioned, the final sample size will vary due to

[6]The Orbis database does not disclose such information and only permits the screening of firms with a certain ownership parameter.

[7]Fixed effect model cannot be used to investigate time-invariant causes of the dependent variables because all variation across entities is eliminated to assess the net effect. On the other hand, a random-effect model assumes that the unique errors (time-invariant effects) are not correlated with the regressors, allowing the inclusion of time-invariant variables within the model.

many missing data on the *absorptive capacity* variable. Since the first hypothesis only tests whether foreign-owned manufacturing firms in ASEAN possess higher productivity than domestic-owned counterparts, *absorptive capacity* is not a relevant variable and will be excluded. This ensures that the sample size will be larger for the first model and that the statistical power of the regression is maintained. The first model can be summarized in *Equation 1* below:

$$\begin{aligned} lnProd_{it} = \beta_0 + \ & \beta_1 For_{it} + \beta_2 lnSize_{it} + \beta_3 Age_{it} \\ & + \beta_4 lnLev_{it} \\ & + \beta_5 lnLiq_{it} + \beta_6 IND_{it} \\ & + \beta_7 MAL_{it} + D_{nace} + \alpha_i + \varepsilon_{it} \end{aligned} \quad (1)$$

For each firm *i*at year *t*, $Prod_{it}$ is labour productivity measured in real terms (adjusted using price deflators) using two proxies: net income and sales per employee. For_{it} is a dummy variable with the value of 1 if foreign ownership >50%; 0 otherwise. $Size_{it}$ is firm size measured by total assets (measured in thousands of USD). Age_{it} is the age of the firm size measured by subtracting the latest fiscal year, 2020, with the year of establishment. Lev_{it} is the firm's leverage measured by the ratio of total debt and liabilities to total assets. Liq_{it} is the firm's liquidity measured by the ratio of current assets to current liabilities. By using Vietnam as the reference category, IND_{it} is a dummy variable with a value of 1 if firm *i* at year *t* is based in Indonesia; 0, otherwise. MAL_{it} is a dummy variable with a value of 1 if firm *i* at year *t* is in Malaysia; 0, otherwise. D_{nace} is a 2-digit NACE Rev.2 dummy for fixed industry effects[8]. β_0 is the intercept of the study, α_i is time-invariant firm-specific random effects, and ε_{it} is the error term over time *t*.

The second model extends the first by adding the variables R&D intensity and its interaction term to test for the second hypothesis that absorptive capacity positively moderates the influence of foreign ownership on the productivity of ASEAN manufacturing firms. RD_{it} is R&D intensity measured by dividing R&D expenses to total sales for firms *i* at year *t*. $For_{it} * RD_{it}$ is the interaction term between foreign ownership and R&D intensity for firms *i* at year *t*, which are included to test the moderation effect outlined in *Hypothesis 2*. The second model is summarized into *Equation 2* as presented below:

$$\begin{aligned} lnProd_{it} = \beta_0 + \ & \beta_1 For_{it} \\ & + \beta_2 lnRD_{it} + \beta_3 For_{it} * lnRD_{it} \\ & + \beta_4 lnSize_{it} + \beta_5 Age_{it} \\ & + \beta_6 lnLev_{it} \\ & + \beta_7 lnLiq_{it} + \beta_8 IND_{it} \\ & + \beta_9 MAL_{it} + D_{nace} + \alpha_i + \varepsilon_{it} \end{aligned} \quad (2)$$

[8] 2-digit NACE Rev.2 reflects the primary code of the industry. The use of primary code instead of secondary code (4-digit) is done to prevent the creation of too many dummy variables that represent the industry fixed effects.

c) Descriptive statistics

	N	Mean	St. dev	Skewness	Min	Max
Log of sales per employee	2502	4.37	1.24	-0.04	-4.93	10.06
Log of net income per employee	2098	1.24	1.66	-0.41	-6.85	6.90
Foreign Ownership (50%)	2502	0.16	0.36	1.88	0.00	1.00
Firm age	2502	36.13	19.61	1.62	1.00	160.00
Firm size	2502	10.91	1.81	0.26	3.12	16.99
Firm liquidity	2502	0.42	0.84	-0.87	-6.91	4.28
Firm leverage	2502	-0.82	0.66	-0.50	-4.14	2.83
R&D intensity	229	-6.16	1.84	-0.05	-11.17	-1.61
Indonesian firms	2502	0.38	0.48	0.51	0.00	1.00
Malaysian firms	2502	0.11	0.32	2.44	0.00	1.00

Table 1: Descriptive Statistics

A descriptive statistic is provided in *Table 1* to examine the variables and the nature of the dataset. This also allows for the discovery of any potential problem that violates the assumptions of regression such as heteroscedasticity and normality. It is important to note that the descriptive statistics seen above is after the removal of outliers. As can be seen in *Table 1*, the number of observations vary from 229 to 2502 due to missing data on the variable *net income per employee* and *R&D intensity*. When complete, the proportion of firms in the sample that originates from Indonesia, Malaysia, and Vietnam are 38%, 11%, and 51%, respectively.[9] Moreover, 16% percent of the firms in the sample are foreign-owned (as defined by the 50% ownership threshold) while 84% are domestic-owned. By looking at the skewness value, all of the variables appear to be normally distributed with the exception of *foreign ownership, firm* age, and Malaysian dummy. However, since it is inappropriate to log-transform these variables, no further adjustments were made.[10]

d) Multicollinearity

In addition to normality, the variables also need to be checked for multicollinearity. Multicollinearity problems exist when two or more independent variables are highly correlated with one another. When left unchecked, it may result in larger standard errors and counter-intuitive coefficient signs. To check for multicollinearity issue, we can examine the correlation matrix and calculate the variance inflation factor (VIF) for each variable.

[9]Vietnam is used as the reference category, which explains why it does not have a designated dummy variable.

[10]*Foreign ownership* and Malaysian dummy cannot be log-transformed since they are both a dummy variable. Additionally, log-transforming *firm age* would result in an incorrect interpretation of the coefficient (expressed in %)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Log of sales per employee	1.00							
(2) Log of net income per employee	0.70***	1.00						
(3) Foreign Ownership (50%)	0.06	0.07	1.00					
(4) Firm age	0.20**	0.10	0.40***	1.00				
(5) Firm leverage	0.08	-0.27***	-0.14*	-0.09	1.00			
(6) Firm liquidity	-0.04	0.32***	0.16*	0.05	-0.83***	1.00		
(7) Firm size	0.44***	0.31***	0.10	0.37***	0.03	-0.15*	1.00	
(8) R&D intensity	-0.09	0.15*	-0.07	0.02	-0.08	0.13	-0.20**	1.00

Table 2: Correlation Matrix

*p< 0.05, **p< 0.01, ***p< 0.001

Variable	**VIF**	**1/VIF**
Firm liquidity	3.50	0.285
Firm leverage	3.36	0.297
Firm age	1.39	0.717
Firm size	1.28	0.780
Foreign ownership	1.24	0.807
R&D intensity	1.08	0.929
Mean VIF	1.98	

Table 3: Variance Inflation Factor

Referring to the correlation matrix in *Table 2*, there is an indication of multicollinearity between the variable *firm liquidity* and *firm leverage* since the correlation coefficient is higher than |0.8|. However, upon further inspection of the VIF scores presented in *Table 3*, all variables have VIF scores below 10 and 5 (conservative approach). This suggests that multicollinearity is not a major issue in this study.

e) Heteroscedasticity

Another assumption that must be satisfied prior to running a regression is homoscedasticity, which is defined as a situation in which the variance of the residual is the same for all values of the independent variables. The opposing term, heteroscedasticity, violates this assumption and can be diagnosed using a Breusch-Pagan test. With the null hypothesis that there is a constant variance among the residuals, the test yielded the following value: $\chi^2 = 44.56$; significant at the 1% level. This means that heteroscedasticity is present in the data. To address this issue, all regressions will be done using a robust standard error, which corrects for any heteroscedasticity problems.

IV. ANALYSIS AND RESULTS

	(1a) Log of sales per employee	**(1b)** Log of net income per employee	**(2a)** Log of sales per employee	**(2b)** Log of net income per employee
Foreign Ownership (50%)	0.227*	0.291	-1.114**	-1.737
	(0.119)	(0.178)	(0.545)	(1.166)
Firm age	-0.009***	-0.008***	0.009	0.004
	(0.002)	(0.003)	(0.009)	(0.013)
Firm size	0.282***	0.308***	0.240**	0.124
	(0.033)	(0.036)	(0.097)	(0.166)
Firm leverage	0.180*	-0.127	-0.180	-0.221
	(0.103)	(0.132)	(0.218)	(0.346)
Firm liquidity	0.229**	0.345***	-0.106	0.096
	(0.104)	(0.099)	(0.160)	(0.242)
Indonesian firms	0.013	0.045	-0.059	0.189
	(0.102)	(0.143)	(0.285)	(0.651)
Malaysian firms	0.098	0.639***	0.460	0.717
	(0.124)	(0.161)	(0.759)	(0.955)
R&D intensity			0.004	0.075
			(0.022)	(0.052)
Foreign Ownership * R&D Intensity			-0.187**	-0.281
			(0.080)	(0.194)
Industry Dummies	Yes	Yes	Yes	Yes
Constant	1.560***	-2.399***	1.058	0.238
	(0.377)	(0.424)	(1.199)	(1.995)
N	2502	2098	229	205
R^2	0.309	0.311	0.380	0.405

Table 4: Regression Results

Standard errors reported in parentheses
*p< 0.10, **p< 0.05, ***p< 0.01

Table 5 presents the regression results for Model 1 and Model 2, which tests for *Hypothesis 1* and *Hypothesis 2*, respectively. The coefficient for the foreign ownership variable is positive and significant in model 1a ($\beta = 0.227$, $p < 0.10$) and positive but insignificant in model 1b ($\beta = 0.291$). In line with *Hypothesis 1*, these findings imply that foreign-owned ASEAN manufacturing firms experience 25.5% higher sales per employee as well as 33.77% higher net income per employee.[11] However, given that the productivity differential is only significant for one proxy of labour productivity: *sales per employee*, we can conclude that *Hypothesis 1* is only partially supported. The result is similar to Doms and Jensen (1998) who found that productivity differentials persist even after controlling for observable firm characteristics. As such, contrary to the findings of Ito (2002) and Globerman et al. (1994), there is partial evidence that foreign ownership, per se, confer productivity advantage to firms.

With respect to the firm-level controls, there are three significant variables: *firm age*, *firm size*, and *firm liquidity*. The effect of firm age towards productivity is significant but negligible (model 1a: $\beta = -0.009$, $p < 0.01$; model 1b: $\beta = -0.008$, $p < 0.01$). This means that there is no evidence that

[11] The exact interpretation of the regression coefficient is calculated using the following formula: $(e^{\beta} - 1)*100\%$

younger or older firms possess higher productivity compared to one another as proposed by De Backer (2001) or Jovanovic (1982). The effect of size on productivity is largely positive (model 1a: $\beta = 0.282$, $p < 0.01$; model 1b: $\beta = 0.308$, $p < 0.01$), which indicates that larger firms are generally more productive than smaller firms due to its ability to exploit economies of scale more efficiently. Similarly, the effect of liquidity on productivity is also significant and largely positive (model 1a: $\beta = 0.229$, $p < 0.05$; model 1b: $\beta = 0.345$, $p < 0.01$). This result shows the importance of financing access in determining productivity level of firms (Javorcik and Spatareanu, 2009). Lastly, the effect of firm leverage on productivity is mixed (model 1a: $\beta = 0.180$, $p < 0.10$; model 1b: β =-0.127).

Unlike the first model, the second model presents contrasting results with respect to the foreign ownership variable. Referring to *Table 5*, the coefficient for the foreign ownership dummy is negative and significant in model 2a ($\beta = -1.114$, $p < 0.05$) but insignificant in model 2b (β =-1.737). Contrary to *Hypothesis 1*, this indicates that foreign-owned ASEAN manufacturing firms are significantly less productive than domestic-owned firms. [12] Moreover, the interaction term between *foreign ownership* and *R&D intensity* are negative and significant in model 2a ($\beta = -0.187$, $p < 0.05$) as well as negative and insignificant in model 2b ($\beta = -0.281$). The corresponding marginal effect graphs can be observed in Figure B1 and Figure B2 in Appendix B. These findings are not in line with both *Hypothesis 1* and *Hypothesis 2* and indicate instead that absorptive capacity negatively moderates the productivity disadvantage experienced by ASEAN manufacturing firms. These counter-intuitive findings may be caused by two reasons. First, there are a lot of missing data on *R&D intensity* to the extent where the sample size in the second model is reduced to less than 10% of the first model. This significant reduction in sample size can result in unreliable statistics and regression outcomes. Secondly, the variable *R&D intensity and foreign ownership* might be substitutes to one another in explaining productivity growth (Kinoshita, 2000). This is evident in the sample because firms that possess high R&D intensity tend to be foreign owned. With that said, if both constructs measure the intangible assets of the firm (e.g., technological capacity and stock of knowledge); then controlling for *R&D intensity* would render foreign ownership to be insignificant or negative by itself. Nevertheless, *Hypothesis 2* is not supported and in line with Kinoshita (2000) and Kneller (2010), there is no evidence of a significant positive interaction effect between foreign ownership and absorptive capacity.

V. CONCLUSION

A. Summary of results

This study attempts to investigate the effect of foreign ownership on the productivity of ASEAN manufacturing firms and whether such effect is positively moderated by the firm's absorptive capacity. The analysis is performed using a random-effect GLS regression on a panel dataset consisting of 688 firms from Indonesia, Malaysia, and Vietnam over the 2014-2018 period.

By using a foreign ownership dummy and controlling for observed and unobserved firm heterogeneity, industry composition, and country-level factors; this study provides partial support to the proposition that foreign ownership confers a productivity advantage to ASEAN manufacturing firms. Furthermore, it can be observed as well that size, liquidity, and leverage are important firm-level productivity determinants that partially explain the existence of productivity differentials between foreign-owned and domestic-owned firms. In the second part of the analysis, the results significantly contrast the previous analysis such that the coefficient signs for the foreign ownership variable and its interaction term with R&D intensity are negative. This implies that foreign-owned ASEAN manufacturing firms possess lower productivity than its domestic counterpart and that absorptive capacity widens this gap. However, as previously mentioned, the results obtained from the second model might lack internal validity due to large missing data resulting in a small sample size as well as the substitutability of *foreign ownership* and *R&D intensity* as a construct in capturing the intangible assets of the firm.

B. Theoretical and managerial implications

The findings of this study highlight that foreign ownership is a significant determinant of productivity level even after factors at the firm, industry, and country-level are controlled for. Moreover, it provides some support to the notion that foreign-owned firms carry with them firm-specific advantages such as technological or managerial expertise that consequently translate to some form of productivity advantage as proposed by Caves (1996) and Dunning (2009). By employing multiple countries and a recent time frame to a relatively understudied ASEAN region, this paper adds depth and richness to the already vast literature on productivity differentials between foreign and domestic-owned firms. Furthermore, this paper also explores the role of absorptive capacity in facilitating the transfer of productivity-enhancing intangible assets across borders and MNE networks.

From a policy-making standpoint, the existence of productivity differentials between foreign-owned and domestic-owned manufacturing firms in ASEAN should prompt governments in the region to keep introducing policies and regulations (e.g., investment liberalization and free-trade agreements) to incentivize the inflows of manufacturing FDI. This is because productivity differentials might indicate the presence, scale, and scope of productivity spillovers arising from inward FDI, which consequently might lead to economic growth. Therefore, a complete de-industrialization experienced by many ASEAN countries to the service sector might not be the best approach to pursue.

C. Limitations and further direction of the study

This study has two major limitations which should be rectified in future research. First, due to missing data, particularly for R&D intensity, the result of the second hypothesis is questionable. Moreover, the substitutability of the variable *foreign ownership* and *R&D intensity* might also explain the counter-intuitive findings. Secondly, this study has

[12] Foreign-owned manufacturing firms in ASEAN possess 67.1% and 82.4% less sales per employee and net income per employee, respectively.

several methodological issues with respect to variable measurements. The use of foreign ownership dummy as the main IV for instance is problematic because it yields less insight and renders the use of fixed-effect models useless.[13] Additionally, this study could also have used total factor productivity in measuring productivity level since it considers varying inputs which are useful to the study of productivity determinants. Aside from addressing the limitations, future studies can examine ASEAN's service sector, which has been on the rise over the last couple of decades. Moreover, future studies can also take it one step further by examining productivity spillovers upon establishing that productivity differentials exist between foreign and domestic-owned firms.

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[13]By using a foreign ownership dummy, it is impossible to determine how different degrees of ownership will affect the productivity level of firms.

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APPENDIXES

A. Appendix A: Tables

Industry name	NACE Rev.2 code	No. of observations	Percentage (%)
Manufacture of food products	10	397	15.87
Manufacture of beverages	11	79	3.16
Manufacture of tobacco products	12	25	1.00
Manufacture of textiles	13	167	6.67
Manufacture of wearing apparel	14	73	2.92
Manufacture of leather and related products	15	20	0.80
Manufacture of wood	16	74	2.96
Manufacture of paper and paper products	17	161	6.43
Manufacture of coke and refined petroleum	19	44	1.76
Manufacture of chemicals and chemical products	20	242	9.67
Manufacture of basic pharmaceutical products and pharmaceutical preparations	21	175	6.99
Manufacture of rubber and plastic products	22	151	6.04
Manufacture of other non-metallic mineral products	23	213	8.51
Manufacture of basic metals	24	172	6.87
Manufacture of fabricated metal products	25	79	3.16
Manufacture of computer, electronic, and optical products	26	115	4.60
Manufacture of electrical equipment	27	65	2.60
Manufacture of machinery and equipment	28	151	6.04
Manufacture of motor vehicles, trailers, and semi-trailers	29	51	2.04
Manufacture of furniture	31	48	1.92
Total Observations		2502	100

Table A1. Variable Description and Data Source

Variable(s)	Description
Dependent Variable	
Labour Productivity	Measured by using two proxies: natural log of sales per employee and natural log of net income per employee. Both proxies are measured in thousands of USD and adjusted using a manufacturing price deflator to obtain the real terms. The price deflator, obtained from the Economic Transformation Database, is calculated by dividing the nominal value-added in the manufacturing industry by its corresponding real value-added (using 2015 as the base year).
Independent Variable	
Foreign Ownership	Dummy variable with the value of 1 if foreign ownership of a firm is equal to or greater than 50%; 0, otherwise.
Moderating Variables	
R&D Intensity	Measured by taking the natural logarithm of R&D expenses divided by total sales.
Control Variables	
Firm Age	Measured by subtracting the latest fiscal year, 2020, with the firm's year of establishment.
Firm Size	Measured by taking the natural logarithm of total assets (measured in thousands of USD).
Firm Leverage	Measured by taking the natural logarithm of total debt and liabilities divided by total assets.
Firm Liquidity	Measured by taking the natural logarithm of current ratio, which is obtained by dividing current assets by current liabilities.

Indonesian Firms	Using Vietnam as the reference category, this variable takes the value of 1 if the firm is based in Indonesia; 0, otherwise.
Malaysian Firms	Using Vietnam as the reference category, this variable takes the value of 1 if the firm is based in Malaysia; 0, otherwise.

Table A2: Variable Description

*All data are sourced from Orbis.

B. Appendix B: Figures

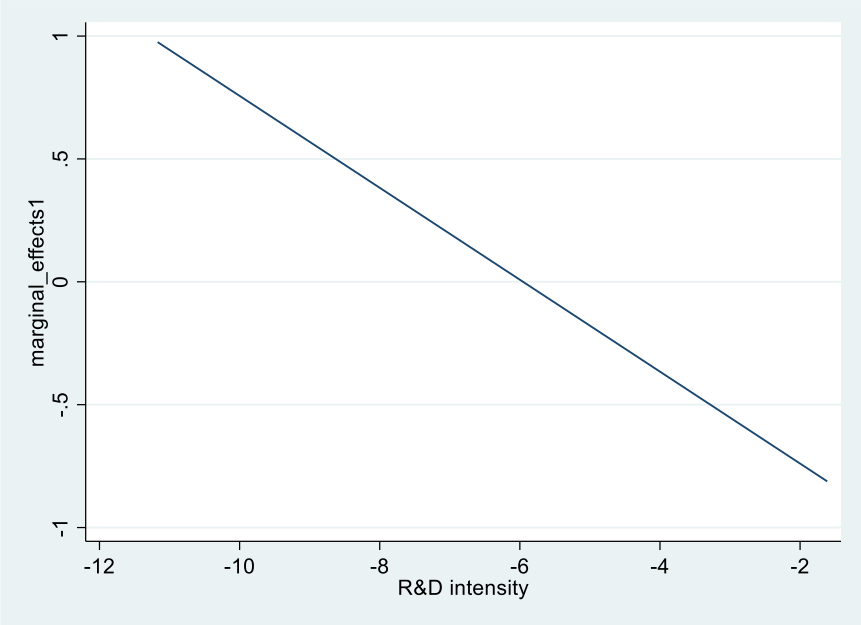

Fig. B1: Marginal effect of foreign ownership on labour productivity (sales per employee)

Note: R&D intensity is a log-transformed variable.

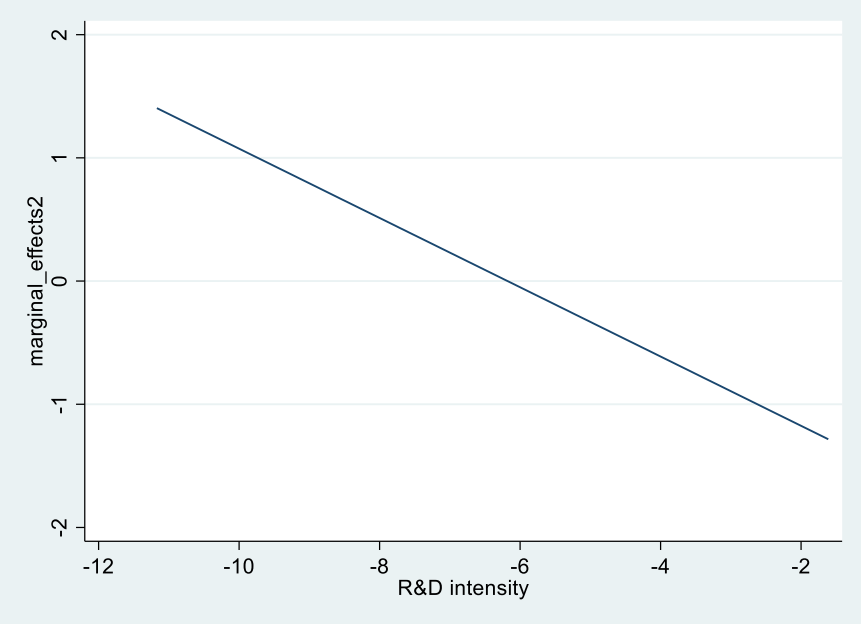

Fig. B2: Marginal effect of foreign ownership on labour productivity (net income per employee)

Note: R&D intensity is a log-transformed variable.

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