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1. Introduction

Recent empirical studies have rigorously examined the differences between exporting and non-exporting firms in both developed and developing countries, revealing that exporters are usually more productive and perform better than non-exporters in most cases.[1] The fundamental background of this finding is that, due to fixed costs pertaining to exporting activities, only the more productive firms are profitable enough to be able to bear the additional costs necessary to integrate into foreign and export markets (Crinò and Epifani, 2009). These costs commonly include transportation costs, distribution and marketing costs, foreign network costs, production costs for foreign consumption, and so forth. These costs are an entry barrier that less productive firms cannot overcome (Wagner, 2007). According to results from past studies in this field of trade literature, productivity differentials of exporting firms compared to non-exporting firms are generally found to be statistically significant and economically important.[2] These productivity differentials are mainly due to the self-selection hypothesis of more productive firms into export and international markets.

The empirical connection between firm/plant characteristics and export destinations can be perceived as additional evidence supporting the view that the self-selection mechanism depends on the type of market served by the firm/plant. Actually, there are also several reasons why self-selection may vary across markets. On one hand, different sunk costs are related to different markets' characteristics; such as distance, income, familiarity, language, legal and institutional structures. For instance, as trade costs increase with distance, lower productivity firms no longer find it profitable to serve export markets. Additionally, familiarity and affinity with the foreign market could be other determinants of the heterogeneity among trading firms. On the other hand, one may argue that more advanced

[1] See Wagner (2012a) for a recent comprehensive survey of empirical studies in the current trade literature.
[2] See, in particular, Bernard and Jensen (1999a), and Eaton, Kortum and Kramarz (2004, 2011). See also Tybout (2003), Bernard et al. (2007), Greenaway and Kneller (2007), Mayer and Ottaviano (2008).

markets, characterized by a higher competitive pressure, should impose stronger productivity requirements to exporting firms (Serti and Tomasi, 2008).

At the moment, few empirical studies have considered how exporters' performances vary with the characteristics of export destinations (Serti and Tomasi, 2008). For example, Damijan et al. (2004) provide evidence for Slovenia exporters, reporting that the productivity level required to enter developing countries is lower than that observed for firms serving high-income economies. De Loecker (2007) reports significantly higher productivity premia for firms starting to export to higher income countries. More importantly, the trade literature based on micro-level data has basically neglected the profitability aspect of firm/plant heterogeneity. This is partly due to data constraints in empirics, but comes as a surprise as success and survival of the firm/plant in the long run strictly depend on firm profitability.

Regarding this issue, a case in point that can be expected to be relevant for firms in Thailand is the distinction in performance (both productivity and profitability aspects) among domestic firms (firms that do not export), firms exporting to top trade partners and neighboring countries (i.e., ASEAN countries,[3] China, Japan, the US, and the EU) and firms exporting to countries that are not Thailand's main trade partners (i.e., Middle-Eastern countries and the rest of the world). A firm that exports has to deal with all aforementioned extra costs, while a non-exporter serving only the domestic market does not need to take care of these costs. Furthermore, other export-related costs can be expected to be higher for serving more advanced markets or markets that Thai exporters are not familiar with.

Despite the importance of the issue, this implication has not been tested empirically before. A reason for this gap in the literature is that the data from the official statistical offices in Thailand that were used in the past to investigate the connection between exporting and productivity did not contain any information for export destination. Fortunately in recent

[3] ASEAN was established on 8 August 1967 in Bangkok by the five original member countries: Indonesia, Malaysia, Philippines, Singapore, and Thailand. Brunei Darussalam joined on 8 January 1984, Vietnam on 28 July 1995, Laos and Myanmar on 23 July 1997, and Cambodia on 30 April 1999.

years, there are now some data that are rich enough to investigate this issue in detail in Thai manufacturing. The limited evidence available on the relationship between trader (especially exporter) characteristics and market heterogeneity need to be filled up with new findings. As a result, the aim of this paper is to broaden the micro-level evidence on firm/plant heterogeneity literature by giving a picture of the relationship between export destinations and plant heterogeneity, using Thai manufacturing as a case study for other developing countries.

Compared with previous studies, this paper examines in detail the relationship between export destinations and various plant performances and extends the analysis to include both productivity and profitability aspects. A cross-sectional econometric analysis is applied using the 2007 Industrial Census which was conducted by the Thai National Statistical Office (NSO) in 2006. In the empirical model, our analysis proceeds in three steps. We first convey a picture of how plant heterogeneity is associated with export destinations, distinguishing between plants that engage in export activities and plants that do not export. Second, we further extend the analysis by investigating the issue using OLS (Ordinary Least Squares) and probit estimations to provide more evidence. Third, multinomial logistic estimation is applied to analyze the choice of export destinations and plant heterogeneity.

The rest of this paper is organized as follows. Section 2 reviews the related literature and a brief picture of Thailand's trade classified by country. Section 3 presents the data and methodology used in the analysis. Section 4 reports the estimation results for exporter premia characterized by export destinations and plant heterogeneity by various estimations. Section 5 discusses the empirical evidence for the choice of export destinations and basic determinants. Finally, section 6 concludes the overall findings and suggests for possible implications for future research.

2. Related Literature and Thailand's Trade Classified by Country

Researchers have recently begun to carefully explore the number and characteristics of export markets and their relationships with firm/plant performance. According to the recent literature, the empirical evidence indicates a better performance of exporting firms and robust evidence for the self-selection hypothesis. Nevertheless, results for the learning-by-exporting hypothesis are still not conclusive. Most studies support the hypothesis that sunk entry costs to foreign markets are country-specific and are different among export destination countries. Therefore, self-selection would explain the greater productivity of firms exporting to more developed countries (Vacek, 2010). Moreover, some studies also reveal that exporting to more developed countries could bring greater productivity gains (i.e., Trofimenko, 2008; Boermans, 2010). Regarding the learning effects, two notable papers; namely, Damijan et al. (2004) and De Loecker (2007), examine whether learning effects depend on the export destinations. Examining Slovenian manufacturing firms by using the same data, Damijan et al. (2004) conclude that exporting per se does not guarantee productivity improvements. However, significant productivity improvements occur only when serving advanced and high-wage foreign markets. De Loecker (2007) also reveals evidence in favor of the learning-by-exporting hypothesis and reports that the productivity gains are higher for firms exporting to high-income regions. These two empirical studies have considered the relationship between exporters' productivity and destinations, while as far as we know, there are still extremely few studies documenting how exporters' characteristics regarding firm/plant profitability are associated with export destinations.

For empirical studies on the mode of internationalization of firms, Bernard and Jensen (2007) and Bernard et al. (2010) show that U.S. firms with the lowest productivity supply for only the domestic market, firms with higher productivity export, and firms with the highest

productivity invest abroad. Mayer and Ottaviano (2008) provide similar evidence for European firms. Wakasugi and Tanaka (2009) examines how productivity heterogeneity affects the sorting of export and foreign direct investment of Japanese firms in North America and Europe. Their results reveal that the internationalization modes of Japanese firms in North America and Europe are consistent with the theoretical prediction and the fixed costs are critical for determining the choice of internationalization modes.

For Thai manufacturing, there has been no complete study so far regarding this topic. This study is the first and comprehensive study for the Thai case to examine the relationship between export destinations and plant productivity and profitability aspects at the micro level.

Regarding a brief picture of the export destination of Thailand, Table 1 reveals that after 2002 the ASEAN (Association of Southeast Asian Nations) has replaced the US as Thailand's largest export market. Japan has been Thailand's largest import market for a long time since at least 2000. Total exports and imports in Thailand have vastly been increasing every year since 2000. Generally, the ASEAN, the US, the EU and Japan have been the top destinations for both exports and imports in Thailand, especially in the case of export markets. It is revealed that manufactured goods, machinery and food have been the main source of Thailand's international trade both in terms of exports and imports. By and large, total exports and imports in Thailand demonstrate an increasing trend almost every year since 2000.

Specifically, the manufacturing sector has dominated and accounted for a majority of total exports in Thailand since the trade liberalization in the 1990s. Thailand's exports, classified by the product group, mainly consist of manufacturing and agro-manufacturing products, electronics, and automotive. In recent years, exports in petroleum and petro-chemical products, machinery and equipment, and electrical appliances have also shown a huge increasing trend. Together, these products represent most of the total exports in Thailand.

Table 1: Thailand's Trade Classified by Country (Unit: Millions of US Dollars)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Exports														
Japan	10,283	9,946	9,950	11,356	13,492	15,090	16,386	18,119	20,094	15,723	20,309	23,870	23,466	22,236
United States	14,870	13,200	13,509	13,596	15,503	16,996	19,450	19,416	20,275	16,661	20,201	21,783	22,786	22,959
EU (28)	11,381	10,919	10,597	12,227	14,460	15,118	18,028	21,727	23,443	18,189	21,846	24,194	21,859	22,432
ASEAN	13,498	12,600	13,569	16,486	21,238	24,390	27,022	32,792	40,152	32,489	44,320	54,044	56,499	59,318
Middle East	2,111	2,150	2,450	2,881	3,698	4,469	5,721	7,483	9,494	8,750	9,633	10,352	11,677	11,715
Australia	1,636	1,362	1,642	2,160	2,468	3,175	4,350	5,938	7,983	8,578	9,370	7,997	9,763	10,349
China	2,837	2,874	3,555	5,689	7,113	9,167	11,728	14,847	16,191	16,119	21,474	26,250	26,870	27,238
Hong Kong	3,518	3,307	3,688	4,315	4,940	6,165	7,167	8,695	10,046	9,484	11,249	11,952	13,097	13,189
Taiwan	2,444	1,925	1,969	2,582	2,608	2,722	3,366	3,330	2,703	2,251	3,224	3,862	3,419	3,371
Others	1,266	1,037	1,089	1,307	1,877	2,543	2,857	4,057	5,379	4,761	5,603	6,864	7,029	7,321
Total Exports	**69,776**	**65,187**	**68,156**	**80,039**	**96,502**	**110,936**	**129,722**	**153,868**	**177,778**	**152,422**	**193,306**	**222,576**	**229,236**	**228,530**
Imports														
Japan	15,378	13,770	14,804	18,075	22,294	26,033	25,668	28,383	33,535	25,025	37,854	42,206	49,610	41,082
United States	7,317	7,162	6,147	7,093	7,206	8,683	9,588	9,495	11,423	8,374	10,677	13,394	12,520	14,627
EU (28)	6,524	7,822	7,257	7,758	9,413	10,819	11,248	11,954	14,342	12,053	13,889	17,892	20,196	22,863
ASEAN	10,346	10,014	10,819	12,490	15,834	21,624	23,599	25,068	30,140	24,700	30,362	37,157	40,349	41,738
Middle East	6,351	5,962	5,668	7,455	10,813	15,249	18,143	18,448	28,071	16,539	21,241	30,414	32,315	35,454
Australia	1,164	1,347	1,494	1,568	2,197	3,253	3,410	3,801	5,165	3,826	5,908	7,948	5,447	5,477
China	3,390	3,697	4,898	6,003	8,144	11,158	13,604	16,226	20,156	17,030	24,237	30,502	37,121	37,727
Hong Kong	887	822	904	1,064	1,326	1,505	1,541	1,441	1,958	1,730	1,817	2,340	1,901	1,625
Taiwan	2,908	2,590	2,886	3,195	3,964	4,503	5,099	5,735	6,220	4,798	6,815	7,506	8,216	7,599
Others	2,169	2,760	2,765	2,859	3,188	3,950	4,277	5,083	5,603	4,225	5,395	5,417	7,639	8,328
Total Imports	**62,180**	**61,752**	**64,242**	**75,038**	**94,034**	**118,178**	**128,773**	**139,966**	**179,225**	**133,709**	**182,921**	**228,787**	**249,988**	**250,723**

Notes: Since January 2007, EU comprises 27 countries, including Bulgaria and Romania. Since July 2013, EU comprises 28 countries, including also Croatia. Middle East comprises Bahrain, Egypt, Iran, Israel, Kuwait, Oman, Qatar, Saudi Arabia, UAE, Yemen, Iraq, Jordan, Lebanon, Libya, and Syria.
Source: Bank of Thailand (BOT)

3. Data, Variable Construction and Empirical Methodology

In this study, we use a detailed data set at the plant level from the 2007 Industrial Census of Thailand for the analysis throughout the paper. This data set was conducted by the National Statistical Office of Thailand which surveyed all establishments in 2006. The information is one of the most extensive sets of Thai industrial census data. The original sample size consists of 73,931 observations. Of these, 62,723 are enumerated observations (plants which were still in existence at the time the census was conducted). Due to missing information for some key variables, the census was cleaned up by first deleting plants that had not responded to one or more key questions and that had provided seemingly unrealistic information such as a negative value added and inputs used or total employment being less than one. As described in more detail (Ramstetter, 2004; Kohpaiboon, 2008), there are some duplicated records in both the data from Manufacturing Surveys and in the Industrial Census, presumably because plants belonging to the same firm completed the questionnaire using the same records. The procedure followed to address this problem was to treat the records that reported the same value for the seven key variables of interest in this study as one record.[4] Industries that are either for serving niches in the service sector's domestic market or are explicitly preserved for local enterprises were excluded from the Census data.[5]

As a result, the final dataset for the 2007 Industrial Census contains 49,432 observations in 115 industries at the 4-digit ISIC industry level and 22 industries at the 2-digit ISIC industry level. These observations will be the main sample used for the analysis in this paper. The statistical summary of the key variables is summarized in Table 2.

[4] See details in Ramstetter (2004) footnote 5. In addition, there are near-duplicate records. A careful treatment to maximize the coverage of the samples is used as described in more detail in Ramstetter (2004).
[5] See details in Kohpaiboon and Ramstetter (2008).

Table 2: Statistical Summary of the Key Variables

Variable	Unit	Obs	Mean	Std. Dev.	Min	Max
EX (Exporters)	zero-one dummy	49432	0.0781275	0.2683749	0	1
EX-ASEAN	zero-one dummy	49432	0.0170942	0.1296238	0	1
EX-CHMT	zero-one dummy	49432	0.0080312	0.0892575	0	1
EX-JPN	zero-one dummy	49432	0.0162041	0.126261	0	1
EX-US	zero-one dummy	49432	0.0143429	0.1189012	0	1
EX-EU	zero-one dummy	49432	0.0115108	0.10667	0	1
EX-ME	zero-one dummy	49432	0.0026906	0.0518014	0	1
EX-AUS	zero-one dummy	49432	0.0016791	0.0409425	0	1
EX-ROW	zero-one dummy	49432	0.0065747	0.0808183	0	1
VAL	baht	49432	263218.7	1562576	12.96296	2.37E+08
ln*VAL*	(ln) baht	49432	11.19161	1.678269	2.562096	19.28195
KI	proportion	49432	3.67E+07	4.61E+08	114	4.30E+10
ln*KI*	(ln) proportion	49432	11.50807	1.893647	1.221672	20.21774
MI	proportion	49432	337118	3561379	0.0040984	5.36E+08
ln*MI*	(ln) proportion	49432	10.72206	2.194733	-5.497168	20.10041
Sales	baht	49432	8.30E+07	1.01E+09	1	8.28E+10
ln(*Sales*)	(ln) baht	49432	14.19991	2.650745	0	25.1398
Sales Profit	baht	49432	7.27E+07	9.26E+08	-1.08E+07	8.25E+10
ln(*Sales Profit*)	(ln) baht	49380	14.11438	2.628411	5.298317	25.13578
Rate of Profit	proportion	49432	0.3288171	0.6613381	-80.29344	0.9999998
ln(*Rate of Profit*)	(ln) proportion	49011	0.2797566	0.2666292	-5.349608	0.6931471

Notes: Mean = simple average; Std. Dev. = standard deviation; Min = minimum; and Max = maximum;
Variables in the unit of (ln) proportion are the variables which are converted from original units into logarithmic form as ln (*x*) where *x* is the variable.
Source: Author's calculation

For variable definition, *EX* is an exporter dummy variable that takes the value of 1 if plant *i* in industry *j* exports and 0 otherwise. *EX-ASEAN* is a dichotomous variable that takes the value of 1 if a plant is an exporter to ASEAN countries (there are 9 countries included: Brunei Darussalum, Myanmar, Cambodia, Indonesia, Lao, Malaysia, Philippines, Singapore, and Vietnam) and 0 otherwise. *EX-CHMT* is a dichotomous variable that takes the value of 1 if a plant is an exporter to Chinese-based (Chinese speaking) countries/regions (there are 4 regions included: China, Hong Kong, Macao, and Taiwan) and 0 otherwise. *EX-JPN* is a dichotomous variable that takes the value of 1 if a plant is an exporter to Japan and 0 otherwise. *EX-US* is a dichotomous variable that takes the value of 1 if a plant is an exporter

to the United Sates (US) and 0 otherwise. *EX-EU* is a dichotomous variable that takes the value of 1 if a plant is an exporter to the European Union (there are 30 countries included for the EU in this analysis: see Appendix B) and 0 otherwise. *EX-ME* is a dichotomous variable that takes the value of 1 if a plant is an exporter to the Middle-Eastern countries/regions (there are 14 countries included for the ME in this analysis: see Appendix B) and 0 otherwise. *EX-AUS* is a dichotomous variable that takes the value of 1 if a plant is an exporter to Australia. *EX-ROW* is a dichotomous variable that takes the value of 1 if a plant is an exporter to the rest of the world (there are 41 countries included for the ROW in this analysis: see Appendix B). The details for classification of export destination for Thai manufacturing plants used in the analysis can be found in the Appendix B at the end of this paper.

As for other variables, *VAL* is value added per worker of a plant, *KI* represents capital intensity, *MI* represents material input intensity. *Sales* represents the total sales reported in a plant. Concerning the definition of profits used in this paper. Two profit measures are calculated and utilized from the available data. There are two types of profit measures which will be used for the analysis. The explanation of each type of firm profit is as follows.

First, *Sales Profit*, defined as the difference between revenue from total sales and the cost of making products before deducting taxation and interest payments, reflects gross profit of a firm that is primarily the difference between total sales and total production costs. Total sales include every type of sales of goods produced. Total production costs include cost of fuel and electricity for the production process, cost of materials and components, cost of repair and maintenance of goods, cost of repair and maintenance of machinery and equipment and other costs. Sales profit is a firm's residual profit after selling products and deducting costs associated with its production. Sales profit (or gross profit) is essential because it indicates how efficiently the firm/plant uses labor and supplies in the production process.

$$Sales\ Profit = Total\ Sales - Total\ Production\ Costs$$

Second, following Wagner (2012b), the *rate of profit* of a firm is computed as gross firm surplus (computed as gross value added minus total remunerations paid by the firm) divided by total sales minus net change of inventories:

$$Rate\ of\ Profit = \frac{Gross\ Value\ Added - Total\ Remunerations}{Total\ Sales - Net\ Change\ of\ Inventories}$$

Specifically, gross value added is calculated from the difference between gross output and total costs of production and expenditure of establishment. Total remunerations include gross wages, salaries, bonuses, and costs for medical care and social insurance paid by the firm. This profit measure is a measure for the price-cost margin which, under competitive conditions, should generally equal the required rental on assets employed per money unit of sales (Wagner, 2012b). Differences in profitability between firms, therefore, can follow from productivity differences, but also from different mark-ups of prices over costs and from differences in the capital intensity. In terms of our economic analysis, the rate of profit here is used as a proxy for the profit margin (the ratio of net income to net sales) in accounting.

Regarding the investigation of the relationship between export destinations and plant heterogeneity, a commonly used approach to examine differences in plant performances (i.e., productivity and profitability measures) between exporters and non-exporters, and among exporters that export to various destinations is to follow (sometimes with extensions and modifications) the methodology introduced by Bernard and Jensen (1999a and 1999b). Here, we start by exploring the differences in average plant performance (e.g., value added per worker) between exporters and non-exporters, and among exporters that export to various destinations. The next stage is the calculation of exporter premia, defined as the percentage

difference of several plant performances between exporters and non-exporters, and among exporters. These premia are evaluated from a regression of plant performance on the current export status (or type of exporter) and a set of control variables (typically including year, region, industry, firm size measured by the number of employees, and so forth). The equation for exporter premia can simply be written as follows:

$$ln(Plant\ Performance)_{it} = \beta_0 + \beta_1 Export_{it} + \beta_2 Control_{it} + e_{it} \qquad (1)$$

where i is the index of the plant, t is the index of the year. In our analysis, *Plant Performance* is productivity and profitability measures in any given plant, *Export* is a dummy variable for export status (1 if the plant exports in year t, 0 otherwise) or (1 if the plant exports to a given country/region in year t, 0 otherwise), *Control* is a vector of control variables (industry dummies, dummies for regions and firm size, and year dummies), and e is an error term. The export premia, calculated from the estimated coefficient β_1, demonstrates the average percentage difference on various measures between exporters and non-exporters, and among exporters that controls for the characteristics included in the *Control* vector (Wagner, 2007). An alternative of equation (1) is usually estimated with fixed or random effects to control for unobserved firm or plant heterogeneity due to time-invariant firm characteristics that might be correlated with the variables included in the empirical model, and that might result in biased estimates of the exporter premia. Equation (1) will be utilized later in both OLS and probit estimations.

Next, the export destinations which plants choose are categorized as follows:

(i) export to ASEAN countries (*EX-ASEAN*);

(ii) export to Chinese-based countries (*EX-CHMT*);

(iii) export to Japan (*EX-JPN*);

(iv) export to the United States of America (*EX-US*);

(v) export to Europe (*EX-EU*);

(vi) export to Middle Eastern countries (*EX-ME*);

(vii) export to Australia (*EX-AUS*);

(viii) export to the rest of the world (*EX-ROW*);

(ix) domestic supply only (non-exporters).

We assume that the plant chooses the optimal mode of internationalization (export destinations) among the potential choices so as to maximize its profit, ceteris paribus.

Following Wakasugi and Tanaka (2009), we conduct an additional test to investigate the relationship between the choice of export destinations and plant heterogeneity based on the multinomial logit model. As a result, the probability of the choice of export destinations is expressed by a multinomial logit function. Consequently, the probability that plant *i* chooses export destination *s* is simply expressed as follows:

$$P_i^s = \frac{exp\left[\alpha_{0,s} + \sum_j \beta_{j,s} Z_{i,j,s} + \sum_{m=1}^{n} \delta_{m,s} H_{i,m,s}\right]}{\sum_{s=1}^{9} exp\left[\alpha_{0,s} + \sum_j \beta_{j,s} Z_{i,j,s} + \sum_{m=1}^{n} \delta_{m,s} H_{i,m,s}\right]} \qquad (2)$$

where *s* is the export destination of plant *i*. α is the constant term. $Z_{i,j,s}$ are plant-specific factors that affect the choice of export destinations. For plant-specific factors in this study, we use labor productivity (*VAL*), capital intensity (*KI*), and material intensity (*MI*). $\beta_{j,s}$ is the parameter corresponding to each variable of plant-specific factors. $H_{i,m}$ is a dummy variable indicating the industry *m* to which plant *i* belongs. $\delta_{m,s}$ is the parameter indicating the degree to which plant characteristics affect the choice of export destinations.

4. Export Destinations and Plant Heterogeneity in Thai Manufacturing

4.1 Average Percentage Differences between Exporters and Non-exporters

As discussed in the introduction that there exists the detailed literature documenting the better performances of internationalized firms/plants relative to firms/plants that serve only the domestic market. In order to provide an informative empirical account of the correlation between international involvement (i.e., various export destinations or types of exporters) and plant performances, we proceed as follows. First in this section, we report simple descriptive statistics of differences between exporters and non-exporters in Thai manufacturing by graphical distributions of various plant performances both for productivity and profitability aspects between exporters and non-exporters. The estimated differences on the distributions of labor productivity, material intensity, capital intensity, total sales, sales profit, and the rate of profit are reported in Figure 1 to Figure 6, respectively, at the Appendix A of this paper. As expected from the theoretical prediction, exporters are more productive, more material- and capital-intensive, have more total sales and sales profit, and exhibit higher rate of profit when compared with non-exporters. The results displayed in Figure 1 to Figure 6 are statistically significant based on the Kolmogorov-Smirnov tests.

To this point, our analysis for the relationship between exporters' behavior and plant characteristics has been only focused on export status. We highlight that exporters differ from non-exporters in terms of various economic performances. We now extend our analysis by estimating average percentage differences for distinct export markets. One, in fact, can also argue that the heterogeneity among exporters depends largely on the destinations of exports. As discussed before, there are several reasons which could make export premia market-specific. Firms/plants trading with countries characterized by similar institutional, political and cultural conditions may not have to be as competitive as firms that trade with more distant

markets in geographical terms. Exporters with more traditional markets are likely to face lower sunk costs than exporters trading with unfamiliar markets. Specifically, the former may have access to well-established distributional networks. Hence, in general, heterogeneity among exporting firms/plants may emerge as a consequence of different competitive pressures, technological competencies, institutional and legal structures characterizing the various markets of destination and origin (Serti and Tomasi, 2008).

The estimated results for average percentage differences among exporters to various export destinations are reported in Table 3 for labor productivity (*VAL*), Table 4 for material intensity (*MI*), Table 5 for capital intensity (*KI*), Table 6 for *total sales*, Table 7 for *sales profit,* and Table 8 for the *rate of profit,* respectively. Table 3, Table 4 and Table 5 are the results for the depiction of differences among exporters in terms of productivity and input intensities. Table 6, Table 7 and to Table 8 are the results for the depiction of differences among exporters in terms of profitability.

As can be seen from Table 3 to Table 8, roughly speaking for productivity and input intensity aspects, *EX-ASEAN* (exporters to ASEAN countries) usually exhibit relatively higher labor productivity, material intensity and capital intensity when compared with other groups of exporters. Specifically on average (mean) term, exporters to ASEAN countries are 147.16% more productive, 161.17% more material-intensive, and 185.46% more capital-intensive than non-exporters. However, *EX-JPN* (exporters to Japan) tend to be the most capital-intensive groups of exporters (190.37% compared to non-exporters). *EX-CHMT* (exporters to Chinese-based regions) also exhibit relatively high values of material and capital intensities (142.79% and 186.49% respectively compared to non-exporters). Furthermore, generally speaking for profitability aspects, exporters to Japan have the largest total sales (189.15%) and are the most profitable groups of exporters in terms of sales profit (189.12%) and the rate of profit (13.14%). Exporters to ASEAN countries also have moderately higher

total sales and sales profit when compared with non-exporters. Precisely for the rate of profit, exporters to Japan exhibit 13.14% higher rate of profit when compared with non-exporters and the rate is the highest among exporters. Surprisingly, *EX-AUS* (exporters to Australia) is the second groups of exporters that have fairly high rate of profit at 12.88%.

Thai plants tend to export to familiar and neighboring markets/countries such as ASEAN countries, Chinese-based regions, and Japan. As already shown in Table 1, these export destinations are Thailand top destinations for exporters in recent years. Thai exporters are also likely to have well-established exporting networks with these countries/regions. It follows that a relatively high productivity level might be required to serve these markets.

Table 3: Average Percentage Difference in Labor Productivity (VAL)

Statistical Summary of Exporting Plants & Non-Exporting Plants in the Sample						Percentage Difference in VAL	
Type of Plant	Obs	Mean	Std. Dev.	Min	Max	Compared to Non-Exporting Plants	
Exporters to ASEAN	845	1346571	5186623	2392.563	1.17E+08	147.16%	[1]
Exporters to CHMT	397	956185.7	1543976	6748.729	1.51E+07	129.40%	
Exporters to JPN	801	1140082	3713545	2381.657	8.79E+07	139.05%	[2]
Exporters to US	709	616632.5	1065868	2433.267	1.57E+07	100.22%	
Exporters to EU	569	561281.5	1323194	2286.702	2.81E+07	93.01%	
Exporters to ME	133	669140.4	960306.1	6363.636	6.63E+06	106.21%	
Exporters to AUS	83	1047494	1648711	23074.41	1.05E+07	134.54%	[3]
Exporters to ROW	325	949748.3	1846885	19388.23	2.11E+07	129.00%	
Exporters	3862	950759	3148214	2286.702	1.17E+08	129.07%	
Non-Exporters	45570	204950.5	1328665	12.96296	2.37E+08	0	

Notes: [1] is marked for the highest value. [2] is marked for the second highest value and [3] is marked for the third highest value.

Table 4: Average Percentage Difference in Material Intensity (MI)

Statistical Summary of Exporting Plants & Non-Exporting Plants in the Sample						Percentage Difference in MI	
Type of Plant	Obs	Mean	Std. Dev.	Min	Max	Compared to Non-Exporting Plants	
Exporters to ASEAN	845	2345924	1.91E+07	1500	5.36E+08	161.17%	[1]
Exporters to CHMT	397	1511103	3410903	2073.333	3.64E+07	142.79%	[2]
Exporters to JPN	801	1215813	2692690	1780.731	3.96E+07	131.28%	
Exporters to US	709	744226.9	1452881	281.6667	1.56E+07	98.75%	
Exporters to EU	569	643094.9	1728405	85.10638	3.06E+07	87.32%	
Exporters to ME	133	1195208	3155703	4365	2.21E+07	130.30%	
Exporters to AUS	83	1294571	2255127	8000	1.40E+07	134.78%	
Exporters to ROW	325	1399141	3313654	0.5	4.15E+07	138.91%	[3]
Exporters	3862	1338889	9232130	0.5	5.36E+08	136.59%	
Non-Exporters	45570	252219.2	2538597	0.0040984	3.97E+08	0	

Notes: [1] is marked for the highest value. [2] is marked for the second highest value and [3] is marked for the third highest value.

Table 5: Average Percentage Difference in Capital Intensity (KI)

Statistical Summary of Exporting Plants & Non-Exporting Plants in the Sample						Percentage Difference in KI	
Type of Plant	Obs	Mean	Std. Dev.	Min	Max	Compared to Non-Exporting Plants	
Exporters to ASEAN	845	3.42E+08	1.37E+09	7750	2.48E+10	185.46%	[3]
Exporters to CHMT	397	3.69E+08	1.67E+09	152450	2.28E+10	186.49%	[2]
Exporters to JPN	801	5.23E+08	2.41E+09	2850	4.30E+10	190.37%	[1]
Exporters to US	709	1.95E+08	6.56E+08	47500	1.27E+10	175.18%	
Exporters to EU	569	1.67E+08	9.30E+08	11450	1.87E+10	171.32%	
Exporters to ME	133	1.44E+08	4.89E+08	119750	4.45E+09	167.11%	
Exporters to AUS	83	1.81E+08	5.71E+08	198700	4.76E+09	173.39%	
Exporters to ROW	325	3.31E+08	1.40E+09	58501	1.71E+10	185.00%	
Exporters	3862	3.18E+08	1.52E+09	2850	4.30E+10	184.41%	
Non-Exporters	45570	1.29E+07	1.70E+08	114	1.80E+10	0	

Notes: [1] is marked for the highest value. [2] is marked for the second highest value and [3] is marked for the third highest value.

Table 6: Average Percentage Difference in Total Sales

Statistical Summary of Exporting Plants & Non-Exporting Plants in the Sample						Percentage Difference in Total Sales	
Type of Plant	Obs	Mean	Std. Dev.	Min	Max	Compared to Non-Exporting Plants	
Exporters to ASEAN	845	7.26E+08	2.93E+09	40000	4.16E+10	184.08%	[3]
Exporters to CHMT	397	6.26E+08	2.37E+09	420000	3.95E+10	181.65%	
Exporters to JPN	801	1.08E+09	3.97E+09	120000	7.24E+10	189.15%	[1]
Exporters to US	709	6.28E+08	3.38E+09	47750	8.28E+10	181.70%	
Exporters to EU	569	3.80E+08	1.29E+09	210000	1.99E+10	170.64%	
Exporters to ME	133	3.76E+08	1.11E+09	800000	7.43E+09	170.35%	
Exporters to AUS	83	3.84E+08	7.26E+08	166000	4.03E+09	170.92%	
Exporters to ROW	325	7.94E+08	3.52E+09	620000	5.60E+10	185.39%	[2]
Exporters	3862	7.07E+08	3.03E+09	40000	8.28E+10	183.67%	
Non-Exporters	45570	3.01E+07	5.46E+08	1	7.08E+10	0	

Notes: [1] is marked for the highest value. [2] is marked for the second highest value and [3] is marked for the third highest value.

Table 7: Average Percentage Difference in Sales Profit

Statistical Summary of Exporting Plants & Non-Exporting Plants in the Sample						Percentage Difference in Sales Profit	
Type of Plant	Obs	Mean	Std. Dev.	Min	Max	Compared to Non-Exporting Plants	
Exporters to ASEAN	845	6.33E+08	2.69E+09	39000	4.00E+10	183.81%	[2]
Exporters to CHMT	397	5.43E+08	2.22E+09	414240	3.75E+10	181.25%	
Exporters to JPN	801	9.55E+08	3.75E+09	112800	7.18E+10	189.12%	[1]
Exporters to US	709	5.61E+08	3.33E+09	44150	8.25E+10	181.83%	
Exporters to EU	569	3.33E+08	1.15E+09	185000	1.81E+10	170.31%	
Exporters to ME	133	3.35E+08	1.01E+09	716000	6.75E+09	170.47%	
Exporters to AUS	83	3.18E+08	6.26E+08	162000	3.97E+09	169.02%	
Exporters to ROW	325	6.30E+08	2.18E+09	610600	2.92E+10	183.74%	[3]
Exporters	3862	6.16E+08	2.78E+09	39000	8.25E+10	183.38%	
Non-Exporters	45570	2.67E+07	5.00E+08	-1.08E+07	7.04E+10	0	

Notes: [1] is marked for the highest value. [2] is marked for the second highest value and [3] is marked for the third highest value.

Table 8: Average Percentage Difference in Rate of Profit

Statistical Summary of Exporting Plants & Non-Exporting Plants in the Sample						Percentage Difference in Rate of Profit	
Type of Plant	Obs	Mean	Std. Dev.	Min	Max	Compared to Non-Exporting Plants	
Exporters to ASEAN	845	3.58E-01	2.43E-01	-2.886373	9.57E-01	9.05%	
Exporters to CHMT	397	3.46E-01	4.73E-01	-8.207151	9.40E-01	5.65%	
Exporters to JPN	801	3.73E-01	2.09E-01	-1.567339	9.65E-01	13.14%	[1]
Exporters to US	709	3.41E-01	2.34E-01	-1.755352	9.20E-01	4.19%	
Exporters to EU	569	2.98E-01	9.62E-01	-21.90576	9.20E-01	9.28%	[3]
Exporters to ME	133	3.35E-01	1.95E-01	-0.7700012	7.58E-01	2.42%	
Exporters to AUS	83	3.72E-01	1.87E-01	-0.1413359	7.55E-01	12.88%	[2]
Exporters to ROW	325	3.47E-01	1.85E-01	-0.2537068	9.49E-01	5.93%	
Exporters	3862	3.46E-01	4.43E-01	-21.90576	9.65E-01	5.65%	
Non-Exporters	45570	3.27E-01	6.77E-01	-80.29344	1.00E+00	0	

Notes: [1] is marked for the highest value. [2] is marked for the second highest value and [3] is marked for the third highest value.

4.2 OLS Estimation: Export Premia for Various Export Destinations

Up to this point, we show the statistical differences between exporters and non-exporters and the average percentage differences among exporters by various plant performances in terms of both productivity and profitability aspects. In this subsection, we extend our analysis for the relationship between export destinations and plant heterogeneity by using OLS (Ordinary Least Squares) estimation to provide econometric evidence for export premia among different types of exporters classified by their export destinations. The estimation results are reported in Table 9 for both OLS and robust OLS estimations. In our econometric definition, OLS regression is a least squares regression with White's heteroscedasticity robust t-statistics and robust OLS regression is a least squares regression when eliminating from the data set the influential observations, that is, the outliers and/or the explanatory variables significantly deviated from the mean judged in terms of Cook's distance measure. The estimated results for OLS are displayed in the upper row and results for robust OLS are displayed in the lower row of each corresponding type of exporter in Table 9.

From Table 9, regarding productivity and input intensity aspects, *EX-CHMT*, *EX-ASEAN*, and *EX-JPN* are among the most productive (*VAL*) groups of exporters, respectively. Next, *EX-CHMT*, *EX-ASEAN*, and *EX-AUS* are among the most material-intensive (*MI*) groups of exporters, respectively. Lastly, *EX-CHMT*, *EX-ASEAN* and *EX-JPN* are among the most capital-intensive (*KI*) groups of exporters, respectively (as revealed by the highest values of export premia when compared with other types of exporters). Concerning profitability aspects, similar to the case of labor productivity, *EX-CHMT*, *EX-ASEAN*, and *EX-JPN* generally have the highest total sales, respectively. As expected, *EX-CHMT*, *EX-ASEAN*, and *EX-JPN* also exhibit the highest sales profit, respectively. Finally, *EX-JPN*, *EX-CHMT* and *EX-ASEAN* reveal the highest rate of profit, respectively.

Table 9: OLS Estimation - Export Destinations and Plant Heterogeneity

	ln*VAL*	ln*MI*	ln*KI*	ln(*Total Sales*)	ln(*Sales Profit*)	ln(*Rate of Profit*)
	Estimated Coefficients by OLS					
EX-ASEAN	0.741***	0.942***	0.746***	1.095***	1.067***	0.0188**
	(16.58)	(16.17)	(14.06)	(18.12)	(17.55)	(3.04)
Adjusted R^2	0.367	0.263	0.202	0.564	0.56	0.038
[Robust OLS]	0.660***	0.838***	0.637***	1.029***	1.005***	0.0112
	(14.81)	(14.43)	(11.24)	(16.46)	(16.06)	(1.67)
Adjusted R^2	0.379	0.309	0.196	0.569	0.561	0.079
EX-CHMT	0.924***	1.102***	0.903***	1.360***	1.336***	0.0239**
	(14.19)	(12.60)	(11.33)	(15.03)	(14.73)	(3.03)
Adjusted R^2	0.366	0.262	0.201	0.563	0.559	0.038
[Robust OLS]	0.840***	0.999***	0.807***	1.277***	1.249***	0.0132
	(13.18)	(12.04)	(9.98)	(14.30)	(13.97)	(1.37)
Adjusted R^2	0.378	0.308	0.196	0.568	0.561	0.079
EX-JPN	0.668***	0.678***	0.538***	0.953***	0.913***	0.0300***
	(15.11)	(11.96)	(9.75)	(16.86)	(16.04)	(5.30)
Adjusted R^2	0.366	0.261	0.201	0.563	0.559	0.038
[Robust OLS]	0.584***	0.602***	0.493***	0.907***	0.870***	0.0175*
	(12.51)	(9.89)	(8.32)	(13.86)	(13.28)	(2.48)
Adjusted R^2	0.377	0.307	0.195	0.568	0.56	0.079
EX-US	0.389***	0.492***	0.227***	0.674***	0.664***	0.00959
	(8.57)	(8.65)	(4.02)	(11.09)	(10.98)	(1.48)
Adjusted R^2	0.364	0.26	0.2	0.562	0.558	0.038
[Robust OLS]	0.326***	0.394***	0.139*	0.614***	0.609***	0.00103
	(6.60)	(6.11)	(2.21)	(8.86)	(8.78)	(0.14)
Adjusted R^2	0.376	0.307	0.194	0.567	0.559	0.079
EX-EU	0.343***	0.371***	0.158**	0.585***	0.564***	-0.00166
	(7.20)	(5.86)	(2.59)	(9.15)	(8.81)	(-0.19)
Adjusted R^2	0.364	0.26	0.2	0.562	0.558	0.038
[Robust OLS]	0.275***	0.302***	0.0778	0.536***	0.527***	-0.00344
	(5.09)	(4.30)	(1.13)	(7.08)	(6.95)	(-0.42)
Adjusted R^2	0.376	0.306	0.194	0.567	0.559	0.079

	ln*VAL*	ln*MI*	ln*KI*	ln(*Total Sales*)	ln(*Sales Profit*)	ln(*Rate of Profit*)
	Estimated Coefficients by OLS					
EX-ME	0.437***	0.598***	0.247*	0.733***	0.717***	-0.00901
	(4.39)	(4.27)	(2.01)	(5.07)	(4.89)	(-0.51)
Adjusted R^2	0.364	0.26	0.2	0.561	0.557	0.038
[Robust OLS]	0.336**	0.428**	0.140	0.607***	0.593***	-0.00761
	(3.09)	(3.02)	(1.01)	(3.98)	(3.88)	(-0.47)
Adjusted R^2	0.376	0.306	0.194	0.566	0.559	0.079
EX-AUS	0.607***	0.839***	0.392*	0.931***	0.901***	0.0261
	(4.76)	(5.21)	(2.43)	(5.37)	(5.13)	(1.69)
Adjusted R^2	0.364	0.26	0.2	0.561	0.557	0.038
[Robust OLS]	0.556***	0.797***	0.350*	0.922***	0.895***	0.0132
	(4.04)	(4.46)	(2.01)	(4.79)	(4.64)	(0.64)
Adjusted R^2	0.376	0.307	0.194	0.566	0.559	0.079
EX-ROW	0.525***	0.723***	0.479***	0.880***	0.854***	0.00617
	(8.04)	(7.88)	(6.29)	(10.08)	(9.76)	(0.77)
Adjusted R^2	0.364	0.26	0.2	0.562	0.558	0.038
[Robust OLS]	0.460***	0.689***	0.405***	0.836***	0.811***	-0.00524
	(6.55)	(7.53)	(4.54)	(8.49)	(8.22)	(-0.50)
Adjusted R^2	0.376	0.307	0.194	0.567	0.56	0.079
Industry Controlled	Yes	Yes	Yes	Yes	Yes	Yes
Region Controlled	Yes	Yes	Yes	Yes	Yes	Yes
Size Controlled	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49432	49432	49432	49432	49380	49011

Notes: Heteroscedasticity robust t-statistics in parentheses. ***, **, and * represent significance at 1%, 5%, and 10% confidence levels, respectively.
Source: Author's calculation

4.3 Probit Estimation: Export Premia for Various Export Destinations

For this subsection, we utilize the probit estimation to provide additional evidence and confirmation for the differences among export destinations and plant heterogeneity. The estimated results for both coefficients and marginal effects are reported in Table 10.

As can be seen, the overall size of marginal effects is rather small, but this can be used to provide further insight regarding export destinations and plant heterogeneity in Thai manufacturing. For productivity and input intensity aspects, being an exporter to ASEAN countries (*EX-ASEAN*) increases the probability of an improvement in labor productivity by 0.29% (0.24% for *EX-JPN*, 0.16% for *EX-US*, and 0.14% for *EX-CHMT*). Moreover, being an *EX-ASEAN* increases the probability of an improvement in material intensity by 0.22% (0.17% for *EX-JPN*, 0.11% for *EX-US*, and 0.10% for *EX-CHMT*). Furthermore, being an *EX-*

ASEAN also increases the probability of an improvement in capital intensity by 0.21% (0.16% for *EX-JPN*, 0.11% for *EX-CHMT*, and 0.08% for *EX-US*).

Regarding the profitability aspects, being an *EX-ASEAN* raises equally the probability of an enhancement in both total sales and sales profit by approximately 0.20% (0.17% for *EX-JPN*, 0.12% for *EX-US*, and 0.11% for *EX-EU*). Importantly, being an *EX-JPN* raises the probability of an enhancement in the rate of profit by 0.57%. (0.23% for *EX-US* and 0.16% for *EX-CHMT*). The estimated results for *EX-ASEAN* for the rate of profit are not statistically significant. The estimated results for the rate of profit may not come as a surprise since Japan has been one of the major trade partners for Thailand for decades. From past experience, Thai exporters to Japan tend to be able to learn to improve their products and eventually learn how to improve the overall rate of profit over time.

One reason for *EX-ASEAN* associating with high productivity and profitability (as reflected by marginal effects) is that of the country proximity and the similarity between Thailand and these countries. Since, in geographical terms, ASEAN countries are near to Thailand and many Thai exporters are familiar with trading with these neighboring countries, trade in Thailand in recent years tend to concentrate in Asian countries, including ASEAN countries, Chinese-based countries (especially China), and Japan, instead of countries that are far away (e.g., the EU and Middle-Eastern countries). As a result, familiarity and affinity with the foreign market and export destination could be an important determinant of the heterogeneity among Thai exporters.

Generally, the findings in this section confirm the facts that ASEAN countries, China and Japan have been the most important trade partner and top export destinations for Thai manufacturing in recent years. These results from Thai manufacturing contribute to the existing literature and new aspects of examining empirically the relationship between export destinations and firm/plant heterogeneity, especially for the case of developing countries.

Table 10: Probit Estimation - Export Destinations and Plant Heterogeneity

	EX-ASEAN	*EX-CHMT*	*EX-JPN*	*EX-US*	*EX-EU*	*EX-ME*	*EX-AUS*	*EX-ROW*
	Estimated Marginal Effects (%) and Coefficients							
ln(Labor Productivity)	0.29%	0.14%	0.24%	0.16%	0.13%	0.03%	0.03%	0.09%
	0.266***	0.266***	0.275***	0.208***	0.170***	0.155***	0.182***	0.192***
	(17.03)	(14.36)	(17.04)	(12.70)	(10.42)	(5.63)	(5.85)	(9.93)
Observations	49392	49109	49391	49391	49227	47515	48295	49267
Pseudo R^2	0.2677	0.2395	0.3199	0.3172	0.2621	0.1868	0.1844	0.2187
ln(Material Intensity)	0.22%	0.10%	0.17%	0.11%	0.08%	0.02%	0.02%	0.07%
	0.191***	0.175***	0.151***	0.129***	0.0936***	0.110***	0.139***	0.133***
	(16.18)	(11.47)	(12.82)	(10.79)	(7.70)	(5.06)	(5.73)	(6.42)
Observations	49392	49109	49391	49391	49227	47515	48295	49267
Pseudo R^2	0.2677	0.2295	0.3032	0.3104	0.2551	0.1854	0.1841	0.2161
ln(Capital Intensity)	0.21%	0.11%	0.16%	0.08%	0.05%	0.01%	0.01%	0.05%
	0.155***	0.153***	0.129***	0.0771***	0.0499***	0.0418*	0.0668*	0.0910***
	(12.22)	(9.45)	(9.54)	(6.27)	(4.13)	(2.06)	(2.55)	(5.94)
Observations	49392	49109	49391	49391	49227	47515	48295	49267
Pseudo R^2	0.2531	0.2171	0.296	0.3006	0.2484	0.1731	0.1661	0.2045
ln(Total Sales)	0.20%	0.09%	0.17%	0.12%	0.11%	0.03%	0.02%	0.07%
	0.250***	0.250***	0.245***	0.216***	0.182***	0.166***	0.176***	0.204***
	(20.91)	(17.34)	(20.42)	(17.09)	(14.53)	(8.28)	(7.60)	(13.72)
Observations	49392	49109	49391	49391	49227	47515	48295	49267
Pseudo R^2	0.2907	0.2611	0.3307	0.3325	0.2752	0.2008	0.1976	0.2372
ln(Sales Profit)	0.20%	0.09%	0.17%	0.12%	0.11%	0.03%	0.02%	0.07%
	0.243***	0.245***	0.233***	0.212***	0.176***	0.162***	0.170***	0.197***
	(20.61)	(17.14)	(19.70)	(17.03)	(14.11)	(7.94)	(7.37)	(13.32)
Observations	49340	49058	49339	49339	49175	47465	48245	49215
Pseudo R^2	0.2878	0.2589	0.3268	0.3314	0.2736	0.1997	0.1956	0.235
ln(Rate of Profit)	0.21%	0.16%	0.57%	0.23%	0.00%	-0.02%	0.05%	0.04%
	0.128	0.192*	0.407***	0.211*	0.00253	-0.0909	0.224	0.0546
	(1.52)	(2.01)	(4.49)	(2.52)	(0.03)	(-0.78)	(1.32)	(0.64)
Observations	48971	48689	48970	48970	48806	47097	47877	48846
Pseudo R^2	0.2325	0.1949	0.2841	0.2957	0.2456	0.1711	0.1617	0.1962

Notes: Heteroscedasticity robust t-statistics in parentheses. ***, **, and * represent significance at 1%, 5%, and 10% confidence levels, respectively.
Source: Author's calculation

5. The Choice of Export Destinations and Plant Heterogeneity

Several empirical studies, especially in the case of developed countries, have provided evidence on the relationship between firm heterogeneity and internationalization status. In this section, we test for the basic determinants and the probability of plants' choices in choosing export destinations in Thai manufacturing by applying the multinomial logistic regression to equation (2). The estimated results for both coefficients and marginal effects, and tests of Independence of Irrelevant Alternatives (IIA) are all reported in Table 11. As can be seen, Table 11 presents the estimated results showing that labor productivity (*VAL*), material intensity (*MI*) and capital intensity (*KI*) significantly affect the probability of choosing export destinations. All the estimated results on the relationship between productivity and the choice of export destinations under the multinomial logit model are comparatively consistent with the findings and results in section 4. From table 11, it is revealed that plants with high productivity are more likely to choose to export to the US, the EU, Japan and ASEAN countries, respectively. This means that plants are likely to export to destinations farer as their productivity improves. Furthermore, plants with high capital intensity are more likely to choose to export to ASEAN countries and Chinese-based (China, Hong Kong, Macao, Taiwan) regions, respectively. Lastly, plants with high material intensity are more likely to choose to export to the US, ASEAN countries, Japan and the EU, respectively.

For the post multinomial logistic regression by tests of IIA (independence of irrelevant alternatives) assumption and tests of independent variables, we can see that IIA is not violated in Small-Hsiao tests of IIA assumption (a significant test is evidence against H_o).[6] Additionally, we can also see that the effects of each variable are significant at the 5 percent confidence level.

[6] See Small and Hsiao (1985) for the details concerning multinomial logit specification tests.

Table 11: Multinomial Logistic Estimation – The Choice of Export Destinations

	Non-Exporters	*EX-ASEAN*	*EX-CHMT*	*EX-JPN*	*EX-US*	*EX-EU*	*EX-ME*	*EX-AUS*	*EX-ROW*
					Coefficients				
ln*VAL*		0.745***	0.729***	0.869***	0.699***	0.739***	0.727***	0.763***	0.700***
		(16.87)	(12.54)	(20.88)	(17.09)	(18.07)	(8.01)	(6.15)	(11.21)
ln*KI*		0.0906***	0.0972*	0.0301	-0.132***	-0.148***	-0.145**	-0.0602	-0.00191
		(3.42)	(2.54)	(1.10)	(-5.94)	(-6.07)	(-3.11)	(-0.81)	(-0.05)
ln*MI*		0.353***	0.322***	0.245***	0.260***	0.180***	0.293***	0.361***	0.352***
		(11.23)	(7.31)	(8.67)	(8.63)	(5.82)	(4.12)	(3.91)	(6.49)
Constant		-18.44***	-18.66***	-17.92***	-14.00***	-13.53***	-16.29***	-19.16***	-17.60***
		(-47.20)	(-38.56)	(-49.15)	(-43.76)	(-41.60)	(-22.43)	(-17.00)	(-33.75)
					Marginal Effects				
ln*VAL*	-0.0220***	0.00357***	0.00181***	0.00437***	0.00486***	0.00454***	0.000858***	0.000417***	0.00161***
	(-31.22)	(13.92)	(9.64)	(16.38)	(15.11)	(15.42)	(6.32)	(5.01)	(8.41)
ln*KI*	0.00121**	0.000454***	0.000253**	0.000162	-0.000937***	-0.000929***	-0.000175**	-0.0000332	-0.00000157
	(3.29)	(3.49)	(2.59)	(1.15)	(-5.91)	(-6.13)	(-2.93)	(-0.78)	(-0.02)
ln*MI*	-0.00799***	0.00170***	0.000805***	0.00122***	0.00181***	0.00109***	0.000347***	0.000199***	0.000814***
	(-16.80)	(9.88)	(6.84)	(7.96)	(8.25)	(5.62)	(3.98)	(3.34)	(6.45)
Observations	49432								
Psedo R^2	0.1637								

Small-Hsiao tests of IIA assumption (Observations =49432)
Ho: Odds (Outcome-J vs Outcome-K) are independent of other alternatives

EXmlogit	Frequency	Percent	Omitted	lnL(full)	lnL(omit)	chi2	df	P>chi2	evidence
Non-Exporters	45,570	92.19							
EX-ASEAN	845	1.71	1	-6918.251	-6910.588	15.326	28	0.975	for Ho
EX-CHMT	397	0.8	2	-7683.024	-7675.798	14.452	28	0.984	for Ho
EX-JPN	801	1.62	3	-6896.707	-6887.438	18.539	28	0.912	for Ho
EX-US	709	1.43	4	-6973.602	-6964.306	18.592	28	0.91	for Ho
EX-EU	569	1.15	5	-7173.44	-7164.108	18.665	28	0.908	for Ho
EX-ME	133	0.27	6	-8135.689	-8125.297	20.786	28	0.834	for Ho
EX-AUS	83	0.17	7	-8272.132	-8262.167	19.932	28	0.867	for Ho
EX-ROW	325	0.66	8	-7712.403	-7702.909	18.987	28	0.899	for Ho
Total	49,432	100							

Likelihood-ratio tests for independent variables (N=49432)
Ho: All coefficients associated with given variable(s) are 0.

	chi2	df	P>chi2
ln*VAL*	1098.285	8	0
ln*KI*	74.877	8	0
ln*MI*	363.986	8	0

6. Conclusions and Implications

This paper contributes to the existing international trade literature by being one of the first studies for Thailand, a leading actor in the Southeast Asian region, to utilize the actual data on export destinations at the plant level to examine the relationship between export destinations and plant heterogeneity. The results and findings from this study could provide insights for further discussions and international strategies of the country. Overall, the results show that Thai exporters to Asian countries (especially, ASEAN countries, Chinese-based countries and Japan) are the most productive groups of exporters and are relatively more material- and capital-intensive on average. For profitability aspects, Thai exporters to ASEAN and Chinese-based countries generally exhibit the highest total sales and sale profits. However, exporters to Japan have the highest rate of profit. In accounting, the high rate of profit for exporters to Japan means that these exporters have a relatively high profit margin in exporting their goods or products to Japan. We also find that Thai plants with high productivity, if given rational choices, are more likely to choose to export to the US, the EU, and Japan and ASEAN countries, respectively. The estimated results and findings in this study are in line with the theoretical prediction that firms/plants with higher productivity tend to export to farer destinations and have high chances of success in exporting or engaging in trade activities in an unfamiliar market.

Thailand is an interesting case for this kind of analysis because its manufacturing sector is broad-based and covers a wide range of industries, and exporting firms/plants in Thai manufacturing export their products all over the world to various destinations. Thus, evidence from Thai manufacturing should provide a good model at least for other developing countries where there is a scarcity of empirical evidence at the present time.

Apart from the main analysis of this paper, it is potentially important to identify learning-by-exporting effects since the productivity and profitability gains from exporting, if they exist, are likely to depend on the characteristics of destination countries. Because of the advanced technologies used in developed countries, exports to such locations may be expected to generate more learning opportunities than shipping products to less developed destinations. In addition, markets in developed countries are generally more competitive than those in developing countries (Pisu, 2008).

As a consequence, open research questions for Thai manufacturing regarding this field of analysis are the directions of causality between exporting and productivity/profitability across export destinations. Specifically, it is interesting and crucial to inspect whether firms/plants that export beyond Asian countries are more productive than firms/plants that export inside Asia only before they start to sell their products in these markets (self-selection), or does exporting and selling in other regions increase productivity (more than selling inside Asia) due to learning effects and more intense competition that leads to higher improvements in productivity. These are motivating topics that cannot be examined due to data limitations at the time of this study and are potential areas for future studies for both Thai manufacturing and other countries' cases.

References

Bernard, A.B., and Jensen, J.B. (1999a), "Exceptional Exporter Performance: Cause, Effect, or Both?", *Journal of International Economics*, 47(1), 1-25.

Bernard, A.B., and Jensen, J.B. (1999b), "Exporting and Productivity", *NBER Working Paper*, 7135.

Bernard, A. B., Redding, S.J, and Schott, P.K. (2010). "Multiple-product Firms and Product Switching", *American Economic Review*, 100(1), 70-97.

Bernard, A.B., and Jensen, J.B. (2007), "Firm Structure, Multinationals, and Manufacturing Plant Deaths", *Review of Economics and Statistics*, 89(1), 1-11.

Bernard, A.B., Redding, S.J., and Schott, P.K. (2007), "Comparative Advantage and Heterogeneous Firms", *The Review of Economic Studies*, 74(1), 31-66.

Boermans, M.A. (2010), "Learning-by-Exporting and Destination Effects: Evidence from African SMEs", Working Paper No. 22658. University Library of Munich, Germany.

Crinò, R., and Epifani, P. (2009), "Export Intensity and Productivity", *Development Working Papers*, 271.

Damijan, J.P., Polanec, S., and Prasnikar, J. (2004), "Self-Selection, Export Market Heterogeneity and Productivity Improvements: Firm-level Evidence from Slovenia", LICOS Discussion Paper No. 148, Centre for Transition Economics.

De Loecker, J. (2007), "Do Exports Generate Higher Productivity? Evidence from Slovenia", *Journal of International Economics*, 73, 69–98.

Eaton, J., Kortum, S., and Kramarz, F. (2004), "Dissecting Trade: Firms, Industries, and Export Destinations", *The American Economic Review: Papers and Proceedings*, 94(2), 150-154.

Eaton, J., Kortum, S., and Kramarz, F. (2011). "An Anatomy of International Trade: Evidence from French Firms", *Econometrica*, 79(5), 1453-1498.

Greenaway, D., and Kneller, R. (2007), "Firm Heterogeneity, Exporting and Foreign Direct Investment", *The Economic Journal*, 117(517), 134-161.

Kohpaiboon, A. (2008), *MNEs and Global Integration of Thai Clothing Industries: Policy Implication for SME Development,* Report submitted to Institute of Developing Economies, Japan.

Kohpaiboon, A., and Ramstetter, E.D. (2008), "Producer Concentration, Conglomerates, Foreign Ownership and Import Protection: Thai Manufacturing Firms a Decade after the Crisis", International Center for the Study of East Asian Development Working Paper.

Mayer, T., and Ottaviano, G.I. (2008), "The Happy Few: The Internationalisation of European Firms", *Intereconomics*, 43(3), 135-148.

Pisu, M. (2008), "Export Destinations and Learning-by-Exporting: Evidence from Belgium", Working Paper No. 140, National Bank of Belgium, Brussels.

Ramstetter, E.D. (2004), "Labor Productivity, Wages, Nationality, and Foreign Ownership Shares in Thai Manufacturing 1996-2000", *Journal of Asian Economics*, 14(6), 861-884.

Serti, F., and Tomasi, C. (2008), "Firm Heterogeneity: Do Destinations of Exports and Origins of Imports Matter?", Laboratory of Economics and Management (LEM) Working Paper Series No. 2008/14, Sant'Anna School of Advanced Studies, Pisa, Italy.

Small, K. A., and Hsiao, C. (1985), "Multinomial Logit Specification Tests", *International Economic Review*, 619-627.

Trofimenko, N. (2008), "Learning by Exporting: Does It Matter Where One Learns? Evidence from Colombian Manufacturing Firms. *Economic Development and Cultural Change*, 56(4), 871-894.

Tybout, J.R. (2003), "Plant- and Firm-Level Evidence on the 'New' Trade Theories" in E.K. Choi and J. Harrigan, eds., *Handbook of International Trade*, 388-415, Blackwell Publishing, Oxford.

Vacek, P. (2010), "Productivity Gains From Exporting: Do Export Destinations Matter?", IES Working Paper No. 2010/18, Institute of Economic Studies, Faculty of Social Sciences Charles University, Prague.

Wagner, J. (2007), "Productivity and Size of the Export Market: Evidence for West and East German Plants, 2004", *Journal of Economics and Statistics (Jahrbuecher fuer Nationaloekonomie und Statistik)*, 227(4), 403-408.

Wagner, J. (2012a), "International Trade and Firm Performance: A Survey of Empirical Studies Since 2006", *Review of World Economics*, 148(2), 235-267.

Wagner, J. (2012b), "Exports, Imports and Profitability: First Evidence for Manufacturing Enterprises", *Open Economies Review*, 23(5), 747-765.

Wakasugi, R., and Tanaka, A. (2009). "Firm Heterogeneity and the Choice of Internationalization Modes: Statistical Evidence from Japanese Firm-level Data", Discussion Papers 09024, Research Institute of Economy, Trade and Industry (RIETI).

Appendix A: Differences between Exporters and Non-exporters in Thai Manufacturing

Figure 1: Difference in Labor Productivity (VAL) between Exporters and Non-Exporters

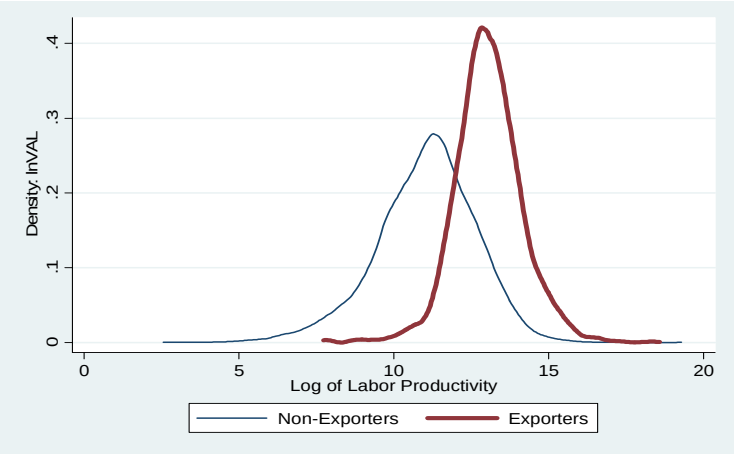


Figure 2: Difference in Material Intensity (MI) between Exporters and Non-Exporters

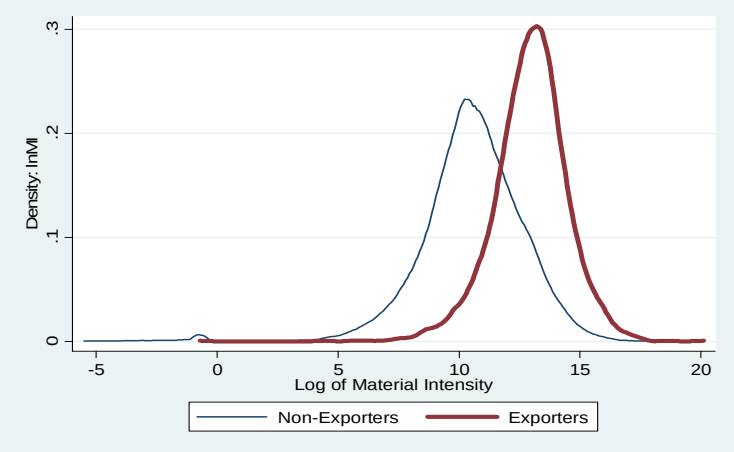


Figure 3: Difference in Capital Intensity (KI) between Exporters and Non-Exporters

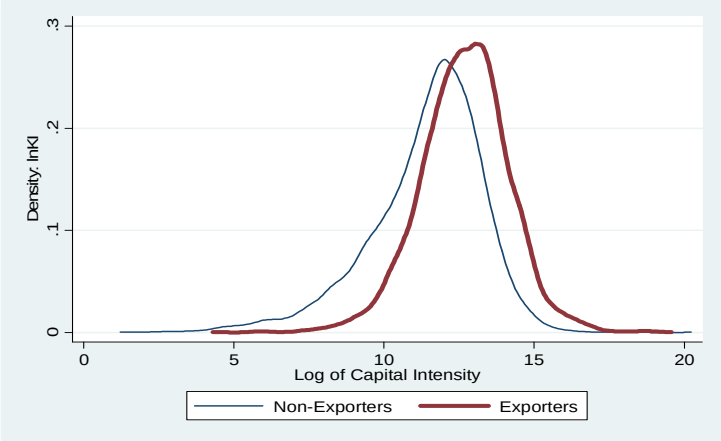


Figure 4: Difference in Total Sales between Exporters and Non-Exporters

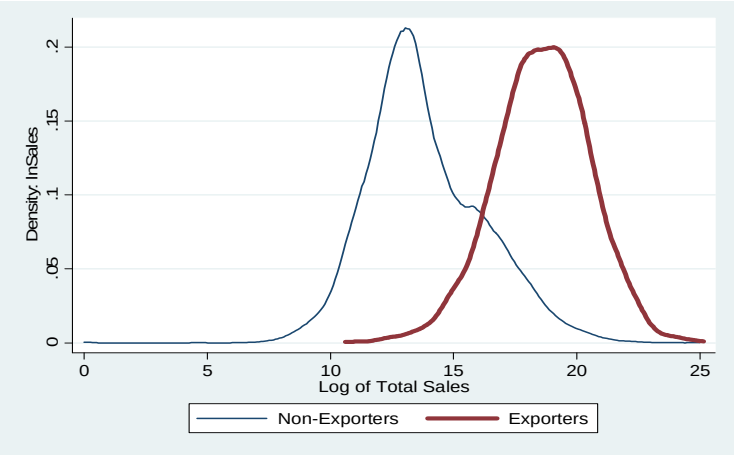


Figure 5: Difference in Sales Profit between Exporters and Non-Exporters

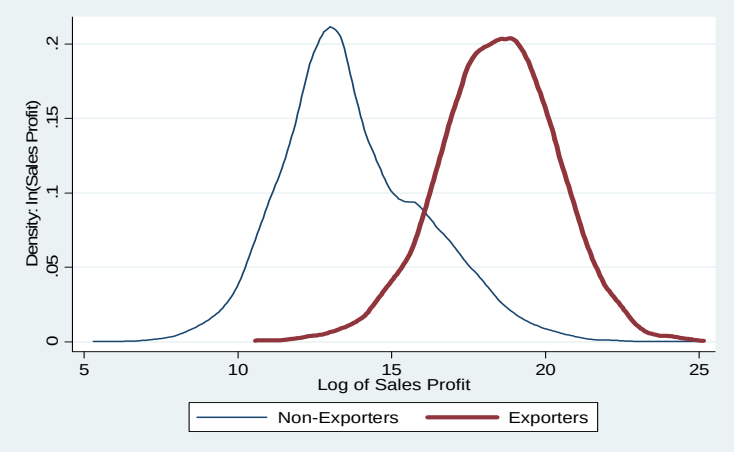
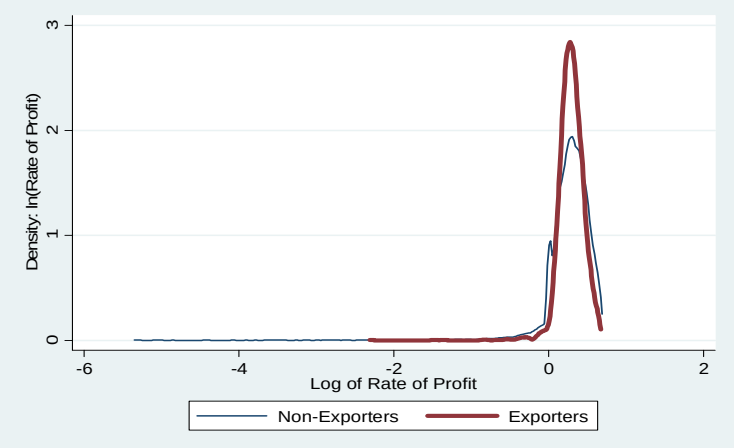


Figure 6: Difference in Rate of Profit between Exporters and Non-Exporters



Appendix B: Classification of Export Destination in Thai Manufacturing

	Country Code	Freq.	Percent	Cum.	Export Destination Dummy							
					EX-ASEAN	EX-CHMT	EX-JPN	EX-US	EX-EU	EX-ME	EX-AUS	EX-ROW
Azerbaijan	4	1	0.03	0.03								1
Albania	8	1	0.03	0.05					1			
Andorra	20	1	0.03	0.08					1			
Australia	36	83	2.15	2.23							1	
Austria	40	14	0.36	2.59					1			
Bangladesh	50	19	0.49	3.08								1
Belgium	56	20	0.52	3.6					1			
Bosnia and Herzegovina	70	3	0.08	3.68					1			
Brazil	76	6	0.16	3.83								1
Solomon Islands	90	1	0.03	3.86								1
Brunei Darussalam	96	3	0.08	3.94	1							
Bulgaria	100	5	0.13	4.07					1			
Myanmar	104	55	1.42	5.49	1							
Cambodia	116	61	1.58	7.07	1							
Cameroon	120	1	0.03	7.09								1
Canada	124	24	0.62	7.72								1
Sri Lanka	144	14	0.36	8.08								1
Chile	152	1	0.03	8.1								1
China	156	209	5.41	13.52		1						
Colombia	170	3	0.08	13.59								1
Congo	178	1	0.03	13.62								1
Costa Rica	188	1	0.03	13.65								1
Croatia	191	2	0.05	13.7					1			
Cyprus	196	1	0.03	13.72					1			
Czech Republic	203	2	0.05	13.78					1			
Denmark	208	14	0.36	14.14					1			
Estonia	233	1	0.03	14.16					1			
Finland	246	5	0.13	14.29					1			
France	250	87	2.25	16.55					1			
Gambia	270	1	0.03	16.57								1
Palestinian Territory	275	1	0.03	16.6						1		
Germany	276	119	3.08	19.68					1			
Ghana	288	2	0.05	19.73								1
Greece	300	10	0.26	19.99					1			
Guatemala	320	2	0.05	20.04								1
Honduras	340	1	0.03	20.07								1
Hong Kong	344	79	2.05	22.11		1						
Hungary	348	2	0.05	22.16					1			
Iceland	352	2	0.05	22.22					1			
India	356	47	1.22	23.43								1
Indonesia	360	75	1.94	25.38	1							
Iran	364	9	0.23	25.61						1		
Ireland	372	2	0.05	25.66					1			
Israel	376	9	0.23	25.89						1		

	Country Code	Freq.	Percent	Cum.	Export Destination Dummy							
					EX-ASEAN	EX-CHMT	EX-JPN	EX-US	EX-EU	EX-ME	EX-AUS	EX-ROW
Italy	380	49	1.27	27.16					1			
Japan	392	801	20.74	47.9			1					
Jordan	400	4	0.1	48.01						1		
North Korea	408	21	0.54	48.55								1
Korea	410	30	0.78	49.33								1
Kuwait	414	5	0.13	49.46						1		
Lao	418	51	1.32	50.78	1							
Lebanon	422	2	0.05	50.83						1		
Libya	434	1	0.03	50.85						1		
Liechtenstein	438	4	0.1	50.96					1			
Macao	446	2	0.05	51.01		1						
Malaysia	458	265	6.86	57.87	1							
Maldives	462	4	0.1	57.98								1
Mauritius	480	1	0.03	58								1
Mexico	484	9	0.23	58.23								1
Mozambique	508	1	0.03	58.26								1
Oman	512	1	0.03	58.29						1		
Nepal	524	3	0.08	58.36								1
Netherlands	528	29	0.75	59.11					1			
Netherlands Antilles	530	4	0.1	59.22								1
Vanuatu	548	1	0.03	59.24								1
New Zealand	554	11	0.28	59.53								1
Nigeria	566	10	0.26	59.79								1
Niue	570	1	0.03	59.81								1
Norway	578	6	0.16	59.97					1			
Pakistan	586	15	0.39	60.36								1
Panama	591	5	0.13	60.49								1
Paraguay	600	1	0.03	60.51								1
Philippines	608	51	1.32	61.83	1							
Poland	616	4	0.1	61.94					1			
Portugal	620	2	0.05	61.99					1			
Qatar	634	2	0.05	62.04						1		
Romania	642	2	0.05	62.09					1			
Russian Federation	643	11	0.28	62.38								1
Saudi Arabia	682	21	0.54	62.92						1		
Senegal	686	1	0.03	62.95								1
Singapore	702	174	4.51	67.45	1							
Viet Nam	704	110	2.85	70.3	1							
South Africa	710	11	0.28	70.59								1
Zimbabwe	716	1	0.03	70.61								1
Spain	724	27	0.7	71.31					1			
Swaziland	748	1	0.03	71.34								1
Sweden	752	14	0.36	71.7					1			
Switzerland	756	26	0.67	72.37					1			
Syria	760	1	0.03	72.4						1		
Tajikistan	762	1	0.03	72.42								1

	Country Code	Freq.	Percent	Cum.	Export Destination Dummy							
					EX-ASEAN	EX-CHMT	EX-JPN	EX-US	EX-EU	EX-ME	EX-AUS	EX-ROW
United Arab Emirates	784	49	1.27	73.69						1		
Turkey	792	8	0.21	73.9								1
Ukraine	804	7	0.18	74.08					1			
Egypt	818	13	0.34	74.42						1		
UK and Northern Ireland	826	108	2.8	77.21					1			
United States of America	840	709	18.36	95.57				1				
United States Virgin Islands	850	4	0.1	95.68								1
Venezuela	862	1	0.03	95.7								1
Yemen	887	7	0.18	95.88						1		
Taiwan	901	107	2.77	98.65		1						
Other	999	52	1.35	100								1
	Total	3,862	100									

Notes: Freq. stands for frequency and Cum. stands for cumulative percentage. Since January 2007, EU comprises 27 countries, including Bulgaria and Romania. Since July 2013, EU comprises 28 countries, including also Croatia. Middle East comprises Bahrain, Egypt, Iran, Israel, Kuwait, Oman, Qatar, Saudi Arabia, UAE, Yemen, Iraq, Jordan, Lebanon, Libya, and Syria.
Source: Author's calculation from the 2007 Industrial Census of Thailand