Multi-product firms and exporting: a developing country perspective

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Multi-Product Firms and Exporting: A Developing Country Perspective

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Abstract

In this paper we make the distinction between single-product and multi-product firms to contribute to our understanding of the complex relationship between multinational enterprises (MNEs), exporting and economic development. Using firm-level data for Thailand we show that the number of goods produced causes a larger variation in exports volumes than production volumes. Whilst the number of products and the total volume of exports are positively correlated we find, in contrast to US studies, a negative correlation between the number of products produced and the volume of production per product. We then investigate the characteristics associated with multi-product firms and find a distinction between foreign-owned and domestic firms. The presence of foreign firms producing single products solely for the domestic market as well as those producing many products for export demonstrates the diversity of behaviour of foreign-owned firms in developing countries.

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1. Introduction

The study of international trade has been transformed by the modelling of firm heterogeneity, productivity and exporting (see e.g. Melitz 2003, Yeaple 2005, Melitz and Ottaviano 2005 and Bernard et al. 2007a). What the early literature failed to take into account was that world production and trade is dominated by multi-product firms which has led to recent developments in both the theoretical and empirical literature (Eckel and Neary 2010, Iacovone and Javorcik 2008, Bernard et al. 2007b, Bernard et al. 2006a and Nocke and Yeaple 2006).

The importance of multi-product firms was first revealed for the US by Bernard et al. (2005 and 2006a) who show that 41 percent of firms produce more than one product but that multi-product firms account for 91 percent of total output while multi-product exporters account for more than 95 percent of total exports. An important element of firm heterogeneity therefore is how firms expand or contract their product range in response to changes in trading conditions.

However, detailed investigations of the multi-product firm phenomenon are limited and almost exclusively concentrated on developed countries. Yet, the role of foreign firms in developing countries is considered a crucial part of the development story with developing countries becoming increasingly aggressive in their approach to attracting foreign direct investment (FDI). Thus, gaining an understanding of the dynamics of introducing new products at the firm level and how government policy can influence the export structure of firms is of direct policy relevance.

In this paper, we examine the role of multi-product firms in a developing country, in this case Thailand. A first pass of the data suggests that there are both similarities and dissimilarities with the US. For Thailand, 43 percent of firms produce more than one product (compared to the 41 percent figure for the US). However, 57 percent of output is produced by multi-

product firms and 52 percent of total exports are from firms that export multiple products (compared to the US figures of 91 and 95 percent respectively). The headline figures for the production and exporting share are clearly of a different magnitude to those of Bernard et al. (2006a) for the US. The smaller output percentage for Thailand hints at the differences in the behaviour of firms in developed and developing countries certainly in terms of the size distribution of firms.[1]

In this paper we argue that for the case of a newly industrialising country such as Thailand it is important to make the distinction between single and multi-product firms for the following reasons. First, FDI subsidies and tax breaks for foreign firms are often justified by their ability to attract firms and to subsequently benefit from technology and knowledge spillovers. From a spillover perspective, multi-product firms are likely to be more attractive as logically, the greater the number of products produced, the wider the range of technologies employed and thus the greater the likelihood that domestic firms will benefit. The process of a firm becoming multi-product is also associated with process and product R&D which is also strongly associated with positive spillovers.

Second, since the growth through exporting route has proved to be particularly successful for many East Asian countries over the last two decades, governments are likely to prefer investment from foreign firms that produce more than one product as this will increase the likelihood of exporting at least one of the products. Third, multi-product firms may be more attractive to host governments as they should exhibit less susceptibility to demand shocks as

[1] Comparisons between our results and Bernard et al. (2005, 2006a) must be made carefully as the definition of whether a firm is multiple product or not depends on how a product is defined. The greater the level of disaggregation, the larger the number of multi-product firms. In this paper we define a product according to the equivalent of the 5-digit International Standard Industrial Classification (ISIC). Bernard et al. (2006a) use a 5-digit US SIC classification and Bernard et al. (2005) use a 10-digit Harmonised System (HS) classification to measure their output and export statistics respectively and is probably one explanation for at least some of the difference in our headline figures. The SIC 5-digit data consists of around 1,800 products whilst the HS 10-digit data contains 8,500 products of which two thirds are from the manufacturing sector. The data reveal that firms produce across four and even 2-digit industries and that the product distribution tends to be highly skewed where for example, exports of one product in a multi-product firm may account for considerably more than 50 percent of total exports. See Bernard et al. (2006a) for further discussion.

the risk from, for example, changes in fashion or advances in product-specific technology, is spread over a variety of exports and possibly export markets. Hence, domestic employment may benefit from a smoothing effect.

In this paper we provide an analysis of the structure of foreign firms and the characteristics of firms that produce multiple products which should provide a useful insight into the role of MNEs in developing countries. More specifically we examine two aspects of the multi-product and development question. In the first stage we examine the relationship between multi-product firms' extensive margins (number of products produced or exported) and intensive margins (output or export sales per product). Given that changes in trade barriers or trade costs will lead to intra-firm adjustment along firms' extensive and intensive margins we examine how this relationship affects the distribution in firm size. In addition, we examine the correlation between firms' extensive and intensive margins.

In the second stage of the paper, we examine the characteristics associated with multiple product producers making a distinction between domestic and foreign-owned firms. A complex picture of the behaviour of MNEs in developing countries emerges where foreign-owned firms that export are strongly associated with being multi-product but foreign firms that only serve the domestic market show a strong negative partial correlation with being multi-product. These factors might explain, in part, why evidence for knowledge diffusion and productivity spillovers is less widespread that one might expect. Our finding that a significant proportion of foreign-owned firms supply only the domestic market and produce just a single product is an interesting new stylised fact.

The structure of the remainder of this paper is organised as the follows. Section 2 describes the data. In section 3, we discuss our empirical model and present the results of our intensive and extensive margin analysis while section 4 presents our results examining the characteristics

of those firms that produce multiple products and the factors related to the number of goods produced. Section 5 concludes.

2. Descriptives and Data

Thailand has been the third largest exporter from the Southeast Asian region over the last 10 years (ASEAN Statistical Yearbook, 2005). As a member of ASEAN, Thailand shares in the benefits of the ASEAN Free Trade Area.[2] Not surprisingly, the ASEAN region remains a major export market for Thailand. The share of Thai exports to ASEAN in 2007 was about 21.3 percent of total exports with 12.6 percent and 12.8 percent exported to the US and EU-15 respectively. Since 1999, the total export value of trade has increased dramatically reaching US$ 152,477.58 million in 2007. In contrast to many developed countries, the manufacturing sector still dominates, accounting for 78 percent of total exports in 2007.

For Thailand, sectors with a large volume of exports tend to be high-technology products such as computers, parts, and accessories, automobiles and parts, and integrated circuits. The production of computers and parts has been Thailand's leading industrial export sector for many years, accounting for 11.35 percent of the country's total exports in 2007. The second leading export industry is the automotive industry. Numerous foreign automotive manufacturers from Japan, the US and Europe are based in Thailand and use the country as an export platform to sell their products to the rest of the world. Other prominent export sectors include labour-intensive products such as gems, jewellery, and garments.[3]

[2] Attempts at organised regional co-operation between Southeast Asian countries dates back to August 1967 when the ASEAN was established with original members Indonesia, Malaysia, the Philippines, Singapore and Thailand. Expansions to the membership of ASEAN were Brunei in 1984, Vietnam in 1995, Myanmar and Laos in 1997 and Cambodia in 1999. The ASEAN Free Trade Area was finally established in 1992 and aims to eliminate tariff and non-tariff barriers in both manufacturing and agricultural sectors among member countries.

[3] After 2004, the growth of exports from the textile industry fell as a result of the elimination of quota restrictions in early 2005 and increased competition from China, Vietnam and India (Bank of Thailand, 2006).

For the empirical analysis in this paper we use the Annual Survey of Thailand's manufacturing industry by the Office of Industrial Economics (OIE), Ministry of Industry, Thailand. In 2001 a questionnaire was sent out to 6,735 firms. The response rate was around 60 percent. The survey covers 79 types of manufacturing activity at the 4-digit ISIC level that consists of 23 2-digit ISIC industries and in 2001 included small (35 percent), medium (32 percent), and large (33 percent) firms. The sample can be considered representative of Thai manufacturing industries with the value added of firms included in the survey accounting for 95 percent of total manufacturing GDP (OIE, 2001). The questionnaire includes twenty-five questions that cover different aspects of a firm's characteristics and performance including balance sheet information. We control for possible outliers by excluding 0.5 percent tails of all the regression variables except for binary dummies. Our final unbalanced panel comprises 15,115 observations for the period 2001--2004.[4]

The data contain detailed information on standard firm-level variables such as structure of ownership, employment, region, wage, productivity, research and development (R&D), output and exports. One significant advantage of this data is that we are able to identify the number of products a firm produces. Our product classification is based loosely on ISIC classifications of what constitutes a product and are based on the question in the survey that asks the firms to "list the products that you produce". We believe this approximates to a 5-digit product classification.[5]

When we examine trends at the 2-digit ISIC level for the four years of our sample 2001 to 2004 we observe that the sectors that have a high percentage of exporting firms of more than 70 percent are ISIC 18 (Wearing Apparel; dressing and dying of fur), ISIC 32 (Radio, television and communication equipment) and ISIC 36 (Furniture). In 17 out of 22 2-digit ISIC sectors

[4] Each year, some firms do not respond or even shut down which causes our data set to have an unbalanced structure. To compensate for the dosure or none response of some firms, in 2004 the sampling was extended and data collected for additional plants (OIE, 2004). Unfortunately we do not have specific data on firm deaths.
[5] Product identification matched product lists with the ISIC 5-digit classification by visual inspection.

we observe an increase in the proportion of firms that export with ISIC 34 (Motor vehicles, trailers & semi-trailers) showing the largest increase in exports during this period.

In Table 1 we present the share of output and the share of firms that produce single and multiple products across various groupings. When we consider all firms, we see that the majority of firms produce only one product (57.12 percent) with 17.81 percent producing two products and only 9.15 percent producing five or more products.[6] However, those 57.12 percent of firms only produce around 43 percent of total output with the 9.15 percent of firms producing five or more products producing 15 percent of total output. If we compare foreign-owned and domestic firms we observe that a larger proportion of domestic firms produce just one product. Thus, consistent with Bernard et al. (2006b) we find that foreign firms have a higher likelihood of being multi-product and a higher share of output with 17.25 percent of firms producing five or more products. Comparing exporters and non-exporters is also illuminating where we find an even greater difference with 61.16 percent of non-exporters and only 53.15 percent of exporters producing a single product.

[Table 1 about here]

Finally, we introduce a final complication by making a distinction between foreign-owned exporters and non-exporters. We find that 68 percent of foreign non-exporters produce a single product. The fact that approximately one fifth of foreign firms do not export is a stylised fact that we believe has not been previously highlighted in the literature and suggests that FDI may be substituting for exports for a significant number of firms even in the context of a relatively small developing country. This insight adds a layer of complexity to our analysis and hints at a more subtle relationship between foreign firms and the benefits accrued to the host country.

[6] Our figures are broadly consistent with a study by Goldberg et al. (2010) who find that for manufacturing firms in India the single-product and multi-product firms account for 53 and 47 percent respectively.

3. Multi-Product Firms' Intensive and Extensive Margins

As previously noted, multi-product firms in Thailand produce 57 percent of total output while firms that export multiple products account for over 52 percent of total export sales. Bernard et al. (2006b) investigate this phenomenon for multi-product firms in the US by examining the contribution of firms' extensive margins to firm-size distribution. Similarly, Yeaple (2005) argues that large firms are responsible for much in the variation in sales across firms managing product lines much more actively than small firms. This line of thinking is matched by Berger and Ofek (1995) who find single product firms have larger sales per product than multi-product firms. In this section we follow Bernard et al. (2006b) to examine the relationship between intensive and extensive margins and size distribution for Thailand where the importance of attracting large MNEs is often part of government industrial policy.

Bernard et al. (2006b) begins with a cross-section estimation. The basic framework for firm-size distribution is to identify firm' extensive (number of products) and intensive (output per product) margins. We have a panel estimation so the relationship is presented in equation (1),

$$Y_{it} = n_{it}\bar{y}_{it} \qquad (1)$$

where Y_i is firm size measured by total output of each individual firm, n_i is the number of products produced by firm and $\bar{y}_i$ is the average output per product that is defined as

$$\bar{y}_{it} \equiv \frac{1}{n_{it}} \sum_{p} y_{pit} .$$

The subscripts i, t and p denote firm, time and product respectively. The relationship between firm size and multiple product firms requires a knowledge of how firm size varies. By taking the log of equation (1), the model can be separated into two regressions for firms' intensive and extensive margins as a function of the log of total output,

$$\ln n_{it} = \delta_1 + \beta_1 \ln Y_{it} + \mu_{it} \quad (2)$$

$$\ln \bar{y}_{it} = \delta_2 + \beta_2 \ln Y_{it} + \varepsilon_{it} \quad (3)$$

where μ_{it} and ε_{it} denote stochastic errors and by using OLS estimation techniques, $\beta_1 + \beta_2 = 1$. Thus the coefficient of β_1 captures the partial correlation between total output and the extensive margin and β_2 captures the partial correlation between total output and the intensive margin (Bernard et al. 2006b).

In addition, we examine the relationship between exporting and firms' intensive and extensive margins. In the case of an exporting firm, total exports is the number of products exported (n_i^e) multiplied by average exports per product $(\bar{y}_i^e)$. Thus, the estimated regression decompositions for exporting are presented as,

$$\ln n_{it}^e = \delta_3 + \beta_3 \ln Y_{it}^e + \mu_{it} \quad (4)$$

$$\ln \bar{y}_{it}^e = \delta_4 + \beta_4 \ln Y_{it}^e + \varepsilon_{it} \quad (5)$$

Since a firm's extensive and intensive margins are related by construction through an accounting identity (the log of the two margins sums to the log of total exports), where $\beta_2 = 1 - \beta_1$ and $\beta_4 = 1 - \beta_3$ we simply report the estimated results of a firm's extensive margin (β_1 and β_3). A robust variance estimation corrects for the problem of heteroscedastic errors. The results from OLS estimations with and without region, industry and time fixed effects are presented in Table 2 and are based on a sample of multi-product firms only.

In Columns (1) and (2), we find that the number of products produced accounts for approximately one percent of the variation in total firm output. This means that an increase in the number of products (extensive margin) accounts for only one percent of the increase in

total output. On the other hand, this result indicates that the variation of total firm output in Thailand is mainly due to changes in average output per product (intensive margin).[7]

A slightly higher variation is observed if we consider the number of products exported and total export sales (Columns 3 and 4). The coefficient shows that the number of products exported causes a variation in total export sales of 7.4 percent. This means that the number of products exported raises total export sales by 7.4 percent by keeping average export sales per product constant.

[Table 2 about here]

Next we examine the relationship between intensive and extensive margins by regressing firms' output or exports per product on the number of products produced or exported by firm. The estimated regressions are presented as follows,

$$\ln \bar{y}_{it} = \sigma_1 + \gamma_1 \ln n_{it} + \xi_{it} \tag{6}$$

$$\ln \bar{y}^{e}_{it} = \sigma_2 + \gamma_2 \ln n^{e}_{it} + \omega_{it} \tag{7}$$

In Table 3 we observe a positive correlation between the extensive and intensive margins in Columns (3) and (4) only. Whether the correlation is positive, negative or insignificant depends on the functional form of the distribution of shipments across products within firms. In this case, the positive relationship indicates that the number of products exported increases export sales per product by between 50.1 percent and 58.4 percent. We can conclude therefore that multi-product firms only marginally increase the number of products exported but for each product, multi-product firms export a larger volume of each. However, in contrast to Bernard et al. (2006b) and Iacovone and Javorcik (2008), we find a negative and

[7] As Bernard et al. (2006a) point out, our use of the equivalent of 5-digit ISIC data will have the effect of masking unobserved changes within 5-digit categories thus our results are likely to underestimate the importance of firm adjustments to the extensive margins.

significant correlation for firms' extensive and intensive margins when we consider production data. Thus, in Columns (1) and (2), we find that an increase in the number of products produced decreases the amount of output per product by between 64.1 percent and 69.2 percent. This negative correlation is consistent with the relationship predicted by the models of Nocke and Yeaple (2006), and Eckel and Neary (2010). The empirical result suggests that in Thailand, the more products a firm develops, the less of each one is produced. This can be explained by diseconomies of scope in the production unit of multi-product firms in Thailand and inefficiency in monitoring various production process.[8] Another explanation is that there may be advantages associated with the production of a number of products and that by using the same production unit, distributing products through the same channels and managing production within the same organisation there is no discernible difference in cost. A third explanation is that multi-product firms in Thailand may be trying to expand their market potential by increasing the number of products produced rather than merely increasing sales of existing products. If firms produce a greater number of products it may help to reduce future risk resulting from the product life cycle at any given period.

[Table 3 about here]

From the decomposition of the firm-size distribution and firms' extensive margins, we found that intra-firm adjustment on the number of products produced and exported by multi-product firms positively and significantly affects the variation in firm size (the classification for production and export data is the same). The effect on the variation in firm size is mainly due to changes in output and export sales per product. When we consider the relationship between firms' extensive and intensive margins, our results show that extensive and intensive margins are negatively correlated in production but positively correlated in exporting.

[8] Diseconomies of scope occurs when a firm faces higher marginal costs of production if the new production lines are added and therefore causes a reduction of the existing product line.

We now know that multi-product firms also play a significant but complex role in Thailand's economy. Although there are a larger number of single product firms, approximately 57 percent of total output is accounted for by multi-product firms. Given the importance of multi-product firms we now investigate which factors, in addition to size, are associated with a firm's decision to produce multiple products.

4. The Characteristics of Multi-Product Firms

4.1 Being a Multi-Product Firm

Recent stylised facts have shown that, in both domestic and international markets, multi-product firms have become increasingly important. We now investigate the characteristics of those firm's that produce multiple products.

We estimate a pooled probit model for the binary dependent variable, which indicates the status of a firm.[9] All independent variables are lagged by one year in order to mitigate against possible simultaneity problems. Unfortunately the data does not provide a set of instruments to control for possible exogeneity between multi-product production and our dependent variables. For example, being multi-product may cause total factor productivity (TFP) to rise or make it more likely that a firm will export. We believe this is less of a problem than with the traditional determinants of exporting regressions. However, we acknowledge that lagging by one year is not ideal and hence in our results section we refer to associations and partial correlations instead of determinants and effects. Thus, our probit model is as follows,

$$\Pr(MULTIDUM_{it} = 1 \,|\, Z_{i(t-1)}) = \Phi(\beta' Z_{i(t-1)}) \qquad (8)$$

[9] Since our data has a short panel structure we are not able to use alternative estimation methods (e.g. a fixed effects estimator or a GMM first-difference estimator). Arellano and Bond (1991) explain that the GMM first-difference estimator requires two or more lags of all the right-hand-side variables as instruments.

where, $MULTIDUM_{it}$ is a dummy variable that is 1 if the firm is multi-product and 0 otherwise. The term Z is a vector of firm characteristics and Φ is the cumulative distribution function of the normal distribution function.

We include five region dummies, twenty-three 2-digit industry and two year-dummies in order to control for unobserved effects.[10] In addition, we allow for robust clustering at the 2-digit industry level (clustering at the regional level made little difference to the results). This relaxes the independence assumption and requires only that the observations are independent across sectors. In equation (8), the vector of firm characteristics Z includes the following:

- EX is an export dummy which equals 1 if the firm has positive export sales and 0 otherwise.

- $FOREIGN$ is a dummy, which equals 1 if at least 10% of shares are foreign owned, and 0 otherwise. Cut-offs of 25% and 50% were used in a sensitivity analysis.

- $EX*FOREIGN$ is an interaction term that measures the effect of being both foreign and an exporter over and above the individual effects.

- TFP^{LP} is a measure of total factor productivity. The calculation of the variable is obtained from the semi-parametric approach of Levinsohn and Petrin (2003) which takes account of unobserved firm-specific productivity shocks. In a sensitivity analysis, we use two alternative measures of TFP. The R&D estimator of TFP ($TFP^{BUETTNER}$) is obtained from a semi-parametric and nonlinear least square regression of Buettner

[10] Region dummies are Bangkok and Metropolitan area, Central, East, North and South (see Table 8 in the Appendix).

(2003) that allows for endogenous R&D. The standard labour productivity ($TFP^{LABPROD}$) is calculated from the log of value added over total labour.[11]

- *size* is measured as the log of total employment. As a robustness check we also categorise firm size into small (*SMALL*), medium (*MEDIUM*), large (*LARGE*) and very large (*VLARGE*) by following the quartile distribution of the total employment for all firms operating in the same 2-digit ISIC (Rev.3).

- *wage* is the log of wage per employee. Wage is an indicator of labour quality. It is expected that the higher the wages, the more superior the quality of labour and the more likely that a firm will be able to produce multiple products.

- *RDPRODUCT* and *RDPROCESS* are dummy variables for R&D to capture those firms that undertake R&D in product development and production processes respectively. R&D activity is an important mechanism for firms to introduce new products (Brander and Eaton, 1984). R&D is also an important procedure for enhancing the quality of existing products and for developing new products as well as highlighting cost savings. It is expected that a firm that carries out R&D especially product R&D is more likely to be multi-product.

The results reported in Tables 4 and 5 are marginal effect estimations that are calculated at the mean of the independent variables except for dummy variables. Each coefficient indicates the change in the probability of the outcome. Our variables are defined and descriptive statistics presented in Tables 8 and 9 in the appendix respectively. It should be noted that the results are based on reduced form regressions for Thailand data so they cannot be generalised to other contexts.

[11] Due to limitations of space we do not indude the methodology underlying our Levinsohn and Petrin (2003) and Buettner (2003) TFP calculations but this information is available from the authors upon request.

In Table 4, the results of our preferred specification in Columns (3) and (4) show a complex relationship between export status and the probability of a firm to be a multi-product producer. The results suggest that for Thailand it is not whether you are an exporter that is important but the export status of the firm combined with our ownership variable. For example, being foreign and an exporter has a large positive partial correlation with being a multi-product producer. In contrast, being an exporter per se is insignificant. This suggests a difference in behaviour between domestic and foreign exporters.

In Thailand, foreign ownership appears therefore to have an important association with multi-product production although it is not a straightforward relationship. The individual partial correlation for foreign ownership is negative and significant for all specifications. This suggests that foreign-owned firms per se are negatively associated with multi-product production. This is a surprising result. One explanation might be overseas firms setting up single product assembly plants that specialise in the production of one single product for sale either domestically in Thailand or for export (possibly to Thailand's ASEAN neighbours). This would also fit with the Baldwin and Ottaviano (2001) hypothesis that MNEs locate the production of different varieties in different countries. However, as noted earlier, foreign-owned firms that also export are positively and significantly correlated with firms that produce multiple products. Thus it is clear that foreign firms cannot be considered one homogenous group. A further possible explanation is that foreign-owned firms which export and foreign-owned firms which serve the domestic market maybe engaged in either horizontal or vertical FDI.[12]

For TFP, as expected we observe that highly productive firms are positively associated with multi-product firms. The positive and significant coefficients for product R&D and process

[12] Horizontal FDI takes place when foreign firms establish production plants with similar production activities in different countries to serve local and neighbouring markets. Vertical FDI is where foreign firms locate different stages of production in other countries that can produce at a lower cost.

R&D suggests that firms that carry out R&D in either product development or production processes, or both, are positively related to the probability that a firm will be a multi-product producer. When we examine our proxy for the quality of labour we see that the coefficient on wage is positive but generally insignificant.

As expected, the relationship between size and being a multi-product firm is positive and significant at the one percent level. Increasing firm size by one unit is associated with an increase in the probability of producing multiple products of approximately 6 percentage points. If we categorise firm size into small, large and very large firms, the coefficients are also significant at the one percent level with small firms being negatively correlated with being multi-product producers. As firm sizes increases, we observe increasingly positive results so that the larger the size, the greater the probability of producing multiple products.

To further investigate the negative foreign ownership and exporter results from Table 4 we split the sample into domestic firms and foreign firms. Approximately one quarter of our firm sample are foreign-owned firms. We retain the 10 percent foreign-owned definition.[13]

The results are presented in Table 5. The insignificant coefficient for export status in Table 4 is now explained. Observe that the export status of Thai domestic firms has no relationship with the probability of a firm producing multiple products. In contrast exporting has a significant and positive partial correlation with the probability of a foreign firm being a multi-product producer and is picked up in Table 4 by the positive and significant interaction term. This suggests a systemic difference between the behaviour of foreign and domestic firms with foreign exporters producing more than one product and domestic exporters tending to concentrate on the export of a single product. The larger number of domestic firms explains why the overall figure in Table 4 is insignificant (6,878 domestic against 2,643 foreign firms).

[13] In a sensitivity analysis we tested 25 percent and 50 percent cut-off points with broadly similar results.

For productivity, the coefficients for both domestic and foreign firms are positive and significant for only four of our twelve specifications. For process R&D, the positive significant coefficients for the domestic sample indicate that for domestic firms, R&D in production processes is associated with a higher probability of a firm becoming multi-product producer. In contrast, the insignificant coefficient for our foreign firm sample suggests that neither R&D process development nor wages are associated with an increase in the probability of being a multi-product producer. However, R&D product development is positive and significant at the one percent level for domestic firms and five percent for foreign firms except in Column (9). Firm size for both domestic and foreign firms is positive and significant.

Our results suggest therefore that for Thailand the relationship between ownership and multiple product production is complex. We observe that individually foreign-owned firms and exporters have a negative partial correlation with the likelihood of being a multi-product producer but that being foreign and an exporter means a firm has a positive partial correlation with the production of multiple products.

[Table 4 and 5 about here]

4.2 The Number of Products Produced

In the previous section we examined the characteristics of being a multi-product firm. In this section we identify a firm's performance by investigating the characteristics associated with the number of products produced. Thus, our dependent variable is now a count of the number of products produced. A simple histogram of the distribution of the number of products reveals that approximately 50% produce just one product, 20% two products and 10% for three, four and five products with only 1% producing six or more.

Since count data is used as our dependent variable, there are two alternative regression models for counts which are poisson regression model and negative binomial regression model.[14] In this paper, we estimate count data using a negative binomial regression model. Additionally, we also estimated a simple poisson count model for a sensitivity check.[15] We lag all independent variables by one year to avoid possible simultaneity problems. As this is not ideal we continue to avoid direct causal language in discussing our results. Our negative binomial regression model can be specified as follows,

$$\Pr(NPRODUCT|Z) = \frac{\Gamma(NPRODUCT + \alpha^{-1})}{NPRODUCT!\Gamma(\alpha^{-1})}\left(\frac{\alpha^{-1}}{\alpha^{-1}+\mu}\right)\left(\frac{\mu}{\alpha^{-1}+\mu}\right)^{NPRODUCT} \quad (9)$$

where $NPRODUCT$ is a count for the number of products produced by each firm. Z is a vector of firm level characteristics. $\Gamma()$ is the gamma function. α is the degree of overdispersion which equals to zero when negative binomial and poisson has the same distribution. Finally, μ is known as the observed heterogeneity and is estimated from the observed firm characteristic where $\mu = \exp(\beta' Z + \varepsilon)$.[16]

In equation (9), the independent variables included in a vector of firm-level characteristics (Z) are the same as before. Five region, 2-digit ISIC industry and two year-dummies are included in order to control for unobserved effects. A robust variance estimation corrects for possible heteroscedasticity in the error term and we allow for clustering at the 2-digit industry level. Tables 6 and 7 present the coefficients obtained from the estimation of marginal effects for

[14] Poisson regression estimation assumes that the observed count is drawn from a poisson distribution of which the mean and variance are equal. In practice, the poisson regression model may be inappropriate due to overdispersion. Therefore, the negative binomial regression model which is an extension of Poisson regression alleviates the over dispersion problem by including a parameter that captures unobserved heterogeneity.

[15] The estimated results from poisson regression are identical to the negative binomial regression. This indicates that we do not have a problem with over dispersion in our data.

[16] According to Long (1997) and Cameron and Trivedi (1998), $\exp(\varepsilon)$ is unknown but it can be drawn from a gamma distribution of which mean equals 1 and variance equals α.

our negative binomial regressions calculated at the mean of the independent variables except for the dummy variables.

In general, the sign and significant level of results in Tables 6 and 7 are consistent with those presented in Tables 4 and 5. Table 6 shows that being an exporter does not have any significant association with the number of products produced. For ownership status, the relationship of foreign ownership and the product count is not so simple. The negative and significant coefficient indicates that being a foreign-owned firm is negatively associated with the number of products produced. However, the interaction term between being a foreign-owned firm and an exporter has a positive effect.

TFP has a significant positive impact on the number of products produced in two of the six columns. For example, the TFP coefficient in Column (1) indicates that increasing TFP by one unit is associated with 10.8 percentage points increase in the expected change in the product count. Other variables such as R&D of both product and production process, wage, size have positive and significant effect on the number of products produced as expected.

In Table 7, the sample is split into domestic and foreign firms. The insignificant results for export status in Table 6 are now explained. This is also picked up by the positive and significant results for the interaction term in Table 6. The export status of domestic firms has no significant association with the product count. In contrast, the export status of foreign firms has a positive and significant impact on the number of products produced. For example, the EX coefficient in Column (12) indicates that being a foreign exporters is associated with 30.8 percentage points increase in the expected change in the number of product count.

When we consider the productivity of domestic firms, the coefficient is positive and significant when size is excluded. In the foreign firms' sample, the coefficients of TFP are generally positive and significantly associated with the number of products produced. In both samples,

product R&D and process R&D have positive coefficients but are only significant in the sample of domestic firms. Wage of only domestically owned firms is associated with an increase in the expected change in the number of products produced. As expected, firm size of both domestic and foreign firms is positive and significant. A one unit change in firm size is associated with a proportional increase in the expected change in the number of products by 16 percentage points for domestic firms and 18 percentage points for foreign firms.

Finally, it is worth pointing out that we performed a series of sensitivity checks. For ownership structure, we tested 25 percent and 50 percent foreign owned as the cut-off point. For productivity, the Buettner (2003) approach and standard labour productivity were employed instead of our Levinsohn and Petrin (2003) approach.[17] The results are broadly consistent with results shown in Tables 4 to 7 but are not included for reasons of space.

[Tables 6 and 7 about here]

5. Conclusions

In this paper, we investigate different aspects of multi-product firms in international trade using the Annual Survey of Thailand's manufacturing industry from 2001 to 2004. The empirical analysis comprises two sections. First, we examine the relationship between multi-product firms' extensive margin (number of products) on output or exporting. Second, we investigate the characteristics associated with being a multi-product firm using binary data and the number of products produced using count data. The use of the former allowed us to analyse the characteristics of those multi-product firms while the latter is used to explain factors that affect the number of products produced. We also examine the systematic differences between domestic and foreign firms by estimating each sample separately.

[17] With the Buettner (2003) measure of TFP we lose approximately four percent of our observations.

Our results show that little variation is observed for firms' extensive margins in both total output and export sales. However, firms' extensive margins seem to have a higher variation in export sales than in total output. We suspect a partial explanation for these low variations, at least relative to the findings in Bernard et al. (2006b), is because of the level of aggregation we use when we classify the number of products. Another explanation arises from the fact that multi-product firms in Thailand do not dominate domestic production and exporting.

Various factors such as export status, foreign ownership, TFP, R&D both in product and in the production processes and firm size are important correlates with both multi-product firms and the number of products produced. Productive and large firms and those that carry out R&D also have a strong association with being a multiple product firm. Similarly, the effects of different factors on the expected number of products produced by firms are generally consistent with the factors associated with the probability of becoming a multi-product firm.

We did however find that there are systematic differences in the factors correlated with multi-product production between different groups in our sample of Thai firms. The differences in the significance and sign of factors indicate that domestic firms perform differently to foreign firms. Although our results for Thailand cannot be generalised, from a development policy perspective the weak association between R&D and the propensity of a foreign firm to be multi-product or the number of products produced is of interest. Assuming that potential benefits from spillovers increase with the number of varieties this may partially explain the lack of evidence for spillovers found in many studies. In contrast, it could be argued that a technologically advanced single-product firm could offer greater potential spillovers than a less technologically advanced multi-product firm.

In sum, for Thailand we show therefore that the relationship between MNEs and development is complex. We show that multi-products firms have played a significant role in international

trade especially though exporting and FDI. The results from the empirical analysis also confirm that being foreign owned and an exporter is an important characteristics associated with the emergence of multi-product firms and number of products produced. There appears however to be differences in the behaviour of foreign firms in developing and developed countries. In future research it would be useful to break down foreign ownership into country of origin to see whether there is a difference between the behaviour of firms from developing and developed countries. A further extension that would require a longer time period would be to examine the behaviour of firms in response to a shock to see whether product adjustment occurs at the intensive or extensive margin.

Table 1: Share of Firms and Output for Different Groups by Product Distributions

Number products produced	All Firms		Domestic Firms		Foreign Firms		Non-Exporting Firms		Exporting Firms		Foreign Non-Exporting Firms		Foreign Exporting Firms	
	Share Firms	Share Output	Share Firms	Share Output	Share Firms	Share of Output	Share Firms	Share Output	Share Firms	Share of Output	Share Firms	Share of Output	Share Firms	Share of Output
1	57.12	43.02	58.17	42.49	54.37	43.31	61.16	52.63	53.15	40.54	68.29	48.34	50.85	42.75
	(5,438)		(4,001)		(1,437)		(2,883)		(2,555)		(364)		(1,073)	
2	17.81	19.79	16.89	20.19	20.20	19.58	16.31	20.79	19.28	19.57	16.70	22.76	21.09	19.21
	(1,696)		(1,162)		(534)		(769)		(927)		(89)		(445)	
3	9.16	13.74	9.57	16.91	8.10	11.42	8.59	17.14	9.71	12.95	6.38	21.99	8.53	10.25
	(872)		(658)		(241)		(405)		(467)		(34)		(180)	
4	6.76	8.66	6.54	8.87	7.34	8.44	5.11	4.59	8.38	9.60	3.75	3.51	8.25	9.01
	(644)		(450)		(194)		(241)		(403)		(20)		(174)	
5+	9.15	14.79	8.83	11.54	9.99	17.25	8.82	4.85	9.47	17.33	4.88	3.41	11.28	18.78
	(871)		(607)		(264)		(416)		(455)		(26)		(238)	
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	(9,521)		(6,878)		(2,643)		(4,714)		(4,807)		(533)		(2,110)	

Note: Numbers of observation are reported in parentheses.

Table 2: OLS Regression Decomposition of Firm Size and Firms' Extensive Margins

	Production		Exporting	
	(1)	**(2)**	**(3)**	**(4)**
$\ln Y_{it}$	0.009*** (4.17)	0.012*** (5.20)		
$\ln Y_{it}^{e}$			0.074*** (21.87)	0.074*** (20.48)
Observations R-squared	6042 0.003	6042 0.057	3331 0.118	3331 0.189
Additional Covariates	None	Region, Industry and Time Fixed Effects	None	Region, Industry and Time Fixed Effects

Note: Sample includes multi-product firms only. Dependent variable in Column (1) and (2) is the log of number of products produced ($\ln n_{it}$), and Column (3) and (4) is the log of number of product exported ($\ln n_{it}^{e}$). Robust *t* - statistics in parentheses. *** significant at 1%.

Table 3: OLS Regression of Firms' Extensive and Intensive Margins

	Production		Exporting	
	(1)	**(2)**	**(3)**	**(4)**
$\ln n_{it}$	-0.692*** (9.32)	-0.641*** (9.22)		
$\ln n_{it}^{e}$			0.584*** (7.49)	0.501*** (6.33)
Observations R-squared	6042 0.014	6042 0.200	3331 0.018	3331 0.139
Additional Covariates	None	Region, Industry and Time Fixed Effects	None	Region, Industry and Time Fixed Effects

Note: Sample includes multi-product firms only. Dependent variable in Column (1) and (2) is log of output per product ($\ln \overline{y}_{it}$), and Column (3) and (4) is the log of export sales product per product ($\ln \overline{y}_{it}^{e}$). Region, industry and time dummies are included. Robust *t*-statistics in parentheses. *** significant at 1%.

Table 4: The Characteristics Associated with Multiple Product Producers (Dep. Var. is $MULTIDUM_{it}$)

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.031	0.033	-0.029	-0.030	-0.024	-0.023
	(1.00)	(1.04)	(0.86)	(0.86)	(0.69)	(0.67)
$FOREIGN_{i(t-1)}$	-0.139***	-0.139***	-0.159***	-0.160***	-0.158***	-0.159***
	(4.33)	(4.30)	(4.77)	(4.77)	(4.73)	(4.72)
$(EX * FOREIGN)_{i(t-1)}$	0.127***	0.127***	0.144***	0.145***	0.145***	0.146***
	(2.67)	(2.68)	(3.20)	(3.22)	(3.10)	(3.12)
$TFP^{LP}_{i(t-1)}$	0.056***	0.057***	0.019*	0.019*	0.023**	0.024**
	(4.85)	(4.86)	(1.85)	(1.82)	(2.14)	(2.13)
$RDPRODUCT_{i(t-1)}$	0.093***		0.067***		0.076***	
	(5.51)		(4.48)		(5.18)	
$RDPROCESS_{i(t-1)}$		0.102***		0.083***		0.088***
		(4.63)		(4.08)		(4.02)
$wage_{i(t-1)}$	0.000	-0.001	0.023	0.023	0.019	0.019
	(0.00)	(0.02)	(1.20)	(1.19)	(0.93)	(0.91)
$size_{i(t-1)}$			0.058***	0.059***		
			(6.63)	(6.68)		
$SMALL_{i(t-1)}$					-0.078***	-0.078***
					(4.73)	(4.73)
$LARGE_{i(t-1)}$					0.072***	0.071***
					(3.01)	(3.01)
$VLARGE_{i(t-1)}$					0.132***	0.133***
					(4.74)	(4.75)
Observations	9,521	9,521	9,521	9,521	9,521	9,521

Note: Robust z-statistics in parentheses. Standard errors are adjusted for clustering at the 2-digit industry level. Region, 2-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: The Characteristics Associated with Multiple Product Producers by Ownership (Dep. Var. is $MULTIDUM_{it}$)

	Domestic Firms						Foreign Firms					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
$EX_{i(t-1)}$	0.027	0.027	-0.027	-0.028	-0.025	-0.026	0.159***	0.161***	0.115***	0.116***	0.124***	0.126***
	(0.94)	(0.93)	(0.83)	(0.86)	(0.75)	(0.77)	(4.34)	(4.38)	(3.10)	(3.14)	(3.23)	(3.28)
$TFP^{LP}_{i(t-1)}$	0.051***	0.051***	0.017	0.016	0.020	0.019	0.070***	0.071***	0.020	0.021	0.032	0.033
	(3.70)	(3.69)	(1.49)	(1.47)	(1.61)	(1.59)	(2.79)	(2.80)	(0.82)	(0.83)	(1.27)	(1.30)
$RDPRODUCT_{i(t-1)}$	0.106***		0.077***		0.083***		0.060**		0.042		0.052**	
	(3.47)		(2.67)		(2.93)		(2.24)		(1.51)		(2.00)	
$RDPROCESS_{i(t-1)}$		0.145***		0.126***		0.129***		0.022		0.007		0.012
		(4.77)		(4.48)		(4.44)		(0.56)		(0.18)		(0.29)
$wage_{i(t-1)}$	0.020	0.020	0.032*	0.032*	0.029	0.029	-0.039	-0.040	0.010	0.010	-0.001	-0.002
	(0.90)	(0.90)	(1.74)	(1.76)	(1.59)	(1.60)	(0.81)	(0.83)	(0.20)	(0.20)	(0.03)	(0.04)
$size_{i(t-1)}$			0.054***	0.055***					0.067***	0.067***		
			(6.22)	(6.14)					(5.18)	(5.25)		
$SMALL_{i(t-1)}$					-0.068***	-0.068***					-0.120***	-0.120***
					(3.04)	(3.07)					(2.97)	(2.96)
$LARGE_{i(t-1)}$					0.087***	0.088***					0.023	0.022
					(2.91)	(2.91)					(0.62)	(0.59)
$VLARGE_{i(t-1)}$					0.135***	0.136***					0.103***	0.105***
					(3.68)	(3.57)					(3.08)	(3.08)
Observations	6,878	6,878	6,878	6,878	6,878	6,878	2,643	2,643	2,643	2,643	2,643	2,643

Notes: Robust z-statistics in parentheses. Standard errors are adjusted for clustering at the 2-digit industry level. Region, 2-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: The Characteristics Associated with the Number of Products Produced (Dep. Var. is $NPRODUCT_{it}$)

	(1)	(2)	(3)	(4)	(5)	(6)
$EX_{i(t-1)}$	0.035	0.039	-0.144	-0.144	-0.120	-0.117
	(0.39)	(0.44)	(1.57)	(1.57)	(1.27)	(1.25)
$FOREIGN_{i(t-1)}$	-0.404***	-0.405***	-0.454***	-0.455***	-0.449***	-0.451***
	(6.07)	(5.98)	(6.92)	(6.88)	(6.76)	(6.69)
$(EX * FOREIGN)_{i(t-1)}$	0.411***	0.410***	0.462***	0.463***	0.464***	0.464***
	(3.44)	(3.46)	(4.44)	(4.50)	(4.14)	(4.18)
$TFP^{LP}_{i(t-1)}$	0.108***	0.109***	-0.001	-0.001	0.018	0.019
	(4.78)	(4.88)	(0.04)	(0.05)	(0.79)	(0.80)
$RDPRODUCT_{i(t-1)}$	0.288***		0.202***		0.233***	
	(6.21)		(5.50)		(5.97)	
$RDPROCESS_{i(t-1)}$		0.302***		0.238***		0.255***
		(4.82)		(4.22)		(4.21)
$wage_{i(t-1)}$	0.037	0.035	0.106**	0.105**	0.088*	0.087*
	(0.69)	(0.64)	(2.34)	(2.32)	(1.81)	(1.77)
$size_{i(t-1)}$			0.167***	0.169***		
			(7.91)	(8.07)		
$SMALL_{i(t-1)}$					-0.213***	-0.213***
					(4.59)	(4.52)
$LARGE_{i(t-1)}$					0.210***	0.210***
					(2.83)	(2.82)
$VLARGE_{i(t-1)}$					0.373***	0.379***
					(5.80)	(5.86)
Observations	9,521	9,521	9,521	9,521	9,521	9,521

Notes: z-statistics in parentheses. Region, 2-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: The Characteristics Associated with the Number of Products Produced by Ownership structure (Dep. Var. is $NPRODUCT_{it}$)

	Domestic Firms						Foreign Firms					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
$EX_{i(t-1)}$	0.034	0.035	-0.127	-0.131	-0.117	-0.119	0.385***	0.390***	0.261***	0.264***	0.304***	0.308***
	(0.41)	(0.42)	(1.55)	(1.58)	(1.38)	(1.39)	(4.55)	(4.65)	(3.03)	(3.07)	(3.45)	(3.53)
$TFP^{LP}_{i(t-1)}$	0.098***	0.098***	-0.006	-0.007	0.005	0.004	0.168***	0.173***	0.036	0.039	0.085*	0.089*
	(3.01)	(3.03)	(0.21)	(0.27)	(0.18)	(0.15)	(3.69)	(3.71)	(0.80)	(0.82)	(1.92)	(1.94)
$RDPRODUCT_{i(t-1)}$	0.325***		0.230***		0.252***		0.170		0.119		0.151	
	(3.44)		(2.61)		(2.88)		(1.56)		(1.02)		(1.35)	
$RDPROCESS_{i(t-1)}$		0.433***		0.364***		0.376***		0.037		0.001		0.017
		(4.58)		(4.23)		(4.22)		(0.35)		(0.00)		(0.16)
$wage_{i(t-1)}$	0.066	0.065	0.102**	0.102**	0.091**	0.091**	-0.024	-0.029	0.111	0.110	0.059	0.059
	(1.19)	(1.16)	(2.16)	(2.21)	(1.97)	(1.97)	(0.25)	(0.29)	(1.05)	(1.03)	(0.59)	(0.55)
$size_{i(t-1)}$			0.160***	0.161***					0.176***	0.179***		
			(8.90)	(9.08)					(5.38)	(5.55)		
$SMALL_{i(t-1)}$					-0.201***	-0.202***					-0.268*	-0.268*
					(3.43)	(3.41)					(1.92)	(1.92)
$LARGE_{i(t-1)}$					0.259***	0.260***					0.040	0.036
					(2.69)	(2.71)					(0.36)	(0.33)
$VLARGE_{i(t-1)}$					0.401***	0.403***					0.230***	0.2334**
					(5.59)	(5.50)					(2.62)	(2.61)
Observations	6,878	6,878	6,878	6,878	6,878	6,878	2,643	2,643	2,643	2,643	2,643	2,643

Notes: z-statistics in parentheses. Region, 2-digit industry and time dummies are included. All the dependent variables are lagged one year. * significant at 10%; ** significant at 5%; *** significant at 1%.

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Appendix

Table 8: Definition of Variables

Variable	Definition
Y_{it}	Total output of the firm
Y_{it}^{e}	Total firm export sales
n_{it}	Number of products produced by firm
n_{it}^{e}	Number of products exported by firm
$\overline{y}_{it}$	Average output per product that is calculated from the aggregation of output of individual products divides by the number of product.
$\overline{y}_{it}^{e}$	Average export sales per product calculated as the aggregation of output of individual products divided by the number of products exported.
$MULTIDUM_{it}$	A dummy variable for a multi-product firm which equals 1 if a firm produces multiple products and 0 if a firm produces a single product.
$NPRODUCT_{it}$	Count data for the number of products produced by each firm.
$EX_{i(t-1)}$	A dummy variable for export status where a dummy equals 1 if firm i has positive export sales and 0 otherwise.
$FOREIGN_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 10% are foreign owned.
$FOREIGN25_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 25% are foreign owned.
$FOREIGN50_{i(t-1)}$	A dummy variable that indicates the structure of foreign ownership where a dummy equals 1 if shares of at least 50% are foreign owned.
$TFP_{i(t-1)}^{LP}$	Total factor productivity that is obtained from the estimation of the semi-parametric approach of Levinsohn and Petrin (2003).
$TFP_{i(t-1)}^{BUETTNER}$	Total factor productivity obtained from the system estimation (a semi-parametric and nonlinear least square regression) by Buettner (2003).
$TFP_{i(t-1)}^{LABPROD}$	Labour productivity calculated as the log of value added divided by total labour.
$size_{i(t-1)}$	Size is measured as the log of total employees.
$SMALL_{i(t-1)}$	A dummy variable equal to 1 if the total labour of firm i at time $t-1$ is in the first quartile of the distribution of the total labour of all firms operating in the same 2-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$LARGE_{i(t-1)}$	A dummy variable equal to 1 if the total labour of firm i at time $t-1$ is in the third quartile of the distribution of the total labour of all firms operating in the same 2-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$VLARGE_{i(t-1)}$	A dummy variable equal to 1 if the total labour of the firm i at time $t-1$ is in the forth quartile of the distribution of the total labour of all firms operating in the same 2-digit ISIC level (Rev. 3) as firm i at time $t-1$.
$wage_{i(t-1)}$	The log of wage per employee calculated as the ratio of total labour payments over total labour less owner's wage.
$RDPRODUCT_{i(t-1)}$	A dummy variable equals 1 if a firm carries out R&D in product development and 0 otherwise.
$RDPROCESS_{i(t-1)}$	A dummy variable equals 1 if a firm performs R&D in the development

	of production processes and 0 otherwise.
BKKM	A dummy variable identifies whether firm locates in Bangkok and Metropolitan Area or not.
CENTRAL	A dummy variable equals 1 if a firm locates in Central region excluding Bangkok and Metropolitan Area and 0 otherwise.
EAST	A dummy variable equals 1 if a firm locates in Eastern region and 0 otherwise.
NORTH	A dummy variable equals 1 if a firm locates in the North of Thailand and 0 otherwise.
SOUTH	A dummy variable equals 1 if a firm locates in the South of Thailand and 0 otherwise.

Table 9: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
$\ln Y_{it}$	6,042	14.81	2.21	6.31	20.61
$\ln \bar{y}_{it}$	6,042	13.73	2.22	5.21	19.80
$\ln n_{it}$	6,042	1.08	0.38	0.69	2.30
$\ln Y_{it}^{e}$	3,331	14.70	2.36	3.86	20.37
$\ln \bar{y}_{it}^{e}$	3,331	13.87	2.23	3.86	19.21
$\ln n_{it}^{e}$	3,331	0.83	0.51	0	2.08
$MULTIDUM_{it}$	9,521	0.43	0.49	0	1
$NPRODUCT_{it}$	9,521	1.95	1.38	1	10.00
$EX_{i(t-1)}$	9,521	0.50	0.50	0	1
$FOREIGN_{i(t-1)}$	9,521	0.28	0.45	0	1
$FOREIGN25_{i(t-1)}$	9,521	0.25	0.43	0	1
$FOREIGN50_{i(t-1)}$	9,521	0.14	0.35	0	1
$TFP_{i(t-1)}^{LP}$	9,521	9.22	1.84	0.47	16.69
$TFP_{i(t-1)}^{BUETTNER}$	9,195	10.19	1.28	1.21	15.31
$TFP_{i(t-1)}^{LABPROD}$	9,521	8.98	1.05	1.45	14.00
$RDPRODUCT_{i(t-1)}$	9,521	0.08	0.27	0	1
$RDPROCESS_{i(t-1)}$	9,521	0.06	0.24	0	1
$wage_{i(t-1)}$	9,521	7.71	0.53	4.19	10.29
$size_{i(t-1)}$	9,521	4.79	1.50	1.10	9.00
$SMALL_{i(t-1)}$	9,521	0.26	0.44	0	1
$LARGE_{i(t-1)}$	9,521	0.25	0.43	0	1
$VLARGE_{i(t-1)}$	9,521	0.25	0.43	0	1

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