Outsourcing Decisions: Theory and Evidence

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Abstract

This paper attempts to theoretically and empirically examine outsourcing decisions. We develop a partial equilibrium model of outsourcing decisions in which heterogeneous firms face choices between disintegration and internalisation. We show that more productive firms are inclined to contract out production activities at arm’s length. The key driver of this result rests with the spirit of Grossman and Helpman (2002) who posited that an outsourcing decision involves a trade-off between efficiency gains from core competences and specialisation and transaction costs in terms of searching for potential suppliers and contractual enforcement. Having established the theoretical proposition, we then turn attention to an empirical investigation of international outsourcing determinants using the establishment-level data of Thailand’s manufacturing industries. We employ the Probit model of international outsourcing decisions taking into account various econometric issues. These include the endogeneity bias problem, unobserved industry-specific characteristics, and heteroscedasticity. The consistent estimates reveal a positive correlation between productivity levels and probability that the outsourcing decision is made, and therefore sheds light on our theoretical prediction. In addition to productivity levels, the empirical framework highlights several establishment-specific characteristics as a key determinant of international outsourcing. These comprise their export statuses, foreign ownership

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1 Introduction

Outsourcing has become an essential part of business activities in the era of globalisation. Firms for the time being contract out what they once did for themselves with an ever expanding set of production activities, including the upstream stages, such as material and service inputs, human resource department, and research and development activities, and downstream stages like delivery, marketing and packaging. This trend of organisational disintegration has attracted substantial research inquiries into its economic impacts. For instance, much research done by Feenstra and Hanson (1996, 1999), Anderton and Brenton (1999), Geishecker (2002), and Hsieh and Woo (2005), among others, has been devoted to the impacts of international outsourcing on the shifts in the relative demand for skilled workers. Recent studies such as Egger and Egger (2006), Görzig and Stephan (2002), and Görg and Hanley (2004, 2005) in contrast weigh in on the relationships between international outsourcing and firm performance. Nevertheless, little has been done to push forward the understanding of international outsourcing decisions. The insight into this subject is equally indispensable as it offers the policy tools to harness the economic impacts of international outsourcing.

This paper is among the very first attempts to theoretically and empirically examine outsourcing decisions. We develop a partial equilibrium model of outsourcing decisions in which heterogeneous firms face choices between disintegration and internalisation. We show that more productive firms are inclined to contract out production activities at arm’s length. The key driver of this result rests with the spirit of Grossman and Helpman (2002) who posited that an outsourcing decision involves a trade-off between efficiency gains from core competences and specialisation and transaction costs in terms of searching for potential suppliers and contractual enforcement.

Having established the theoretical proposition, we then turn attention to an empirical investigation of international outsourcing determinants using the establishment-level data of Thailand’s manufacturing industries. We employ the Probit model of international outsourcing decisions taking into account various econometric issues. These include the endogeneity bias problem, unobserved industry-specific characteristics, and heteroscedasticity. The consistent estimates reveal a positive correlation between productivity levels and probability that the outsourcing decision is made, and therefore sheds light on our
theoretical prediction. In addition to productivity levels, the empirical framework highlights several establishment-specific characteristics as a key determinant of international outsourcing. These comprise their export statuses, foreign ownership, and new entrance to the markets, on top of market size, and capacity utilisation.

The organisation of this paper can be structured as follows. Section 3.2 elaborates a partial equilibrium model of outsourcing decisions incorporating firm heterogeneity. The solutions and analyses are given at the end of this section. Section 3.3 examines various characteristics and international outsourcing activities in Thailand’s manufacturing industries and introduces the empirical framework of outsourcing decisions. Section 3.4 presents and discusses the empirical evidence. Section 3.5 concludes.

2 The Model of Outsourcing Decisions

This section attempts to develop a simple, partial equilibrium model of outsourcing decisions – the arrangements that entail contractual costs but allow firms to tap on specialised skills possessed by external contractors. The theoretical framework builds upon the spirit of Grossman and Helpman (2002), incorporating firm heterogeneity in terms of differences in productivity levels. A testable hypothesis the model highlights is that more productive firms tend to resort to outsourcing than do less productive ones. The econometric framework and estimations introduced later in this paper aims to empirically investigate this base-line theoretical result.

2.1 Demand

Consider an economy in which a continuum of varieties \( i \) is produced. As in Dixit and Stiglitz (1977), the love-of-variety preference of a representative consumer in each country is assumed to take a constant elasticities of substitution (CES) functional form whereby consumption spans over a continuum of goods indexed by \( i \).

\[
U = \left[ \int_{\omega} q(i)^{\rho} di \right]^\frac{1}{\rho},
\]

where \( \rho \in (0,1) \) and the set of \( \Omega \) represents the mass of available varieties. It is noteworthy that the assumption \( \rho \in (0,1) \) implies goods \( i \in \Omega \) are substitutes, and thus an elasticity of substitution between two goods lying in the set of \( \Omega \) is straightforwardly represented
by $\sigma = 1/(1 - \rho) > 1$. Accordingly, an aggregate price or price index in the economy can be portrayed as:

$$P = \left(\int_{\Omega} p(i)^{1-\sigma} di\right)^{1-\sigma}.$$  

(2)

With this aggregate price, we can derive a demand and expenditure functions for each good $i$ by employing the utility maximization conditions. Let $E$ denote an aggregate expenditure in each country. The Walrasian demand function can be derived as:

$$q(i) = \frac{E}{P} \left(\frac{p(i)}{P}\right)^{\sigma}.$$  

(3)

It is straightforward to see that the demand for the good $i$ in (3) well behave since it is negatively correlated with its own price $p(i)$ and positively correlated with the aggregate expenditure $E$. In addition, it also captures substitution between the good $i$ and other goods $j$, where $j \in \Omega$ and $j \neq i$, now that an increase in the aggregate price $P$ results in an outward shift in the demand for the good $i$. Using the Walrasian demand function (3), we can also derive the expenditure spent on good $i$ denoted by $r(i)$.

$$r(i) = \frac{E}{P} \left(\frac{p(i)}{P}\right)^{1-\sigma},$$  

(4)

where $E = \int_{\Omega} r(i) di$.

2.2 Production

A continuum of firms operates in the monopolistic competition market without entry barriers. For simplicity, we assume that the production technology is linear and requires only one factor of production – labour. Firms are heterogeneous with respect to their inherent productivity, indexed by $\theta \in (0, \infty)$. Firm productivity is captured by the constant marginal cost of producing $q$ units of final outputs, whereby more productive firms can produce the same amount of final outputs at lower marginal cost than less productive firms. In particular, the amount of labour needed to produce $q$ units of goods by a firm $\theta$ is represented as

$^{1}$ Since each producer manufactures differentiated product indexed by the good $i$, the expenditure spent on each variety is also revenue for each heterogeneous firm.
where \( f_v, v > 0 \). The constant parameter \( f_v \) captures the fixed production cost and thus represents the number of workers a firm has to employ, regardless of the final goods produced. The \( v_v/\theta \) workers are needed to produce an additional unit of final goods. Ones may observe that a more productive firm (with a higher value of \( \theta \)) has lower marginal cost of production than a less productive firm (with a lower value of \( \theta \)), ceteris paribus.

As Grossman and Helpman (2002) pointed out, two conceptual frameworks account for outsourcing decisions. The first is the transaction costs theory by Coase (1937), which has dominated the literature on outsourcing decisions, such as Williamson (1975 and 1986), Klein, et al. (1978), Monteverde and Teece (1982), and Murray, et al. (1995). This theoretical proposition articulates that outsourcing pertains to the prohibitive costs of turning to the market which in turn induce firms to carry out production activities in-house, instead of disintegrating production. This problem, according to the transactions cost theory, emanates from either: (1) fewness of firms in the market, \textit{ex ante}; or (2) asset specificity that causes a lock-in problem between buyer and seller, \textit{ex post}. The former implies that a decision to contract out production at arm’s length incurs costs of searching potential providers. The latter in contrast obliges firms costly investment in commitment technology, such as cost of running more complex organisations and enforcing contracts, since lock-in effects and transaction-specific capital put quasi-rents at risk of being appropriated \textit{ex post} by their contractual partners. These transaction costs are independent of the amount of goods produced and thus taken by \( c \).

The other has to do with the core competences approach to outsourcing decisions, where firm competitiveness arises from outsourcing (Grant, 1991; and Gainey and Klaas, 2003). This theoretical explanation points out that improved productivity performance in a firm can be attained through specialisation in production activities that provide core competences and contracting out the rest. The productivity enhancement stems from the extent to which outsourcing enables firms to procure what they do not know how to do and at the same time develop in-house what they do better than the suppliers (Argyres, 1996). The productivity gains from a decision to outsource are captured by the reduction of marginal cost by \( g \).
Accordingly, the labour demand function that takes into consideration transaction costs and enhancement of productivity performance associated with a decision to rope in outsourcing can be expressed as:

\[ l_o(\theta, q) = f_o + \frac{v_o q}{\theta}, \tag{6} \]

where \( f_o = f_v + c > f_v \) and \( v_o = v_v - g < v_v \).

Since the preference of a representative consumer is assumed to be a CES utility function over a continuum of varieties, it is apparent from (3) that the elasticities of demand for the variety \( i \) uniquely produced by the firm \( \theta \) is equal to \( \sigma \). Hence, ones can derive the mark-up pricing condition using the profit maximization condition as follows:

\[ p_k(\theta) = \frac{v_k}{\rho \theta}, \tag{7} \]

where \( k = v, o \). By substituting (7) into (4), the revenue function of a firm \( \theta \) can be shown as:

\[ r_k(\theta) = E \left[ \frac{P \rho \theta}{v_k} \right]^{\sigma-1}. \tag{8} \]

The exogenously given wage rate is normalised to unity. Accordingly, by using (5), (6), and (7) and simple manipulations, ones can show that a firm \( \theta \)'s profit function is:

\[ \pi_k(\theta) = \frac{E}{\sigma} \left[ \frac{P \rho \theta}{v_k} \right]^{\sigma-1} - f_k, \tag{9} \]

where \( k = v, o \).^2

### 2.3 Outsourcing Decisions

Having solved for the firm’s profit functions, we then turn attention to the solutions to optimal outsourcing decisions. The firm’s objective is to choose the production structure \( (k) \) such that its profits are maximised. Specifically, the firm’s objective function can be written as follows.

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^2 In fact, the aggregate expenditure \((E)\) and aggregate price \((P)\) are exogenous to the firms in a partial equilibrium setting like ours. However, in the general equilibrium setting, both variables are endogenously determined by free exit/entry and stability conditions.
\[
Max_{k=v,o} \pi_k(\theta) = Max \left\{ 0, \frac{E}{\sigma} \left[ \frac{P \rho \theta}{v_v} \right]^{\sigma-1} - f_v, \frac{E}{\sigma} \left[ \frac{P \rho \theta}{v_o} \right]^{\sigma-1} - f_o \right\} 
\]

(10)

It should be highlighted that the outsourcing decisions in (10) depend upon the endowed productivity levels (\( \theta \)). If \( k = v \), the production takes place in-house (no outsourcing). If \( k = o \), the firm decides to contract out production activities. In the latter case, the firm bears transaction costs and enjoy productivity improvements. The solutions to the profit maximisation problem (10) are characterised by the cut-off productivity levels that help identify the optimal outsourcing decisions for each firm \( \theta \).

[Insert Figure 3.1 here]

Figure 3.1 illustrates the first equilibrium in which some firms internalise production in-house while the others make use of outsourcing. Two cut-off productivity levels are concerned with this equilibrium. One is the zero-profit cut-off (\( \bar{\theta}_v \)) where the form is indifferent between market entry and exit. Thus, \( \bar{\theta}_v \) is the firm’s productivity level such that \( \pi_v(\theta) = 0 \). The solution to this equality takes the following expression.

\[ \bar{\theta}_v = \frac{v_v}{P \rho} \left( f_v \frac{\sigma}{E} \right)^{\frac{1}{\sigma-1}} \]

(11)

The other is the cut-off productivity level (\( \bar{\theta}_o \)) above which the firms downsize their production structure by outsourcing, instead of integrating production. This cut-off must therefore satisfies \( \pi_v(\theta) = \pi_o(\theta) \) and can be shown as

\[ \bar{\theta}_o = \frac{1}{P \rho} \left\{ \frac{\sigma(f_o - f_v)}{E \left[ \frac{1}{v_o^{\sigma-1}} - \frac{1}{v_v^{\sigma-1}} \right]} \right\}^{\frac{1}{\sigma-1}}. \]

(12)

The existence of \( \bar{\theta}_v \) and \( \bar{\theta}_o \) is not straightforward, nevertheless. The reason is that some firms, which find outsourcing more profitable than internalising the whole production
process, may not be able to stay active in the market unless they are sufficiently productive. To rule out which case, ones can show that the following condition must be satisfied.\(^3\)

\[(1 + g)^{\sigma-1} < 1 + c\]  \hspace{1cm} (13)

If productivity gains from outsourcing \((g)\) are minimal, relative to transaction costs \((c)\), then some firms choose to outsource, while some other firms internalise production. While less productive firms \(\theta\), where \(\theta \in [\bar{\theta}_i, \bar{\theta}_o]\), refrain from outsourcing activities and undertake all production stages in-house, more productive firms \(\theta\), where \(\theta \in [\bar{\theta}_o, \infty)\), resort to contracting out production. Intuitively, a decision to outsource has to do with transaction costs in terms of \textit{ex ante} outlay of searching potential suppliers and \textit{ex post} contractual enforcement, which are not related to production scale. If the reduction in marginal production costs as a result of outsourcing is comparatively limited, the firms must be sufficiently productive such that the huge production scale enables them to overcome the transaction costs.

[Insert Figure 3.2 here]

Figure 3.2 portrays the other characterisation of the equilibrium. If productivity gains from outsourcing \((g)\) are sufficiently large such that the condition (13) is violated, the positive correlation between firm productivity and the decision to downsize production structure still holds, but all firms find outsourcing more profitable than in-house production. The intuition is straightforward. If outsourcing considerably plunges marginal costs, then even the least productive firms that remain in the market can tap on contracting out production activities. In this case, the only relevant cut-off productivity level is \(\bar{\theta}\) in which a decision to outsource produces zero profit. The expression of \(\bar{\theta}\) can be easily shown as

\[
\bar{\theta} = \frac{v_o}{\rho P \left( f_o \frac{\sigma}{E} \right)^{\frac{1}{\sigma-1}}}. \hspace{1cm} (14)
\]

As represented in Figure 2, when efficiency gains from outsourcing are pronounced, only outsourcing firms \(\theta\), where \(\theta \in [\bar{\theta}_o, \infty)\), exist in the market. Again, only productive firms can enter the market and make use of the outsourcing strategy.

\(^3\) As shown in Figure 3.1, the existence of \(\bar{\theta}_i\) and \(\bar{\theta}_o\) requires that \(\bar{\theta}_i < \bar{\theta}_o\). This holds only if the intersection point between the \(\bar{\theta}_o\) nexus and the horizontal axis lies in the right hand side of \(\bar{\theta}_i\).
To summarise, not all firms find outsourcing options profitable. Our simple, partial equilibrium model articulates that more productive firms tend to leverage on outsourcing. A key catalyst of this theoretical proposition rests with the transaction costs (e.g. costs of searching potential providers and contract enforcement) and efficiency gains (e.g. improved competitiveness and ability to tap on core competences) associated with outsourcing activities. To find an outsourcing decision profitable, a firm must be sufficiently productive such that a large production scale allows gains from declines in marginal costs to dominate the incurred transaction costs.

3.3 The Empirical Framework

This section develops an empirical test of our theoretical model in which a firm’s inherent productivity serves as a crux determinant of outsourcing decisions. It should be highlighted that our focus in this paper abstracts from an attempt to empirically investigating a causal relationship between outsourcing and firm-level productivity as a relationship between outsourcing decisions and firm productivity is two-folded. On the one hand, our theoretical framework establishes that more productive firms are inclined to make use of outsourcing. Much research, on the other hand, points to the reversed causality – the effects of outsourcing on firm performance, such as Görzig and Stephan (2002), Girma and Görg (2004), Egger and Egger (2006), and Amiti and Wei (2009). This section zeroes in on examining determinants of outsourcing decisions.

Another noteworthy issue pertains to the scope of the outsourcing definition. While the notion of outsourcing in the theoretical framework is loosely defined as downsizing the in-house production scale and thus includes both domestic and international outsourcing, this section puts emphasis specifically on the decisions on international outsourcing since the primary objective of this book is to deepen the understanding of international outsourcing in the context of the Southeast Asian economies.

3.1 Overview of Data

The empirical framework employs the establishment-level data retrieved from the report of the Manufacturing Industry Survey in 2003 provided by the National Statistical Office (NSO), Thailand. From this point onwards, we shall substitute ‘firm’ by ‘establishment’. The dataset includes basic information on manufacturing establishments, such as the numbers of employees, raw materials, parts and components, sales values,
inventory and fixed assets, among others. The establishments under the scope of this survey are those engaged primarily in manufacturing industries (Category D of the International Standard Industrial Classification – ISIC Rev.3). The dataset classifies the sample establishments into 6 sizes based on the numbers of employees. They are located in the premises throughout Thailand, including Bangkok and Pattaya, on top of municipal areas and non-municipal areas that form as a sub-district administration organization.

Data collection weighs in on interviews. The enumerators who are permanent and temporary staff of NSO were sent out to interview the owners or the entrepreneurs of the sample manufacturing establishments. According to the survey, manufacturing industries are classified according to the 4-digit ISIC levels. The dataset covers the 64 types of manufacturing activities (4-digit codes) in 21 industries (2-digit codes) and builds upon a Stratified Systematic Sampling method. The selection of sample establishments is carried out separately and independently in each type of manufacturing activities.

Table 1 summarises the sample establishments classified by regions. The total numbers of the sample establishments amount to 8,730 establishments. The manufacturing establishments are intensively located in the vicinity and central (38.8 percent) areas followed by the southern areas (20.7 percent), northern areas (17.7 percent), northeast areas (12.5 percent), and Bangkok (10.4 percent).

3.2 Econometric Model

This sub-section develops an econometric model that conveys empirical evidence that establishes a relationship between establishment-level productivity and outsourcing decisions. In so doing, we consider the following econometric specification:

\[ \Pr(Out_i = 1|\theta_i, X_i, Size_i, Capu_i) = \Phi(\alpha + \beta_1 \theta_i + \beta_2 X_i + \beta_3 Size_i + \beta_4 Capu_i + \lambda_i) \]

where \( \Pr(\bullet) \) denotes probability, and \( \Phi(\bullet) \) is the cumulative distribution function (CDF). The binary variable of outsourcing decisions \( Out_i \) takes the value of unity if an establishment \( i \) deals with international outsourcing; it takes the nil value otherwise. \( \theta_i \) represents the establishment-level productivity. \( X_i \) is a vector of establishment-specific characteristics. We

5 Specifically, the sizes of establishments are segregated into those with 1-15, 16-25, 26-30, 31-50, 51-200, and more than 200 persons.
control for market size and capital utilisation designated by $Size_i$ and $Capu_i$, respectively. The vector of 2-digit ISIC industry dummies ($\lambda_i$) enters the specification to control for the industry-specific effects.

It should be highlighted that the econometric model (15) can also be seen as a latent variable model where a latent (unobserved) variable ($Out_i^*$) is regressed on the independent variables.

$$Out_i^* = \alpha + \beta_1\theta_i + \beta_2X_i + \beta_3Size_i + \beta_4Capu_i + \lambda_i + \varepsilon_i,$$

(16)

where $Out_i = \begin{cases} 0 & \text{if } Out_i^* < 0 \\ 1 & \text{if } Out_i^* \geq 0 \end{cases}$, and the error term ($\varepsilon_i$) is assumed to be independently and identically distributed ($iid$).

[Insert Tables 2 and 3 here]

Table 2 portrays detailed information on outsourcing decisions in Thailand’s manufacturing industries. Out of 8,730 establishments, 1,677 establishments thrived on international outsourcing. This table also breaks down the sample establishments according to their intensity of international outsourcing activities. The breakdown indicates that the intensity of international outsourcing activities is evenly distributed among Thailand’s manufacturing establishments as approximately 6-15 percent of samples are found in all ranges of outsourcing intensity. Table 3 reveals the number and percentage of establishments that contract out their production to foreign providers. It can be observed that international outsourcing seems to be the most prevalent among the relatively advanced industries in which approximately 40-50 percent of establishments are concerned with international outsourcing. These industries include communication equipment and apparatus, refined petroleum products, electronic machinery and apparatus, and office, accounting and computer machinery. These figures are much higher than the traditional, labour-intensive sectors where the proportion of outsourcing establishments takes the value merely 10-15 percent, such as food and beverages, textiles, wearing apparel (including dressing and dyeing of fur), publishing, printing and reproduction of recorded media, and non-metallic mineral products. This observation sheds clearer light on our hypothesis that international outsourcing decisions
have to do with establishment-level productivity now that the advanced industries tend to exert higher productivity.

Central to our analysis is productivity levels of establishments \( (\theta_i) \). We measure the establishment-level productivity by outputs per worker, e.g. \( \theta_i = y_i / l_i \), where \( y_i \) is the value of outputs produced, and \( l_i \) is the number of workers employed in-house. This index of establishment productivity is identical to that of Bernard and Jensen (1999), Fixler and Siegel (1999), Girma and Görg (2002), and Egger and Egger (2006). Our theoretical framework developed in Section 2 establishes that outsourcing decisions hint upon productivity levels. We argued that a decision to procure intermediate inputs from markets reduces production costs (in terms of the amount of labour required to produce the same units of final outputs), thanks to increased core competences and specialisation. However, reliance on the market, as opposed to in-house production, incurs transaction costs in terms of searching potential providers and contract enforcement. In this sense, only sufficiently productive producers find outsourcing profitable as their large market shares allow a plunge in production costs to dominate the arising transaction costs.

Three establishment-specific characteristics in the vector \( X_i \) are taken into account, including foreign ownership \( (F_{hold_i}) \), exporters \( (Export_i) \) and new entry to the markets \( (New_i) \). These characteristics enter the specification (16) as dummies. \( F_{hold_i}, Export_i \) and \( New_i \) take the value of unity if the establishments are foreign-owned, exporting, and new, respectively; they take the nil value otherwise. The first two dummies aim to control for exposure to international markets in that foreign-owned and exporting establishments tend to find international outsourcing easier than do domestically owned and non-exporting establishments, thanks to their superior knowledge and/or information on foreign markets and input providers (Markusen, 1995 and Girma and Görg, 2002). The last characteristic – new entry to the markets – may hinder outsourcing decisions due to inferior knowledge about the markets and production technologies, compared to incumbent establishments.

[Insert Table 3.4 here]

Table 3.4 reveals various attributes of establishments in Thailand’s manufacturing industries that may influence their outsourcing decisions. The first column reports the numbers of foreign-owned establishments. The numbers of establishments that carry out
exporting activities are shown in the second column. The last column exposes the numbers of new establishments. A new establishment is defined as one which has operated for less than 12 months. In these columns, the percentages of the total numbers of establishments appear in parentheses.

Out of 8,730 samples, there were 934 foreign-owned establishments. Industrial decomposition further demonstrates that advanced manufacturing industries tend to have relatively high foreign ownership, particularly office, accounting and computing machinery (42.86 percent), communication equipment and apparatus (41.84 percent), electrical machinery and apparatus (29.08 percent), and motor vehicles, trailers and semi-trailers (27.27 percent). Nevertheless, the figures are relatively low for labour-intensive industries including wood and cork (3.60 percent), tobacco (4.26 percent), publishing, printing and reproduction of recorded media (4.31 percent), and food and beverages (5.24 percent).

Excluding publishing, printing and reproduction of recorded media and tobacco, Thailand’s manufacturing industries are export-oriented with the proportion of exporting firms ranging from 12.80 percent in the machinery and equipment industry to 44.68 percent in the communication equipment and apparatus industry. The particularly large proportions of exporting establishments in some advanced industries, like communication equipment and apparatus (44.68 percent), office, accounting and computing machinery (35.71 percent) and electrical machinery and apparatus (33.33 percent), suggest that comparative advantages of Thailand’s manufacturing sector have departed from traditional, labour-intensive production, like food and beverages and textiles, and rested with sophisticated, capital-intensive production.

The other establishment-specific characteristic our empirical framework attempts to control for is whether an establishment is a new entrant in the market. In our dataset, the new entrants on average amount to roughly 15 percent of sample establishments. The breakdown by industries further reveals that the new entrants are concentrated intensively in labour-intensive industries like food and beverages (34.16 percent) and textiles (13.39 percent). These figures are much higher than those for relatively advanced industries, like electrical machinery and apparatus, communication equipment and apparatus, medical precision and optical instruments, motor vehicles, trailers and semi-trailers, and transportation equipment, where the new entrants make up less than one percent.
Market size denoted by $\text{Size}_i$ is measured by the ratio of an establishment $i$’s asset values to total asset values of all establishments in the same 4-digit industries. It is meant to control for scale economies adjusted by the degree of competitiveness in the final output markets. Intuitively, market size may have a say in international outsourcing decisions since the magnitude of efficiency gains is dependent upon their market size. In addition, large establishments are able to exploit scale economies to compensate the incurred transaction costs associated with international outsourcing. In this sense, ones would expect that large establishments are more likely to tap on international outsourcing to enhance their competitiveness.

Last but not least, the rate of capacity utilisation ($\text{Capu}_i$) proxied by the ratio of fuel and electricity costs to total values of machinery is introduced to account for the possibilities that production capacity may be varied at least in short run. If this is the case, a short-run swing of production capacity may alter outsourcing decisions. For instance, a positive demand shock to a final output market may force an establishment to temporarily over-utilise the exiting production factors. As the production scale expands, a decision to contract out production activities would offer greater efficiency gains. Hence, we hypothesises that a relationship between capacity utilisation and international outsourcing decisions exhibits a positive sign.

3.3.3 Model Estimations

Since the dependent variable in the base-line econometric specification (15) is binary, the simplest approach to the model estimation is perhaps to employ the Probit model in which the estimators are obtained by the Maximum Likelihood (ML) estimation. Nevertheless, at least three concerns regarding consistency of the estimates arise and must be addressed.

First and most important, even though the establishment productivity level ($\theta_i$) is assumed to be exogenous in the theoretical model, it is at best questionable whether this assumption indeed holds empirically. As is well-known, if the regressors are endogenously determined by other unobservables, the ML estimates are biased and inconsistent. The potential endogeneity problem seems imperative as much research has identified a wide array of drivers of establishment-level productivity performance, such as investment in human capital, organisational management, and uses of information technology (Black and Lynch, 2001; Griliches, 1997; and Oliner and Sichel, 1994, among others). To tackle this issue, the
productivity levels ($\theta_i$) is instrumented by two instrumental variables (IVs): skill intensity ($\text{Skill}_i$) and value-added contributed by workers ($\text{Vadd}_i$). The ratio of skilled to total workers serves as a proxy of skill intensity while the latter is measured by the ratio of an establishment’s value-added to total workers.

The instrumental variable (IV) estimations of the Probit model are not straightforward, nevertheless. We employ Newey’s two-step minimum chi-square estimation to obtain the efficient estimators of the Probit model with endogenous regressors (Newey, 1987). Based on this approach, the minimum chi-square (MCS) estimators make use of the initial estimates of the reduced form parameters and the restrictions imposed by the model structure to estimates all structural parameters. Ferguson (1958) shows that the MCS estimators are asymptotically efficient in the absence of the restrictions implied by the structure, and thus the MCS estimation is an efficient method in which reduced form parameters are employed to estimate the structural parameters. In addition, we also produce the Wald test of endogeneity using Newey’s two-step estimators. The statistic is chi-square distributed under the null of no endogeneity. A rejection of the null implies that the ML estimates are biased and inconsistent, and thus Newey’s MCS estimation is imperative.

The other econometric issue is concerned with the industry-specific fixed effects. Our dataset covers a wide range of manufacturing activities and industries, and therefore the absence of other unobservable industry-specific effects may convey biased estimators. A vector of two-digit ISIC industry dummies ($\lambda_i$) enters the model specification to account for the industry-specific effects.

The final econometric issue we attempt to address is the heteroscedasticity problem. We concern that the assumption that the stochastic error term ($\varepsilon_i$) is homoscedastic, is violated due to the variation of establishment size in our dataset. If this is the case, the standard estimators of the Probit model are biased. To obtain consistent estimates, we tap on White’s (1980) heteroscedasticity-robust standard error procedure in the estimation of the base-line specification (15).
4 Empirical Results

Table 3.5 presents the estimation of the Probit model where all regressors are treated as exogenous. The parameter estimates are portrayed in terms of the marginal effects, $\Phi'(\bullet)$. The second column (Probit) reports the maximum likelihood (ML) estimates of the Probit model without the 2-digit industry dummies, while the last column (FEProbit) reveals the ML estimates where the 2-digit industry dummies are included. The standard error estimators are heteroscedasticity-robust for all estimations. The econometric specification (15) is adequate as Wald’s chi-squared appears to be statistically significant at the 1 percent level across all estimations and hence reject the null hypothesis that the parameter estimates are jointly equal to zero. The predictability of the model is satisfactory since the correctly specified rates amount to 84.69 and 85.3 percent for the Probit and FEProbit results, respectively.7

Table 3.6 produces the Instrumental Variable (IV) estimates based on Newey’s two-step minimum chi-squared method. The second column denoted by IV presents the IV estimates of the Probit model without the 2-digit industry dummies whereas the last column indicated by IVFE refers to the IV estimations in which the proxy of establishment productivity ($\theta_i$) is instrumented by two instrumental variables – skill intensity ($Skill_i$) and value-added contributed by workers ($Vadd_i$). These two variables potentially serve as valid IVs in that they are strongly correlated with $\theta_i$ and are likely to be exogenous to the establishments at least in short run.8 The Wald test of exogeneity, however, fails to reject the null of no endogeneity bias problem as the statistics are statistically insignificant across all estimations. This result points to the fact that the ML estimation of the Probit model in Table 5 suffices to convey consistent estimates. The finding that the endogeneity bias problem does not pose serious challenges to consistency of the estimates seems plausible given the casual

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6 For the establishment-specific dummies represented by the vector $X_i$, the interpretation of the parameter estimates is a discrete probability change of the dummies from 0 to 1.

7 An outsourcing decision is correctly specified when the predicted probability of outsourcing is greater than 0.5 for an outsourcing establishment and is lower than 0.5 for a non-outsourcing establishment.

8 The rationale is that skill intensity and labour contribution to value-added typically count on production technology an establishment ropes in. Since the production technology is unlikely to be volatile at least in short run, these two IVs are arguably exogenous to the establishments.
observation that the parameter estimates are qualitatively unchanged when the establishment productivity ($\theta_i$) is treated as endogenously determined.\footnote{We spot slight sensitivity of the parameter estimates in the IVFE column. Although still positive, the coefficient of $Rsize_i$ turns out to be statistically significant.}

The key findings of our empirical exercise based on Table 5 can be summarised as follows.

First and foremost, we find strong evidence supporting our theoretical proposition that more productive establishments tend to make use of international outsourcing than do less productive firms since the coefficients of establishment productivity ($\theta_i$) are positive and statistically significant at the 1 percent level across all estimations. Intuitively, even though contracting out production stages at arm’s length enables producers to tap on core competences and thus enhance overall production efficiency, reliance on the markets as opposed to in-house production incurs transaction costs in terms of searching for potential providers and enforcing contracts. Therefore, outsourcing is not always optimal for all establishments. The establishments must be sufficiently productive such that their large market size allows gains from improved production efficiency to dominate incurred transaction costs.

Exposure to international trade matters to the use of international outsourcing. The coefficient of $Export_i$ appears to be positive and statistically significant at the 1 percent level across all estimations. Intuitively, exporters have advantage of information on international contractors and markets over non-exporters and thus stand in good stead to exploit the global production networks. The positive relationship between the export status and the international outsourcing decisions is consistent with Feenstra and Hanson (1997) who presented the evidence from Mexico’s plants that exporters are more likely to contract out production stages at arm’s length than non-exporters.

Foreign-owned establishments tend to contend with international outsourcing now that foreign ownership ($Fhold_i$) has a positive effect on the tendency of international outsourcing. As manifested in Table 5, the coefficient of $Fhold_i$ is, again, persistently positive and statistically significant at the 1 percent level. This finding substantiates the previous study by Girma and Görg (2002). They produce evidence that nationality of ownership has a say in the use of international outsourcing. A possible explanation of this
evidence is that foreign-owned establishments may have superior knowledge of foreign input suppliers, better access to the global production networks, and exceptional managerial technology and organisational structure. These advantages enable foreign-owned firms to trim their in-house production and procure intermediate inputs from the markets.

Another establishment-specific characteristic that explains international outsourcing decisions among Thai manufacturers is new entry. The coefficient of the new entry dummy ($New_i$) turns out to be negative and statistically significant at the 1 percent level. Our estimations therefore point to the evidence that newcomers, compared to incumbent establishments, are less likely to take on international outsourcing. The insights into this finding perhaps rest with several advantages possessed by incumbent establishments. These include richer knowledge about the markets and better access to intermediate input suppliers. Another possible explanation is that new entrants may have limited capability to contract out production stages due to the lack of core competences and specialisation. Over time, they realise where their comparative advantages lie, and are ultimately thrive on international outsourcing.

Our empirical estimations also control for market size. We find that establishments with larger market shares are more likely to contract out production activities since the coefficient of $Rsize_i$ in Table 5 is consistently positive and statistically significant at least at the 5 percent level. Intuitively, a decision to downsize in-house production on the one hand enhances an establishment’s core competencies and thus lower production costs. The decision forces the establishment to invest in transaction costs in terms of contractual arrangement and enforcement, on the other. Therefore, the establishment must attain the sufficiently large market share if it is to tap on international outsourcing.

Last, capacity utilisation seems to be positively correlated with an international outsourcing decision as the coefficient of $Capu_i$ exhibits a positive, statistically significant sign. The positive correlation between capacity utilisation and outsourcing decisions may be explained by the fact that higher capacity utilisation implies larger amount of output produced. The expansion of the production scale makes the use of international outsourcing desirable to the establishments as improvement of production efficiency rendered by international outsourcing becomes more pronounced.
5 Policy Conclusions

This paper examines the theory and evidence of international outsourcing decisions. The simple, partial equilibrium model of outsourcing decisions developed in this paper builds upon that of Grossman and Helpman (2002). They articulated that contracting out production stages at arm’s length on the one hand enhances production efficiency as the outsourcing firms leverage on core competences and improved specialisation. Outsourcing activities, on the other hand, come at cost in that reliance on the markets, as opposed to in-house production, incurs transaction costs, in particular costs of searching prospective providers and investment in contractual enforcement technology. Given this trade-off, our model of outsourcing decisions incorporating firm heterogeneity shows that more productive firms tend to rope in outsourcing than less productive ones.

We then empirically investigate the determinants of international outsourcing decisions, using establishment-level data of Thailand’s manufacturing industries. Addressing several econometric issues such as the potential endogeneity bias, industry-specific characteristics, and heteroscedasticity, we find strong evidence that establishment productivity is positively correlated with probability of international outsourcing in Thailand’s manufacturing sector. This finding therefore substantiates our theoretical proposition.

Our empirical framework sheds further light on several establishment-specific characteristics that shape outsourcing decisions. The estimates reveal that exporters and foreign-owned establishments have higher tendency that the international outsourcing decision is made, than do non-exporters and locally owned establishments. This may be attributable to superior international contacts and information about foreign markets and contractual partners. Interestingly, new entrants tend to internalise production activities and hence refrain from outsourcing activities, due probably to the lack of core competences and specialisation. The establishments must take time to learn what they are good at in order to contract out parts and components others can do better.

The effects of market size and capacity utilisation are also of expected sign. Our estimates show that establishments with larger market size and higher capacity utilisation prone to undertake international outsourcing. The intuition is that market size and capacity utilisation have to do with the production scale. In this sense, large establishments and those
intensively utilising their fixed capital are able to overcome the arising transaction costs of and realise considerable production efficiency gains from international outsourcing.

References


Figure 1: Cut-off Productivity Levels with the Presence of Non-outsourcing Firms.

Source: Authors’ estimation.

Figure 2: Cut-off Productivity Level without the Presence of Non-outsourcing Firms.

Source: Authors’ estimation.
Table 1: Sample Manufacturing Establishments by Regions.

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of Establishments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangkok</td>
<td>909</td>
</tr>
<tr>
<td>Vicinity and</td>
<td>3,383</td>
</tr>
<tr>
<td>Northern</td>
<td>1,545</td>
</tr>
<tr>
<td>Northeastern</td>
<td>1,089</td>
</tr>
<tr>
<td>Southern</td>
<td>1,804</td>
</tr>
<tr>
<td><strong>Whole Kingdom</strong></td>
<td><strong>8,730</strong></td>
</tr>
</tbody>
</table>


Table 2: International Outsourcing Decisions in Thailand’s Manufacturing Industries.

<table>
<thead>
<tr>
<th>Outsourcing Decisions</th>
<th>Number of Establishments</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>1,677</td>
<td>19.2</td>
</tr>
<tr>
<td>NO</td>
<td>7,053</td>
<td>80.8</td>
</tr>
<tr>
<td>&lt; 10 %</td>
<td>261</td>
<td>15.6</td>
</tr>
<tr>
<td>10 % - 19 %</td>
<td>228</td>
<td>13.6</td>
</tr>
<tr>
<td>20 % - 29 %</td>
<td>199</td>
<td>11.9</td>
</tr>
<tr>
<td>30 % - 39%</td>
<td>173</td>
<td>10.3</td>
</tr>
<tr>
<td>40 % - 49 %</td>
<td>102</td>
<td>6.1</td>
</tr>
<tr>
<td>50 % - 59 %</td>
<td>134</td>
<td>8.0</td>
</tr>
<tr>
<td>60 % - 69 %</td>
<td>114</td>
<td>6.8</td>
</tr>
<tr>
<td>70 % - 79 %</td>
<td>129</td>
<td>7.7</td>
</tr>
<tr>
<td>80 % - 89 %</td>
<td>135</td>
<td>8.1</td>
</tr>
<tr>
<td>90 % - 100 %</td>
<td>202</td>
<td>12.1</td>
</tr>
</tbody>
</table>

Table 3: International Outsourcing Decisions by Industries.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of Establishments</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food and beverages</td>
<td>211 (9.37)</td>
<td>9.37</td>
</tr>
<tr>
<td>Tobacco</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Textiles</td>
<td>101 (12.95)</td>
<td>12.95</td>
</tr>
<tr>
<td>Wearing apparel; dressing and dyeing of fur</td>
<td>46 (13.65)</td>
<td>13.65</td>
</tr>
<tr>
<td>Leather footwear products</td>
<td>72 (25.90)</td>
<td>25.90</td>
</tr>
<tr>
<td>Wood and cork, except furniture</td>
<td>63 (18.92)</td>
<td>18.92</td>
</tr>
<tr>
<td>Paper and paper products</td>
<td>50 (26.74)</td>
<td>26.74</td>
</tr>
<tr>
<td>Publishing, printing and reproduction of recorded media</td>
<td>27 (11.64)</td>
<td>11.64</td>
</tr>
<tr>
<td>Refined petroleum products</td>
<td>16 (44.44)</td>
<td>44.44</td>
</tr>
<tr>
<td>Chemicals and chemical products</td>
<td>127 (33.96)</td>
<td>33.96</td>
</tr>
<tr>
<td>Rubber and plastics products</td>
<td>122 (27.73)</td>
<td>27.73</td>
</tr>
<tr>
<td>Other non-metallic mineral products</td>
<td>84 (11.62)</td>
<td>11.62</td>
</tr>
<tr>
<td>Basic metals</td>
<td>34 (23.78)</td>
<td>23.38</td>
</tr>
<tr>
<td>Fabricated metal products</td>
<td>163 (20.87)</td>
<td>20.87</td>
</tr>
<tr>
<td>Machinery and equipment</td>
<td>105 (33.55)</td>
<td>33.55</td>
</tr>
<tr>
<td>Office, accounting and computing machinery</td>
<td>6 (42.86)</td>
<td>42.86</td>
</tr>
<tr>
<td>Electrical machinery and apparatus</td>
<td>61 (43.26)</td>
<td>43.26</td>
</tr>
<tr>
<td>Communication equipment and apparatus</td>
<td>75 (53.19)</td>
<td>53.19</td>
</tr>
<tr>
<td>Medical precision and optical instruments</td>
<td>37 (38.54)</td>
<td>38.54</td>
</tr>
<tr>
<td>Motor vehicles, trailers and semi-trailers</td>
<td>65 (36.93)</td>
<td>36.93</td>
</tr>
<tr>
<td>Other transport equipment</td>
<td>40 (23.12)</td>
<td>23.12</td>
</tr>
<tr>
<td>Furniture manufacturing</td>
<td>172 (20.65)</td>
<td>20.95</td>
</tr>
<tr>
<td>Recycling</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td><strong>Total manufacturing</strong></td>
<td><strong>1677</strong></td>
<td><strong>19.2</strong></td>
</tr>
</tbody>
</table>

Table 4: Characteristics of Manufacturing Establishments.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Foreign Ownership</th>
<th>Exports</th>
<th>New Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food and beverages</td>
<td>118 (5.24)</td>
<td>309 (13.73)</td>
<td>439 (34.16)</td>
</tr>
<tr>
<td>Tobacco</td>
<td>2 (4.26)</td>
<td>3 (6.38)</td>
<td>n.a.</td>
</tr>
<tr>
<td>Textiles</td>
<td>62 (7.95)</td>
<td>121 (15.51)</td>
<td>172 (13.39)</td>
</tr>
<tr>
<td>Wearing apparel; dressing and dyeing of fur</td>
<td>19 (5.64)</td>
<td>64 (18.99)</td>
<td>58 (4.51)</td>
</tr>
<tr>
<td>Tobacco footwear products</td>
<td>29 (10.43)</td>
<td>64 (23.02)</td>
<td>48 (3.74)</td>
</tr>
<tr>
<td>Wood and cork, except furniture</td>
<td>12 (3.60)</td>
<td>67 (20.12)</td>
<td>64 (4.98)</td>
</tr>
<tr>
<td>Paper and paper products</td>
<td>27 (14.44)</td>
<td>46 (24.60)</td>
<td>13 (1.01)</td>
</tr>
<tr>
<td>Publishing, printing and reproduction of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>recorded media</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refined petroleum products</td>
<td>10 (4.31)</td>
<td>8 (3.45)</td>
<td>10 (.78)</td>
</tr>
<tr>
<td>Chemicals and chemical products</td>
<td>8 (22.22)</td>
<td>9 (25.00)</td>
<td>4 (.31)</td>
</tr>
<tr>
<td>Rubber and plastics products</td>
<td>70 (18.72)</td>
<td>80 (21.39)</td>
<td>55 (4.28)</td>
</tr>
<tr>
<td>Other non-metallic mineral products</td>
<td>82 (18.64)</td>
<td>147 (33.41)</td>
<td>65 (5.06)</td>
</tr>
<tr>
<td>Basic metals</td>
<td>45 (6.22)</td>
<td>99 (13.69)</td>
<td>110 (8.56)</td>
</tr>
<tr>
<td>Fabricated metal products</td>
<td>19 (13.29)</td>
<td>28 (19.58)</td>
<td>15 (1.17)</td>
</tr>
<tr>
<td>Machinery and equipment</td>
<td>78 (9.99)</td>
<td>100 (12.80)</td>
<td>62 (4.82)</td>
</tr>
<tr>
<td>Office, accounting and computing</td>
<td>55 (17.57)</td>
<td>72 (23.00)</td>
<td>30 (2.34)</td>
</tr>
<tr>
<td>Electrical machinery and apparatus</td>
<td>6 (42.86)</td>
<td>5 (35.71)</td>
<td>n.a.</td>
</tr>
<tr>
<td>Communication equipment and apparatus</td>
<td>41 (29.08)</td>
<td>47 (33.33)</td>
<td>5 (.39)</td>
</tr>
<tr>
<td>Medical precision and optical instruments</td>
<td>59 (41.84)</td>
<td>63 (44.68)</td>
<td>4 (.31)</td>
</tr>
<tr>
<td>Motor vehicles, trailers and semi-trailers</td>
<td>21 (21.88)</td>
<td>24 (25.00)</td>
<td>2 (.16)</td>
</tr>
<tr>
<td>Other transport equipment</td>
<td>48 (27.27)</td>
<td>48 (27.27)</td>
<td>6 (.47)</td>
</tr>
<tr>
<td>Furniture manufacturing</td>
<td>26 (15.03)</td>
<td>25 (14.45)</td>
<td>12 (.93)</td>
</tr>
<tr>
<td>Recycling</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td><strong>Total manufacturing</strong></td>
<td><strong>934 (10.70)</strong></td>
<td><strong>1,648 (18.9)</strong></td>
<td><strong>1,285 (14.72)</strong></td>
</tr>
</tbody>
</table>

**Source:** The 2003 Manufacturing Industry Survey, National Statistical Office, Thailand.

**Note:** Percentages in parentheses.
Table 5: Probit Model Estimates.

**Dependent Variable:** Pr(Out$_i$ = 1)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Probit</th>
<th>FEProbit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta_i$</td>
<td>.0244*** (.4408)</td>
<td>.0241*** (.0049)</td>
</tr>
<tr>
<td>Export$_i$</td>
<td>.3224*** (.0176)</td>
<td>.3294*** (.0183)</td>
</tr>
<tr>
<td>Fhold$_i$</td>
<td>.2744*** (.0232)</td>
<td>.2407*** (.0231)</td>
</tr>
<tr>
<td>New$_i$</td>
<td>-.0832*** (.0141)</td>
<td>-.0618*** (.0149)</td>
</tr>
<tr>
<td>Rsize$_i$</td>
<td>1.258*** (.4408)</td>
<td>.8135** (.3872)</td>
</tr>
<tr>
<td>Capu$_i$</td>
<td>.0058*** (.0012)</td>
<td>.0062*** (.0012)</td>
</tr>
</tbody>
</table>

Number Obs. 6,981
Wald Chi-squared ***26.589
Pseudo R-squared .3046
Log Pseudolikelihood 66.538
Correctly Specified Rate %69.84

**Note:** 1) ** and *** statistically significant at 5 and 1 percent, respectively; 2) The parameter estimates are the marginal effects of the Probit model; and 3) Robust standard errors are in parentheses.

Table 6: Instrumental Variable (IV) Estimates of the Probit Model.

**Dependent Variable:** Pr(Out$_i$ = 1)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>IV</th>
<th>IVFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta_i$</td>
<td>.2092*** (.0218)</td>
<td>.2239*** (.0240)</td>
</tr>
<tr>
<td>Export$_i$</td>
<td>.9930*** (.0513)</td>
<td>1.030*** (.0541)</td>
</tr>
<tr>
<td>Fhold$_i$</td>
<td>.8128*** (.0640)</td>
<td>.7339*** (.0656)</td>
</tr>
<tr>
<td>New$_i$</td>
<td>-.3474*** (.0917)</td>
<td>-.2134** (.0939)</td>
</tr>
<tr>
<td>Rsize$_i$</td>
<td>2.965*** (1.284)</td>
<td>1.466 (1.192)</td>
</tr>
<tr>
<td>Capu$_i$</td>
<td>.0125** (.0055)</td>
<td>.0131** (.0059)</td>
</tr>
</tbody>
</table>

Number Obs. 5,145
Wald Chi-squared ***18.340
Wald Test of Exogeneity .07

**Note:** 1) ** and *** statistically significant at 5 and 1 percent, respectively; 2) The parameter estimates are based on Newey’s two-step minimum chi-squared estimation; 3) Robust standard errors are in parentheses; and 4) The Wald statistic is chi-squared distributed based on the null of no endogeneity.