Sector Switching and Efficient Resource Allocation: An Unexplored Dimension of Firm Dynamics in Developing Countries

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Abstract

Much of the literature on industry evolution has found firm turnover to be an important source of sector-level productivity growth. In this paper, industry dynamics is approached from a new angle by considering whether the definition of entry and exit firms matters in terms of analyzing the impact of firm turnover on outcomes. Using data from Vietnam for the 2001-2004 period, we find that the sub-group of exiting firms that continue production in a different sector have different characteristics to those that cease production altogether. We also find differences in the factors determining the decision to switch sector and those that determine whether a firm exits.

Key Words: Firm dynamics, sector switching, efficiency, Vietnam

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1. Introduction

An important indicator of performance in the manufacturing sector is productivity. There are many studies documenting the link between productivity growth and other indicators of success in an evolving industry such as employment growth, export status and technology adoption (see Tybout (2000) for an overview of the productivity literature in a developing country context). Of particular interest in this literature has been the relationship between productivity and firm turnover. Efficient resource allocation has been studied extensively using firm level data, focusing on whether entry firms are more efficient than enterprises exiting a particular sector.[1] Several of these studies have found firm turnover to be an important source of sector-level productivity growth (see for example Aw *et al*. (2001), Bartelsman and Doms (2000) and Tybout (2000)). However, not much attention has been given to the effect differences in definitions of entrants and exits have on efficiency outcomes. For example, in Aw *et al*. (2001) firms changing legal ownership form, location or sector are treated as exits from the original sector and entrants to the new sector. These firms are pooled together with firms closing down production (real exits) and newly established firms (real entrants), respectively. There are several reasons to believe that efficiency differences exist between for example "real exits" and firms just labelled as an exit due to misclassification, particularly in a developing country reform context. First, besides from mixing the privatization process with turnover effects, changes in legal ownership may occur as a result of increased foreign participation in the economy. Foreign firms entering relatively unknown territory may seek to merge with domestically owned firms that are efficient and/or dominant in the selected sector (Javocik, 2004). Second, efficient firms tend to move towards urban growth centers to benefit from the agglomeration advantage that comes from localization or urbanization economies (Henderson, 1986). This means that we expect to see a high level of efficiency among exits in rural areas according to the conventional measure of firm exit. Third, well established sector switchers have better management experience than new entrants, which have been suggested to improve firm productivity (see for example the overview in Bartelsman and Doms, 2000). Moreover, sector switchers may have better knowledge

[1] See for example Hopenhayn (1992), Ericson and Pakes (1995), Olley and Pakes (1996), Pakes and Ericson (1998) amongst a multitude of others.

of the general business environment and the market conditions facing the firm. We therefore expect sector switchers to have an initial advantage at the management level relative to "real entrants".

In this paper we explore the factors determining sector switching decisions of manufacturing firms in Vietnam. In particular, we consider how these factors differ from those that determine "real" exits from a sector. Vietnam represents and ideal case study for exploring these issues given the high rates of economic growth experienced by the Vietnamese economy in the last five years and the important contribution the industrial sector has made in achieving this growth.[2] Accession to the World Trade Organisation in January 2007 will present a new set of challenges to the sector. The industry dynamics literature has recently evolved to consider the impact of trade liberalisation and other policy reforms on productivity, primarily through the vehicle of firm exit and entry. For example, Melitz (2003) presents an economic model that allows exposure to trade to induce the more productive firms to export while simultaneously forcing the least productive firms to exit. This leads to a reallocation of market shares to the most productive firms in the industry thus yielding overall productivity improvements. Similarly, Pavcnik (2002) finds evidence from Chile to show that with trade liberalisation, domestic prices fall forcing high cost producers to exit the market thus leading to a reallocation of output from less efficient to more efficient producers. Eslava *et al*. (2004) find that market reforms in Columbia are associated with rising overall productivity that is largely driven by reallocation away from low toward high productivity businesses. Thus, the literature suggests that the extent to which trade liberalisation will have positive effects for the industrial sector in Vietnam will depend on the extent to which firms have the ability to reallocate activity across sub-sectors and whether or not this reallocation is productivity enhancing. More than ever it will be important for firms to be both flexible and dynamic in terms of where and how they allocate resources. Finding and using the key opportunities for growth will be important for firm survival and to the buoyancy of the manufacturing sector. Given the dynamic nature of the sector, firm turnover and sector switching are likely to play an important

[2] Between 2001 and 2005 growth in GDP averaged around 7 percent annually with growth in 2005 reaching 8.1 percent. Industry's share of GDP reached 41 per cent in 2005, with growth in the sector driven by private sector expansion.

role in determining the overall productivity performance of the manufacturing sector both now and in the future.

In order to address these issues we must understand the extent to which manufacturing sub-sectors differ in terms of the factors that impact on firm decisions to reallocate resources. In particular, knowing which sectors are performing better in terms of productivity or efficiency improvements will provide some important insights into which sectors are likely to perform well in a more open market environment and which are likely to feel the strain of a new set of challenges and constraints. The relationship between firm ownership and firm dynamics may also be important, particularly in a Vietnamese context where there has been a long history of state ownership of manufacturing firms and a more recent history of foreign investment into the sector. For example, we expect that foreign owned firms will be more efficient than their domestic counterparts while state-owned firms may benefit from scale economies and easy access to capital which may allow them to out-perform indigenous firms. Thus the concentration of foreign and state owned firms in a sector may impact on exit, entry and sector switching decisions. For example, a large amount of foreign investment in a sector arguably acts as a signal to domestic firms that there is potential for growth in that sector. Alternatively, it could be the case that higher levels of foreign investment are a signal that competition will be tougher and so domestic firms may move away from these sectors. Other sector specific factors may also impact on firm turnover such as the overall concentration ratio of a sector or the extent of government protection a sector receives.

Using data from the Vietnamese Census of Production for 2001-2004 provided by the General Statistics Office (GSO) of Vietnam we explore the factors determining firm sector switching and exit decisions in the run up to WTO accession using a two stage approach. In the first stage, stochastic frontier production functions are estimated for sub-sectors of the manufacturing sector and relative efficiency measures are calculated for each firm for the period 2001 to 2004. This firm-specific efficiency measure allows us to explore the extent to which the efficiency of incumbents differs from that of entrants, exits and firms that reallocate resources across sectors. In the second stage, we formally explore the relationship between efficiency and firm exit and sector switching

decisions. A number of other firm and sector specific factors are also considered. The paper is structures as follows. The theoretical background is outlined in Section 2 and Section 3 presents the empirical approach. Section 4 describes the data while the empirical results are presented in Section 5. Section 6 concludes.

2. Background and theoretical framework

Bernard *et al*. (2006a) emphasize the importance of product switching for sector dynamics. They found (using U.S. manufacturing data) that "product/industry/sector switching is frequent, widespread and influential in determining both firm and aggregate outcomes".[3] However, they do not address the important issue of whether differences exist between the decision to switch sectors on the one hand and exit and entry decisions on the other. In the following we specifically focus on the un-explored topic of whether productivity differences exist between firms closing down production and firms that "just" change main production sector (defined at the 2-digit ISIC level), but have been well-established firms for years (sector switchers).

Based on the literature, we propose a number of firm and sector specific determinants of firms' exit and sector switching decisions. Considering first the firm specific explanations, Bernard *et al*. (2006a) provide evidence using U.S. data that an extended version of standard sector dynamics models can be used to explain various aspects of sector switching. The seminal work of Jovanovic (1982) considers a passive learning model in which information is gathered at no cost. Firms entering a new product market (sector switchers) do not know their exact cost structure and assuming that firms differ with regard to efficiency, they incur different costs when producing the same levels of output. Since entrants do not know their exact abilities (productivity) in the new product market their performance is unknown, and each participant has to go through a learning process, accumulating information from actual market experience. Gradually firms

[3] Bernard *et al*. (2006a) refer to 2-digit ISIC categories as sectors, 4-digit ISIC categories as industries and 5-digit ISIC as products or goods. We follow their definition and focus on sector switching (2-digit level), which may be considered a more conservative measure of switching behaviour. While the data allow for analysis at the 4-digit level, which would significantly increase the number of switchers (at the industry level), we have chosen to select the 2-digit ISIC level to make our study comparable to the wide range of firm dynamic studies that use this level of disaggregation.

discover whether their abilities meet prior expectations, and if not they will exit. Consequently, efficient firms survive and experience growth, whereas over-optimistic firms eventually switch sector or close down. The longer a firm has been in the market the more knowledge it has about its own abilities, suggesting that the probability that a firm switches sector is negatively related to firm age. As such, it is expected that the probability of a firm switching sector is decreasing in firm level productivity and firm age and size.

Ownership structure may also influence sector switching, even when firm specific variables are controlled for. In China (see Wen *et al*. (2002) for details), state owned enterprises (SOEs) have undergone economic reform, gradually changing the specific production decisions from being planned at the central government level to a decentralized decision process at the firm level. However, although the importance of central planning departments and committees has been shrinking over time, SOE strategies are still planned at the central level. In particular, decisions about which industries SOEs should engage in continue to be made at the central level. This political hierarchy in SOE management structure limits inter-sector dynamics and we would therefore expect SOEs to switch sector less frequently. On the other hand, the ongoing privatization process also leads to relatively more state owned enterprises being closed down. We therefore hypothesize that there is a positive association between state ownership and firm closure in the exit specification.

Foreign owned enterprises, or enterprises with some foreign participation, are also expected to be more "locked in" to a specific sector due to the legal constraints facing these firms in the Vietnamese business sector. Until recently, foreign and domestic investors were governed by two separate laws: the Law of Foreign Investment and the Law of Domestic Investment.[4] Although the 1999 Enterprise Law aimed to level the playing field for domestic and multinational firms, foreign investment has generally been directed towards special sub-sectors selected by the Vietnamese authorities.[5] On

[4] A new investment law came into effect in July 2006. This law aimed to equalize opportunities for domestic and foreign investors. However, as outlined in Freshfields Bruchhaus Deringer (2006), a truly common framework has not yet been achieved in all areas.

[5] Thuyet (1995) documents the Vietnamese government's approach to foreign investment, which includes a list of five broad sub-sectors where foreign investors are encouraged to conduct business. The five broad sub-sectors are: (1) large scale industries (with a focus on export-oriented and import substitution

the other hand, capital shortage and technological spillover arguments lead in the late 1990s to a business environment that encouraged foreign investment and provided preferential treatment to foreign-owned firms. Following the Chinese model, special economic zones were created, opening up special tax schemes for foreign firms. Thus, while we expect foreign enterprises to be less likely to switch sector, such special arrangements for firms with foreign participation make it less likely for foreign firms to shut down.

Bernard *et al*. (2006a) propose that aside from firm-specific characteristics, firm exit and sector switching could be driven by forces that are sector-specific and common to all firms. For example, sudden changes in consumer preferences (demand shock), supply shocks driven by sudden changes in sector structure due to political decisions (privatization or closure of larger SOEs), changes in production technologies or trade liberalization will all affect a specific product's future profitability and thus firm allocation decisions.

In this context, we consider five sector specific "push" and "pull" factors. First, we consider the dominance of state enterprises (SR) (state owned enterprise share of total sector output) as a potential "push" or "pull" factor. On the one hand, preferential treatment of SOEs makes it difficult for non-state enterprises to compete and may force more efficient non-state firms to exit (or they never enter highly SOE concentrated industries). On the other hand, the shift from a planning to a market economy often increases the SOE share of material inputs bought at market conditions (see Jefferson and Rawski (1994) for evidence from China) increasing the attractiveness of highly SOE concentrated industries for smaller (private) enterprises acting as producers of intermediates for SOEs.

Second, similar arguments are important when considering the dominance of foreign enterprises (FR) (foreign enterprises share of total sector output). As emphasized in Aitkin and Harrison (1999) preferential treatment of foreign owned firms (such as tax holidays and import duty exemptions) may distort competition and force (equally

industries), (2) high-technology industries, (3) labour intensive industries using raw materials and natural resources available in Vietnam, (4) construction of infrastructure, and (5) foreign-exchange-earning service industries.

efficient) domestically owned counterparts out of the sector.[6] However, governments grant several types of special treatment to foreign enterprises based on standard technology transfer arguments. This technology transfer can take many forms. New products and/or production processes introduced by foreign firms may directly spill-over to domestic firms. Moreover, diffusion can also occur through labour turnover. A high presence of foreign enterprises in a particular sector can therefore act as a magnet for domestic firms. Whether FR is positively or negatively related to sector switching and firm exit depends on which of the above effects dominate (competition versus technology transfer).[7]

Third, the sector concentration ratio (CR), measured as the ratio of the four largest firms accumulated revenue to the total revenue in the sector, is often referred to as a proxy for the degree of competition in a sector. As documented by Siegfried and Evans (1994), a high CR is expected to strengthen coordinated efforts among incumbent firms and increase the likelihood of predatory behaviour in the sector in order to prevent entry and maintain higher expected profits. However, Audretsch (1991) have empirically shown that a high CR will help the survival rates of new entrants in the short run. We therefore expect that a high CR reduces firm incentives to exit or switch sector.

Fourth, the average sector efficiency score (EFF) (calculated from the individual firm efficiency levels) is another indicator of sector level competition. However, as compared to CR the mechanism, through which EFF influences firm exit and sector switching decisions, is somewhat different. A high EFF serves as push factor, increasing the probability of exit and sector switching for under average firm performers to sectors displaying lower average efficiency levels where they may be better able to compete.

Finally, the effective rate of protection (ERP), based on Arthukorola (2006), measures the proportionate increase in per unit value added of a sector due to the complete system of tariffs. More specifically, it takes into account the protection on output and the cost-raising effects of protection on inputs. Our hypothesis is that firm turnover is lower in

[6] Evidence for Venezuela suggests that once sector specific effects are controlled for, domestic firms perform worse as foreign dominance in a sector increases (Tybout, 2000).

[7] Foreign enterprises may also create a basis for domestically owned firms to produce intermediate inputs as in the case of SOEs. Therefore, inter-industry spillovers from FDI may occur. Javorcik (2004) finds evidence of backward linkages for Lithuania while Alfaro and Rodriguez-Clare (2004) find similar evidence for Venezuela, Brazil and Chile.

highly protected sectors, although as stated in Arthukorola (2006), much of the ERP levels and changes reflect levels and increases in import duties on intermediates rather than final goods.

3. Empirical approach

3.1 Estimating efficiency

A broad range of methodologies have been developed for the purpose of estimating productivity.[8] There are some important considerations that must be made in choosing an appropriate approach for estimating productivity. Measurement error in inputs is common in most firm level data, particularly for developing countries. Parametric approaches that calculate productivity from a stochastically estimated production function will be less vulnerable to measurement errors than their non-parametric alternatives.[9] While this will come at the cost of a less flexible technology specification, appropriate testing procedures can be used to ensure that the production function is correctly specified. An additional issue is the simultaneity of productivity and firm input choices. This is due to the fact that when choosing inputs firms are aware of their own productivity but the econometrician is not. As such the inputs will be correlated with the unobserved error term which captures productivity. One approach to dealing with this is the stochastic frontier approach.[10] This involves the calculation of productivity from a parametrically estimated production function which imposes assumptions on the distribution of the unobserved productivity component to separate productivity from the deterministic part of the production function and the statistical noise term.

The production technology is defined separately for each sub-sector using a stochastic production frontier which expresses output as a function of inputs, technical

[8] See Van Biesebroeck (2003) for an overview of the various methodologies that have been proposed in the literature.
[9] For example, index number approaches or data envelopment analysis (DEA).
[10] See Kumbhakar and Lovell (2000) for an overview. Alternative approaches, not considered here due to data limitations, are instrumental variables estimation, for example the approach developed by Blundell and Bond (1998; 2000) and semi-parametric estimation, for example the approaches developed by Olley and Pakes (1996) and Levinsohn and Petrin (2003).

inefficiencies capturing the degree to which firms produce below the optimal level of production and a random error component (Pitt and Lee, 1981).

$$y_i^t = f\left(x_i^t;\beta\right)e^{v_i^t - u_i}$$

$$i = 1,2,....,n_j;\ \ t = 1,2,...T \tag{1}$$

where y_i^t is the output of the i th firm in a particular sub-sector in time period t, x_i^t is the vector of inputs into the production process, β is the vector of parameters of the production function, v_i^t represents statistical noise and other random external events influencing the production process.[11] The technical efficiency of the i th firm relative to the stochastic frontier for its group is given by:

$$TE_i = \frac{y_i^t}{f\left(x_i^t;\beta\right)e^{v_i^t}} = e^{-u_i} \tag{2}$$

As such, u_i are the firm specific inefficiency effects for a particular sector. If $u_i = 0$, the firm is efficient and operates on the group specific production frontier. If $u_i > 0$, there are inefficiencies and the firm is operating beneath the best-practice frontier for the sub-sector. v_i^t and u_i are assumed to be independent.

The stochastic production function for each sub-sector can be estimated by specifying an appropriate functional form for each model. Here we consider a translog production function which incorporates controls for exogenous fixed time effects ω^t, for example, due to technological change or policy changes which affect all firms equally.

$$\ln y_i^t = \alpha + \sum_{k=1}^{K}\beta_k \ln x_{ik}^t + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{L}\beta_{kl}\ln x_{ik}^t \ln x_{il}^t + \omega^t + v_i^t - u_i \tag{3}$$

The short panel available to us prevents time varying components in the production function and the inefficiency component from being separately identified (Greene,

[11] v_{ij}^t is assumed to be iid $N\left(0,\sigma_{vj}^2\right)$.

2005). As such, inefficiency effects are assumed not to vary over the course of the four years. This implies that the position of firms in terms of efficiency relative to the best-practice firms is assumed constant. Average efficiency levels in an industry can only change from year to year if firms exit or enter the sector. The inefficiency effects are assumed to be distributed as a truncated normal distribution with mean μ. Where μ is found to be insignificant a half normal distribution is assumed.

We hypothesise that a firm's position relative to others in their sub-sector will influence their decision to either remain in the sub-sector or reallocate. Firms will remain if they perform well and switch sector if they under-perform relative to the average. The sub-sector they switch to may be determined by the average performance of firms in other sectors. As such, there are three components of efficiency that will matter for a firm's reallocation decision: 1) the average efficiency level of the sub-sector they are in, 2) how well they are doing relative to other firms in that sub-sector, and 3) the average efficiency level of the sub-sector they intend to move to.

3.2 Modelling the reallocation decision

We estimate random effects probit models of the sector switching and exit decisions. This specification is chosen given that controlling for unobserved heterogeneity using fixed effects is complicated by the incidental parameters problem (see Lancaster, 2000).[12] In order to overcome problems of measuring productivity in multi-product firms (see Bernard *et al*., 2006a) we focus on single-product firms.[13] Specifically, the

[12] The binary nature of the dependent variable leads to the incidental parameters problem which prevents the unobserved heterogeneity from being treated as a fixed effect (Neyman and Scott, 1948). As an alternative, the unobserved effects can be treated as a random effect. It should be noted, however, that consistent estimation of the random effects model by maximum likelihood requires the assumption that the errors are independent of other regressors in the model. Since much of the focus here is on sector specific explanatory factors, correlations between the regressors and the individual effects are of less concern.

[13] Bernard et al. (2006b) examine the implications of unobserved product-mix variation and product switching for the measurement of firm and sector level productivity. They demonstrate that production-technology differences across products and product-choice variation across firms interact to bias standard production function based estimates of firm productivity. When firms endogenously choose between products with heterogeneous techniques, standard measures of TFP will be systematically biased (Bernard et al., 2006b). For example Olley and Pakes (1996) and Levinsohn and Petrin (2003) control for several sources of measurement error, but they do not eliminate the bias in productivity measures due to

underlying latent model for the sector switching decision is presented in equation (1), where s_{ijt} represents the sector switching decision for firm *i*, in sector *j*, at time *t*. Vectors x_{ijt-1} and z_{jt-1} are one-period lagged firm specific and sector specific explanatory variables, respectively, and the unobserved heterogeneity is treated as a random effect, υ_i.

$$s_{ijt}^{*} = \alpha_0 + x_{ijt-1}'\alpha_1 + z_{jt-1}'\alpha_2 + \upsilon_i + e_{ijt} \tag{4}$$

where $s_{ijt} = 0$ if $s_{ijt}^{*} \leq 0$ and $s_{ijt} = 1$ if $s_{ijt}^{*} > 0$ and α_0, α_1 and α_2 are parameters to be estimated.

4. Data

The data are taken from the Vietnamese Census of Production for 2001-2004 provided by the General Statistics Office of Vietnam (see GSO (2005) for a thorough description of the data). The dataset includes all registered enterprises at the end of each year considered. Nineteen 2-digit level sub-groups of the manufacturing sector are considered (detailed in Table 1). The total sample consists of 61,510 observations on 23,916 manufacturing firms. We exclude from our analysis firms that produce products for different sub-sectors to eliminate the possibility of unobserved within firm reallocations across sectors. Thus, our sample is restricted to 44,712 observations on 20,521 manufacturing firms.[14]

[TABLE 1 ABOUT HERE]

For the production function analysis, the output variable is defined as the gross value added of the firm deflated by the industrial output price index relevant to the 2 digit sub-sector. It is constructed by adding total labour costs to gross profit. Two inputs are considered: labour, measured as the total number of persons employed at the end of the

endogenous product choice. We correct for this by sorting firms into groups that make a single product, and measure productivity across firms making the same product.

[14] As a robustness check we also consider a sample of firms who remain in the sample for the entire period, thus eliminating the impact of exit/entry decisions.

year in question;[15] and capital, measured as the total assets of the firm at the end of the year deflated by a capital price series. Descriptive statistics are presented in Table 2.

[TABLE 2 ABOUT HERE]

Table 3 outlines the number of sector switchers, exits and entrants in the sample. Sector switching "OUT" counts the number of firms, which change main production sector (2-digit ISIC) in the subsequent year. Similarly, sector switching "IN" documents the number of firms that have just entered a new sector as compared to the previous year. We are interested in comparing firms that fall into the sector switching "OUT" and "IN" categories to 'real' exits and new entrants, respectively. Around 4.6 percent (on average) switch out of a given sector each year. This is somewhat below the average number of exit firms (8-10 percent on average exit each year, depending on the sample considered). Even larger differences exist between sector switchers "IN" and new entrants, mainly due to the nature of the data (registered firms).[16]

[TABLE 3 ABOUT HERE]

Table 4 provides sector details on sector switching firms, focusing on the 1,076 firms that switch "OUT" of a particular sector.[17] Each row illustrates the number of firms that switch "OUT" of a particular sector and categorizes these firms across the columns by the sector they switch "IN" to. For example, 10 firms leaving production within "Fabricated metal products" (ISIC 28) change to "Repairing of other transport equipment" (ISIC 35), whereas nine firms move in the opposite direction. The sectors

[15] All firms with 4 employees or less are excluded from the analysis.

[16] Given that only registered firms under the enterprise law are covered makes analysing several aspects of firm entry problematic. Firms entering in 2002, 2003 or 2004 may have existed for several years before registering, and therefore do not constitute entrants in strict terms. Registration involves several benefits to firms (easier access to credit etc.). However it also makes firms more visible to government authorities (and especially tax collectors). It is therefore uncertain during which stage in their life-cycle a firm decides or is forced to register. Moreover, the post 2001 surveys did not collect information on establishment year. Given the nature of the data we therefore focus most of our attention on efficiency differentials between incumbents, exits and sector switching firms.

[17] The observations used in the construction of Table 4 correspond to the total in Table 3 for sector switching "OUT" (with consistent information on firm age (establishment year)). The 1,076 sector switching observations occur among 949 firms. Some 829 firms switch sector only once, whereas 113 and 7 firms switch main production two and three times respectively. A similar table for firms in the "IN" category has been excluded due to space considerations. Results are available on request. The same table for the total of 1,431 switching "OUT" firms is presented in the Appendix (Table A). Entry rates by sector are also included.

that experience the greatest proportion of outward switchers are "Assembling/repairing of motor vehicles" (ISIC 34 – 12.7%), "Furniture" (ISIC 36 – 10.3%) and "Medical and optical instruments" (ISIC 33 – 8.9%). These sectors are also the ones that sector switchers most frequently switch in to suggesting a positive correlation between the number of firm switchers entering and exiting specific sectors. This is consistent with much of the literature on firm dynamics which finds a positive correlation between exit and entry rates at the sector level.[18] Over 33 percent of the firms leaving a particular sector switch to the tertiary/service sector. This is particularly so for "Food processing" (ISIC 15), where 76.1 percent of exiting firms switch to the service sector. The table also documents exit rates by sector. As a percentage of the total number of firms in the sector, most firms exit "Non-metallic mineral products" (ISIC 26 – 9.4 percent) and "Basic metals" (ISIC 27 – 8.9 percent).

[TABLE 4 ABOUT HERE]

Table 5 reports summary statistics for each of the sector specific variables considered in the exit and sector switching specifications. Firstly, the variation in the SOE concentration ratio (SR) across sectors is quite high (ranging from 76.2 percent in "Publishing and printing" (ISIC 22) to 6.0 percent in manufacture of "Furniture" (ISIC 36)).[19] There is also a relatively high level of foreign participation (FR) in Vietnamese manufacturing ranging from 3.1 percent in "Publishing and printing" – ISIC 22 (where there is high degree of state involvement) to 61.6 percent having some foreign involvement in "Radio and communication equipment" – ISIC 32. The sector concentration ratio (CR), measured as the ratio of the accumulated revenue of the four largest firms to total revenue in the sector shows very high concentration ratios in "Basic Metals" – ISIC 27 (49.2 percent) and in "Medical and optical instruments" – ISIC 33 (50.3 percent). Finally, summary statistics for the effective rate of protection (ERP) reveal that "Food processing" (ISIC 15), "Textiles" (ISIC 17), "Wearing

[18] See for example Disney et al. (2003) who find a high level of correlation between entry and exit rates within UK manufacturing industries and Roberts and Tybout (1996) who find similar evidence in a developing country context.

[19] Note that not all firms labelled as state owned firms have 100 percent state ownership. For example, for "Publishing and printing" (ISIC 22) 76.2 percent of output in the sector is produced by a firm with at least 50 percent state ownership.

Apparel" (ISIC 18) and "Assembling/repairing of motor vehicles" (ISIC 34) were highly protected sectors in the period under study.

[TABLE 5 ABOUT HERE]

5. Empirical results

5.1 Production function estimation and efficiency

The model is estimated separately for each 2-digit sub-sector described in Table 1 using Frontier Version 4.1 (Coelli, 1996). As discussed in Section 3, parametric approaches to production function estimation require restrictions on the technology underlying the production process. A series of specification tests is performed to ensure an appropriate functional form for each production function (see Table B in the Appendix). While the model should be as flexible as possible, this should not come at the price of theoretical inconsistency. Tests for the theoretical consistency of the estimated stochastic production functions are presented in Table C of the Appendix. As discussed by Sauer *et al*. (2006), if the estimated parameters violate the assumptions of monotonicity and quasi-concavity, elasticities and technical efficiency estimates can be misleading. This is particularly the case for the application considered here where the primary purpose of the model is to produce accurate measures of firm level productivity. In all cases the partial derivatives of the production functions are of the appropriate sign at the sample mean with few violations of the monotonicity assumption throughout the sample as a whole. Curvature assumptions are satisfied at the mean for most sub-samples (i.e., quasi-concavity in inputs) with the exception of sectors 31 and 34. In these cases, a more restrictive Cobb-Douglas specification is chosen.[20] The parameters of the final specification of each production function for each sub-sector are presented in Table 6.[21]

[TABLE 6 ABOUT HERE]

[20] While violations also occur for a large proportion of observations in sectors 19 and 27, the results of the Cobb-Douglas and translog models are very similar so we proceed with the more flexible translog specification. Efficiency results are considered both including and excluding the observations which violate the curvature assumptions with almost identical results found in all cases.

[21] It should be noted that in estimating stochastic frontier production functions of this kind it is assumed that technology is homogenous across each 2-digit sub-sector analysed.

The purpose of estimating production functions for each manufacturing sector is to use the inefficiency estimates to determine which sectors are performing well relative to their own technology frontier. A key assumption of the stochastic frontier approach is that all firms *within* a sub-sector use the same technology and so this approach does not allow us to compare production technologies across sub-sectors. The inclusion of fixed time effects in the production function controls for exogenous changes to the environment in which the sector operates, for example changes in technology or the regulatory environment, and policy changes that may affect the production process in each year. Controlling for these aspects, our model produces one efficiency score for each firm in each sector, regardless of how many time periods they are present in that sector. We calculate a relative efficiency measure for each firm by comparing their estimated efficiency score relative to the top performing firm in each sector in each year, thus adjusting for firms that exit, enter or change activity. Using this measure we can analyse how firms in each sector are performing on average (given the technology at hand) and how different groups of firms within sectors are performing relative to that average. We focus here on differences between exits, entrants, switchers and incumbents by sector as presented in Table 7.

[TABLE 7 ABOUT HERE]

Column (1) documents mean relative efficiency differences between incumbents and new entrants. In all sectors incumbents are on average more efficient than newcomers (in 14 out of 19 sectors the estimate is statistically significant). A similar result emerges from comparing efficiency differences between incumbents and exits (column 2). These results show that exit is concentrated among the least efficient firms, and entrants are also less efficient (on average) as compared to incumbents. These results are consistent with the findings of Aw *et al*. (2001) for Taiwanese firms in the 1980s. Focusing strictly on efficiency differences between "real" entrants and "real" exits (column 3) reveals that exits in 78.9 percent of the sectors (15 out of 19 – and in five cases significant negative coefficient) have on average higher efficiency levels than new entrants. This suggests that the standard finding that firm turnover contributes to a more efficient reallocation of resources (i.e. transferring resources from less efficient to more efficient

producers) may not hold in the case of the Vietnamese manufacturing sector.[22] Columns 4 and 5 in Table 7 compare sector switchers with incumbents. Our findings suggest that incumbents produce more efficiently than both types of sector switchers ("IN" and "OUT"), in line with the predictions of traditional life-cycle theories. Finally, the two remaining columns (columns 6 and 7) compare mean efficiency differences between sector switchers and entrants and exits, respectively. In nine out of 19 sectors we find that sector switchers are (on average) significantly more efficient producers than "real" new entrants. This is also the case for three sectors when sector switchers are compared to exits. Overall, our results indicate that significant efficiency differences exist between different types of entrants and exits. We emphasize that merging different types into single entrant and exit groups constrain our understanding of the underlying features determining firm dynamics. In the following we formally analyse the relationship between efficiency and firm dynamics and extend our analysis to consider several firm and sector specific indicators. We focus on exits and sector switching decisions paying particular attention to the differences in the determinants of each.

5.2 The sector switching and exit decision

The results for random effects probit models of the sector switching and the exit specifications including only firm specific explanatory variables are presented in Table 8. The first columns in both the sector switching and the exit specification include the weighted relative efficiency score (computed as the efficiency level of the firm relative to the frontier for each sector in each year) together with a set of province, sector and time dummies. As expected we find a significant negative relationship between a firm's relative efficiency and both sector switching and exit. Less productive firms are more likely to switch sector and to close down. Controlling for firm size and age does not change this conclusion, and both control variables have the expected (and well-determined) sign in the sector switching specification. Older and larger firms are more likely to remain non-switchers, in accordance with the predictions of traditional firm life-cycle theories. Firm size has the expected negative sign in the exit specification,

[22] For example, results for Chile and Columbia find that inefficient plants are replaced with slightly more efficient plants thus increasing overall productivity in the sector albeit by a small amount (Tybout, 2000).

whereas firm age is positive and significant (contrary to the hypothesized effect). The ongoing privatization process (and the general legal restructuring of the business sector) is likely to be central in explaining this result, particularly given that the effect of firm age is no longer well-determined in the exit specification once we control for legal ownership types (column 3). Ownership structure matters for both the sector switching and exit decision. As hypothesized, state owned firms and foreign owned enterprises are more likely to remain within the pre-selected sector than domestic privately owned firms. Similarly, in the exit specification state owned firms are more likely to exit, whereas the foreign enterprise indicator variable has the expected negative and significant sign.

[TABLE 8 ABOUT HERE]

Table 9 presents results from the same model but using different sub-samples of the data.[23] Column 1 compares sector switchers with incumbent firms only, whereas column 2 is restricted to a comparison between exits and incumbents. The results from both sub-samples yield the same conclusions as the full-sample. Column 3 in Table 9 restricts the sample under consideration to sector switchers and exits only. First, as suggested by the results presented in Table 7, there is no evidence of a significant efficiency difference between exits and sector switchers, even when controlling for size, age, location, sector and ownership form. However, sector switchers are more likely to be larger, younger and with foreign participation than firms closing down production. Moreover, exit firms are more often found among SOEs as expected given the nature of the privatization process in Vietnam.

[TABLE 9 ABOUT HERE]

Table 10 presents the results of the sector switching and exit models incorporating the sector specific explanatory variables. Each model also includes the firm specific variables. Columns 1 (without province and sector dummies), 3 (without sector dummies) and 5 use the same sample as the results presented in Table 8 (the total

[23] In Table D of the Appendix we also analyse differences between firms changing main production to the tertiary/service sector and intra-manufacturing sector switchers. We do not find differences in efficiency levels (when controlling for size and age). However, among sector switchers the firms that change to services are smaller in size compared to firms switching within manufacturing. Moreover, foreign firms tend to stay within the manufacturing sector.

sample), whereas columns 2 (without province and sector dummies), 4 (without sector dummies) and 6 are comparable with column 3 in Table 9 (comparing switchers and exits only). The overall (robust) results from Table 10 can be summarized in two main headlines. First, firms are less likely to exit and switch from sectors that are highly dominated by SOEs. As hypothesised in Section 2, the shift from a centrally planned to a market economy may open up opportunities for smaller (private) enterprises in a sector, particularly for those acting as producers of intermediates for SOEs. Second, as expected there is a significant lower probability of switching in sectors that are highly protected. This result is not found, however, for the exit specification. Switching focus to column 2 and 4 we see that this result is consistent with our findings for sector switchers compared with exits only.

Several other interesting (but less robust) results can be seen from Table 10. A high presence of foreign enterprises and a high average sector efficiency level tends to increase the probability of sector switching and exit. In contrast to the technology transfer argument hypothesised in Section 2, a high proportion of foreign ownership may be associated with higher levels of competition and thus a greater tendency for firms who find it difficult to compete to either exit or switch sector. Similarly, a high concentration ratio also increases the probability that a firm switches sector, but this result does not hold for firm exit decisions.

In summary, sector switchers and exits tend to be affected differently by firm and sector specific factors. Younger firms are more likely to switch sectors while exit is significantly associated with older firms. The latter result is primarily due to changes in ownership structure as state owned firms are more likely to exit rather than switch sector as a result of the privatization process. Foreign owned firms are less likely to exit and switch sectors but when the sample is restricted to firms who either exit or switch the latter group have a significantly higher concentration of foreign participation. Sector specific differences also exist. In particular, higher levels of concentration in a sector are more associated with sector switching while sector switching is less likely than exits where sectors are more heavily protected.

6. Conclusion

Much of the literature on industry evolution has found firm turnover to be an important source of sector-level productivity growth. In this paper, industry dynamics is approached from a new angle by considering whether the definition of "entry" and "exit" firms matters in terms of analyzing the impact of firm turnover on outcomes. We find that the sub-group of exiting firms that continue production but in a different sector have different characteristics to those that cease production altogether. We also find differences in the factors determining the decision to switch sector and those that determine whether a firm exits.

For the manufacturing sector in Vietnam, we find that less productive firms are more likely to switch sector and to exit. However, we find that while firms that switch sectors have lower efficiency levels than incumbents, for most sectors they are significantly more efficient than new entry firms. This is important given that average efficiency levels are higher amongst exiting firms compared with entrants once the sector switchers are netted out, suggesting that the "real" exit and entry of firms in the Vietnamese manufacturing sector may negatively impact on overall productivity. Younger firms are more likely to switch sectors while exit is significantly associated with state ownership. Market forces also matter differently for firms who switch sector compared with those who exit. The former are influenced by the competitiveness of the sector they are in as measured through its concentration ration and average efficiency level and the extent of protection that the sector offers. In contrast, of these factors only efficiency levels appear important in the exit decision.

Overall, we can conclude that sector switchers are motivated by different factors than exits and as such they are likely to play an important role in understanding industry dynamics. A key issue for the Vietnamese manufacturing sector is how trade liberalisation will impact on the productivity and profitability of the sector. Much of the literature suggests that this will depend on firm turnover. The findings of this paper suggest that differences between firms that exit and firms that switch sectors should also be considered. In particular, the success of the sector may not only depend on the extent to which inefficient firms are replaced with better performing firms, but also on firm ability to reallocate activity across sub-sectors. Here we have shed some light on the

characteristics of reallocating firms in the run up to the liberalisation process. More importantly, we have established how they differ from firms that cease production altogether. Having information on the nature of these firms, what motivates them and what makes the reallocation process easier appears as essential information to better guide industrial policy through the challenging years ahead.

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Tables

TABLE 1: TWO-DIGIT MANUFACTURING SECTORS

Sector 15:	Manufacture of food products and beverages
Sector 17:	Manufacture of textiles
Sector 18:	Manufacture of wearing apparel, dressing and dyeing of fur
Sector 19:	Tanning and dressing of leather, manufacture of luggage, handbags, saddler, harness and footwear
Sector 20:	Manufacture of wood and of products of wood and cork; manufacture of articles of straw and plaiting materials
Sector 21:	Manufacture of paper and paper products
Sector 22:	Publishing, printing and reproduction of recorded media
Sector 24:	Manufacture of chemicals and chemical products
Sector 25:	Manufacture of rubber and plastic products
Sector 26:	Manufacture of other non-metallic mineral products
Sector 27:	Manufacture of basic metals
Sector 28:	Manufacture of fabricated metal products, except machinery and equipment
Sector 29	Manufacture of equipment and machinery
Sector 31:	Manufacture of electrical machinery and apparatus
Sector 32:	Manufacture of television and communication equipment and apparatus
Sector 33:	Manufacture of medical precision and optical instruments, watches and clocks
Sector 34:	Manufacture of motor vehicles, trailers and semi-trailers
Sector 35:	Manufacture of other transport means
Sector 36:	Manufacture of furniture; manufacturing n.e.c.

Note: The following sub-sectors are excluded from the analysis due to having few firms to facilitate the estimation of a production function:

16: Manufacture of tobacco products
23: Manufacture of coke, refined petroleum products and nuclear fuel
30: Manufacture of office machinery and computers
37: Recycling

TABLE 2: SUMMARY STATISTICS FOR PRODUCTION FUNCTION ANALYSIS

Sector	15	17	18	19	20	21	22
No. of firms	4,462	816	1,574	498	1,563	823	965
No of obs.	10,643	1,768	3,249	1,012	3,217	1,895	1,998
Value Added	628	1,277	1,478	3,070	448	703	746
(VND Million)	(2,275)	(2,935)	(2,883)	(4,809)	(1,501)	(1,896)	(2,214)
Labour Units	69	161	274	539	73	73	50
	(186)	(297)	(404)	(775)	(148)	(109)	(83)
Capital	5,848	15,195	7,751	14,128	3,353	8,828	5,708
(VND Million)	(19,133)	(32,831)	(14,973)	(24,978)	(10,359)	(23,531)	(17,811)

Sector	24	25	26	27	28	29	31
No. of firms	839	1,178	1,711	332	2,158	639	360
No of obs.	1,873	2,607	4,096	690	4,185	1,311	758
Value Added	2,045	1,058	1,390	921	469	954	1,725
(VND Million)	(4,492)	(2,864)	(3,677)	(2,837)	(1,412)	(2,127)	(3,722)
Labour Units	82	91	104	78	52	86	107
	(129)	(188)	(190)	(246)	(108)	(151)	(191)
Capital	17,443	12,068	8,510	13,107	6,231	9,371	21,924
(VND Million)	(31,880)	(25,846)	(25,501)	(31,841)	(18.302)	(19,687)	(43,868)

Sector	32	33	34	35	36
No. of firms	181	89	341	481	1,611
No of obs.	372	188	707	1,028	3,115
Value Added	4,071	1,422	1,102	1,124	663
(VND Million)	(6,368)	(2,946)	(2,917)	(2,511)	(1,706)
Labour Units	147	159	91	119	117
	(206)	(317)	(189)	(190)	(245)
Capital	33,770	26,043	14,904	16,416	6,800
(VND Million)	(50,899)	(55,670)	(37,781)	(36,272)	(16,399)

Note: Variance of variables given in parenthesis

TABLE 3: OVERVIEW OF FIRM DYNAMICS

	2001	2002	2003	2004	Total
Sector switch IN	..	214	466	489	1,169
(SW1)	..	[212]	[330]	[250]	[792]
	..	(2,0)	(3,9)	(3,5)	(2,6)
Sector switch OUT	301	607	523	..	1,431
(SW2)	[298]	[483]	[295]	..	[**1,076**]
	(3,6)	(5,7)	(4,4)	..	(3,2)
Entrants	..	2,125	2,581	3,419	8,125
(ENTRY)	..	..	..	..	..
	..	(19,8)	(21,8)	(24,8)	(18,2)
Exits	682	1,088	1,308	..	3,078
(EXIT)	[682]	[662]	[593]	..	[**1,937**]
	(8,2)	(10,1)	(11,1)	..	(6,9)
Total	8,351	10,743	11,814	13,804	44,712
	[8,339]	[8,608]	[7,416]	[6,580]	[30,943]

Note: Total number of firms (percentage in parenthesis). In brackets the number of observations without missing information on firm age. Sector switch IN (SW1): The number of firms that switched from another 2-digit ISIC sector. Sector switch OUT (SW2): The number of firms that switch main sector the coming year.

TABLE 4: SECTOR DETAILS ON SECTOR SWITCHERS

	Switch to:	15	17	18	19	20	21	22	24	25	26	27	28	29	31	32	33	34	35	36	OTH	AGR	SER	Total switchers	Percent of total	Exits	Percent of total
Switch from	ISIC 15			1		2	1		4		1		3				1	1	1	1	1	5	70	92	(1.4)	562	(8.5)
	ISIC 17	1		14		1	2		1	7												1	4	31	(3.3)	68	(7.1)
	ISIC 18		15		12	2	1	1		2			1			1				2		1	27	65	(4.2)	125	(8.1)
	ISIC 19			7		1				2		1	1							3			4	19	(3.3)	43	(7.5)
	ISIC 20	3		1			4		3	2	3	1	4						3	91		4	33	152	(8.7)	141	(8.1)
	ISIC 21	2	1	2		2		10		8	1									1			6	33	(3.1)	83	(7.7)
	ISIC 22			2			16						1	1		1							8	29	(3.2)	62	(6.9)
	ISIC 24	5	3			1	1	1		2	8		2		1		1			2		4	12	43	(4.2)	69	(6.7)
	ISIC 25		2	2	3	1	3	2	3		1	1	2	2	1	1		1	4	8	1	1	17	56	(4.2)	90	(6.7)
	ISIC 26					3		1	9	2		1	1							5		13	27	62	(2.5)	236	(9.4)
	ISIC 27					1					2		9						1				3	16	(4.5)	32	(8.9)
	ISIC 28	1			2	1	2	1		3	3	22		21	5			8	10	7		1	40	127	(6.8)	143	(7.7)
	ISIC 29	1						1		3			22		5		1	3	2	1			17	56	(8.2)	56	(8.2)
	ISIC 31						1						4	1		7		1		2			7	23	(5.7)	18	(4.5)
	ISIC 32												3		2		1				1		2	9	(4.7)	11	(5.7)
	ISIC 33										2		2	2					1				3	10	(8.9)	4	(3.6)
	ISIC 34									1			10	5					18			1	17	52	(12.7)	28	(6.8)
	ISIC 35	2				1				3			9	2	1			11		3			11	43	(7.4)	45	(7.8)
	ISIC 36			2		82	3		3	7	1	2	5	1		3		1					48	158	(10.3)	121	(7.9)
	Total switchers	15	21	31	17	98	34	17	23	42	22	28	79	35	15	13	4	26	40	126	3	31	356	**1,076**	(4.4)	**1,937**	(8.0)
	Percent of total	(0.2)	(2.2)	(2.0)	(3.0)	(5.6)	(3.1)	(1.9)	(2.2)	(3.1)	(0.9)	(7.8)	(4.3)	(5.1)	(3.7)	(6.7)	(3.6)	(6.3)	(6.9)	(8.3)				(4.4)			

Note: Total number of firms switching from/to a particular sector (percentage in parenthesis). OTH = ISIC 16, ISIC 23, ISIC 30 and ISIC 37. AGR = Agriculture/Primary sector. SER = Service/tertiary sector. Only firms for which efficiency estimates could be calculated are included.

TABLE 5: SUMMARY STATISTICS FOR SECTOR SWITCHING ANALYSIS

SECTOR SPECIFIC VARIABLES

ISIC	Main production sector	SR	FR	CR	EFF	ERP
15	Food products and beverages	0.419	0.139	0.047	0.386	72.980
17	Textiles	0.498	0.243	0.172	0.586	70.790
18	Wearing apparel	0.279	0.327	0.057	0.693	70.560
19	Leather products	0.235	0.322	0.125	0.658	39.150
20	Wood and wood products	0.260	0.124	0.088	0.678	1.150
21	Paper and paper products	0.330	0.152	0.130	0.636	17.090
22	Publishing and printing	0.762	0.031	0.098	0.452	-4.090
24	Chemical and chemical products	0.571	0.199	0.147	0.478	9.670
25	Rubber and plastic products	0.265	0.299	0.128	0.621	35.670
26	Non-metallic mineral products	0.538	0.087	0.075	0.587	50.830
27	Basic metal	0.626	0.135	0.492	0.455	0.750
28	Fabricated metal products	0.294	0.250	0.077	0.696	-20.940
29	Machinery and equipment	0.587	0.127	0.127	0.622	-8.580
31	Electrical machinery and app.	0.385	0.452	0.298	0.352	13.150
32	Radio and communication equip.	0.239	0.616	0.218	0.646	13.430
33	Medical and optical instruments	0.080	0.495	0.503	0.363	-2.950
34	Assembling/repairing motor vehicles	0.327	0.415	0.184	0.370	79.220
35	Repairing of other transport equip.	0.445	0.334	0.143	0.314	28.100
36	Furniture	0.060	0.392	0.084	0.694	23.610
Manufacturing average		0.348	0.388	0.205	0.100	38.137

Note: Summary statistics are based on the same 24,363 observations used in Table 8. SR = State owned enterprise (SOE) share of total sector output. FR = Foreign owned enterprise share of total sector output. CR = Ratio of the four largest firms accumulated revenue to the total revenue in the sector. EFF = Average sector efficiency score (EFF) calculated from the individual firm efficiency levels. ERP = Effective rate of protection, estimates obtained from Arthukorola (2006).

TABLE 6: PARAMETER ESTIMATES OF GROUP SPECIFIC PRODUCTION FUNCTIONS

Sector	15	17	18	19
Constant	0.734*** (0.046)	0.415*** (0.060)	0.167*** (0.036)	0.243*** (0.071)
$\ln x_1$	0.661*** (0.015)	0.731*** (0.037)	0.856*** (0.026)	0.769*** (0.040)
$\ln x_2$	0.466*** (0.013)	0.352*** (0.030)	0.297*** (0.025)	0.314*** (0.045)
$\ln x_1 * \ln x_1$	0.048*** (0.008)	-0.037** (0.015)	0.030** (0.012)	0.014 (0.019)
$\ln x_2 * \ln x_2$	0.045*** (0.005)	0.014 (0.009)	0.028*** (0.010)	0.059*** (0.015)
$\ln x_1 * \ln x_2$	-0.043*** (0.010)	-0.006 (0.016)	-0.043** (0.017)	-0.082*** (0.026)
Dummy 2002	0.105*** (0.018)	0.143*** (0.051)	-0.084** (0.038)	0.032 (0.059)
Dummy 2003	0.052*** (0.019)	0.134*** (0.051)	0.086** (0.038)	0.176*** (0.056)
Dummy 2004	0.018 (0.019)	0.313*** (0.051)	0.093** (0.038)	0.182*** (0.055)
$\hat{\gamma}$	0.490*** (0.015)	0.705*** (0.025)	0.875*** (0.024)	0.916*** (0.023)
$\hat{\mu}$	1.198*** (0.055)	Restricted to zero	-3.395*** (0.887)	-4.064*** (1.303)
Log likelihood	-12,169.77	-2,147.44	-3,807.50	-1,205.59
Sector	20	21	22	24
Constant	0.211*** (0.051)	0.279*** (0.043)	0.574*** (0.140)	0.729*** (0.129)
$\ln x_1$	0.830*** (0.036)	0.726*** (0.041)	0.901*** (0.042)	0.677*** (0.047)
$\ln x_2$	0.348*** (0.035)	0.454*** (0.031)	0.437*** (0.033)	0.604*** (0.035)
$\ln x_1 * \ln x_1$	0.012 (0.011)	-0.016 (0.035)	-0.002 (0.031)	0.057* (0.030)
$\ln x_2 * \ln x_2$	0.012 (0.008)	0.043*** (0.016)	0.042*** (0.015)	0.039** (0.012)
$\ln x_1 * \ln x_2$	0.015 (0.015)	-0.014 (0.042)	-0.037 (0.038)	-0.069** (0.031)
Dummy 2002	-0.045 (0.011)	0.008 (0.039)	0.051 (0.041)	0.024 (0.048)
Dummy 2003	0.011 (0.010)	-0.002 (0.040)	0.090** (0.040)	-0.001 (0.048)
Dummy 2004	0.037 (0.015)	0.124*** (0.040)	-0.055 (0.040)	-0.106** (0.049)
$\hat{\gamma}$	0.884*** (0.037)	0.926*** (0.033)	0.590*** (0.036)	0.645*** (0.051)
$\hat{\mu}$	-3.243 (3.116)	-3.943 (2.537)	1.071*** (0.185)	0.964*** (0.270)
Log likelihood	-3,507.73	-2,065.29	-1,992.56	-2,277.06
Sector	25	26	27	28
Constant	0.336*** (0.048)	0.380*** (0.034)	0.729*** (0.087)	0.257*** (0.034)
$\ln x_1$	0.662*** (0.032)	0.688*** (0.026)	0.737*** (0.069)	0.754*** (0.023)
$\ln x_2$	0.530*** (0.028)	0.485*** (0.019)	0.482*** (0.047)	0.461*** (0.018)
$\ln x_1 * \ln x_1$	0.032 (0.021)	-0.007 (0.015)	0.048 (0.041)	-0.031** (0.016)
$\ln x_2 * \ln x_2$	0.072*** (0.011)	0.039*** (0.007)	0.087*** (0.020)	0.049*** (0.007)
$\ln x_1 * \ln x_2$	-0.101*** (0.026)	-0.044** (0.018)	-0.098* (0.053)	-0.023 (0.018)
Dummy 2002	…	0.132*** (0.025)	0.1662* (0.085)	-0.077** (0.033)
Dummy 2003	…	0.154** * (0.026)	0.1274 (0.086)	-0.015 (0.034)
Dummy 2004	…	0.257*** (0.026)	0.0458 (0.0855)	-0.012 (0.033)
$\hat{\gamma}$	0.895*** (0.059)	0.766 *** (0.012)	0.381*** (0.053)	0.865*** (0.025)
$\hat{\mu}$	-3.281*** (3.1729)	Restricted to zero	1.038*** (0.055)	-3.187*** (0.795)
Log likelihood	-3,061.35	-4,168.85	-816.75	-4,789.87

Sector	29	31♣	32	33
Constant	0.396*** (0.074)	1.281*** (0.171)	0.475*** (0.074)	1.278*** (0.299)
$\ln x_1$	0.650*** (0.045)	0.573*** (0.050)	0.332*** (0.076)	0.824*** (0.101)
$\ln x_2$	0.499*** (0.038)	0.604*** (0.037)	0.756*** (0.056)	0.337*** (0.081)
$\ln x_1 * \ln x_1$	0.001 (0.031)	…	0.036 (0.051)	…
$\ln x_2 * \ln x_2$	0.048*** (0.018)	…	0.081*** (0.020)	…
$\ln x_1 * \ln x_2$	-0.054 (0.041)	…	-0.164*** (0.053)	…
Dummy 2002	0.023 (0.053)	…	…	…
Dummy 2003	0.004 (0.053)	…	…	…
Dummy 2004	0.095* (0.053)	…	…	…
$\hat{\gamma}$	0.884*** (0.070)	0.569*** (0.058)	0.944*** (0.027)	0.656*** (0.072)
$\hat{\mu}$	-2.341 (2.701)	1.430*** (0.247)	-4.508* (2.694)	1.501*** (0.392)
Log likelihood	-1,495.70	-914.79	-423.63	-215.01

Sector	34♣	35	36
Constant	0.346*** (0.069)	0.983 *** (0.148)	0.264*** (0.042)
$\ln x_1$	0.620*** (0.058)	0.745*** (0.059)	0.756*** (0.026)
$\ln x_2$	0.670*** (0.043)	0.399*** (0.045)	0.406*** (0.024)
$\ln x_1 * \ln x_1$	-0.058 (0.042)	0.050 (0.036)	0.020 (0.015)
$\ln x_2 * \ln x_2$	0.106*** (0.015)	0.049*** (0.015)	0.048*** (0.009)
$\ln x_1 * \ln x_2$	-0.064 9(0.045)	-0.085** (0.038)	-0.059*** (0.020)
Dummy 2002	…	0.225*** (0.060)	-0.006 (0.038)
Dummy 2003	…	0.244*** (0.060)	-0.127*** (0.037)
Dummy 2004	…	0.260*** (0.066)	-0.108*** (0.036)
$\hat{\gamma}$	0.759*** (0.047)	0.598*** (0.030)	0.868*** (0.018)
$\hat{\mu}$	Restricted to zero	1.436*** (0.170)	-3.257*** (0.530)
Log likelihood	-735.86	-1,242.07	-3,629.46

$\ln x_1$ is the log of labour, $\ln x_2$ the log of capital, $\ln x_3$ the log of material costs, $\hat{\gamma}$ an estimate of the share of technical efficiency in total variance and $\hat{\mu}$ the mean of the distribution of inefficiency effects.

Standard errors are given in parenthesis, *** indicates significance at the 1% level, ** indicates significance at the 5% level, * indicates significance at the 10% level

♣Restricted to Cobb-Douglas model due to violation of theoretical properties

TABLE 7: MEAN RELATIVE EFFICIENCY DIFFERENCE BETWEEN INCUMBENTS, EXITS, ENTRANTS AND SECTOR SWITCHERS

by sector	(1) INC-ENTRY t-test	(2) INC-EXIT t-test	(3) ENTRY-EXIT t-test	(4) INC-SW1 t-test	(5) INC-SW2 t-test	(6) SW1-ENTRY t-test	(7) SW2-EXIT t-test
ISIC 15	0.0137***	0.0001**	0.0000	0.0183	0.0002	0.0000	0.0000
	(3.18)	(2.41)	(0.12)	(0.98)	(1.14)	(0.78)	(0.60)
ISIC 17	0.1687***	0.0014*	-0.0003*	0.1313	0.0002	0.0004**	0.0012**
	(3.30)	(1.84)	(1.75)	(1.05)	(0.17)	(2.53)	(2.02)
ISIC 18	0.0907***	0.0009***	0.0001	0.0982**	0.0004	-0.0001	0.0006***
	(6.94)	(4.75)	(0.94)	(2.21)	(0.98)	(0.34)	(2.97)
ISIC 19	0.2474***	0.0021**	-0.0002	0.3207**	0.0028*	-0.0005	-0.0007
	(3.41)	(2.42)	(0.30)	(2.25)	(1.73)	(0.63)	(0.87)
ISIC 20	0.1009***	0.0008**	-0.0002**	0.0802	0.0007	0.0002***	0.0001
	(3.86)	(2.24)	(2.42)	(1.36)	(1.60)	(2.82)	(0.82)
ISIC 21	0.0760	0.0011*	0.0005	0.1498	0.0014	-0.0007	-0.0003
	(1.42)	(1.69)	(0.86)	(1.54)	(1.27)	(0.84)	(1.12)
ISIC 22	0.1171***	0.0010**	-0.0001	0.1310	0.0000	-0.0001	0.0011
	(3.07)	(2.02)	(0.19)	(0.99)	(0.05)	(0.14)	(1.47)
ISIC 24	0.1329***	0.0008*	-0.0005*	0.1425**	0.0013*	0.0000	-0.0005
	(4.31)	(1.89)	(1.90)	(2.16)	(1.95)	(0.19)	(0.99)
ISIC 25	0.1083***	0.0010**	-0.0001	0.0181	0.0010	0.0009***	0.0000
	(3.68)	(2.22)	(0.58)	(0.25)	(1.36)	(3.03)	(0.08)
ISIC 26	0.0251	0.0004*	0.0002	0.0640	0.0004	-0.0004	0.0000
	(1.56)	(1.65)	(0.65)	(1.18)	(0.80)	(0.78)	(0.07)
ISIC 27	0.2762	0.0038	0.0011	0.3941	0.0015	-0.0008	0.0023**
	(1.45)	(1.29)	(1.12)	(1.24)	(0.34)	(0.77)	(2.16)
ISIC 28	0.0720***	0.0003	-0.0004**	0.0197	0.0007**	0.0005**	-0.0003
	(4.75)	(1.41)	(2.09)	(0.58)	(1.99)	(2.31)	(1.18)
ISIC 29	0.1938***	0.0013	-0.0008*	0.1337	0.0011	0.0007	0.0002
	(2.82)	(1.32)	(1.75)	(1.02)	(0.95)	(1.09)	(0.20)
ISIC 31	0.2776***	0.0015	-0.0013	0.0373	0.0024	0.0024**	-0.0009
	(3.17)	(1.08)	(1.41)	(0.20)	(1.28)	(2.32)	(0.53)
ISIC 32	0.9370***	0.0079	-0.0013	1.0713**	0.0084	-0.0001	-0.0005
	(2.56)	(1.59)	(0.55)	(2.19)	(1.54)	(0.06)	(0.16)
ISIC 33	1.1092	0.0106	-0.0004	1.1227	0.0109	0.0005**	-0.0003
	(1.26)	(1.32)	(0.64)	(1.12)	(0.96)	(2.38)	(0.47)
ISIC 34	0.3180	0.0017	-0.0012	-0.0515	0.0031	0.0037*	-0.0014
	(1.61)	(0.65)	(0.56)	(0.16)	(1.22)	(1.76)	(0.61)
ISIC 35	0.1906**	0.0018	-0.0001	0.0433	0.0015	0.0015***	0.0003
	(2.27)	(1.61)	(0.34)	(0.37)	(1.07)	(2.62)	(0.93)
ISIC 36	0.1107***	0.0010***	-0.0001	0.0731*	0.0007*	0.0004***	0.0003
	(5.42)	(3.00)	(0.92)	(1.85)	(1.79)	(3.37)	(1.34)
Sector difference negative (percent of total sectors)	0.0	0.0	78.9	5.3	5.3	42.1	52.6
Percent positive and significant	73.7	57.9	0.0	26.3	21.1	47.4	15.8

Note: Difference in weighted relative efficiency (t-stats in parenthesis - *, **, *** indicate significance at a 10%. 5% and 1% level, respectively.). Numbers reported relates to the year 2003. A similar general pattern emerges using estimates from 2002. Incumbents = INC. Sector Switchers = SW. Exits = EXIT. Entrants = ENTRY.

TABLE 8: SECTOR SWITCHING AND EXIT DETERMINANTS - FIRM SPECIFIC EXPLANATIONS

	Sector Switching (SW2)			Firm Exit (EXIT)		
	(1)	(2)	(3)	(4)	(5)	(6)
Firm specific variables						
Relative efficiency (weighted)	-2.0266***	-0.9144***	-0.6624**	-2.7734***	-0.9068***	-0.5573*
	(7.13)	(3.33)	(2.44)	(7.79)	(2.78)	(1.69)
Firm size (log)		-0.0091***	-0.0062***		-0.0241***	-0.0268***
		(6.27)	(3.77)		(10.88)	(11.09)
Firm age (log)		-0.0134***	-0.0097**		0.0204***	0.0077
		(3.55)	(2.34)		(3.62)	(1.33)
State owned enterprise (SOE)			-0.0253***			0.0575***
			(4.15)			(4.96)
Foreign owned firm (Multinational)			-0.0225***			-0.0432***
			(3.88)			(5.46)
Provincial dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,363	24,363	24,363	24,363	24,363	24,363
Groups	10,570	10,570	10,570	10,570	10,570	10,570
Log Likelihood						
Wald (chi-sq)						
Likelihood ratio test (p-value)						

Note: Dependent variable: Sector switching (SW2) and exit (EXIT). Random effects probit estimation. All estimations included a constant term and time dummies. t-values reported in parenthesis. *, **, *** indicate significance at a 10%, 5% and 1% level, respectively. Base: Food processing and HCMC. The total number of sector switchers and exits are 1,076 and 1,937 in the unbalanced panel, respectively.

TABLE 9: SECTOR SWITCHING AND EXIT DETERMINANTS - FIRM SPECIFIC EXPLANATIONS, CONTINUED

	SW2 (INC)	EXIT (INC)	SW2 (EXIT)
	(1)	(2)	(3)
Firm specific variables			
Relative efficiency (weighted)	-0.6774**	-0.5802*	0.3497
	(2.39)	(1.71)	(0.10)
Firm size (log)	-0.0083***	-0.0289***	0.0175**
	(4.61)	(11.46)	(2.01)
Firm age (log)	-0.0106**	0.0068	-0.0368*
	(2.35)	(1.12)	(1.95)
State owned enterprise (SOE)	-0.0244***	0.0581***	-0.2715***
	(3.63)	(4.88)	(8.25)
Foreign owned firm (Multinational)	-0.0259***	-0.0461***	0.1106**
	(4.18)	(5.65)	(2.45)
Provincial dummies	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes
Observations	22,426	23,287	3,013
Groups	9,705	10,316	2,850
Log Likelihood			
Wald (chi-sq)			
Likelihood ratio test (p-value)			

Note: See Table 8 for details.

TABLE 10: SECTOR SWITCHING AND EXIT DETERMINANTS - SECTOR SPECIFIC EXPLANATIONS

		All	SW2 (EXIT)	All	SW2 (EXIT)	All	SW2 (EXIT)
		(1)	(2)	(3)	(4)	(5)	(6)
Sector specific variables							
SOE share of total sector (SR)	SW2	-0.1116***	-0.3165***	-0.1065***	-0.2977***	0.0110	0.4107
		(7.30)	(5.70)	(6.91)	(5.31)	(0.19)	(1.04)
	EXIT	-0.0397**		-0.0338*		-0.1322*	
		(2.24)		(1.89)		(2.11)	
Multinational share of total sector (FR)	SW2	0.1682***	0.5464***	0.1410***	0.4237***	0.0416	-0.1130
		(8.01)	(7.38)	(6.45)	(5.52)	(0.71)	(0.30)
	EXIT	0.0445*		0.0432*		0.0710	
		(1.91)		(1.82)		(1.17)	
Sector concentration ratio (CR)	SW2	0.1183***	0.5633***	0.0583*	0.2982**	0.1066	0.7665
		(3.95)	(4.66)	(1.79)	(2.44)	(1.20)	(1.22)
	EXIT	-0.0251		-0.0277		-0.1300	
		(0.72)		(0.75)		(1.28)	
Sector efficiency level (EFF)	SW2	0.1420***	0.4452***	0.1183***	0.2984***	0.0060	-0.0198
		(8.53)	(6.78)	(6.15)	(4.17)	(0.03)	(0.01)
	EXIT	0.0811***		0.0789***		0.2461	
		(3.74)		(3.38)		(1.12)	
Sector effective rate of protection (ERP)	SW2	-0.0006***	-0.0027***	-0.0005***	-0.0021***	-0.0015***	-0.0060***
		(9.51)	(10.83)	(6.48)	(7.80)	(2.80)	(4.20)
	EXIT	0.0001		0.0002**		0.0002	
		(1.50)		(2.06)		(0.64)	
Province dummies		No	No	Yes	Yes	Yes	Yes
Sector dummies		No	No	No	No	Yes	Yes
Observations		24,363	3,013	24,363	3,013	24,363	3,013
Groups		10,570	2,850	10,570	2,850	10,570	2,850

Note: Dependent variable: Sector switching (SW2) and exit (EXIT). Linear probability model, random effects estimation. All estimations included the firm specific variables documented in Table 4, a constant term and time dummies. t-values (reported in parenthesis) are heteroskedasticity robust. *, **, *** indicate significance at a 10%, 5% and 1% level, respectively. Base: Food processing (ISIC 15) and HCMC.

Appendix

TABLE A: SECTOR DETAILS ON SECTOR SWITCHERS – INCLUDING ENTRANTS

Switch from: Switch to:	15	17	18	19	20	21	22	24	25	26	27	28	29	31	32	33	34	35	36	OTH	AGR	SER	Total switchers	Percent of total	Total exits	Percent of total
ISIC 15		1	1		2	1		11		1		4				1	1	1	1		6	70	101	(1.3)	756	(9.8)
ISIC 17	1		23	1	3	2	1	1	10											1	1	4	48	(3.9)	101	(8.2)
ISIC 18		24		14	2	1	5		3			2			1				3		1	27	83	(3.9)	246	(11.5)
ISIC 19		2	9		1				4		1	2	1						3			4	27	(3.8)	75	(10.6)
ISIC 20	3	2	1	1		6		3	5	3	1	5						4	130		4	33	201	(9.0)	231	(10.3)
ISIC 21	2	1	2		2		18		10	1		1							2			6	45	(3.4)	124	(9.4)
ISIC 22		1	2		1	25			2			2	1	1	2				1	1		8	47	(3.7)	136	(10.7)
ISIC 24	7	3		1	1	1	1		4	9		3		1		1			4		4	12	52	(4.0)	117	(9.0)
ISIC 25		2	3	4	2	7	5	5		1	1	11	3	2	1		2	5	9	1	1	17	82	(4.7)	144	(8.2)
ISIC 26					4	1	1	14	3		1	6		1		1			6		13	27	78	(2.7)	311	(10.6)
ISIC 27					1				1	2		16				1		1		1		3	26	(5.5)	41	(8.7)
ISIC 28	1		1	2	2	3	1	1	5	4	29		37	9		1	9	15	11		1	41	173	(6.5)	292	(10.9)
ISIC 29	1	1			1		1		3	1		33		11	1	2	5	3	2			17	82	(9.1)	101	(11.1)
ISIC 31						1			1			7	2		9		2		2			7	31	(6.0)	37	(7.2)
ISIC 32							1					4	1	4		2		1		2		2	17	(7.0)	23	(9.4)
ISIC 33										2		2	3					1	1			3	12	(9.3)	10	(7.8)
ISIC 34	1								2			14	6	2				23	1		1	17	67	(13.0)	49	(9.5)
ISIC 35	2				2				3			10	3	1			16		3			11	51	(6.9)	72	(9.7)
ISIC 36			2	1	104	3	4	7	8	3	2	15	3	1	4		1	1		1		48	208	(10.1)	212	(10.3)
Total switchers	18	37	44	24	128	51	38	42	64	27	35	137	60	33	18	9	36	55	179	7	32	357	**1,431**	(4.6)	**3,078**	(10.0)
Percent of total	(0.2)	(3.0)	(2.1)	(3.4)	(5.7)	(3.9)	(3.0)	(3.2)	(3.6)	(0.9)	(7.5)	(5.1)	(6.6)	(6.4)	(7.4)	(7.0)	(7.0)	(7.4)	(8.7)				(4.6)			
Total entrants	811	190	448	104	369	169	266	187	287	335	81	589	163	80	38	11	70	107	401				**4,706**			
Percent of total	(10.5)	(15.5)	(20.9)	(14.8)	(16.5)	(12.8)	(20.9)	(14.4)	(16.3)	(11.4)	(17.3)	(22.0)	(18.0)	(15.5)	(15.6)	(8.5)	(13.6)	(14.4)	(19.4)				(15.2)			

Note: Total number of firms switching from/to a particular sector (percentage in parenthesis). OTH = ISIC 16, ISIC 23, ISIC 30 and ISIC 37. AGR = Agriculture/Primary sector. SER = Service/tertiary sector. Only firms for which efficiency estimates could be calculated are included.

TABLE B: PRODUCTION FUNCTION ESTIMATION – SPECIFICATION TESTING

Sector 15	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-12,277	-12,191	-12,191	-12,986
LL Unrestricted	-12,191	-12,170	-12,170	-12,170
Test Statistic	172.99	41.60	42.94	1,633.25
Result	Reject null (1%)	Reject null (1%)	Reject null (1%)	Reject null (1%)
Sector 17♦	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-2,172	-2,166	-2,147	-2,264
LL Unrestricted	-2,166	-2,147	-2,147	-2,147
Test Statistic	13.28	37.64	1.18	233.72
Result	Reject null (1%)	Reject null (1%)	Do not reject	Reject null (1%)
Sector 18	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-3,831	-3,824	-3,816	-3,978
LL Unrestricted	-3,824	-3,807	-3,807	-3,807
Test Statistic	13.22	33.72	17.20	341.48
Result	Reject null (1%)	Reject null (1%)	Reject null (1%)	Reject null (1%)
Sector 19	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-1,223	-1,212	-1,211	-1,297
LL Unrestricted	-1,212	-1,206	-1,206	-1,206
Test Statistic	21.07	13.28	11.22	183.35
Result	Reject null (1%)	Reject null (1%)	Reject null (1%)	Reject null (1%)
Sector 20	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-3,524	-3,511	-3,510	-3,700
LL Unrestricted	-3,511	-3,507	-3,507	-3,507
Test Statistic	25.74	7.28	6.41	386.47
Result	Reject null (1%)	Reject null (10%)	Reject null (5%)	Reject null (1%)
Sector 21	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-2,087	-2,073	-2,069	-2,284
LL Unrestricted	-2,073	-2,065	-2,065	-2,065
Test Statistic	28.26	15.01	7.89	436.62
Result	Reject null (1%)	Reject null (1%)	Reject null (1%)	Reject null (1%)
Sector 22	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-2,013	-2,004	-2,001	-2,187
LL Unrestricted	-2,004	-1,993	-1,993	-1,993
Test Statistic	18.20	23.29	17.13	389.03
Result	Reject null (1%)	Reject null (1%)	Reject null (1%)	Reject null (1%)
Sector 24	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-2,288	-2,282	-2,280	-2,471
LL Unrestricted	-2,282	-2,277	-2,277	-2,277
Test Statistic	12.26	10.59	5.89	388.97
Result	Reject null (1%)	Reject null (5%)	Reject null (5%)	Reject null (1%)
Sector 25	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-3,085	-3,061	-3,064	-3,302
LL Unrestricted	-3,061	-3,061	-3,061	-3,061
Test Statistic	46.72	1.67	6.16	481.23
Result	Reject null (1%)	Do not reject	Reject null (5%)	Reject null (1%)
Sector 26♦	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-4,237	-4,216	4,169	-4,578
LL Unrestricted	-4,216	-4,168	-4,168	-4,169
Test Statistic	41.47	95.64	1.15	871.45
Result	Reject null (1%)	Reject null (1%)	Do not reject	Reject null (1%)

TABLE B CONTINUED: PRODUCTION FUNCTION ESTIMATION – SPECIFICATION TESTING

Sector 27	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-833	-821	-819	-847
LL Unrestricted	-821	-817	-817	-821
Test Statistic	23.86	9.36	4.10	51.44
Result	Reject null (1%)	Reject null (5%)	Reject null (5%)	Reject null (1%)
Sector 28	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-4,839	-4,794	-4,797	-5,014
LL Unrestricted	-4,794	-4,790	-4,790	-4,790
Test Statistic	90.55	7.40	14.00	450.22
Result	Reject null (1%)	Reject null (10%)	Reject null (1%)	Reject null (1%)
Sector 29	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-1,505	-1,499	-1,497	-1,618
LL Unrestricted	-1,499	-1,496	-1,496	-1,496
Test Statistic	11.89	6.92	3.13	245.49
Result	Reject null (1%)	Reject null (10%)	Reject null (10%)	Reject null (1%)
Sector 31♦	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-915	-894	-895	-962
LL Unrestricted	-894	-894	-894	-895
Test Statistic	40.78	1.59	1.18	134.48
Result	Reject null (1%)	Do not reject	Do not reject	Reject null (1%)
Sector 32	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-436	-424	-426	-473
LL Unrestricted	-424	-421	-424	-424
Test Statistic	24.75	5.30	3.91	99.79
Result	Reject null (1%)	Do not reject	Reject null (5%)	Reject null (1%)
Sector 33	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-215	-215	-217	-241
LL Unrestricted	-214	-213	-215	-215
Test Statistic	1.38	4.77	4.58	52.46
Result	Do not reject	Do not reject	Reject null (5%)	Reject null (1%)
Sector 34♦	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-780	-735	-736	-794
LL Unrestricted	-735	-732	-735	-736
Test Statistic	90.32	4.36	2.57	116.53
Result	Reject null (1%)	Do not reject	Do not reject	Reject null (1%)
Sector 35	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-1,258	-1,251	-1,255	-1,343
LL Unrestricted	-1,251	-1,242	-1,242	-1,242
Test Statistic	14.08	18.47	25.67	201.72
Result	Reject null (1%)	Reject null (1%)	Reject null (1%)	Reject null (1%)
Sector 36	$\beta_{kl}=0$	$\omega^t=0$	$\mu=0$	$\gamma=0$
LL Restricted	-3,655	-3,639	-3,641	-3,796
LL Unrestricted	-3,639	-3,629	-3,629	-3,629
Test Statistic	32.36	19.45	23.52	333.37
Result	Reject null (1%)	Reject null (1%)	Reject null (1%)	Reject null (1%)

♦ Tests are re-run for the restrictions $\beta_{kl}=0$ and $\omega^t=0$ imposing the restriction $\mu=0$. The results are confirmed.

TABLE C: THEORETICAL PROPERTIES OF ESTIMATED PRODUCTION FUNCTIONS

Sector	15	17	18	19	20
$\partial \ln y / \partial \ln x_1$: Mean	0.6040	0.8369	0.8606	0.8710	0.7846
% negative	0.00	0.00	0.00	0.00	0.00
$\partial \ln y / \partial \ln x_2$: Mean	0.3506	0.3116	0.2564	0.2164	0.3002
% negative	0.00	0.00	0.00	6.52	0.00
Curvature Violation (%)	0.13	0.00	0.00	24.51	0.00
Sector	21	22	24	25	26
$\partial \ln y / \partial \ln x_1$: Mean	0.7678	0.9611	0.6735	0.7532	0.7962
% negative	0.00	0.00	0.00	0.00	0.00
$\partial \ln y / \partial \ln x_2$: Mean	0.3492	0.3342	0.5477	0.4073	0.3732
% negative	0.00	0.00	0.00	0.42	0.00
Curvature Violation (%)	0.63	0.00	0.00	7.10	0.00
Sector	27	28	29	31	32
$\partial \ln y / \partial \ln x_1$: Mean	0.7932	0.8454	0.7271	0.5832	0.5398
% negative	0.00	0.00	0.00	5.41	0.54
$\partial \ln y / \partial \ln x_2$: Mean	0.2837	0.3120	0.4092	0.6088	0.6378
% negative	5.51	0.02	0.00	1.06	0.54
Curvature Violation (%)	36.23	3.58	0.00	59.89	7.80
Sector	33	34	35	36	
$\partial \ln y / \partial \ln x_1$: Mean	0.8236	0.8992	0.7967	0.8122	
% negative	0.00	0.00	0.00	0.00	
$\partial \ln y / \partial \ln x_2$: Mean	0.3375	0.2569	0.3068	0.3079	
% negative	0.00	29.56	0.10	0.06	
Curvature Violation (%)	0.00	51.06	3.50	2.34	

TABLE D: COMPARISON BETWEEN INTRA-MANUFACTURING AND SERVICE SECTOR SWITCHERS

	(1)	(2)	(3)	(4)	(5)	(6)
Firm specific variables						
Relative efficiency (weighted)	-44.7841**	-45.4567**	-6.5822	-6.2422	-0.9871	-1.1072
	(2.44)	(2.44)	(0.74)	(1.16)	(0.12)	(0.13)
Firm size (log)			-0.1186***	-0.1235***	-0.1136***	-0.1196***
			(7.16)	(7.18)	(6.73)	(6.81)
Firm age (log)			0.0132	0.0139	0.0078	0.0065
			(0.43)	(0.43)	(0.25)	(0.20)
State owned enterprise (SOE)					0.0394	0.0788
					(0.37)	(0.72)
Foreign owned firm (Multinational)					-0.2253***	-0.2330***
					(3.46)	(3.53)
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,076	1,045	1,076	1,045	1,076	1,045
Pseudo R-squared	0.16	0.17	0.19	0.21	0.20	0.22

Note: Dependent variable: Switching to the tertiary sector (SER). Pooled probit estimates – marginal effects. All estimations included a constant term and time dummies. t-values (reported in parenthesis) are heteroskedasticity robust. *, **, *** indicate significance at a 10%, 5% and 1% level, respectively.