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OWNERSHIP STRUCTURE AND DETERMINANTS OF EFFICIENCY IN VIETNAM'S INDUSTRIAL SECTOR, 2001-2005

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ABSTRACT

The main purpose of this paper is to examine determinants of the "level" and the "rate" of technical efficiency by firstly exploring a firm-level data set of 4600 enterprises in the industrial sector of Vietnam from 2001-2005. The empirical results reveal a strong ownership impact on efficiency. Private ownership exhibits the highest robustness and state ownership, on the other hand, exhibits the lowest robustness to both the "level" and the "rate" of technical efficiency. Firms have gained efficiency from implementing higher levels of capital intensity, operating in larger business of scales, operating in high competitive industries and locating in high-income regions. The paper also suggests policy implication from the empirical findings.

Keywords*: Reform, Efficiency, Corporate Governance, Privatization, Transition, Vietnam.*

JEL classification: *P21, G34, D24, O53*

1. INTRODUCTION

Since the enunciation of a commitment to reform during the Sixth Party Congress in 1986, Vietnam has moved in two decades from a centrally planned economy to a market-oriented economy in which more than 60 per cent (%) of total GDP is produced by a combination of the private and foreign sectors. This transformation has had consequences for ownership structures observed in Vietnam brought about by reform of the state sector and the rapid emergence of the non-state sector. In the industrial sector, the role of domestic non-state and foreign sectors has become increasingly dominant. The proportion of total industrial GDP produced by the state sector fell from 62% in 1986 to 27% in 2005. Conversely, the proportions of domestic non-state and foreign sectors accounted for 29% and 37%, respectively by 2005. The change in ownership structure has changed the determinants of contribution to GDP of the industrial sector in Vietnam.

Though having its first recognisable impetus in 1986, pursuit of reform was more materially boosted form 1989 onwards with the promulgation by the central government of the popular slogan, "*doi moi hay la chet*" (renewal or death). Bold and comprehensive reform programs directed at the affairs of state owned enterprises (SOE) were introduced commencing in that

year. The essence of that process focused on granting greater autonomy and responsibility for enterprise managers in business decision making and the abolition of inefficient centralized resource allocation mechanisms.

Part of the reform process has involved privatisations of a range of formerly state owned enterprises (SOEs). Simultaneously, a key impact of the reform agenda was to allow markets for products to emerge due to the capacity of enterprises to freely and directly market and sell products to other trading firms and consumers. Further liberalization of regulations pertaining to prices and trade practices and commercialization of the formerly state dominated banking system were also important elements of the change process.

Many of the ideas behind the types of reform outlined above can be seen to be consistent with and reinforced by provisions of the country's new constitution, framed in 1992, which recognizes the "business freedom" of citizens, protects property rights and articulates a clearly defined role for government. Consonant with these basic architectural features, significant efforts have since been expensed on building a regulatory system designed to create a "fair playing field" with a key objective being the encouragement of economic participation by the emergent domestic private and foreign sectors.

One impact of the coming to fruition of these policy settings has been the growth of competition in key areas of the Vietnamese economy, with the result that SOEs are now exposed to substantial rivalry by private sector organisations from within both the domestic and foreign sectors. In summary, Vietnam has transformed to a commodity economy comprising mixed-ownership structures and following market principals.

The implementation of reforms in ownership structure and market institutions described above has opened significant opportunities for the conduct of research. One of the key strands of the research opportunity set opened by the implementation of the transformation of the Vietnamese economy evaluations is the capacity to compare the efficiency of SOEs with other non-state enterprises during a key period of transformation. Given the reliance placed on alternative market and ownership structures as drivers of better practice and outcomes, the motivation for research into this phenomenon is clear.

Bearing this in mind, this paper commences by reporting on a comparison of the efficiency of industrial sector enterprises with varying ownership structures by measuring the "level" and the "rate" of technical efficiency by employing a data envelopment analysis (DEA) technique. Further, the analysis is extended to an evaluation of the impact of competition and control and other firm-specific and regional economic endowment factors on efficiency. The time frame of this research covers 2001 to 2005, an important transition period after 15 years characterized by accelerating rates of economic transformation. By this stage, market institutions were relatively developed and both state and non-state firms were operating on an equal commercial footing (Arkadie and Mallon, 2003). Therefore, the time frame selected for the research facilitates the possibility of evaluating efficiency amongst business enterprises without being confounded by significant distortions driven by government intervention.

In this study, the technical efficiency index is employed as the key measure of efficiency. This index is measured for each firm as a ratio of observed output of the firm to output on the production frontier. Therefore, the technical efficiency index has the capacity to provide insight

into the relative efficiency levels amongst a group of firms. The index has been used widely in the current literature of efficiency's determinants (Zhang and Zhang, 2001, Zheng *et al.*, 1998).

Conversely, profitability is not as useful a means of capturing insights into the phenomenon of interest as technical efficiency because of the possible hidden profitability in the private sector in countries characterised as having relatively weak regulatory and law enforcement structures. There is evidence that in these settings, private enterprises tend to conceal rather than to reveal actual profits, rendering methodologies based on this measure problematic (Sterner, 1990). Both labour and capital productivity have been used in some studies, however taken alone these can measure the contribution of only one factor of productivity. In any event, testing on our data sample suggests that labour productivity and technical efficiency are highly correlated (coefficient score of 0.8, Pearson test). Therefore, we only use technical efficiency scores for regressions in this study.

There have been several studies about productivity in Vietnam's industrial sector. For example, Hoang (1997) calculated the total factor of productivity (TFP) of the industrial sector from 1976 to 1996. His results suggested that TFP had increased by an average of 1.2% per year over the period he examined. Ngu (2002) studied aggregate TFP only in the state sector and concluded that SOEs had an average annual TFP growth rate of 4.22 % for the period from 1986 to 1998. While making valuable contributions to the literature, these studies also faced limitations, the chief amongst these being their reliance on aggregate country-level data. This resulted in the need to rely on assumptions for some indicators such as capital or intermediate inputs. Furthermore, studies reliant on country-level data suffer from distortions introduced by their sensitivity to the hidden economic activities of the non-state sector in Vietnam, which may account for about 35% of GDP.

Rather than using aggregate level data, this study draws upon firm level observations and there is no recent research on productive efficiency in the context of Vietnam based on a firm-level panel data. Thus, this paper may be the first attempt to evaluate technical efficiency in the sector by exploring firm-level data in Vietnam during an important period of transition, from 2001-2005. The study is based on the most comprehensive and updated data set available in Vietnam during this period. It is also the first paper to examine the role of ownership as a determinant of technical efficiency in Vietnam.

A variety of empirical studies of the determinants of technical efficiency in settings broadly analogous to Vietnam (e.g China and Eastern Europe during their transition phases) exist. Various of these studies have indicated the poor performance as measured by technical efficiency of state enterprises (Mei *et al.*, 2002, Zhang and Zhang, 2001). Jones *et al.* (1998) provided empirical evidence of superior efficiency performance of private enterprises compared with other ownership types in Bulgaria. Other research has focused on factors of firm size (Page, 1984), the level of competition (Lee *et al.*, 2000, Ramaswamy and Renforth, 1996), differences in regions (Tong and Chan, 2003) and economic and institutional factors (Junichi, 2006) bearing on the efficiency of firms.

While acknowledging the contribution of these prior studies, this paper specifically focuses on the case of Vietnam, hitherto a hidden transition economy in the literature, and covers the impacts of fundamental reforms in ownership structure and other determinants on technical efficiency amongst enterprises.

In addition to providing insights into a growing but largely under research jurisdiction, the research methodology employed for the purpose of this study offers some improvements over approaches taken in some earlier literature. For example, in some previous studies, technical efficiency scores were estimated from samples of inconsistent data. A common manifestation of this is the technique of varying the number of firms included each year in a multi year pooled data sample (Zheng *et al.*, 1998). This may cause bias in the cross-comparative results of ownership categories because the entries or withdrawals of firms from year to year can change the mean efficiency scores. This problem is avoided in this study as a result of the use of consistent panel data.

Some other studies have employed nominal prices as a means of estimating technical efficiency from pooled data (Ramaswamy and Renforth, 1996). However, price deflation may result in errors in comparative levels of the indices in the pooled data drawn from more than one year. Variations in nominal purchasing power amongst regions of the same country also present the same issue. To avoid this problem, we deflated the values of the observations by relevant price indices and purchasing power amongst regions. This strengthens our capacity to make robust comparisons across time and regions.

The paper is organized as follows. *Section 2* describes the economic context of this study. Vietnam is still a hidden economy in academic literature therefore we dedicate this section to providing a brief view of ownership reforms in the industrial sector. *Section 3* identifies the possible determinants of technical efficiency. *Section 4* introduces the panel data employed in this paper. *Section 5* presents a comparative analysis of performance and determinants of technical efficiency with a focus on the role of ownership structure. Finally, *section 6* summarizes the findings.

2. OWNERSHIP REFORMS IN VIETNAMESE INDUSTRIAL SECTOR

Vietnam experienced an average GDP annual growth rate of 7.1% between 1986 and 2005. The industrial sector has been a major driver of this result, contributing 12% of the average annual growth observed during this period. The contribution of this sector has been recognised by the government in the context of its policies aimed towards industrializing and modernizing a country with generally low income and a high population. However, the inefficiency of many SOEs which comprise a part of the industrial sector, resulting from centralized resource allocation and subsidy mechanisms, had contributed to an economic crisis by the mid-1980s. The industrial sector achieved a negative growth rate from 1976 to 1980 (Ngu, 2002). The introduction of the market economic model in 1986 has stimulated reforms in ownership structure that have increased the sector's growth and efficiency.

The reform of ownership structure was shaped in the context of a different political setting to that of the Eastern European transition economies. In Vietnam, economic reforms have not been associated with radical changes in political regime. The Communist Party still controls political and economic activities. To combine socialist ideologies and market principles as they pertain to ownership structure, the Vietnamese government has implemented a "dual track" approach. The "state track" is the government's control of major economic activities through direct ownership and government authorities. The "market track" depends on the development of private and foreign sectors. The authorities have planned to build up a commodity economy

based on the operation of market mechanisms and the development of multi-ownership structures.

The importance of SOEs in the industrial sector of Vietnam has made them the central focus of economic reforms. In the industrial sector, the reforms targeted at SOEs have been implemented in a number of phases. In the first period, from 1986 to the early 2000s, state ownership was basically maintained but the market was developed. This approach is different from the massive privatization that was widely applied in Eastern European transition economies. SOEs were deregulated from direct government intervention and were granted increasing autonomy and financial responsibility, with the aim of encouraging greater efficiency and responsible use of resources. This corporatization process has continued as the SOEs are exposed to competition with emerging non-state sectors in domestic and international markets.

Vietnam is still very cautious in divesting state ownership and privatizing a number of economic sectors regarded as having strategic value. The Communist Party considers state ownership as the foundation for the socialist regime. During the recent Ninth Party Congress the "leading role" of SOEs was recognised and emphasised. Brezis and Schnytzer (2003) argue that the reason for the caution and gradualness in privatizing SOEs is that Vietnam's approach to privatization is "Market Leninist" rather than the "embezzlement for a rainy day" approach implemented in the Eastern European countries. In contrast, others (Bai *et al.*, 2000) argue that the poor development of institutions in transition economies gives the government reasons for maintaining state ownership and discouraging reform in order to support social security policies. Privatization was encouraged from 1999 with the chief focus being on small SOEs. Given the relative recency of policy settings incorporating privatisation as a reform driver, it is not surprising that approximately 82% of privatization transactions have done in the period from 2000 onwards. By 2004, privatized firms accounted for only 8.2% of the total capital of SOEs, and by 2005 this figure had increased to only around 10%. State ownership was still significant in most privatized firms (45% on average).

Prior to the reforms of 1986, the private industrial sector in Vietnam was relatively significant, contributing around 35% of output, although the scope of these operations was not formally recognized. Most private businesses were small-scale and labour-intensive. The revised policy framework adopted in 1986 recognised the need in a multi-ownership economy for equal legal rights for private enterprises and SOEs. Thus key elements of Vietnam's reform policy agenda have focused on regulatory frameworks intended to create a "level playing field" for all firms and ownership models. This was exemplified by the content of the new 1992 constitution and further solidified by elements of the Enterprise Laws promulgated in 1999 (themselves revisions of the 1990 Law of Private Enterprises).

The new laws have helped reduce entry costs by simplifying procedures for obtaining a licence, extending the scope of business activities and removing minimum capital requirements (except in some industries such as banking or insurance). Other simultaneous reforms in finance, the judicial system, property, and land rights have created an institutional environment conducive to private enterprise with the result of a mushrooming in the number of private enterprises from 5,000 in 1992 to about 40,000 in 1999, and to around 160,000 registered private enterprises during by the period reviewed for the purposes of this study. However, private businesses still

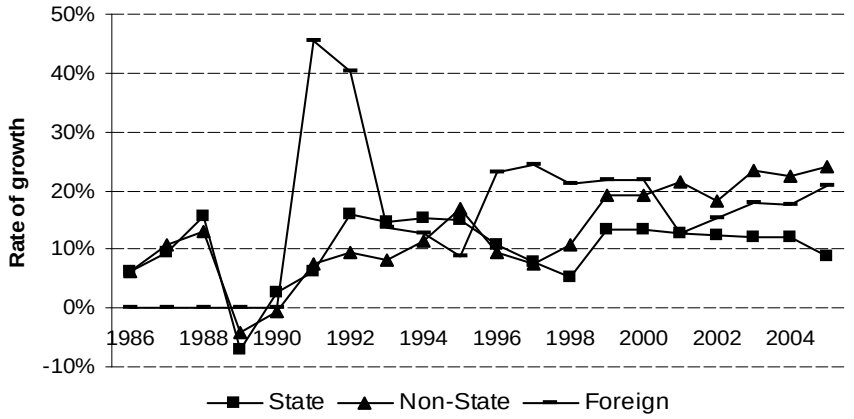
face difficulties such as accessing capital and lands (Keith, 1998, Henrik, 2005). Various hybrids of private ownership have rapidly emerged, such as joint-stock, private, and private limited companies, with the proportion of shared-ownership companies such as joint-stock or private limited companies becoming increasingly dominant.

By way of contrast cooperatives (COEs) which were second only to SOEs as an organisational form before the cornerstone reforms of 1986, have fallen into relative decline. There were at that stage about 30,000 COEs in Vietnam's industrial sector. Organisations having this form were subjected to direct controls and subsidy regimes operated by local governments. Poor governance and a tradition of isolation from competitive forces resulted in COEs being subjected to substantial stress in the wake of the adoption of the central government's reform process. This forced a substantial portion of COEs to the brink of or into insolvency. In 1997, the introduction of new Cooperative Law brought recognition of the principles of volunteerism and democratic management, independence from direct government intervention and the self responsibility of COEs. All established COEs were required to re-register following the new model proposed by the law. Irrespective, there has been no "boom" in establishments of new COEs as in private enterprises, with COEs only accounting for around 1.5 % of the total output of the Vietnamese industrial sector.

Attracting foreign investment has been an integral goal of the reform processes which commenced from 1986. This policy has been met with a considerable degree of success. For example, between 1998 and 2005, total inflows of registered capital amounted to $US 45 Billion. Further, a sequence of amendments to foreign investment laws have been passed in recent years with the objective of reducing obstacles to foreign investors and facilitating further foreign investment inflows. One vehicle through which such investment transpires is the state joint venture (SJV) model in which state sector and foreign parties co-venture. These arrangements have been seen as desirable to foreign parties seeking entry into the Vietnamese market because of the relational and cultural advantages they confer. Other observable models include wholly foreign-owned enterprises and joint-ventures with domestic private partners. There is some evidence that in more recent times, foreign investors have increasingly preferred to invest via wholly owned projects because of difficulties associated with cooperating with SOEs (Leproux and Brooks, 2004).

The entry into the marketplace of enterprises distinguished by different ownership types and the introduction of market mechanisms have simultaneously acted to increase competitive pressure within the economy, while the rapid emergence of the non-state sector has stimulated growth in Vietnam's industrial sector. Understanding the sources of this growth can be facilitated by examining the contribution of the domestic private sector, the foreign sector and the state sector. Of these, the domestic private sector was the main area of growth. Here, the growth rate averaged about 4.8% from 1986-1990, increased to 12% from 1991-1995 and reached 21.9% from 2001-2005. The foreign sector's growth rate averaged a rapid 23.3% in the period from 1991-1995 (albeit off a low base) but slowed to a still robust 16.8% for the period between 2001 and 2005. Finally, the state sector grew at the slower (though still substantial pace) of 11.5% from 2001 through 2005. Diagram 1 compares growth rates of the state, domestic non-state foreign industrial sectors for the period between 1986 and 2005.

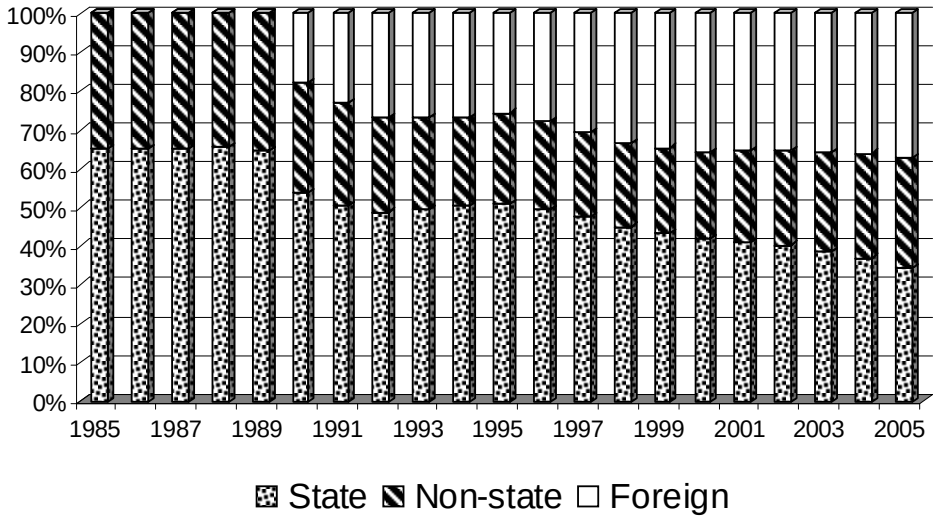
Diagram 1: Growth rate of Vietnam's Industrial Sector at Constant Prices, 1986-2005



Source: Vietnam General Statistics Office-SGO, 2005

The variation in growth rates between the various ownership sectors has caused a significant change in their output proportions. Diagram 2 shows that the state sector's share of total industrial GDP fell from 62% in 1986 to 27% in 2005. The foreign sector began emerging from 1989 and it accounted for 37% in total industrial GDP by 2005. Meanwhile the proportion attributable to the domestic non-state sector increased from 25% in 1990 to 29% in 2005. The data clearly depict the growing dominance of the non-state and foreign sectors in terms of their share of GDP contribution within the industrial sector in Vietnam.

Diagram 2: Output Proportions of Industrial Sector at Constant Price, 1986-2005



Source: Vietnam General Statistics Office-SGO, 2005

The observed changes in ownership structure in the Vietnamese industrial sector during the transition period under discussion have raised questions as to how ownership structure relates to enterprise efficiency. For example, it seems pertinent to question whether there exist observable efficiency differentials between state sector and other industrial firms and what any such observed differences might suggest about the orthodox government view that SOEs do and ought to play a leading role within the industrial sector. Questions may also be raised as to the impact of competition as well as other factors including firm size on efficiency. It is to the pursuit of these questions that the remainder of this paper turns.

3. TECHNICAL EFFICIENCY AND ITS DETERMINANTS

The general definition of productivity pertains to the "efficiency" of production. In this sense the terms productivity and efficiency have often been used interchangeably both in theory and practice. However, in terms of technical measurement, the two concepts have differences. Productivity measures relations between output and input factors at a production point. It is measured by comparing inputs used to create a given quantum of outputs. Efficiency measures the relative capacity to produce outputs from inputs amongst firms.

3.1 Measurement of Technical Efficiency

The production function is the frontier of maximum output that is feasible given a certain level of inputs or minimum usage of inputs for production of a given level of outputs. Efficiency is the measure of the difference between actual production and the potential production of the most efficient firm. The empirical application of such "level" *technical efficiency* measurement is feasible by using a non-parametric technique such as data envelopment analysis (DEA). This method was proposed by Farrell (1957) and has been widely used in empirical research (Färe and Knox, 1978, Coelli *et al.*, 1998).

For the purpose of studying the "rate" of efficiency, we use the DEA method to measure the Malmquist total factor productivity (TFP) index (Färe *et al.*, 1994, Coelli *et al.*, 1998). The differences between technical efficiency scores and the Malmquist TFP index are that the technical efficiency scores measure relative efficiency amongst firms while Malmquist TFP index measures changes of efficiency from time to time. The Malmquist TFP index presents total factor of productivity (TFP) change. The advantages of using the Malmquist TFP index are that the index can be decomposed into two components. The first is due to technical efficiency changes when firms approach the production possibility frontier by reason of using their existing technology and economics inputs more efficiently. The second component of the index is technical progress which results when there is a shift in the frontier production stemming from the adoption of new technology (Mahadevan, 2002). Another advantage associated with the utilization of this tool is that it is unnecessary to assume the common behaviors of cost minimization or revenue maximization of entrepreneurs in measurement of the index. This seems to be relevant for using this index for state ownership enterprises (SOEs) because agency problems in SOEs constrain management incentives and efforts to maximize efficiency in these enterprises.

In this paper, we apply the constant return to scale (CRS) assumption for calculating technical efficiency scores and Malmquist TFP. The rationale for this follow's arguments by

Grifell-Tatjé and Lovell (1995, 1998, review) that a Malmquist TFP index may not present correctly for total factor productivity if the assumption of variable return to scale (VRS) is applied. After measuring the "level" of efficiency and the "rate" of efficiency in the first stage by the DEAP program developed by Coelli (1996), we identify the possible determinants of technical efficiency which are most relevant in the context of the industrial sector in Vietnam.

In Vietnam, the transformation to a market economy has comprised of the emergence of competition and various hybridized forms of organizational ownership. Given this context, the link between ownership structure and efficiency is our first primary concern. Therefore, we estimate the impacts of ownership on the efficiency indices indicated above using a series of regressions calculations based on our panel data. In specifying these regression models, we controlled for other determinants of efficiency, including firm specific factors such as differences in industries, technology choices and other exogenous factors such as the level of market competition, differences in economic development amongst regions.

3.2 Determinants of Technical Efficiency

A substantial volume of literature pertaining to corporate governance has identified and discussed the role of ownership structure as a determinant of enterprise performance. The focal point of this literature often lies on evidence pertaining to the differential efficiency consequent upon the adoption of private and state ownership structures. Shirley and Walsh (2000) argue that although state and private firms both face agency problems, they each respond to these in different ways leaving open the possibility of significantly different performance. In SOEs the dilemma of a lack of "real owners" causes agency problems which can be attributed to two key sources: enterprise managers and government authorities.

Where interventions by government authorities occur, these are often biased by political considerations and individual interests (Shleifer and Vishny, 1994, Boycko *et al.*, 1996). Red tape, soft budget constraints, corruption, political intervention and bias in the appointment of managers are manifestations of agency problems commonly encountered in SOEs as a result of the intervention of government authorities. On the other hand, there are various agency problems associated with SOE managers such as corruption, irresponsibility in decision making and the lack of incentives to enhance the efficiency of performance. Shirley and Walsh (2000) conclude that corporate governance mechanisms of SOEs are not as effective as in private enterprises. These disadvantages result in the poor economic performance of SOEs compared with that of private enterprises.

The literature of SOE reforms in transition economies suggests two main approaches to enhance the efficiency of these enterprises. The first is the market development approach which focuses on building market institutions, encouraging market competition and improving managerial discretion and incentives in SOEs. It is argued that if market institutions are created, the force of competition will improve the efficiency of SOEs (Stiglitz, 1998, Stiglitz, 1994). The second approach is ownership-oriented approach which based on arguments pertaining to property rights and their impact on individual incentives. On this approach, corporate governance problems in SOEs may be viewed as acute and the transfer of ownership rights to private hands seen as a step essential to the stimulation of improved management and efficiency (Earle and Estrin, 2003, Boycko *et al.*, 1996).

There is a widespread agreement amongst economists on the positive causal relationship between private ownership and firm efficiency. This is evident both in theoretical literature (Boycko *et al.*, 1996, Vickers and Yarrow, 1991) and empirical studies on the subject (Megginson and Jeffry, 2001, Megginson *et al.*, 1994, D'souza *et al.*, 2001).

In transition economies, various empirical studies have suggested that privatized firms tend to outperform SOEs (Havrylyshyn and Donal, 1999, Djankov and Murrell, 2002, Jefferson *et al.*, 2000). However, empirical studies in these economies also have emphasized that different approaches to effecting private ownership and the particular political and economic contexts in which these transitions have occurred have been associated with significantly different results. For instance, Havrylyshyn and Donal (1999), from a survey on studies of privatization in transition economies illustrate that transfer of ownership interests to outsiders has in general resulted in greater observable efficiency gains than in cases where ownership interests are transferred to insiders. Djankov and Murrell (2002) also conclude that privatization transactions involving outsiders are associated with the largest restructuring gains. They also argue that the development of market institutions in different regions determines the impact of privatization on efficiency. These studies suggest the important roles of varying private ownership structures and other contextual factors of privatization in this analysis of Vietnam.

Taking the example of foreign-related enterprises, a 2004 survey of the Vietnamese industrial sector suggested that 82 % of SJVs were characterised as being more than 50 % controlled by foreign investors. This high foreign equity participation drives the implementation of a market-orientation corporate governance system in SJVs, which may have implications for success. For example, Jiang (2006) argues that the fact of foreign partner control contributed to the majority of the success of joint-ventures in China. In addition to the control related dimensions, other factors such as access to capital and technology transfer also have implications for success in these structures.

An alternative entry mode for foreign investors desirous of an exposure to Vietnam's industrial sector is the private joint venture. It is estimated that foreign investors control more than 50 % of the equity in 72% of these structures.

Given the common private ownership interest characteristic of domestic private and foreign private enterprises, efficiency differentials between these may not be rooted from ownership factors but from other factors such as technology or human resources (Sterner, 1990). Other studies (e.g Vendrell-Alda (1978)) have linked observed productivity differences to factors such as capital intensity and scale. Thus these are controlled for in this study, though we combine private-joint-ventures and wholly owned joint-ventures in our analysis because they all have the characteristics of private ownership.

There is a significant debate on the roles of and interactions between private ownership and competition on increasing efficiency of SOEs and privatized firms. SOEs in Vietnam have not been involved in mass privatization. Instead, they have been disciplined by market mechanisms and given greater and greater autonomy and responsibility to compete with emerging non-state sectors. Therefore, competition has played a vital role in the context of SOE reform in Vietnam. Competition in product markets is widely recognized to enhance the operational efficiency of firms operating in those markets via incentive effects and information effects. Competition creates incentive effects to managers and owners to respond to inefficient

performance of firms. The X-efficiency theory suggests that managers have incentive effects to reduce costs, given increasing competition (Leibenstein, 1966). The information effects provide information relating to costs and manager efforts for owners. In consequence, owners can effectively monitor managers and cope with changes in market (Hart, 1983). SOEs or privatized firms may gain improvements in efficiency when they are exposed to competition in the market. Empirical studies have demonstrated the positive effect of market competition on efficiency of SOEs (Ramaswamy, 1996, Lee *et al.*, 2000, Djankov and Murrell, 2002). Therefore in this paper, next to the role of ownership, we examine how competition has impacted the efficiency levels of firms.

Other factors which may influence technical efficiency are regional differences. Zheng *et al.* (1998) argue that enterprises in the coastal provinces in China exhibited greater efficiency compared with enterprises domiciled in other regions. Enterprises can gain efficiency when located in areas of rich in social and economic development (Chen, 1996). In light of this, we employed adjusted-purchasing power GDP per capita in 64 provinces in Vietnam as a proxy for the differences in social and economic development in the regions and take this factor into account in analyzing our results.

Capital intensity has been identified in a number of empirical studies as a determinant of efficiency (Ramaswamy, 1996). Capital intensity is a proxy for differences in technological choices amongst firms. Firms may gain efficiency by applying labor intensive or capital intensive technology in their production. Therefore we control the difference in economics of scale by implying a proxy for firm size in our regressions.

In addition to the use of a series of control variables, our regressions also employed standardized coefficients in order to better facilitate direct analysis of the contribution of independent variables to explanation of dependent variables (Gujarati, 2003). The independent variables are the standardized "level" and the "rate" of technical efficiency and the independent variables are standardized dummy variables for ownership and industries, proxy variables of capital intensity and business size, and proxy variables for competition and regional economic development.

4. DATA ISSUES

The panel data used in this paper was obtained from the Vietnam General Statistics Office (GSO). The data is retrieved from official yearly surveys by the GSO on the performance of industrial enterprises. The surveys covered approximately 50% of the total labor force in the industrial sector, and approximately 66% of the total labor force of the industrial state sector in the period between 2001 and 2005. Therefore, the survey data represents a comprehensive panorama of the enterprises performance in the sector of Vietnam. In the more recent surveys in the GSO series, the number of enterprises included was extended by adding new private and foreign enterprises. However, this extension does not result in bias in relation to the comparison of SOEs with other ownership form enterprises, since each firm has its own tax file number which acts as a constant unique identifier for the entire period under review.

Tax file numbers were used as a basis for identifying a constant panel of data covering the period from 2001 to 2005. From this initial set, all enterprises for which complete data was unavailable or which contained zero or minus values for assets or revenue were eliminated.

Data pertaining to micro enterprises with less than 15 employees or less than 45 VDN million (equivalent of USD 4000) total assets was also excluded. After these eliminations the final data set comprised information pertaining to some 4600 enterprises for which consistent data relating to ownership, industry, revenue, labor and capital was available for the entire period under review. Though this data filtration process resulted in the exclusion of a large number of firms, the majority of these were very small in scale. Consequently the final data sample covers a very substantial portion of the Vietnamese industrial sector.

For the purposes of the analysis, we measure the "level" and the "rate" of technical efficiency following Coelli's (1996) approach. Firm sales revenue is used as a proxy for output. The analysis also includes measures for inputs of labor and capital. We deflated the nominal revenue of a firm in a given industry and in a given year by the relevant product price index of the given industry and the given year (2000 as the based year). The GSO provides product price indices for all 25 branch industries from 2000-2005. Data pertaining to labor was measured at the end of each year. The measure of capital employed was obtained by deflating total nominal capital at the end of a given year and consists of the sum of fixed and operating capital. The fixed capital price index was measured from the weighted average of product price indices of five capital goods manufacturing industries: machinery and equipment, automobiles and transport equipment, electrical appliances, electronic and telecommunication equipment, apparatus and instrument-making industries (with 2000 as the base year) following the method of Mc Guckin & Nguyen (1993) and Yiu et. al. (1999). Operating capital in a given year was deflated by the consumer price index in the given year (using 2000 as the base year) because the structure of operating capital consists mostly of "money" assets such as short-term or long-term debts.

In the second stage of the analysis we ran regressions of the "level" and the "rate" of efficiency on explanatory variables to indicating determinants. The expected determinants are ownership structure, firm-specific variables such as industries, capital intensity and business scale, regions and level of competition.

Based on the GSO's categorization of ownership, we re-classified ownership from 14 different ownership types into 7 different types. Our primary concern is to measure the strength in impact of different ownership types on efficiency discussed in section 3. The ownership types employed in this study include state owned enterprises (SOEs), state shareholding firms with dominance of more than 50% of state ownership (SDSHs), state shareholding firms with dominance of more than 50% private ownership (PDSHs) collective-owned enterprises (COEs). All types of private enterprises such as private, private limited enterprises and private joint-stock enterprises are categorized as private enterprises (PEs). Enterprises involving foreign ownership include both state joint-venture enterprises (SJVs) and other private foreign ownership enterprises (FEs).

During 2001-2005, there were potential changes in ownership and legal form of many sample firms. Most of these changes were transformations of state ownership to private ownership such as partial privatization and full-privatization in our sample. The number of SOEs fell from 992 in 2001 to 613 in 2005. On other hand, the number of privatized firms increased from 176 in 2001 to 351 firms in 2005. However, the ownership dummy variable in our regressions still presents correctly the recent ownership status of firms included in our sample.

Table 1
Structure of Enterprises in the Sample

	SOEs	*SDSHs*	*PDSHs*	*SJVs*	*COEs*	*PEs*	*FEs*
Revenue	33%	2.4%	3.2%	20%	0.4%	15%	27%
Assets	45%	1.3%	2.2%	16%	0.3%	11%	24%
Labor	45%	2%	4.1%	16%	0.3%	11%	24%
Number of enterprises	18%	1.51%	3.39%	4%	7%	49%	17%

Table 1 presents the structure of enterprises from the sample. It exhibits a picture of the structure of industrial sector in Vietnam which conforms to that discussed in section 2 of the paper. Because we have excluded a large number of micro enterprises from the original surveys, most of them being PEs, the proportion of private sector enterprises in our sample is only around 15% of total revenue whilst the actual proportion of such organisations in the industrial sector is around 30%. However, measured by numbers, private enterprises still account for 49% of the total in our sample.

On average, SJVs are largest in scale as measured by revenue, assets and labor, followed by SOEs, SJVs, FEs, SDSHs, PDSHs, PEs and COEs. The majority of PEs and COEs are small and medium enterprises with revenue of about 15 % that of SOEs 10% of the revenue base of SJVs. In the privatized firms exhibiting dominant private ownership share, scale is also smaller. Revenue of SOEs was on average of VND 185,544 millions whilst it was only VND 160,019 millions and VND 94,125 millions in SDSHs and PDSHs, respectively. We use the natural log value of revenue, labor and capital to limit the large ranges of variations.

Table 2
Summary of Statistics

	Ownership Categories						
Variables	*SOEs*	*SDSHs*	*PDSHs*	*SJVs*	*PEs*	*COEs*	*FEs*
Revenue (VND millions)	185,544	160,019	94,125	450,489	30,711	5,540	156,977
Standard. Deviation	1,326,944	621,710	191,466	1,067,845	136,050	16,047	506,242
Asset (VND millions)	192,678	64,939	49,259	275,000	16,266	3,118	106,709
Standard Deviation	2,647,972	221,133	85,074	591,885	41,225	9,932	274,264
Fix Asset (VND millions)	84	77	48	469	51	19	168
Standard Deviation	134	405	66	963	117	29	308
Employees (person)	766	474	456	358	200	86	585
Standard Deviation	2,496	837	623	519	508	137	2,105
Observations/ Total of 23,000	4072	348	780	1003	11361	1538	3898

Note: The values of revenue, capital (capital) and fix asset are at 2000 price.

The industry codes of enterprises were categorized according to a standard four-digit industry scheme utilized by the GSO. The panel data covers 4600 firms in 25 branch industries. The branch industries were then regrouped into 17 industry categories to reduce the number of industrial dummy variables in our regressions. The four branch mining industries in coal, stones, fossil resources and mineral industries were merged in to Mining industry. Rubber, plastic and other non-metal products industries merged into Rubber and Plastic industry. Metal and other

metal industries are combined into Metal products industry. Machinery and facilities and other facility industries were named as Machinery industry. Automobiles and other transports are regrouped as the Transport. The Utilities category was formulated to include the water and electricity industries. The 17 final industry groupings used in the study were Mining, Foods and Beverage, Cigarettes, Textiles, Garments, Leathers, Timbers, Papers, Printing, Chemistry, Rubber and Plastic, Metal products, Machinery, Electronic and Communication products, Transports, Furniture and Utilities.

All the firms in the sample data are located throughout the 64 provinces in Vietnam. We adjust the nominal GDP per capita following purchasing power parity index of these 64 provinces as a proxy for economic differences amongst regions. In the pooled data, we use each natural log value of the adjusted GDP per capita for each year during 2001-2005. Purchasing power prosperity index for GDP per capita of each province in Vietnam is retrieved from the research of competitiveness province indices (CPI) in Vietnam. The research on CPI in 2004 (Edmund *et al.*, 2005) used the number of the most popular food in Vietnam-"a bowl of rice noodle" that can be purchased by the nominal GDP per capita in each province as the index for purchasing power parity of GDP per capita. The method of calculating this index is similar with the Big Mac index published by the The Economist. We assume that the purchasing power parity index amongst provinces calculated in 2003-2004 is stable for the time from 2001-2005 of our study. We use the deflated GDP per capita in a given year (price 1994) from 2001-2005 to adjust with the purchasing power parity index to get the proxy for economic development in different regions.

In examining the effect of market competition, we use the Herfindahl index as a proxy for the degree of market competition in each industry. The Herfindahl index is measured by sum of squares of market shares of firms in a given industry. A high observed Herfindahl index value suggests a high level of concentration and less competition in that industry (Zhang and Zhang, 2001). A negative correlation between Herfindahl index and productivity is expected to show the positive effect of market competition on enterprise efficiency. We calculate Herfindahl index scores in industries for each year from 2001-2005 because the index can change from year to year.

From table 1, it is apparent that there is relatively high variation in firm size (high standard deviation), especially as between SOEs. We control the differences in business scale amongst firms by using market share of the firm in given industries for each year.

5. EMPIRICAL RESULTS

5.1 Analysis of Mean of Performance Indices

Table 3 illustrates that on average, all firms achieved relatively high annual growth rates for revenue, assets and labor use (prices measured as at 2000). Growth rates of PEs were at the upper end of the spectrum and the data suggest that the private sector was the major engine of growth in industrial sector during the early millennium years. SOEs also exhibited substantial growth over the period reviewed and of the foreign-invested enterprises, though SJVs tended to be larger, FEs exhibited higher records in growth of revenue, labor and capital.

Foreign-invested enterprises exhibited high levels of capital intensity, SJVs employing the most capital intensity technology, followed by FEs. On the other hand, PEs and COEs used the most labor intensity technology. This illustrates that on average, PEs and COEs were operating at a small and medium business scale, relying on labor intensive technology compared with that of SJVs, FEs and SOEs. However, if we compare average revenue per employee (labor productivity), PEs had a higher labor productivity in comparison with SOEs. In terms of average revenue per unit of capital (capital productivity), PEs exhibited the highest level. During the transition process in Vietnam, a substantial and cheap labor force was available, partly driven by the existence of large numbers of employees retrenched from state sector positions (Clarke, 2004) and surplus labor from the agricultural sector. Labor based growth strategies may also have been preferred in some cases due to constraints in the availability of capital within the private sector in Vietnam (Henrik, 2005). Initially therefore, private firms properly emphasized labor intensity at low wages rather than expensive capital-intensity based approaches to fuelling growth. However with the passage of time, PEs increasingly focused on capital investment with the highest growth rates in asset (1.23) and capital intensity (1.38) compared with other enterprises.

Table 3
Mean of Indicators Following Ownership Categories

	Ownership Categories						
Variables	*SOEs*	*SDSHs*	*PDSHs*	*SJVs*	*PEs*	*COEs*	*FEs*
+ Growth in economic of scale indices							
Growth of revenue	1.51	1.62	1.43	1.39	1.71	1.50	1.85
Growth of asset	1.19	1.16	1.11	1.03	1.23	1.20	1.19
Growth of fix asset	1.31	1.28	1.17	0.99	1.37	1.27	1.14
Growth of employees	1.07	1.01	1.04	1.08	1.13	1.08	1.14
Capital intensity	84	77	48	469	51	19	168
Growth of capital intensity	1.27	1.28	1.17	0.95	1.38	1.29	1.07
+ Productivity and efficiency indices							
Labor productivity	214	328	237	1431	241	73	426
Growth of labor productivity	1.38	1.66	1.43	1.35	1.68	1.48	1.68
Capital productivity	1.50	2.36	1.95	1.72	3.51	2.70	1.48
Growth of capital productivity	1.31	1.57	1.36	1.39	1.47	1.41	1.73
Technical efficiency scores	0.45	0.47	0.46	0.53	0.50	0.49	0.49
Growth of technical efficiency scores	1.02	1.04	1.02	1.01	1.03	1.03	1.02
Growth of TFP:	1.01	1.03	1.02	1.01	1.02	1.02	1.03
Including: + Technical efficiency changes	1.17	1.07	1.14	1.08	1.13	1.15	1.12
+ Technical progress	0.90	0.99	0.92	0.96	0.93	0.92	0.94

Note: Average yearly growth rate of indices from 2001-2005. The values are measured in 2000 prices.

Amongst domestic state-invested ownership enterprises, SOEs had the highest business scale and capital intensity, followed SDSHs and PDSHs. This may represent evidence of gradualism in privatization in Vietnam, and the possibility that the government had a desire to use the privatization process to rid the state of its ownership stakes in small scale and inefficient capital use enterprises, to maintain the leading position for SOEs (Clarke, 2004). However, capital and labor productivity on average in SDSHs and PDSHs were substantially higher than that in SOEs.

Each of the ownership categories defined for the purposes of the study exhibited positive average annual growth rates (from 1 to 4 per cent per year) in technical efficiency scores and TFP. The growth rates of TFP are decomposed into technical efficiency changes and technical progress. All scores of technical efficiency changes were higher than unity and that of technical progress. Therefore, the major source of growth in TFP was from technical efficiency changes (moving towards the frontier) rather than from technical progress (moving of the frontier).

Analysing Table 3 provides a successful story of the "dual track" approach implemented in Vietnam. Both the state and non-state tracks experienced significantly positive growth in all indices of economic performance. However, on average, the SOEs appeared to consistently lag behind in performance compared with other ownership types in the "level" and the "rate" productivity indices. Privatized enterprises (PDSHs and SDSHs) on average outperformed SOEs in both "level" and "rate" indices. This represents evidence of the success in ownership reform of SOEs and is consistent with recent survey evidence drawn from more than 500 privatized firms (CIEM, 2005) which suggested that enterprises after privatization had higher records of growth and productivity improvement, notwithstanding sustained challenges in the domain of corporate governance.

5.2 Determinants of the "Level Effect" of Technical Efficiency

To identify the contribution of the determinants, we ran regression on four panels. The first panel covered only industry identity dummy variables. The second panel extended to ownership variables. Therefore, we observed individually the impacts of industrial variables and ownership variables isolated from firm-specific factors. In the third panel, independent variables were extended to firm-specific factors including capital intensity and economic of scale. The last panel reported comprehensive determinants including firm-specific factors, competition indices and pertaining to the regions form which sample firms were drawn.

Adjusted R-squared increased from 15.5% in the first panel to 23.1% in the second panel. This implies that ownership variables have played a material role in explaining variations of efficiency. The firm-specific and business environmental variables also had a degree of explanatory power, contributing to an increase in adjusted R-squared from 23.1 % (in the second panel) to 25.8 % and 26.6 % in the third and the fourth panels. The F *tests* values for all regressions are all significant at 1% level. The second F-*tests* for the significance of incremental contributions of additional variables (Gujarati, 2003) in the second, third and fourth panels are all significant at 1% level. This suggests that additional variables in these panels are meaningful in terms of their impact in increasing the explanatory power of the estimated regressions.

All panels provided relatively consistent explanations about comparative levels of efficiency amongst industries. The Food and Beverage, Metal products, Transport, Machinery and Electronic & Communication Products industries displayed the highest efficiency (positive coefficients of more than 0.05). The next cluster of industries on the efficiency ladder included the Cigarette, Leather and Mining industries. The Textile, Garment, Rubber and Plastic and Utilities industries formed a group exhibiting low efficiency.

As from panel 2, 3 and 4 including ownership variables, all coefficients of ownership dummy variables were positive. SOEs were the comparative reference for ownership dummy variables; therefore, all enterprises of other ownerships were expected to have a higher efficiency

Table 4
Regression Analysis of Technical Efficiency

Dependent variable: Technical efficiency scores
Independent variables: Industrial dummy variables, ownership dummy variables and standardized variables of firm-specific variables (capital intensity and business scale), business environment variables (regions and competition index)

	Panel 1		*Panel 2*		*Panel 3*		*Panel 4*	
	Beta 1	*T-test*	*Beta 2*	*T-test*	*Beta 3*	*T-test*	*Beta 4*	*T-test*
Foods & Beverages	0.21**	18.28	0.18**	16.26	0.18**	16.3	0.14**	13.50
Cigarettes	0.03**	4.03	0.05**	7.94	0.04**	6.85	0.05**	7.36
Textiles	-0.01	-0.88	-0.02**	-2.52	-0.03**	-3.45	-0.04**	-4.86
Garments	-0.12**	-11.59	-0.15**	-14.83	-0.11**	-11.1	-0.15**	-13.45
Leathers	0.03**	3.47	0.00	-0.49	0.00	0.11	-0.01	-0.89
Timbers	0.12**	13.49	0.08**	10.07	0.06**	6.72	0.03**	4.61
Paper	0.09**	11.78	0.15**	19.35	0.14**	18.8	0.13**	17.33
Printing	0.18**	21.45	0.18**	21.35	0.16**	19.8	0.15**	18.57
Chemistry	0.13**	14.65	0.10**	10.94	0.07**	8.36	0.05**	5.40
Rubber and plastic	-0.03**	-3.15	-0.06**	-5.88	-0.05**	-5.13	-0.06**	-5.93
Metal products	0.22**	22.50	0.18**	19.47	0.17**	18.55	0.15**	16.25
Machinery	0.11**	12.68	0.10**	11.65	0.09**	10.88	0.08**	9.48
Elec., commu.	0.08**	11.77	0.06**	9.40	0.05**	7.89	0.05**	6.71
Transports	0.07**	8.56	0.06**	7.73	0.06**	7.36	0.05**	6.21
Furniture	-0.03**	-2.95	-0.07**	-7.87	-0.06**	-6.96	-0.08**	-8.16
Utilities	-0.03**	-4.01	0.02**	3.04	0.00	0.42	0.03**	3.23
+SDSHs			0.03**	4.64	0.04**	7.10	0.04**	6.00
+PDSHs			0.04**	6.22	0.04**	6.41	0.04**	6.75
+SJVs			0.20**	30.85	0.16**	24.68	0.16**	24.25
+PEs			0.37**	43.09	0.44**	47.69	0.42**	46.34
+ COEs			0.16**	22.69	0.23**	30.78	0.22**	29.99
+ FEs			0.23**	28.97	0.20**	24.90	0.19**	23.55
Capital intensity					0.17**	24.15	0.17**	23.12
Business Scale					0.07**	9.35	0.06**	7.83
Herfindal							-0.06**	-3.06
Regions							0.09**	14.98
Adjusted R_squared	15.5%		23.1%		25.8%		26.5%	
F-test	263 (p=0.00)		301.8 (p=0.00)		321.3 ((p=0.00)		309.6 (p=0.00)	
F-test for incremental contribution of variables		328 (p=0.00) Panel 2/1		418 (p=0.00) Panel 3/2		121 (p=0.00) Panel 4/3		

Notes: Linear regression: * signifies 0.1 level of significance, ** signifies 0.05 level of significance. The T-test column in each panel provides t–test value of the coefficients.

- *Beta coefficients* are standardized coefficients of the standardized independent variables.
- The second F-tests which test for incremental contribution of the additional variables in the second, third and the fourth panels compared with the next previous one, respectively.
- The regressions do not violate the multicollinearity assumption because the tolerance values and the VIF values (variance inflation factor) are all higher than 0.1 and are lower than 10, respectively. We also carried tests on normality, homoscedasticity and the independence of residuals. These requirements are not violated. (Pallant, 2005).

compared with that of SOEs because of their positive coefficients. Partially-privatized enterprises with dominant state ownership (SDSHs) and private ownership (PDSHs) had almost the same levels of efficiency. The SJVs, as expected, had significant higher efficiency compared with that of the group including SOEs, SDSHs, SPSHs. PEs exhibited superior performance in efficiency with coefficients of 0.37 (in 2nd panel), 0.44 (in 2nd panel) and 0.42 (in 3rd panel). After controlling for other factors, private ownership is the most robust to efficiency compared with all other ownership types. Surprisingly, COEs which were considered highly inefficient in the old model of organization before the reforms 1986 appeared to have achieved very high levels of efficiency (higher than that of SOEs, SDSHs, and PDSHs and just lower than PEs). The private nature of their ownership structure and their operation in freely competitive markets of made the efficiency of these organizations not substantially different from that observed for private organization.

The capital intensity index had a positive relationship with the observed level of efficiency. After controlling for the impact of ownership and industrial features, firms having higher levels of capital intensity produced higher levels efficiency.

The coefficient of the business scale index was positive. This indicates that firms can benefit from economies of scale when operating at a larger scale compared with other firms in the same industry. This result differs from those reported in some other empirical studies. For example, Page (1984) found a positive relationship between scale and efficiency in one of a group of four industries surveyed in the Indian manufacturing sector. However, he found the reverse result in the other three industries he examined.

Table 3 illustrates that SJVs exhibited the highest average levels of efficiency (0.53). However, the coefficients of SJVs were lower than PEs, COEs and FEs in the panels 3 and 4 after controlling for the impact of capital intensity and scale. This suggests that the superiority of average of efficiency observed for SJVs did not totally result from ownership factors, but actually from capital intensity and economic scale ones since these factors also had significantly positive impact on the levels of efficiency. SJVs on average had elevated levels of capital intensity and business scale compared with PEs, COEs and FEs. This conclusion is also correct for FEs when the coefficient of FEs was higher than COEs in the second panel but was lower than that in the third and fourth panels after controlling the firm-specific factors.

The local dummy variables explain the impact of the level of economic endowment in provinces on firm's business operations. GDP per capita was the proxy employed for the size and potential of the local markets. Because the coefficients were positive and significant in the panel, it appears plausible to sustain an argument that better local economic conditions make a positive contribution to the level of efficiency of firms.

5.3 Determinants of the "Rate Effect" of Technical Efficiency

In regressions of determinants of the "rate effect" of technical efficiency, the SOE variable was dropped out as comparative reference. The regression results reported in Table 5 describe that SDSHs, PEs, COEs and FEs had statistically significant higher growth rates in Malmquist TFP indices compared with SOEs. Coefficients of PDSHs and SJVs were not statistically significant. The decomposition of the Malmquist index in panels of technical progress and technical efficiency changes explains the sources of growth in Malmquist TFP index. In the

panel of technical progress which measures the shift in of the production frontier, SOEs lagged behind all firms in other ownership categories (coefficients of other ownership categories were all positive). PEs gained the highest technical progress compared with other firms. In technical efficiency which presents the movements of firm to frontier production, SOEs outperformed significantly compared with that of all other ownership firms (coefficients of other ownership categories were all positive). Therefore, growth in Malmquist TFP index of SOEs was subjected to the improvement of technical efficiency changes rather than technical progress.

According to the coefficients of industrial variables, industries mostly benefited from growth in Malmquist TFP index because of improvement in technical progress including textiles (0.03), leather (0.04), timber (0.05), food and beverages (0.13), paper (0.02), printing (0.05), metal products (0.07), chemicals (0.06) and furniture (0.04). Industries which exhibited improvements in technical progress were cigarettes (0.1) and utilities (0.84). There is no clear evidence for explaining the differences in improvements of productivity amongst industries in this paper.

In regressions of table 5, we control the impacts of firm-specific factors. However, the Malmquist TFP index and its components measure the rate of changes, therefore, it is necessary to imply growth rates of capital intensity and business scale indices. In the Malmquist TFP index panel, increasing in capital intensity was statistically insignificantly associated with the Malmquist TFP index. In the sub-panel of technical progress, increasing in capital intensity was negative and statistically insignificant in making difference in technical progress. Increased capital intensity is the major source for advancements in technology which shifts the frontier production. The passive role of increasing capital intensity in technical progress explains why technical progress had poor contribution to changes of Malmquist TFP in Table 3.

The business scale index showed a positive relationship with the Malmquist TFP index. From the sub-panel of technical efficiency changes, the result explains that increases in the business scale index were the major source for technical efficiency changes (coefficient of 0.13 and statistically significant). Therefore, the positive movement of technical efficiency changes drove to the positive changes in Malmquist TFP index. The result implies that when firms grew their business scale relative to other firms in a given industry, they enjoyed increased efficiency from technical efficiency changes by moving toward the frontier production.

The competition index had a significantly negative relationship with changes in the Malmquist TFP index (coefficient of -0.25). The conclusions reached in relation to this phenomenon are similar with those drawn from the analysis of the "level effect" of technical efficiency in Table 4. Firms operating in industries marked by low competition had lower technical efficiency growth rates. The enrichment of economic development in regions also contributed to a higher growth rate in the Malmquist TFP index, the coefficient value sitting at 0.04 and falling into the statistically significant range. Firms which were located in regions of high income had a higher growth rate of technical efficiency.

5. CONCLUSION

The main purpose of this paper has been to assess the determinants of the "level" and "rate" of technical efficiency in production from a panel of data drawn from the industrial sector of Vietnam during the transition process of that nation to a market economy. The results of the study demonstrate that ownership is one of the important determinants of technical

Table 5
Regression Analysis of the "Rate Effect" of Technical Efficiency

Dependent variable: Technical efficiency scores
Independent variables: Industrial dummy variables, ownership dummy variables, firm-specific variables (capital intensity and business scale), business environment variables (regions and competition index)

	Malmquist TFP index		*Sub-Panel Technical Progress*		*Sub-Panel Technical Efficiency*	
	Coefficients	*T-test*	*Coefficient*	*T-test*	*Coefficient*	*T-test*
Intercept	0.98**	126.22	0.45**	29.71	1.74**	82.15
Foods & Beverages	-0.03**	-2.16	0.13**	9.65	-0.15**	-11.51
Cigarettes	0.03**	4.04	-0.08**	-9.84	0.10**	12.16
Textiles	-0.03**	-2.74	0.03**	3.40	-0.05**	-5.04
Garments	-0.03**	-2.19	-0.03**	-2.30	0.02	1.67
Leathers	-0.02**	-2.36	0.04**	4.61	-0.06**	-5.99
Timbers	-0.03**	-3.34	0.05**	5.02	-0.07**	-7.86
Paper	0.00	-0.30	0.02**	2.63	-0.03**	-3.77
Printing	-0.03**	-2.91	0.05**	5.51	-0.07**	-7.66
Chemicals	-0.04**	-4.06	0.06**	6.01	-0.09**	-8.84
Rubber and plastic	-0.02	-1.94	-0.01	-0.97	0.00	0.05
Metal products	-0.03**	-2.99	0.07**	6.19	-0.09**	-8.55
Machinery	-0.01	-1.53	-0.03**	-2.8	0.01	1.57
Elec., communication	-0.02*	-2.01	-0.01	-0.81	-0.01	-0.64
Transports	-0.01	-1.23	-0.01	-0.90	0.00	-0.22
Furniture	-0.02	-1.49	0.04**	3.76	-0.05**	-4.63
Utilities	0.22**	5.76	-0.72**	-18.68	0.84**	22.00
+SDSHs	0.03**	4.12	0.08**	11.35	-0.06**	-8.59
+PDSHs	0.01	1.57	0.03**	4.59	-0.02**	-3.45
+SJVs	0.00	0.56	0.07**	9.99	-0.08**	-10.72
+PEs	0.04**	4.67	0.13**	13.5	-0.12**	-12.49
+ COEs	0.04**	4.96	0.05**	5.95	-0.03**	-4.18
+ Fes	0.06**	7.49	0.11**	12.55	-0.09**	-10.2
Growth Capital intensity	0.00	0.09	-0.01	-1.96	0.01**	2.20
Growth Business Scale	0.31**	50.26	-0.01	-0.84	0.13**	19.87
Herfindal	-0.25**	-6.29	0.81**	20.27	-0.94**	-23.93
Regions	0.04**	6.22	0.18**	27.48	-0.15**	-23.15
R_squared	10.7%		7.1%		8.8%	

Notes: Liner regression: * stands for 0.1 level of significance, ** stands for 0.05 level of significance. The T-test column in each panel provides t–test value of the coefficients.

efficiency. Other determinants which have statistically significant impacts are differences in industry identity, capital intensity, business scale, competition and economic endowment amongst different regions.

The efficiency level varied amongst different industries, with the Food & Beverage and Metal Products industries having the highest efficiency, followed in order by Printing, Chemicals, Machinery, Timber, Paper, Electronic & Communication products, Transport, Leather, Cigarette and the Mining industries. Industries exhibiting the lowest range of efficiency were Textiles, Garments, Rubber & Plastic, Furniture and Utilities.

The renewal process in Vietnam began with reform in the management of state-owned enterprises and in development of non-state owned enterprises. During this process of dynamic transition, ownership was an important determinant of efficiency.

Although enterprises of all ownership types reviewed for the purposes of this paper demonstrated increases in productivity growth and impressive growth in output, employment and capital employed, our analysis suggested that SOEs consistently lagged behind organizations of different ownership forms in productivity. SOEs had the lowest capital, labor productivity and efficiency levels although they had higher levels of capital intensity and business scale than other ownership categories such as COEs, PEs, SDSHs and PDSHs. In terms of growth in labor and capital productivity, and technical efficiency (Malmquist TFP index), SOEs lagged behind all other ownership organizations (FEs, PEs, JSVs and COEs). This result suggests that the relatively poor performance of SOEs is not due to differences in technology or business scale, but rather that they may suffer from governance problems which constrain their incentives to maximize efficiency in production.

Reform in SOEs by privatization had brought the average level of efficiency in privatized firms to a higher levels compared with that of SOEs. However, in partial-privatized firms of dominant state ownership firms, efficiency seemed to be more superior to that of dominant private ownership ones. One of the reasons for this difference from the orthodox theories of privatization is that the Vietnamese government only wanted to rid of poor performance firms into private hands and kept control in equity for the efficient ones. Therefore, dominant state ownership firms have a higher level of efficiency compared with private dominant ownership ones in a relative short time of analysis from 2001-2005.

Another channel of reform in SOEs was to establish join-ventures with foreign partner. SJVs had significant higher level of efficiency compared with other domestic state-invested ownership organizations. The implementation of market-oriented governance in SJVs of dominant foreign ownership should be one of the reasons for better efficiency of SJVs. SJVs had advantage in capital intensity and this factor also contributed positively to higher levels of efficiency.

Domestic private ownership is shown to be most robustness with "level" and "rate" of efficiency compared with all other ownership categories. Surprisingly, COEs had a relatively higher level of efficiency of just lower than PEs. Ownership in COEs was private in nature. Therefore, they gained advantage of the private ownership in maximizing efficiency. Other research about the reform in ownership of COEs in China also reported the high growth rates and superior in efficiency of COEs compared with SOEs (Zheng *et al.*, 1998).

Capital intensity had a significant positive relation with the "level effect" with efficiency. However, its role on "rate effect" was indefinite. The growth in efficiency of industrial sector (Malmquist TFP index) was mostly driven by technical efficiency changes (moving toward frontier production) rather than from technical progress (shifting of the frontier production). The passive role of technical progress can be partly explained by the insignificant contribution of increasing in capital intensity on technical progress, which is considered as a determinant of growth in technical progress.

We have shown that business scale has a positive relationship with the level of efficiency after controlling differences in industries, ownership and capital intensity. Firms can benefit in

efficiency if they operate in a larger business scale compared with other firms in the same industry. Increasing business scale also has a positive relationship with increases in efficiency. Our results suggest that firms located in a high income area have a higher efficiency.

The results from this paper strongly suggest the success of economic reform in Vietnam. There were impressive growth rates in output and productive efficiency in all ownership categories in the industrial sector of Vietnam. The lagged behind in both "level" and "rate" of productive efficiency in the state sector should be the most challenging issue for maintaining the "leading role" as expected by the government of this sector in the transition process. Actually, the foreign and private sectors were the "leading" sectors in terms of productivity. Although the government was still constrained by a cautious approach to privatization, the empirical evidence shows that privatized firms on average had significantly higher "level" and "rate" of efficiency compared with the SOEs. The competition forces of the market mechanisms have stimulated the effective allocation of resources and as a result, encouraged increasing in the technical efficiency of firms. However, the "rate" and the "level" of efficiency can be higher if Vietnamese industrial firms would be able to benefit more from increasing in technical progress which is resulted from effective capital investment in highly productive technology. The reason for the poor contribution of technical progress to growth of productivity efficiency and output seems to be due to the limited impact of technical progress in the short term. This suggests further research about determinants of efficiency, growth and profitability in the industrial sector in Vietnam with a longer observed period.

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