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Firm-level Evidence on Productivity Differentials and Turnover in Vietnamese Manufacturing*

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Abstract: This paper examines the relationship between productivity differentials and firm turnover in Vietnamese manufacturing. We utilize firm-level data between 2000 and 2009, including the year 2007, when Vietnam joined the World Trade Organization (WTO). Our major findings are twofold. First, the productivity of entrants, survivors, and exiters increased simultaneously from 2006 to 2007. This result suggests that the cutoff productivity level increased after trade liberalization. Second, the resource reallocation between firms was facilitated after the liberalization. These findings are consistent with the implications of the recent models of international trade and firm heterogeneity.

Key words: Total factor productivity; Aggregate productivity; Trade liberalization; Firm turnover; Vietnam
JEL classification: O12; D22; O47; F14

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1. Introduction

Does trade liberalization contribute positively to aggregate productivity growth in a country? If so, is this because it enhances resource (and thus market share) reallocation between firms. Is this because it facilitates firm turnover (i.e., firm entry and exit)? Or is this because trade liberalization helps to improve the productivity of each firm? These questions are nontrivial in clarifying the mechanisms of dynamic gains from trade liberalization. However, because theory predicts that all these are possible mechanisms (e.g., Melitz, 2003; Bernard, *et al.*, 2007), the answers are an empirical matter.

This paper utilizes firm-level data for Vietnamese manufacturing between 2000 and 2009, including the year 2007, when Vietnam joined the World Trade Organization (WTO). We examine the relationship between trade liberalization and aggregate productivity growth, building upon empirical firm-level studies.[1] To answer the above questions, we employ a framework to decompose aggregate productivity growth.[2] It first aggregates the productivity growth of firms, and then decomposes this aggregate productivity growth into the contributions from the firms' own growth, resource reallocation between existing firms, and entry and exit by firms.[3] The framework thus enables us to answer the above questions directly. Indeed, a number of studies have examined the relationship between trade liberalization and the decomposition of aggregate productivity growth, employing this decomposition framework.[4]

One of the contributions of this paper is the use of Vietnamese firm-level data. As we will discuss in the next section, firm-level studies of Vietnam are still limited.[5] Indeed, this paper is the first study that examines the relationship between

[1] For studies that focus on the relationship between trade liberalization and firm-level productivity growth, see De Loecker (2011) for Belgium; Pavcnik (2002) for Chile; Fernandes (2007) for Colombia; Topalova and Khandelwal (2011) for India; and Amiti and Konings (2007) for Indonesia.

[2] A number of studies have decomposed aggregate productivity growth employing this framework. See, for example, Baily, *et al.*(1992) for the case of the United States; Aw, *et al.* (2001) for Taiwan; and Nishimura, *et al.* (2005), and Fukao and Kwon (2006) for Japan.

[3] This decomposition methodology is explained in more detail in Section 4.

[4] See, for example, Tybout (2003) and Bernard, *et al.* (2012) for a survey.

[5] Section 2.2 discusses the related literature in more detail.

productivity differentials and firm turnover in Vietnam. Therefore, it contributes to the literature by adding another national perspective to the available evidence. It is also expected to provide helpful policy implications for Vietnamese policy makers regarding the productivity growth of the manufacturing industry and firm turnover.

The major findings of this paper are twofold. First, after 2007, the productivity of entrants, survivors, and exiters increased simultaneously. This result suggests that the cutoff productivity level increased after trade liberalization. Second, the contribution of the reallocation effect to aggregate productivity growth increased after 2007. This implies that resource reallocation between firms was improved after the liberalization, which is consistent with the implications of the recent models of international trade and firm heterogeneity. However, this effect was not large enough to offset the negative net-entry effect between 2008 and 2009, when the global financial crisis hit the Vietnamese economy severely. As a result, aggregate productivity growth was negative between 2008 and 2009.

The rest of the paper is structured as follows. Section 2 briefly describes the Vietnamese economy in the 2000s, the period for which firm-level data are available. Section 3 describes the data and examines the relationship between firm productivity and turnover. Section 4 extends the analysis from firm-level productivity growth to aggregate productivity growth. A summary of our findings and their policy implications is presented in the final section.

2. The Vietnamese Economy in the 2000s

2.1. Overview of Vietnam's International Trade Activities

Economic reform in Vietnam started in 1986 and was aimed at transforming the centrally planned economy to a more market-oriented one. One of the major changes involved the gradual opening up of the economy through participation in bilateral and regional trading agreements. The most comprehensive bilateral trading agreement was signed with one of Vietnam's largest trading partners, the United States, in 2000 and came into force in 2001, covering trade in goods and services, investment and the protection of intellectual property rights. With terms and

conditions that accord with the WTO's principles, the agreement was an important preparation for Vietnam's future negotiation into the WTO.

In terms of multilateral integration, the first benchmark occurred in 1995 when Vietnam joined the Association of Southeast Asian Nations (ASEAN). To fulfill its commitments, Vietnam has reduced tariffs imposed on imports from ASEAN trade partners to 0.5 percent by the year 2006, and will eliminate tariffs on intra-ASEAN trade by year 2015. In addition, the country also became a party to ASEAN's regional trading agreements signed with China, Korea, Japan, Australia, New Zealand, and India. Such cooperation has continuously boosted bilateral trade between the country and its partners, offering larger export markets and requiring Vietnamese firms to improve product quality.

The commencement of Vietnam's integration process was marked by the country's accession to the WTO in January 2007 after 11 years of negotiation. Apart from greater access to the world market, Vietnam can also take advantage of WTO's dispute settlement regulations to protect its firms against discrimination. Furthermore, policy reform supported by multilateral commitments within the WTO will foster the confidence of trade partners in the Vietnamese economy, allowing the country to attract additional trade flows. Under the WTO agreements, Vietnam committed to reduce the average tariff rate by 23 percent compared with the current MFN tariffs within five to seven years following accession. Most of the tariff lines will be reduced to 0{5 percent, while a tariff rate of 10{20 percent will be maintained for a limited number of products. Products with the largest tariff reduction include such major export products as textiles, fish and fish products, wood and paper, electronic parts and machinery, and other manufacturing goods.

Vietnam's accession to the WTO was accompanied by a surge in trade share relative to GDP. In the period from 2000 to 2010, trade accounted for 141 percent of GDP (World Bank, 2012). This figure skyrocketed to 163 percent in the period from 2007 to 2010, implying increasing openness of the economy. At the same time, the GDP growth rate was high at an average rate of 7.2 percent over the period from 2000 to 2010. Manufacturing, in particular, experienced the fastest average output growth of 10.5 percent per year.

Given the theoretical linkage between trade and growth, these figures raise the

question of whether trade liberalization has played an important role in Vietnam's development success. At the micro level, it is possible that trade liberalization has led to higher firm productivity, which in turn improves aggregate productivity growth. Motivated by such an observation, our study aims at investigating productivity dynamics and firm turnover for a 10-year time span when substantial trade liberalization occurred. We focus on productivity growth before and after the year 2007 when Vietnam became a WTO member.

2.2. Related Literature

In Vietnam, to our knowledge, Chu and Kalirajan (2011) is the first study that linked firm productivity and trade liberalization.[6] The study estimated a stochastic production frontier model to analyze the impact of trade liberalization, in the form of a tariff cut, on a firm's technical efficiency.[7] The study used balanced panel data of manufacturing firms obtained from the *Annual Survey on Enterprises* conducted by the GSO, covering the period from 2000 to 2003. The estimated result suggests that movement toward free trade leads to higher firm technical efficiency. They concluded that this positive impact could be attributed to the competition effect of trade liberalization.

Yang and Huang (2012) also examined the impact of trade liberalization on firm productivity. The authors are particularly interested in the productivity effect of trade on firms across different ownership structures. Total factor productivity is calculated using the Levinsohn and Petrin (2003) methodology and data from the *Annual Survey on Enterprises* collected by the GSO from 2002 to 2008. Econometric estimates identified the factors influencing productivity for 2002, 2004,

[6] In Vietnam, only a few firm-level studies have examined issues related to trade liberalization. For example, a study by Nguyen, *et al.* (2011) examined the impact of increased competition and transfer of capabilities through FDI spillover effects and greater exposure to trade. The authors used the *Vietnam Small and Medium Manufacturing Enterprise Survey* conducted in 2007 and 2009 to examine the innovation–export linkage. The cross-section estimates suggest that exports and foreign pressure exert a positive impact on innovation activities, while the share of imported inputs plays an insignificant role in encouraging innovation. Tran and Nguyen (2008) investigated the impact of trade liberalization on performance and business behaviors of nonfarm household enterprises (NFHE) in Vietnam. The study found favorable effects of trade liberalization on NFHE income.

[7] Technical efficiency is measured by the difference between a firm's observed output and its frontier output. Smaller gaps between realized output and the frontier output imply higher levels of firm efficiency

2007, and 2008, which are the years for which data on research and development are available. Their estimation results suggested that multinational enterprises have higher productivity than their domestic counterparts. State-owned enterprises still experience higher productivity than private firms. In addition, WTO accession exerts a positive impact on firm productivity. However, the authors did not examine whether the productivity growth rate in 2007 was higher than that in previous years.

Our study differs from the abovementioned studies in the following ways. First, the time and scope coverage of our dataset is wider than those employed in previous studies. Moreover, it includes the year 2007 when Vietnam joined the WTO. This allows us to investigate the potential impact of the WTO accession on the productivity of firms.[8] Second, the focus of our study is the growth in aggregate productivity and the contribution of a firm's own growth, of the resource reallocation between firms and of the firm's entry and exit, to aggregate productivity growth. The focus of this study is different from that in Nguyen, *et al*. (2011), whose interest is on trade liberalization and innovation activities. Finally, our methodological approach is different from that employed in Chu and Kalirajan (2011) and Yang and Huang (2012).[9] From these perspectives, our study can contribute to the recent debate on the costs and benefits of trade liberalization in general and the WTO accession in particular on the performance of manufacturing firms.

3. Firm Productivity and Turnover in Vietnam

3.1. Data

Source

This paper uses firm-level data from the *Annual Survey on Enterprises* collected by the GSO. The survey was conducted in the year 2000 for the first time, to provide researchers and policy makers with comprehensive information on Vietnamese firms.

[8] However, our data do not consider household enterprises, which are examined in Tran and Nguyen (2008).

[9] While our study also employs the *Annual Survey on Enterprises* from the GSO, the lack of information about intermediate inputs for several of the years covered by the dataset does not allow us to apply such approaches

These data cover registered firms operating in every economic sector, including agriculture, industry and construction, and services. The survey is conducted annually in the second or third quarter of the year. Firms are included in the survey if they were still in operation on December 31st of the previous year. The survey information includes the type of ownership, assets and liabilities, number of employees, sales, capital stock, the industry that the firm belongs to, and obligations to the government, for example, taxes, among others, from January to December of that year.

This is by far the most comprehensive dataset available on Vietnamese firms. The survey covers officially registered firms that were in operation on December 31st of the previous year. A registered firm is defined as "an independent economic unit that has acquired its legal status under Law on State-owned Enterprises, Cooperative Law, Law on Enterprises, Foreign Investment Law or by the Agreement between Vietnamese government and the government of foreign countries" (GSO, 2010, p. 4). In general, there is no requirement for minimum capital, a professional license, or proof of managerial ability for the establishment of a manufacturing firm.[10] Once a firm is registered, it is given a tax code. The GSO converts this tax code to a nine-digit special code to maintain confidentiality. The special code is unique and remains unchanged over the years. Thus, it can be used to track firms over time. This paper constructs a firm-level panel dataset, using this special code as a firm identifier.

The survey covers all state-owned enterprises and foreign-owned firms without any firm-size threshold.[11] However, as for domestic private firms, those that have fewer than 10 workers are chosen by random sampling.[12] Household business activities are also not covered in this survey.[13]

The data have some disadvantages. Some of the input data, such as materials, are only available for some years. Information on working hours and capital utilization

[10] These requirements were included in the past

[11] While foreign-owned firms only account for around 3 percent of the total number of firms in each year from 2000 to 2009, they are responsible for approximately 20 percent of total employment. In 2009, these firms accounted for 48.1 percent of total profits before tax and 40.4 percent of total corporate tax revenues. Compared with 2000, the profits of these firms increased 4.9-fold, and their contribution to the state budget increased fivefold.

[12] This threshold was used in surveys before 2010.

[13] The survey covered 62.2 percent of the total employment in the manufacturing sector in 2009.

rates is also unavailable. Firms' year of establishment and export status are not available every year. Furthermore, the survey does not cover the following:

a. firms that completed the registration procedure but did not start operations before December 31st of the previous year
b. firms that were merged or that changed their main business activities[14]
c. firms that completed the registration procedure but could not be found in the registered area.

There are some reentry firms that disappeared and reappeared later. Some firms changed industry and/or ownership during the sample period. It is thus necessary to clean up the data.

Sample selection and the definition of entry/exit

To estimate TFP, we first clean up the data. Given the threshold for small, domestic private firms and the potential switch between ownership types, to limit the problem of firm exit from the survey and from the market, this study excludes all firms with fewer than 10 employees regardless of their ownership types. We use firms whose information on inputs, output, and cost shares is available. Reentry firms are also omitted because it is not possible to obtain the information for the missing year(s).[15] We assign a single industry code to each firm because, if a firm switches industry, its "reference firm" (defined below) must also change, as the properties of the reference firm are calculated based on industry averages. For firms that switch industry, we use the mode of the industry code.[16] In this paper, following the literature on productivity differentials and firm turnover, such as Aw, *et al.* (2001) and Nishimura, *et al.* (2005), we define entry and exit as a firm's appearance in and disappearance from the dataset.

[14] If two firms merge to establish a new firm, this new firm will have a new tax code and a new registration document set. The two previous firms will disappear from the survey. In the case of an acquisition, the acquired firm no longer exists, while the acquiring firm has to submit new registration documents. The tax code, however, remains unchanged for the acquiring firm.

[15] After the cleanup, our dataset covers 36.2–54.1 percent of the firms in the survey.

[16] If a firm has switched industry, the industry to which the firm belonged for the majority of the surveyed years is regarded as that firm's industry. If there is a tie in the industry code to which the firm belonged for the majority of the surveyed years, we assign the code of the latest year.

3.2. Measurement of Productivity

Because of the limited availability of the data, it is impossible to employ a control function approach (e.g., Olley and Pakes, 1996; Levinsohn and Petrin, 2003) to estimate the TFP. In this paper, therefore, we employ a nonparametric methodology based on the multilateral index number approach developed by Good, *et al.* (1997).[17] Let Ωt be the set of existing firms in year t (= 0, ..., T). The multilateral index measures the TFP of firm i ($\in \Omega t$) in year t relative to that of a hypothetical reference firm r in the base year (t = 0). The reference firm is the firm that has the arithmetic mean values of log output, log inputs, and cost shares over all firms in the same industry in each year. We denote the TFP of firm i and of the reference firm r in year t as φ_{it} and φ_{rt}, respectively. We normalize the TFP of the reference firm in the base year to unity: $\varphi r0 = 1$. The TFP index for firm i in year t relative to the reference firm r in the base year (i.e., $\ln \varphi it - \ln \varphi r0 = \ln \varphi_{it}$) is written as:

$$\ln \varphi_{it} \simeq \ln V_{it} - \overline{\ln V_{rt}} + \sum_{\tau=1}^{t} (\ln V_{r\tau} - \overline{\ln V_{r,\tau-1}}) - \sum_{j=1}^{J} \frac{1}{2}(s_{ijt} - \bar{s}_{rjt})(\ln X_{ijt} - \overline{\ln X_{rjt}}) - \sum_{\tau=1}^{t} \sum_{j=1}^{J} \frac{1}{2}(\bar{s}_{ij\tau} - \bar{s}_{rj,\tau-1})(\overline{\ln X_{ij\tau}} - \overline{\ln X_{rj,\tau-1}}), \quad (1)$$

where $\ln V_{it}$, $\ln X_{ijt}$, and s_{ijt} are the log output, the log input of factor j, and the cost share of factor j in year t, respectively; $\overline{\ln V_{rt}}$, $\overline{X_{rjt}}$, and $\bar{s}_{rjt}$ are those of the reference firm r in year t (i.e., the arithmetic means of the corresponding variables over all firms in the same industry).

The first two terms on the right-hand side are the deviation of the firm's output from the output of the reference firm in year t. The third term is the cumulative change in the output of the reference firm between year 0 (the base year) and year t. The same manipulations are applied to each input j, summed using a combination of the input share for each firm $sijt$ and for the reference firm $\bar{s}_{rjt}$ as weights. The index provides a measure of the proportional difference in the TFP for firm i in year t relative to the reference firm in the base year. We use 2000 as the base year. The reference firm properties are estimated for each industry.[18]

[17] A number of studies on firm heterogeneity in international trade employed the multilateral index number approach. See, for example, Aw, *et al.* (2001); Aw, *et al.* (2003); Kiyota and Okazaki (2005); and Kimura and Kiyota (2006, 2007).

[18] Our data cover 24 manufacturing industries. Therefore, we estimate 24 reference firms.

Output is defined as the real value added, while the inputs are capital and labor.[19] The main advantage in using the real value added is its aggregation property. Real value added is directly comparable across industries, while real gross output is not comparable because, conceptually, it is measured using different units in each industry. This is particularly important for our study because our main focus is aggregate productivity growth.[20]

3.3. Firm Productivity and Turnover

This paper focuses not only on productivity differentials among firms but also on firm turnover and aggregate productivity growth. To address these issues, we employ a descriptive analysis rather than a firm-level regression analysis because it is difficult to obtain the implications for the reallocation and entry/exit phenomena from the firm-level regression analysis. We first estimate the TFP, and then examine how it changed when Vietnam joined the WTO in January 2007.

Table 1 indicates the number of firms, by year.[21] Two findings stand out from this table. First, the number of firms increased between 2000 and 2009, with some fluctuations. The number of firms declined slightly from 5,631 in 2000 to 5,547 in 2001, and then grew to 17,690 in 2008. In 2009, the number of firms declined to 15,465. This sudden drop may reflect the economic downturn in Vietnam after the global financial crisis.

[19] For more detail about the construction of the real inputs and output, see the Appendix.
[20] Summary statistics of inputs and output are reported in Table A1.
[21] The number of firms, by industry and by year, is summarized in Table A2

Table 1: Entry and Exit Patterns of the Manufacturing Firms, 2000-2009

year	Total	Entrants	Survivors	Exiters	Ratio Entrants	Ratio Exiters
Number of firms						
2000	5,631		5,631			
				3,349		0.595
2001	5,547	3,265	2,282		0.589	
				872		0.157
2002	6,720	2,045	4,675		0.304	
				1,165		0.173
2003	7,521	1,966	5,555		0.261	
				1,264		0.168
2004	8,470	2,213	6,257		0.261	
				1,576		0.186
2005	12,751	5,857	6,894		0.459	
				4,989		0.391
2006	10,860	3,098	7,762		0.285	
				1,559		0.144
2007	13,498	4,197	9,301		0.311	
				2,001		0.148
2008	17,690	6,193	11,497		0.350	
				6,347		0.359
2009	15,465	4,122	11,343		0.267	

Notes: The ratio of entrant is the ratio of the number of entrants to the number of all firms in the current year The ratio of exiters is the ratio of the number exiter to the number of all firms in the previous year.

Source: Author's calculation, based on the *Annual Survey on Enterprises* by the GSO.

Second, increases in the number of firms do not necessarily mean a low firm exit rate. Indeed, the entry and exit rates were both rather high. The exit rate varied from 0.144 to 0.595. However, the entry rate was generally greater than the exit rate, which resulted in the increase in the number of firms from 2001 to 2008. From 2008 to 2009, the number of entrants declined while the number of exiters increased. As a result, the number of exiters exceeded the number of entrants, which caused the decline in the number of firms during that period.

Table 2 presents changes in the number of firms in cohorts defined according to the year when firms first entered the market, showing survival trends over time for firms that entered the market in the same year. Table 2 also presents two types of survival rates. One is an unconditional survival rate, which is the ratio of the number of surviving firms to the total number of firms in the original entry year. The other is the conditional survival rate, which is the ratio of surviving firms to the total number of firms in the previous year.

Table 2: Entry and Exit Patterns of the Manufacturing firms, by Entry-year Cohort

	Total	By entry-year cohort									
year		before 2001	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of firms											
2000	5,631	5,631									
2001	5,547	2,282	3,265								
2002	6,720	2,010	2,665	2,045							
2003	7,521	1,781	2,268	1,506	1,966						
2004	8,470	1,603	1,942	1,244	1,468	2,213					
2005	12,751	1,433	1,682	1,044	1,164	1,571	5,857				
2006	10,860	1,331	1,530	919	1,015	1,315	1,652	3,098			
2007	13,498	1,220	1,395	829	895	1,124	1,379	2,459	4,197		
2008	17,690	1,155	1,250	749	796	980	1,203	2,127	3,237	6,193	
2009	15,465	1,051	780	532	610	720	861	1,656	2,181	2,952	4,122
Unconditional survival rate											
2000		1.000									
2001		0.405	1.000								
2002		0.357	0.816	1.000							
2003		0.316	0.695	0.736	1.000						
2004		0.285	0.595	0.608	0.747	1.000					
2005		0.254	0.515	0.511	0.592	0.710	1.000				
2006		0.236	0.469	0.449	0.516	0.594	0.282	1.000			
2007		0.217	0.427	0.405	0.455	0.508	0.235	0.794	1.000		
2008		0.205	0.383	0.366	0.405	0.443	0.205	0.687	0.771	1.000	
2009		0.187	0.239	0.260	0.310	0.325	0.147	0.535	0.520	0.477	1.000
Conditional survival rate											
2000		1.000									
2001		0.405	1.000								
2002		0.881	0.816	1.000							
2003		0.886	0.851	0.736	1.000						
2004		0.900	0.856	0.826	0.747	1.000					
2005		0.894	0.866	0.839	0.793	0.710	1.000				
2006		0.929	0.910	0.880	0.872	0.837	0.282	1.000			
2007		0.917	0.912	0.902	0.882	0.855	0.835	0.794	1.000		
2008		0.947	0.896	0.903	0.889	0.872	0.872	0.865	0.771	1.000	
2009		0.910	0.624	0.710	0.766	0.735	0.716	0.779	0.674	0.477	1.000

Notes: An unconditional survival rate is for the ratio of the number of surviving firms to that in the original entry year. A conditional survival rate is for the ratio of surviving firms to that in the previous year.

Source: Author's calculation, based on the *Annual Survey on Enterprises* by the GSO.

There are two notable findings in this table. First, survival rates just after entry are low. More than 18 percent of new entrants exited from the market within a year. Furthermore, more than half of the firms exited from the market five years after entry. [22]Second, survival probabilities do not necessarily rise as time passes. The conditional survival rate indicates that more than 10 percent of firms exit from the market annually; this pattern is highly consistent.[23]

Table 3 presents firm size and productivity data from 2000 to 2009.[24] Firm size is measured by the total number of employees per firm, or real value added. Table 3 also reports two productivity measures. One is the average labor productivity (ALP), which is defined as per capita real value added. The other is the TFP, which is estimated by the index method discussed in Section 3.2. Table 3 presents the unweighted mean of the reference firms' TFPs across industries.

The major findings are threefold. First, the average number of employees per firm declined after 2007. There may be a general perception that trade liberalization through accession to the WTO leads small firms to exit the market because of the increasing competition with foreign-owned firms. However, such a perception may be misleading because the average number of employees per firm declined after 2007, from about 220 before 2007 to around 170 after 2007.

[22] These figures are comparable to those of other countries such as Japan. See, for example, Nishimura, *et al.* (2005).

[23] Before the passing of the Enterprise Law in 2005, foreign-owned firms operating in Vietnam and domestic enterprises were managed under different legal documents; this dual system favored domestic firms. The unification of these two legal codes has thus leveled the playing field for all firms, creating a more transparent legal environment that conforms to international business practices. In addition, administrative procedures have been simplified to save firms' time and money. More detailed regulations about joint stock companies were introduced. The new law also allowed an individual to establish limited liability, while this right had only belonged to an organization under the previous law. The new enterprise law was approved in 2005 and went into effect in July 2006; thus, the effect of the new enterprise law on our data should be limited.

[24] The TFP of firms by year and by industry is reported in Table A3.

Table 3: Firm Size and Productivity, by Year

year	Level (unweighted mean)			
	Employment size (Number of workers)	Value-added (Millions of VND)	Average labor productivity (ALP) (Millions of VND)	Total factor productivity (TFP) (Index: 2000 = 1)
2000	224	8056	29.7	1.00
2001	217	8377	32.1	1.04
2002	222	8800	34.4	1.11
2003	227	10219	38.3	1.20
2004	216	10439	39.0	1.26
2005	200	9431	37.0	1.20
2006	209	10057	39.9	1.30
2007	192	10894	45.9	1.44
2008	159	8687	45.7	1.46
2009	165	12130	62.8	1.50

period	Growth rate (unweighted mean)			
	Employment size	Value-added	Average labor productivity (ALP)	Total factor productivity (TFP)
2000-01	0.059	0.182	0.123	0.104
2001-02	0.077	0.285	0.209	0.171
2002-03	0.054	0.256	0.202	0.155
2003-04	0.046	0.161	0.115	0.105
2004-05	0.017	0.163	0.146	0.112
2005-06	0.041	0.209	0.168	0.116
2006-07	0.033	0.292	0.259	0.216
2007-08	-0.001	0.142	0.143	0.126
2008-09	-0.009	0.223	0.232	0.086

Notes: For employment size, value added, and ALP, unweighted mean of all firms is reported. ALP is defined as per-capita value added. For TFP, unweighted mean of the reference firm is reported. Growth rates are unweighted means of corresponding variables accross firms. Value-added is valued at 2000 constant price. For more detail, see Appendix.
Source: Author's calculation, based on the *Annual Survey on Enterprises* by the GSO.

Second, both the ALP and TFP increased significantly when Vietnam joined the WTO. From 2006 to 2007, on average, the ALP and TFP grew by 25.9 percent and 21.6 percent, respectively. Finally, although the unweighted means of the ALP and TFP levels showed slight declines around 2005, those of the growth rates were positive throughout the survey period. For example, the TFP growth rate ranged between 8.6 percent and 21.6 percent. Surprisingly, even when the global financial crisis damaged the Vietnamese economy severely, the productivity of firms grew strongly. Note that the ALP does not take into account the adjustment of other inputs

such as capital stock. Hereafter, therefore, we focus on the TFP. Note also that the growth rate was available only for firms that survived for two consecutive years.

How does firm productivity relate to entry and exit? Table 4 reports the unweighted mean number of employees and mean TFP across firms, by survival status.[25] There are five notable findings in this table. First, the average number of employees of the survivors is greater than that of the entrants or exiters. This result implies that larger firms are more likely to survive. On the other hand, the entrants and exiters are comparable in size. Second, the size of the survivors as well as that of the entrants declined after 2007. This result suggests that trade liberalization facilitated not only the exit but also the entry of smaller firms, which led to the decline in the average size of the survivors.

Table 4: Employment Size and TFP of Manufacturing Firms, by Survival Status

	All firms	Employment size (unweighted mean)			All firms	TFP (unweighted mean)		
year		Entrants	Survivors	Exiters		Entrants	Survivors	Exiters
Number of firms								
2000	224		224		1.40		1.40	
				227				1.44
2001	217	206	233		1.44	1.43	1.46	
				82				1.24
2002	222	109	272		1.52	1.33	1.59	
				78				1.39
2003	227	95	274		1.59	1.32	1.69	
				134				1.39
2004	216	89	261		1.67	1.39	1.77	
				70				1.44
2005	200	129	260		1.60	1.31	1.85	
				135				1.40
2006	209	93	256		1.73	1.35	1.89	
				62				1.80
2007	192	84	241		1.94	1.59	2.11	
				66				1.92
2008	159	57	214		2.07	1.55	2.36	
				85				1.94
2009	165	70	200		2.00	1.70	2.11	

Notes: Figures indicate unweighte mean.

Source: Author's calculation, based on the *Annual Survey on Enterprises* by the GSO.

Third, the survivors are more productive than the entrants and exiters.

[25] Note that the TFP reported in Table 4 is not the unweighted mean of the reference firm but that of each firm. This is why the TFP values reported in Tables 3 and 4 differ from each other

Furthermore, the average TFP of the survivors increased from 2000 to 2008. Fourth, the average TFP of the entrants, survivors, and exiters increased after 2007. These increases occurred not only in terms of the mean but also in the entire distribution.[26] These results together suggest that the cutoff productivity level increased after trade liberalization. It is also important to note that productivity growth after 2007 was not necessarily achieved at the expense of smaller firms. Indeed, it was less productive firms, not smaller firms, that were driven out of the industry. Finally, the TFP of exiters is slightly larger than that of entrants, which in turn implies that the net-entry effect could be negative.

Note that survivors include both young and old firms. As we confirmed above, new entrants are generally less productive than survivors. The growth in the TFP may thus be more evident when we control for the entry year. Table 5 presents the unweighted mean of the TFP, by entry cohort (i.e., according to cohorts whose member firms all entered the market in the same year). The table shows that the longer the firm survives, the higher its productivity will be. For almost all entry cohorts, TFP grew steadily as time passed. The result suggests that productivity growth is one of the important factors for firm survival in Vietnam.

[26] We found that not only the mean but also the entire productivity distribution showed a statistically significant shift after 2007. We conducted the KolmogorovSmirnov test to examine whether the TFP distribution changes after 2007. We compared the TFP distributions before and after 2007. The maximum distance between distribution functions is 0.099, with an approximate *p*-value of 0.000. We obtain a significant difference even when we compare the TFP distributions in 2006 and 2007 (the maximum distance between distribution functions is 0.049, with an approximate *p*-value of 0.000). These results suggest that the distribution as well as the mean shifts after trade liberalization

Table 5: TFP of Manufacturing Firms, by Entry-year Cohort

	All firms	By entry-year cohort								
		before 2001	2001	2002	2003	2004	2005	2006	2007	2008	2009
2000	1.40	1.40									
2001	1.44	1.46									
2002	1.52	1.52	1.43								
2003	1.59	1.61	1.65	1.33							
2004	1.67	1.70	1.80	1.63	1.32						
2005	1.60	1.84	1.86	1.74	1.73	1.39					
2006	1.73	1.89	1.99	1.84	1.83	1.72	1.31				
2007	1.94	2.27	2.02	1.94	1.95	1.75	1.79	1.35			
2008	2.07	2.38	2.34	2.41	2.25	1.95	2.03	1.85	1.59		
2009	2.00	2.65	2.71	2.54	4.95	2.30	2.20	1.98	1.86	1.55	
			2.69	2.65	2.36	2.15	2.13	1.92	1.95	1.82	1.70

Notes: Unweighted mean of TFP is reported.

Source: Author's calculation, based on the *Annual Survey on Enterprises* by the GSO.

3.4. The Role of Intermediate Inputs

One possible concern is that our results are driven by the decline in the price of intermediate inputs. For example, using plant-level data in Indonesia, Amiti and Konings (2007) found that the effect of reducing input tariffs significantly increased productivity, and this effect is much higher than reducing output tariffs. Similarly, using plant-level data in Colombia, Fernandes (2007) found that productivity gains under trade liberalization are linked to increases in the imports of intermediate inputs. Using firm-level data in India, Topalova and Khandelwal (2011) also found that the effects of the decline in input tariffs had a larger impact on firm-level productivity than that of the decline in output tariffs.

To address this concern, however, we need detailed information on intermediate inputs at the firm level, which is not available in Vietnam. As a shortcut, we checked the share of intermediate inputs and materials at the industry level.[29] The result (Table A4) indicates that the import share is relatively stable over the period, including the year 2007 when Vietnam joined the WTO. Besides, the large TFP growth is confirmed not only in machinery industries but also in material industries such as basic metals, rubber and plastics products (Table A3). Unlike the previous studies such as Amiti and Konings (2007), therefore, it seems that the productivity growth came from tougher import competition in Vietnam. This finding is in line with that of Nguyen, *et al.,* (2011), which found that the share of imported inputs plays an insignificant role in encouraging innovation. Nevertheless, more detailed analysis is needed to address this issue.

3.5. Alternative Measurement of Productivity

One possible concern is that our results are sensitive to the measurement of productivity. In particular, the reference firm, which is built from the arithmetic

[29] Intermediate inputs and materials are defined as commodities belonging to Broad Economic Categories (BEC) coded 111, 21, 31, 41, 42 and 53. Import data are retrieved from the UNCOMTRADE database at the five-digit Standard Industrial Trade Classification Revision 2 (SITC2) level. To compute the share of imported intermediate inputs by industry, the SITC2 trade data are converted to four-digit International Standard Industrial Classification Revision 2 (ISIC2) and Broad Economic Categories (BEC) codes. The concordance tables between SITC2, ISIC2 and BEC are obtained from the World Bank's World Integrated Trade Solutions. Finally, because our analysis uses Vietnam Standard Industrial Classification version 1993 (VSIC), we have constructed a concordance table between ISIC2 and VSIC based on industry description to obtain the necessary data presented in VSIC codes.

means of inputs and output over all firms, may be affected by the size of firms because the data cover both large and small firms. Another concern may be the reliability of the capital stock data. The construction of reliable capital stock data itself is an issue, even in developed countries. The information on capital stock data may be subject to various problems, such as measurement error.

To address the first concern, we recompute the reference firm based on the median data, rather than the mean data, and then we recompute each firm's TFP using this median reference firm. To address the second concern, we also examine the correlation with the ALP. Because it is tedious to conduct all the analyses based on different productivity measures, as a shortcut, this paper simply examines whether these alternative productivity measures show high correlation or not.

The correlation coefficient between the TFP based on the mean reference firm and the TFP based on the median reference firm is 0.996. This result implies that our results are not sensitive to the choice of the reference point. The correlation coefficient between the TFP based on the mean reference firm and the ALP is 0.595, which is also relatively high. It is thus reasonable to conclude that our main results still hold when using alternative productivity measures.

4. Implications for Aggregate Productivity Growth

In the previous section, we found that the TFP of the Vietnamese manufacturing firms grew constantly from 2000 to 2009 (see Table 3). Does this mean that aggregate productivity also grew constantly? The answer is not necessarily obvious for the following two reasons. First, the unweighted mean does not reflect the size of the firm. If large firms experience negative productivity growth, while small firms experience positive productivity growth, the positive effect of small firms could outweigh the negative effect of large firms. Second, average growth does not take into account entrants and exiters. At the firm level, TFP growth can only be estimated for firms who survived for at least two consecutive years. Besides, Table 4 indicates that the productivity of exiters is slightly greater than that of entrants. The net-entry effect could thus be negative.

To obtain the implications for aggregate productivity growth, we begin by defining industry productivity $\ln \Phi_t$ as the weighted average of the firm productivity levels:

$$\ln \Phi_t \equiv \sum_{i \in \Omega_t} v_{it} \ln \varphi_{it}, \qquad (2)$$

where φ_{it} is the TFP of firm *i* in year *t*, and $_{vit}$ is the value added share of firm *i* in year *t*. According to Olley and Pakes (1996), equation (2) can be rewritten as:

$$\ln \Phi_t = \overline{\ln \varphi_t} + \sum_{i \in \Omega_t} \tilde{v}_{it} \widetilde{\ln \varphi_{it}}, \qquad (3)$$

Where $\tilde{v}_{it} = v_{it} - \bar{v}_t$; $\widetilde{\ln \varphi_{it}} = \ln \varphi_{it} - \overline{\ln \varphi_t}$; and $\bar{v}_t$ and $\overline{\ln \varphi_t}$ are arithmetic means of firms' value added share and TFP at time *t*, respectively. The first term is the unweighted mean of firms' TFP. The second term is the covariance of firms' TFP and value added share. If there is a positive (negative) correlation between firm size and the TFP, the second term will be positive (negative).

Table 6 presents the aggregate (manufacturing) TFP level and its

decomposition.[30] The major findings are twofold. First, at the aggregate level, the TFP did not increase every year. Rather, the aggregate TFP sometimes declined. For example, the aggregate TFP decreased from 1.070 in 2008 to 1.065 in 2009. The effects of the global financial crisis and the country's macroeconomic instability during this period were confirmed at the aggregate level. Note that the unweighted mean TFP growth in Table 3 was positive throughout the period. These results suggest that productivity growth differs between large and small firms. Some of the positive productivity growth of small firms was outweighed by the negative growth of large firms, which results in the negative aggregate productivity growth. Once we control for firm size, aggregate productivity becomes rather small, compared with the unweighted mean growth.

Table 6: Aggregate TFP and its decomposition, by year

year	Aggregate level lnTFP	Unweighted mean lnTFP	Covariance
2000	0.742	-0.124	0.866
2001	0.793	-0.096	0.889
2002	0.807	-0.034	0.841
2003	0.964	0.042	0.923
2004	1.033	0.079	0.955
2005	0.981	0.024	0.956
2006	0.880	0.102	0.778
2007	0.986	0.190	0.796
2008	1.070	0.231	0.839
2009	1.065	0.219	0.847

Source: Authors' calculation, based on the *Annual Survey onEnterprises* by the GSO.

Second, aggregate productivity is mainly attributable to the covariance term. This result implies that the larger share of value added is concentrated in more productive firms. Therefore, aggregate productivity is greater than the unweighted firm mean. Furthermore, positive covariance exists in each year and, unlike the unweighted mean productivity, its magnitude does not vary greatly or systematically over time. This result suggests that shifts in the productivity distribution rather than

[30] Because Table 6 focuses on total manufacturing, the value added share is also estimated as the ratio of a firm's real value added to the total real value added for the manufacturing industry.

resource reallocations are likely to be the main source of the productivity growth.

To address this issue further, following Foster, *et al.*, (2001), we decompose aggregate productivity growth from year $t-1$ to year t, $\ln \Phi_t - \ln \Phi_{t-1}$, as follows:

$$\begin{aligned}\ln \Phi_t - \ln \Phi_{t-1} \simeq & \underbrace{\textstyle\sum_{i\in S} v_{i,t-1}\Delta \ln \varphi_{it}}_{\text{Within effect}} \\ & + \underbrace{\textstyle\sum_{i\in S} \Delta v_{it}(\ln \varphi_{i,t-1} - \overline{\ln \varphi_{t-1}})}_{\text{Between effect}} + \underbrace{\textstyle\sum_{i\in S} \Delta v_{it}\Delta \ln \varphi_{it}}_{\text{Covariance effect}} \\ & + \underbrace{\textstyle\sum_{i\in N} v_{it}(\ln \varphi_{it} - \overline{\ln \varphi_{t-1}})}_{\text{Entry effect}} + \underbrace{\textstyle\sum_{i\in X} v_{i,t-1}(\overline{\ln \varphi_{t-1}} - \ln \varphi_{i,t-1})}_{\text{Exit effect}}, \end{aligned} \quad (4)$$

where S, N, and X are the set of survivors, entrants, and exiters between year $t-1$ and year t,[31] and Δ is the difference between year $t-1$ and year t. TFP with an upper bar denotes the average TFP level.[32]

This decomposition consists of five parts. The first three terms focus on the survivors between year $t-1$ and year t. The first term is a within-firm component based on firm-level changes, weighted by the value added share in year $t-1$. Because this reflects the productivity growth within the firm, it is called the "within effect." The second term represents a between-firm component that reflects changing value added shares, weighted by the deviation of firm productivity in year $t-1$ from the average firm productivity. An increase in the value added share contributes positively to the between-firm component only when the firm has higher productivity than average in year $t-1$. The third term represents a covariance term. The second term is called the "between effect" because it reflects the reallocation of resources between firms, while the second and the third components combined are called the "reallocation effect."

The last two terms focus on the entrants and exiters. The fourth term is an entrant component that reflects the difference between the productivity of entrants in

[31] Therefore, Ωt consists of the sets of S and N, as presented in Table 1.

[32] Griliches and Refev (1995) developed an alternative decomposition method. However, as Foster, *et al.*, (2001) pointed out, their method does not allow us to identify the covariance effects in which we are interested. This paper thus employs the method developed by Foster, *et al.*, (2001).

year t and the average firm productivity in year $t-1$. Similarly, the last term is an exiter component that captures the difference between the productivity of exiters in year $t-1$ and the average firm productivity in year $t-1$. An exiter contributes positively only if she exhibits productivity lower than the average in year $t-1$, while an entrant does so only if she has higher productivity than the average in year $t-1$. These two components combined are called the "net-entry effect." Table 7 presents the decomposition results.

Table 7: Decomposition of the Annual TFP Growth in the Manufacturing

Period	**TFP growth total** **a = b + c + f**	**Within effect** **b**	**Reallocation effect** **c = d + e**	Between effect d	Covariance effect e	**Net-entry effect** **f = g + h**	Entry effect g	Exit effect h
2000-01	**0.051**	**-0.019**	**0.075**	-0.050	0.125	**-0.005**	0.593	-0.597
2001-02	**0.014**	**-0.076**	**0.082**	-0.265	0.347	**0.008**	0.042	-0.034
2002-03	**0.157**	**0.061**	**0.101**	-0.142	0.242	**-0.004**	0.035	-0.039
2003-04	**0.069**	**-0.023**	**0.104**	-0.108	0.211	**-0.011**	0.017	-0.029
2004-05	**-0.053**	**-0.134**	**-0.152**	-0.429	0.278	**0.233**	0.263	-0.030
2005-06	**-0.100**	**-0.078**	**0.254**	0.011	0.243	**-0.276**	0.029	-0.305
2006-07	**0.106**	**0.048**	**0.057**	-0.180	0.238	**0.000**	0.012	-0.012
2007-08	**0.084**	**-0.023**	**0.105**	-0.209	0.314	**0.003**	0.022	-0.019
2008-09	**-0.004**	**-0.086**	**0.246**	-0.155	0.400	**-0.163**	0.004	-0.167
Average	**0.036**	**-0.037**	**0.097**	-0.170	0.266	**-0.024**	0.113	-0.137

Source: Authors' calculation, based on the *Annual Survey on Enterprises* by the GSO.

Three main features stand out in Table 7. First, the main source of aggregate productivity growth is the reallocation effect, rather than the within or net-entry effects. Moreover, the between effect was negative in almost all years, while the covariance effect was positive in every year. These results suggest that firms that improved their productivity obtained larger market shares, which contributes positively to aggregate productivity growth.

Second, on average, the net-entry effect was negative.[33] This means that the entry and exit of firms did not contribute positively to aggregate productivity growth. The result may reflect the fact that, as we confirmed in Table 4, the exiters are more productive than the entrants. The net-entry effect thus was not large enough to contribute positively to aggregate productivity growth.

Finally, the covariance effect strengthened after 2007. This result may reflect the fact that trade liberalization through the accession to the WTO facilitated the reallocation of resources between firms, which is consistent with the implications of the recent models of international trade and firm heterogeneity. Note, however, that aggregate productivity was 8.4 percent in 2007 and 2008 and fell to —0.4 percent in 2008 and 2009, which is mainly a result of the large negative net-entry effect. There was a large negative exit effect between 2008 and 2009. Although the contribution of the reallocation effect to aggregate productivity growth increased after 2007, this effect was not large enough to offset the negative net-entry effects between 2008 and 2009, when the global financial crisis damaged the Vietnamese economy severely. As a result, aggregate TFP growth was negative between 2008 and 2009.

5. Concluding Remarks

This paper examined the relationship between trade liberalization and aggregate productivity growth in Vietnamese manufacturing, decomposing aggregate productivity growth into the effects of firm growth, resource reallocation, and entry

[33] A large negative net-entry effect was confirmed between 2005 and 2006. However, we could not identify any specific reasons.

and exit. We used firm-level data between 2000 and 2009, including 2007, when Vietnam joined the WTO.

The major findings are twofold. First, after 2007, the productivity of entrants, survivors, and exiters increased simultaneously, suggesting that the cutoff productivity level increased after trade liberalization. Second, the contribution of the reallocation effect to aggregate productivity growth increased after 2007. This implies that resource reallocation between firms occurred after the liberalization, which is consistent with the implications of the recent models of international trade and firm heterogeneity. However, this effect was not large enough to offset the negative net-entry effect between 2008 and 2009, when the global financial crisis damaged the Vietnamese economy severely. As a result, aggregate productivity growth was negative between 2008 and 2009.

The results of this paper have important implications for the Vietnamese economy. First, we found that it was not smaller firms but rather less productive firms that were driven out of industries after Vietnam joined the WTO. After 2007, the average productivity level increased, while the average number of employees per firm decreased. The results suggest that trade liberalization does not necessarily have negative effects on small firms. Rather, small but productive firms are more likely to obtain better opportunities.

Second, we found that the main driver o aggregate productivity growth was the real location effect. Both the within and net-entry effects were negative throughout the survey period. That is, both firms' own productivity and firm entry/exit did not necessarily contribute positively to the aggregate productivity growth in Vietnam. The results suggest that it is important for Vietnam to improve these two effects to enhance aggregate productivity growth.

In conclusion, there are several future research issues that are worth mentioning. First, an econometric analysis to identify the effects of trade liberalization on firm productivity is certainly an important extension of our research. Because the main focus of this paper is the decomposition of aggregate productivity growth, this paper compared the changes in aggregate productivity growth before and after 2007, when Vietnam joined the WTO. However, in 2007, shocks other than trade liberalization may have occurred. To separate the effect of trade liberalization from those of other

factors, an econometric analysis may be useful, although the main focus of such an analysis would be the effects on firm-level productivity growth rather than aggregate productivity growth.

Second, the definition of entry and exit can be improved. Because of the limited data availability, following previous studies, this paper defined entry and exit as firms' appearance in and disappearance from the database. Therefore, entry and exit in this paper may include firms that are in operation but change their size, so as to fall short of or exceed the threshold number of employees. The relationship between productivity differentials and firm turnover can be further clarified once data on entry and exit years are available.

Finally, it is also important to estimate firm-level productivity in an alternative way. This paper employs a multilateral index number approach to estimate productivity. However, as van Biesebroeck (2007) pointed out, this approach has some drawbacks as well as advantages. Parametric and semiparametric approaches are useful for checking the robustness of our results. As McGuckin and Nguyen (1995) pointed out, a gross-output-based production function is more appropriate than a value-added-based production function for the firm-level analysis. Moreover, the analysis will be more precise if we can take into account the difference between domestic and imported intermediate inputs. To address these issues, it is imperative that the quality and coverage of the firm-level data be improved and expanded.

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Appendix: Data Description

The firm-level data used in this paper are retrieved from the *Annual Survey on Enterprises* conducted by the GSO, covering a 10-year period from 2000 to 2009. The data include both manufacturing and nonmanufacturing firms. As each firm is provided with a nine-digit special code that is unique and remains unchanged over the years, it is possible to construct a panel dataset that follows individual firms. Manufacturing is filtered from the dataset based on an industry code according to Vietnam's industry classification system, established in 1993.

To estimate total factor productivity (TFP), each firm is modeled as producing real value added using two production inputs: capital and labor. The unit of measurement for labor input is the number of persons, while the unit of measurement for value added and capital is millions of Vietnamese Dong (VND).

Output (value added)

Real value added is defined as nominal value added deflated by the manufacturing GDP deflator of the corresponding year.[34] The manufacturing GDP deflator is compiled by the authors from the World Bank (2012). The base year is 2000. Nominal value added is measured using the addition method, in which the value added is the sum of the total labor cost, accumulated depreciation, operating profit before tax, and indirect taxes. Because of the unavailability of interest payments, the definition of this variable is relaxed in the calculation of value added.

Labor input

Labor input is measured as the total number of employees. Total labor cost includes wages and other income that employees receive in terms of allowances, bonuses, and the employer's contribution to social insurance, health insurance, and trade union fees.

Capital input

Capital input is measured as the real fixed tangible assets at the end of each year. Real tangible fixed assets are measured as nominal tangible fixed assets divided by the manufacturing GDP deflator.[35] For capital costs, we use nominal fixed tangible

[34] The value added deflator is available only at the level of the whole manufacturing industry

[35] Following Aw, Chen, and Roberts (2001), it is preferable to utilize the investment

assets.[36]

Table A1: Summary Statistics of Inputs and Output

Variable	*N*	Mean	Standard deviation	Min	Max
Output (value-added)	104,153	9,928	63,883	0.17	4,485,845
Capital stock	104,153	14,808	147,081	1	32,400,000
Employment	104,153	195	774	10	67,434
Labor cost share	104,153	0.355	0.249	0.000002	0.999810
Capital cost share	104,153	0.645	0.249	0.000190	0.999998

Notes: For output and capital stock, the unit is millions of VND (2000 constant prices). For employment, the unit is the number of workers

Source: Authors' calculation, based on the *Annual Survey on Enterprises* by the GSO.

goods price deflator rather than the manufacturing GDP deflator. However, the investment goods price deflator is not available. Because of the unavailability of the investment goods price deflator, it is also not possible to employ the perpetual investment method.

[36] Aw, Chen, and Roberts (2001) calculated the capital cost as the residual after subtracting the expenditure on inputs from the firm's sales. However, in our data, the residual after subtracting labor costs from value added is negative for more than 10 percent of firms. To keep these firms in our sample, we use nominal fixed tangible assets as the capital costs

Table A2: Number of Firms, by Industry and by Year

Industry	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
All firms	**5,631**	**5,547**	**6,720**	**7,521**	**8,470**	**12,751**	**10,860**	**13,498**	**17,690**	**15,465**
Manufacture of food products and beverages	1,044	1,086	1,232	1,324	1,428	1,950	1,728	2,018	2,451	2,262
Manufacture of tobacco products	17	17	15	15	15	22	16	16	17	16
Manufacture of textiles	251	236	292	316	343	603	506	656	796	720
Manufacture of wearing apparel; dressing and dyeing of fur	458	400	527	652	756	1,027	929	1,180	1,764	1,251
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	207	184	212	233	252	344	306	374	475	344
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	391	355	447	498	545	955	788	1,017	1,351	1,316
Manufacture of paper and paper products	295	272	324	345	383	678	506	619	800	674
Publishing, printing and reproduction of recorded media	192	226	278	317	390	501	467	592	811	641
Manufacture of coke, refined petroleum products and nuclear fuel	17	26	20	16	19	32	17	15	22	26
Manufacture of chemicals and chemical products	287	301	350	398	428	580	542	657	822	719
Manufacture of rubber and plastics products	335	330	422	480	570	806	808	999	1,238	949
Manufacture of other non-metallic mineral products	658	663	711	720	774	1,264	950	1,134	1,453	1,577
Manufacture of basic metals	76	70	83	99	116	286	219	281	361	369
Manufacture of fabricated metal products, except machinery and equipment	396	385	540	649	805	1,319	1,107	1,491	2,048	1,830
Manufacture of machinery and equipment n.e.c.	154	170	206	238	261	373	323	410	524	416
Manufacture of office, accounting and computing machinery	2	2	4	6	10	11	9	14	18	18
Manufacture of electrical machinery and apparatus n.e.c.	127	120	151	162	182	225	205	241	298	267
Manufacture of radio, television and communication equipment and apparatus	73	54	68	79	93	120	110	129	179	157
Manufacture of medical, precision and optical instruments, watches and clocks	32	34	40	44	44	52	47	60	82	62
Manufacture of motor vehicles, trailers and semi-trailers	117	102	132	141	151	212	136	170	210	191
Manufacture of other transport equipment	165	150	184	192	184	353	243	312	384	336
Manufacture of furniture; manufacturing n.e.c.	334	361	478	589	715	1,014	878	1,083	1,549	1,294
Recycling	3	3	4	8	6	24	20	30	37	30

Source: Authors' calculation, based on the *Annual Survey on Enterprises* by the GSO.

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Table A3: TFP Growth of Firms, by Industry and by Year

Industry	Period								
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
All firms	**0.104**	**0.171**	**0.155**	**0.105**	**0.112**	**0.116**	**0.216**	**0.126**	**0.086**
Manufacture of food products and beverages	0.056	0.110	0.082	0.076	0.053	0.128	0.197	0.074	0.141
Manufacture of tobacco products	0.056	0.043	0.130	-0.084	0.183	-0.092	0.396	0.155	0.005
Manufacture of textiles	0.050	0.188	0.121	0.078	0.242	0.182	0.240	0.140	0.113
Manufacture of wearing apparel; dressing and dyeing of fur	0.030	0.209	0.347	0.153	0.178	0.183	0.276	0.274	0.098
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.142	0.154	0.275	0.085	0.216	0.115	0.221	0.244	0.120
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.109	0.195	0.146	0.116	0.078	0.101	0.143	0.124	0.049
Manufacture of paper and paper products	-0.002	0.156	0.133	0.095	0.070	0.049	0.181	0.289	-0.058
Publishing, printing and reproduction of recorded media	0.006	0.135	0.134	0.059	0.137	0.080	0.158	0.132	0.090
Manufacture of coke, refined petroleum products and nuclear fuel	0.352	-0.028	0.312	0.103	0.031	-0.520	0.036	0.834	0.312
Manufacture of chemicals and chemical products	0.132	0.295	0.104	0.140	0.117	0.092	0.203	0.131	0.110
Manufacture of rubber and plastics products	0.290	0.208	0.164	0.069	0.171	0.162	0.268	0.101	0.088
Manufacture of other non-metallic mineral products	0.035	0.164	0.088	0.044	0.061	0.044	0.214	0.178	0.081
Manufacture of basic metals	0.018	0.291	0.133	0.076	0.014	0.242	0.342	0.006	-0.077
Manufacture of fabricated metal products, except machinery and equipment	0.186	0.223	0.185	0.139	0.082	0.154	0.230	-0.032	0.131
Manufacture of machinery and equipment n.e.c.	0.173	0.250	0.169	0.122	0.141	0.041	0.185	0.201	0.060
Manufacture of office, accounting and computing machinery	-0.405	-0.249	1.357	-0.305	0.308	0.078	-0.064	0.927	-0.064
Manufacture of electrical machinery and apparatus n.e.c.	0.226	0.122	0.117	0.142	0.131	0.078	0.213	-0.040	0.251
Manufacture of radio, television and communication equipment and apparatus	0.383	0.043	0.161	0.218	0.101	0.154	0.276	0.140	0.122
Manufacture of medical, precision and optical instruments, watches and clocks	-0.174	0.220	0.316	0.196	0.150	-0.038	0.218	0.159	0.040
Manufacture of motor vehicles, trailers and semi-trailers	0.248	0.207	0.162	0.231	0.038	-0.157	0.334	0.075	0.028
Manufacture of other transport equipment	0.309	-0.027	0.062	0.023	0.014	0.083	0.194	0.176	0.025
Manufacture of furniture; manufacturing n.e.c.	0.238	0.181	0.241	0.171	0.157	0.144	0.195	0.126	0.043
Recycling	-1.308	0.746	-0.953	0.531	0.183	0.670	0.279	-0.226	-0.065

Notes: Unweighted mean of all firms is reported. For the source, see Table A1.

Table A4: Import Share of Intermediate Inputs and Materials, by Industry and by Year

Share of intermediate input in total import value (%)

Industry	Year 2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Manufacture of food products and beverages	0.2	0.4	0.2	0.4	0.5	1.2	0.8	0.9	1.6	0.9
Manufacture of tobacco products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Manufacture of textiles	0.6	1.9	1.6	1.0	0.7	0.8	0.9	0.7	0.7	0.9
Manufacture of wearing apparel; dressing and dyeing of fur	n.a.	0.1	0.1	0.3	0.0	0.0	0.1	0.2	0.2	0.2
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	n.a.	n.a.
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Manufacture of paper and paper products	2.0	2.8	3.6	3.2	4.7	5.0	5.2	6.8	9.8	5.8
Publishing, printing and reproduction of recorded media	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Manufacture of coke, refined petroleum products and nuclear fuel	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Manufacture of chemicals and chemical products	n.a.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacture of rubber and plastics products	29.0	22.9	14.1	15.2	12.7	12.4	14.4	14.7	14.5	18.7
Manufacture of other non-metallic mineral products	3.4	3.2	3.1	4.2	2.0	3.5	1.5	1.9	1.6	1.2
Manufacture of basic metals	0.2	0.3	0.3	0.2	0.3	0.3	0.2	0.5	0.5	0.4
Manufacture of fabricated metal products, except machinery and equipment	25.7	22.8	26.2	34.4	19.0	16.5	17.6	20.0	16.3	17.3
Manufacture of machinery and equipment n.e.c.	94.7	93.9	93.8	94.2	94.5	94.5	94.4	95.1	95.8	95.6
Manufacture of office, accounting and computing machinery	68.0	73.1	67.3	66.1	57.8	62.7	63.1	61.1	41.3	33.7
Manufacture of electrical machinery and apparatus n.e.c.	86.5	75.7	69.9	76.6	74.7	72.4	70.9	76.3	78.3	80.3
Manufacture of radio, television and communication equipment and apparatus	88.7	89.8	86.8	88.8	95.5	95.4	92.7	97.0	97.3	95.8
Manufacture of medical, precision and optical instruments, watches and clocks	78.3	78.7	78.1	80.3	76.7	76.8	75.8	67.8	64.1	61.3
Manufacture of motor vehicles, trailers and semi-trailers	15.2	13.6	9.2	9.1	9.0	14.2	47.1	59.5	54.6	46.6
Manufacture of other transport equipment	10.8	18.6	28.3	29.3	32.4	56.8	57.3	25.0	28.2	54.1
Manufacture of furniture; manufacturing n.e.c.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Recycling	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Notes:

n.a.: not available. Intermediate inputs and materials are defined as commodities belonging to Broad Economic Categories (BEC) coded 111, 21, 31, 41, 42, and 53. Import data are retrieved from the UNCOMTRADE database at five-digit Standard Industrial Trade Classification Revision 2 (SITC2) level. To compute share of imported intermediate inputs by industries, the SITC2 trade data are converted to four-digit International Standard Industrial Classification Revision 2 (ISIC2) and Broad Economic Categories (BEC) codes. The concordance tables between SITC2, ISIC2 and BEC are obtained from the World Bank's World Integrated Trade Solutions. Finally, since our analysis uses Vietnam Standard Industrial Classification version 1993 (VSIC), we have constructed a concordance table between ISIC2 and VSIC based on industry description to obtain necessary data presented in VSIC codes. Note that there are cases when imports were not for intermediate use classified by BEC, and thus there are missing values of imported

intermediate input share in some years and some industries. In particular, imports of industries coded 16, 20, 22, 23, 36 and 37 in VSIC in all years belonged to processed or consumption groups. Similarly, imports of industries coded 18 and 24 VSIC in year 2000, and 19 VSIC in 2008 and 2009 did not fall into BEC intermediate inputs.

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