Globalization and State Capitalism: Assessing Vietnam's Accession to the WTO*

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Abstract

In this paper we analyse the selection effects of trade under State Capitalism. Can we expect substantial efficiency gains from trade in economies with a strong presence of state-owned enterprises (SOEs)? In a model of trade with firm heterogeneity in productivity and ownership we show that the inefficiencies produced by SOEs can hinder reallocation and reduce aggregate productivity gains from trade. Using a new dataset of Vietnamese firms, we find that Vietnam's WTO accession in 2007 is associated with lower markups, higher probability of exit and substantial increases in productivity for private firms but not for SOEs. Our estimates suggest that WTO entry is associated with an increase in average productivity of 4.3 percent in the period 2005-2013. Finally, we show that the overall productivity gains would have been more than 40 percent larger in a counterfactual economy without SOEs. Our results suggest that State Capitalism in Vietnam has represented a large obstacle to trade-induced efficiency gains.

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Keywords: State Capitalism, State-Owned Enterprises, Trade Liberalization, Heterogeneous Firms, WTO, Vietnam.

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1 Introduction

Recent developments in the international trade literature have provided new tools to better understand and empirically assess the effects of trade liberalization. Research based on rich micro-level data has documented large productivity differences across firms and heterogeneity in export participation responses to trade liberalization. Exporters tend to be more productive and larger than non-exporters, and are more likely to benefit from a reduction in trade barriers. Stronger international competition brought about by lower trade costs forces less productive firms to exit and reallocates resources toward more productive firms, thereby increasing the average productivity of the economy and generating new welfare gains.[1] Since Melitz (2003), a stream of theoretical papers have explored the aggregate effects and transmission channels of trade liberalization in the presence of firm heterogeneity.[2]

Although this literature explores several dimensions of firm and plant heterogeneity, little attention is given to their ownership structure. In the major emerging economies, state owned enterprises (SOEs) still account for a substantial share of income and capital. Focusing on the Forbes Global 2000 list of the world's largest 2000 public companies and their 330,000 subsidiaries worldwide, a recent OECD study shows that SOE sales, market values and assets account for a large share of the economy in BRIC countries (Kowalski, Büge, Sztajerowska, Egeland, 2013).[3] The strong presence of SOEs and the staggering recent success of these economies has triggered a new debate over "State Capitalism" as a viable growth and development model (The Economist, 2012). From a trade perspective, this renewed interest in the role of publicly owned firms raises a few fundamental questions: Does a strong presence of SOEs affect the consensus of predictions of new trade models with heterogeneous firms? Can we still expect the productivity gains from trade-induced reallocations described in these models? If not, what are the key features of SOEs shaping new adjustment mechanisms and final outcomes?

We first tackle these questions through the lens of a model of trade with firm heterogeneity in productivity and ownership structure, and provide some basic insights into the role of SOEs in affecting

[1] For recent extensive surveys and assessment of the empirical literature on trade with firm heterogeneity, see Bernard, Jensen, Redding, and Schott (2012) and Melitz and Trefler (2013).

[2] See Melitz and Redding (2014) for an up to date review of the theoretical literature.

[3] Based on Country SOE Share (CSS), an index of weighted averages of SOE shares of sales, assets and market values among countries' top ten companies, the paper reports that about 95% of top 10 Chinese companies are SOEs, while in Russia, India, and Brazil, SOEs represent 80%, 60%, and 50% of top firms respectively.

firm-level and aggregate effects of trade liberalization. We then use the prediction from the model as a guideline for an empirical assessment of the effects of Vietnam's 2007 accession to the WTO.

We set up a model of trade with heterogeneous private and state owned enterprises competing oligopolistically for market shares. In this economy, firms' market power (i.e. their markups) is affected by the number of competitors in the same product line, and responds endogenously to changes in trade costs. Barriers to entry are substantially higher in sectors dominated by SOEs than in sectors dominated by privately owned enterprises (POEs). Restricted entry implies that the number of firms is lower and market concentration is greater for SOEs than for POEs. Hence, SOEs enjoy greater market power and an ability to set higher markups and prices. The probabilities of a firm surviving or exiting depend on the structure of fixed costs and markups.

A reduction in trade costs increases price competition, reducing markups. Lower markups force less productive firms out of the market, reallocating market shares toward more productive firms. While this selection effect operates for POEs, it is weaker and could potentially not take place for SOEs. When entry barriers are high, a reduction in trade costs has negligible effects on markups because restricted entry protects domestic firms from foreign competition. Selection and reallocation lead to increases in average productivity in POE-dominated sectors, while this efficiency effect is less and can even be absent in SOE-dominated sectors. Hence, in our stylized economy, the presence of SOEs reduces the aggregate efficiency gains from trade liberalization.

We use the prediction from the model to guide our empirical investigation of the most important trade liberalization episode in the history of Vietnam: its accession to the WTO in 2007. Given that Vietnam was in a weak bargaining position in seeking accession to the WTO, MFN tariff cuts provide arguably exogenous variation in international exposure, as tariff rates fell from an average of 20% in 2006 to 8% in 2009, and varied extensively across industries. Furthermore, Vietnam represents an ideal case for testing our theory since more than one third of its economy is still state owned. Using a difference-in-differences approach, we directly estimate the impact of the reduction in Vietnam's Most Favored National (MFN) tariffs on the exit and entry of private firms in comparison to those of SOEs. In addition to analysis at the firm level, we assess the impact of MFN cuts on average productivity and markups of industries dominated by privately owned enterprises (POEs) in comparison with SOE-

dominated industries. The main econometric challenge is that private firms are likely to differ from SOEs in many characteristics, which could also affect their probability of entering and exiting the market. We account for this source of heterogeneity by using propensity score matching (PSM) to establish a reasonable comparison group between POEs and SOEs with respect to a battery of firm-level and industry-level confounding factors. A further problem is that other reforms carried out in the same period – privatization, for instance – could have had heterogeneous effects on POE-dominated industries compared to SOE-dominated industries. We address this concern by showing that our results are robust to the inclusion of industry trends at the two-digit level of ISIC disaggregation.

The firm-level panel data we analyze are unique. We rely on data from the General Statistics Office (GSO), which covers the entire spectrum of Vietnamese firms. Our time span covers the period 2005-2013. This rich dataset allows us to unveil important patterns in the data: POEs tend to be smaller than SOEs, and tend to operate in labor-intensive sectors whereas SOEs tend to operate in capital-intensive sectors. Interestingly, while there is a great deal of variation in terms of their presence, SOEs operate in all the manufacturing industries except for the manufacture of office, accounting, and computing machinery. Moreover, POE-dominated sectors show significantly lower levels of market concentration and a smaller number of firms than SOE-dominated sectors.

Our reduced-form econometric analysis produces three main empirical findings. First, we only find strong evidence of trade-induced selection for POEs, but not for SOEs. In particular, our results show that POEs are significantly more likely to exit the market compared to SOEs after Vietnam's accession to the WTO. Importantly, the selection effect scales with the level of MFN tariffs and productivity for POEs: larger tariff cuts are associated with a higher probability of exit, and less productive firms are more likely to exit after liberalization. These results do not hold for SOEs. Second, we find that productivity increases in POE-dominated industries as a result of multilateral trade liberalization, whereas this effect is not observed in SOE-dominated industries. Third, we find that markups decrease in POE-dominated industries after WTO accession, whereas we do not observe any pro-competitive effects of trade in SOE-dominated industries.

The magnitude of these results is substantive. Specifically, we use regression coefficients to obtain the rough magnitudes of the overall productivity gains brought about by the WTO. We find that

the WTO access tariff cuts are associated with an average increase in productivity of 4.3 percent in the period 2005-2013. Furthermore, we use our estimates to try to quantitfy the extent to which the presence of SOEs hampers the potential efficiency gains from trade liberalization. We simulate a counterfactual scenario in which we measure the productivity gains that would have been brought about by WTO accession had SOEs not been present in the Vietnamese economy. This exercise suggests that the overall productivity gains would have been more than 40 percent larger if SOE-dominated industries had been replaced by POE-dominated industries. Hence, our results suggest that SOEs represent a large obstacle to trade-induced efficiency gains.

Our paper is related to several strands of the literature. First, the theoretical framework belongs to the new wave of trade models with firm heterogeneity that started with Melitz (2003). While most of this literature focuses on monopolistically competitive market structures, we follow the less travelled road and focus on oligopolistic trade models (Neary, 2003).[4] Van Long, Raff and Stahler (2011), Impullitti and Licandro (2012) and (2015) and Bekkers and Francois (2013) introduce heterogeneous firms in models of trade under oligopoly to study different aspects of trade liberalization. We contribute to this literature by exploring the role of SOEs in shaping the reallocation effects of trade. Despite being admittedly simple and stylized, our model is, to the best of our knowledge, the first to analyze the role of SOEs in open economies with firm heterogeneity.

Several empirical papers have documented the positive effects of trade on industry productivity through tougher selection and market share reallocation. Pavcnik (2002), Trefler (2004), Bernard, Jensen, and Scott (2006), and Khandelwal and Topalova (2011) among others, analyze the effects of important trade liberalization episodes for Chile, the United States and Canada, the United States alone, and India. These works find that a substantial part of the trade-induced increase in productivity is generated by intra-industry reallocations. These productivity improvements can potentially lead to new gains from trade that economists were not aware of before the availability of rich firm-level data. Although the conventional approach to measuring these gains focuses on welfare improvements, these measures are subject to a set of *ad hoc* parametric assumptions that produce a fair amount of

[4]Trade under oligopoly was introduced by Brander (1981) and Brander and Krugman (1983). See Neary (2010) for a survey of the literature.

uncertainty in the results. Because of the availability of high quality data and of a new methodology, the literature has shifted the focus toward measuring productivity gains from trade (Melitz and Trefler, 2012). Trefler (2004) shows that the reduction in Canadian tariffs following the US-Canada free trade agreement forced less productive, non-exporting Canadian firms out of the market, reallocating output toward highly productive exporters. He finds that this selection effect increased Canadian manufacturing productivity by 4.3 percent. Lileeva and Trefler (2010) find that the reduction in US tariffs associated with the free trade agreement shifted market shares toward highly productive exporters and away from less productive non-exporters, leading to an increase in productivity of 4.1 percent. Substantial gains are also found in the other country studies mentioned above, and for several other liberalization episodes involving other countries.[5]

A massive presence of SOEs can represent an obstacle to the productivity gains from the selection and reallocation processes induced by trade liberalization. This paper contributes to this literature by assessing the productivity gains from trade through inter-firm reallocation in a capitalistic economy with a non-negligible share of firms owned by the state. This is a first step in understanding and measuring the gains from trade under state capitalism. There is an emerging literature analyzing different features of state capitalism. Storesletten, Song, and Zilibotti (2010) present a theory of economic transition in China based on reallocation of manufacturing from less productive SOEs to highly productive "entrepreneurial" firms. Credit constraints and other cost wedges prevent the entry of more productive private firms and shelter sluggish SOEs from competition. Economic reforms reduce the cost wedges between the two types of firms and trigger a reallocation of resources toward the most efficient firms, thereby setting the economy on a path of privatization and fast growth. Hsieh and Klenow (2009) find that about two-thirds of aggregate TFP growth in China between 1998 and 2005 - a period that includes China's access to the WTO in 2001 - can be attributed to reallocation from low to high productivity plants. Hsieh and Song (2015) compare this view of China's growth, the triumph of "Markets over Mao", with the conflicting view that "State Capitalism"through large and successful SOEs has driven growth and development in China. They provide empirical evidence that the drastic reforms of Chinese SOEs which started in the late 1990s led to the privatization or

[5]See Greenaway and Kneller (2007) for a survey of country studies.

closure of small and inefficient firms, while large firms were corporatised and kept under State control. They find that the labor productivity of these large SOEs has converged to that of private firms, and they were responsible for about a fifth of aggregate TFP growth in the period 1998-2007. In line with this research, we analyze the productivity effects of reallocations from low to high productivity firms, but we differ by analyzing the specific role of trade liberalization as a source of productivity growth in an economy with a large presence of SOEs. Another point of difference is our focus on Vietnam instead of China, which allows for an enhancement of the generalizability of the previous work.[6]

The remainder of the paper proceeds as follows. In the next section, we offer an overview of the characteristics of Vietnamese firms and document the reduction in trade barriers produced by WTO accession. In the third section, we present our model and put forward our main hypotheses. In the fourth section, we explain our empirical strategy, presents the empirical results, and implements some robustness checks to further validate our findings. A final section concludes.

2 Market Reforms and Vietnamese Firms

In this section we report several stylized facts on Vietnamese firms, provide a brief discussion of the reforms of SOEs which took place before Vietnam's WTO accession, and document the reduction in trade barriers that it brought about. The descriptive analysis presented here provides the motivation for our theory and sets the stage for the empirical analysis performed later in the paper.

Data. Before presenting the stylized facts, we provide a brief description of the data and of the main variables of interest. Our data come from the annual Enterprise Census of firms performed by of Vietnam's General Statistical Office (GSO) for the period 2005-2013. They include the entire universe of Vietnamese firms which have at least ten employees, and contain a rich set of firm-level characteristics.[7] We follow the classification of firm ownership employed in Vietnamese statistical

[6] There is little work on the productivity and welfare effects of Vietnam's WTO accession. Fosse and Raimondos-Moller (2012) and Gosh and Whalley (2008) use general equilibrium trade models with SOEs and calibrate them to Vietnam in order to study the effects of trade liberalization. These papers limit their analysis to economies with representative firms and perform calibration exercises. Our paper, instead, introduces heterogeneity of firm productivity and ownership and assesses Vietnam's WTO entry using firm-level data and by conducting reduced form econometric analysis.

[7] The Enterprise Census includes a random sample of firms under ten employees outside of those in the panel. The data do not include firms that operate in the informal economy. The variables are reported in Vietnamese and translated into English by us.

handbooks and divide business operations into three large categories: State Owned Enterprises, including centrally-managed SOEs, locally-managed SOEs, and limited liability companies of which all shares are controlled by state agencies; the Non-State Sector, including registered private domestic operations and cooperatives; and foreign invested enterprises (FIEs) that have less than 50% state ownership. Large SOEs often have multiple subsidiaries, which compete in multiple industries, often outside of the core competency of the main SOE. To more directly model the competition between state and private sectors, we treat each subsidiary as an individual unit in our analysis. This allows for more diversity in the sectoral pattern of SOE participation than analyses which rely solely on the mother firm's headline sector. In addition, it aids comparisons between SOEs and private firms, because the subsidiaries are more similarly sized.

Following common practice, we do not include FIEs in our private firms category (POE), although we always control for FIEs in the econometric analysis. The trade categorization of the survey follows the fourth revision of the International Standard Industrial Classifications (ISICv4). The tariff data come from TRAINS (WITS) and are at the HS 6-digit level. We create a crosswalk from ISICv4 to HS 6-digit to merge the GSO data with tariff data. Next, we cross-check the WITS tariff data with Pelc's (2011) data and WTO tariff data. All the sources report the same tariff rates. We merge the tariff data at six-digit level with the four-digit firm-level data using average tariff values. The trade data come from COMTRADE and are at the HS 6-digit level. In merging the WTO tariff data and the GSO firm-level data, we lose around 20,000 firms for which the trade categories do not match. These firms are almost always in sectors, such as incense stick making or ice delivery, for which international analogues are hard to identify.

Before providing an overview of Vietnamese firms, we describe the main variables that we use both in this descriptive section and in the empirical section. In line with Bernard et al. (2006), *Exit* is defined as the probability of exit for firm f in industry i between year t and $t+1$. Formally, $Exit = Pr(Exit_{fi,t} = 1)$. Similarly, *Entry* is defined as the probability of entering the market for firm f in industry i between year t and $t+1$. Formally, $Entry = Pr(Entry_{fi,t} = 1)$. The panel structure of the Vietnamese firm-level data collected by the annual Enterprise Census allows us to track firms by tax code over time. In line with Trefler (2004), *Labour Productivity* is defined as value added per worker,

i.e. the firm's revenue over the firm's number of employees. To mitigate the impact of outliers, we take the natural logarithm of this ratio. Ideally, we would like to use total factor productivity, but the GSO dataset does not report full measures of labor costs. Moreover, following standard practice in the empirical literature (e.g. Roberts and Tybout, 1996; Tybout, 2003; Epifani and Gancia, 2011), we use the price-cost margin (PCM) as a proxy for a firm's market power or markup. Since we have a direct measure of firm profits in our data, it is straightforward to compute PCM as profits over revenues. Similarly to productivity, we use the natural logarithm of this rate. Finally, the logged number of employees is a proxy for size and the capital-labor ratio is a proxy for capital-intensive sectors.

The SOE reform. In 1986, the Vietnamese government launched *Doi Moi* (renovation), an ambitious program of economic reforms which resulted in dismantling most instruments of control over the economy. Among the most critical pillars of *Doi Moi* was a separation of SOE business operations from state planning in Decision 217/HDBT (1987). The 12,000 SOEs which existed at the time were given general guidelines as part of the government's ten-year socioeconomic plan, but their decisions were independent of ministerial planning. They were expected to negotiate the price of inputs with suppliers and set their own prices based on market costs. SOE profits were calculated based on the true costs of material inputs (although this figure did not include land and cheap capital), and, with the exception of a compulsory tax payment to the central or local government, SOEs were allowed to retain their profits and reinvest as they saw fit. A number of SOEs struggled under these conditions and these low-performing operations were soon liquidated by the government authorities or equitized with their shares sold to the private sector.[8] In 1995, the hiving off of SOE business operations was further institutionalized under Decisions 90 and 91. Decision 90 merged SOEs into 17 large holding companies, which became the monopoly conglomerates that we see today. Decision 91 created another group of 70 central conglomerates. The new conglomerates were encouraged to structure themselves in such a way as to provide incentives for SOEs to operate along commercial lines. In 2006, with SOEs now equitizing by selling shares and even listing shares on the stock market, the government formed the State Council Investment Corporation (SCIC) to manage the state assets held by the newly

[8] See Painter (2002) for a detailed discussion of the Doi Moi reforms.

equitized firms under a single entity. The SCIC has decision-making autonomy and is not subject to state planning considerations. Hence, as a result of the economic reform path started in the 1980s, on the eve of the WTO accession Vietnamese SOEs had substantial autonomy from the government in planning their business strategies.[9]

An anatomy of Vietnamese firms. In our census data, before WTO accession we have 2,086 fully-owned SOEs and 1,731 joint stock companies where Vietnamese state agencies were the dominant remaining shareholders. Together, on the eve of WTO accession, these SOEs accounted for 20% of gross industrial output, 37.2% of new investment, and about 11% of total employment (24% of labor employed by the formal business sector). By contrast, there were 151,576 POEs in Vietnam: 146,615 domestic companies and 4,961 active FIE operations. Together, they accounted for 80% of industrial output (35% domestic, 45% foreign), 63% of new investment (38.5% domestic, 24% foreign), and about 33% of total employment (76% of the formal business sector).

Since our tariff data are at the sectoral level, to analyze the characteristics and performance of private and public firms we break down our sample from the GSO census creating two macro sectors based on firm ownership. We code an ISIC 4-digit sector as SOE-dominated if it features a high concentration of SOE firms. SOE market concentration is calculated using the Herfindahl-Hirschman index of revenue (*SOE HHI*).[10] We define SOE market concentration as high if *SOE HHI* is greater than 0.27, which is the median value identified in Vietnam in 2007.[11] In Table 1 we document some key features of the POE- and SOE-dominated sectors for the year 2007. Several key differences between these two sectors emerge. First, the number of firms operating in POE-dominated sectors is substantially larger than that in SOE-dominated sectors. Second, firm exit and entry in POE-dominated sectors is much more frequent than in SOE-dominated sectors. Third, SOE-dominated sectors tend to be more protected, i.e. their Most Favored Nations (MFN) tariffs are higher, and they have higher PCMs, suggesting that there is lower product market competition in those sectors.

[9] Vasavakul (1997) and Vo (2007) provide an in-depth examination of the reforms implemented after Doi Moi.

[10] In the Appendix we show that the correlation between *SOE HHI* and US HHI at the ISIC 2-digit level is quite low, i.e. $\rho = 0.06$ (Figure A1). This low correlation implies that *SOE HHI* does not capture a general tendency of some industries to be more concentrated, e.g. natural monopolies, but rather it is specific to the structure of the Vietnamese economy.

[11] According to the United States Department of Justice, an HHI between 0.15 to 0.25 indicates moderate concentration, whereas an HHI above 0.25 indicates high concentration. For further information, see `http://www.justice.gov/atr`.

Finally, SOE sectors are on average less productive.

Table 1: Sectorial distribution of firms in Vietnam (summary statistics in 2007).

Statistics	SOE Dominated Sectors	POE Dominated Sectors
Firms (%)	23.7	76.3
Exit (%)	22.5	77.5
Entry (%)	35.1	64.9
Mean Labor Productivity (logs)	4.8	5.0
Mean Markup	1.2	1.1
Mean MFN	15.3	13.6
Mean Size (logs)	3.4	3.7
$\frac{Capital}{Labor}$	5.0	4.9

Note: An SOE-dominated sector is one in which SOE market concentration, calculated using the Herfindahl-Hirschman index of revenue, is high, i.e. *SOE HHI* is greater than 0.27, which is its median value. Sectors are at the ISIC four-digit level.

Table 2 provides a snapshot of the distribution of SOEs across broad categories of economic activity in Vietnam. The share of firms accounted for by SOEs is roughly 5% of operations across all broad sectors except for agriculture, where SOEs account for 35%. SOEs are not involved in family farming activities; their agricultural operations include large-scale plantations for producing rubber, and major food processing operations, such as rice mills. The rest of the first panel provides a sense of the scale of SOE capital investment relative to other firms. While SOEs represent only 7.5% of mining firms, they account for over 80% of the stock of capital in this sector. Similarly, large SOEs account for 80% of capital in the agriculture and electricity sectors. The major exception is manufacturing, where SOEs account for about 40% of capital, which, far from being the majority of capital, still represents a substantial share. Given the emphasis of our empirical analysis on manufacturing industries, Table 2 also shows the distribution of SOE activity (i.e. % of firms and % of capital) in manufacturing at the ISIC 2-digit level. The data suggest that SOEs have a non-negligible presence in a wide range of sectors in the economy, with a striking dominance in the manufacture of gas and tobacco products. SOEs are only absent in the computer industry.

WTO accession. Having documented the presence and the role of SOEs in the Vietnamese economy before the WTO accession, we now turn to discussing the characteristics of the tariff cuts brought about by WTO entry. We also provide an overview of SOE and POE performance after the accession.

Table 2: Sectoral distribution of SOEs activity (summary statistics in 2007).

Statistics	% of Firms	% of Capital
Agriculture	36.1	81.1
Mining	7.5	82.9
Electricity	4.4	79.2
Manufacturing	5.4	40.2
Manufacturing Sector (ISIC 2-digit)		
Manufacture of food products and beverages	2.8	16.4
Manufacture of tobacco products	67.7	86.3
Manufacture of textiles	5.6	17.2
Manufacture of wearing apparel	1.4	11.3
Tanning and dressing of leather	3.8	2.8
Manufacture of wood and of products of wood and cork, except furniture	1.1	13.7
Manufacture of paper and paper products	1.6	20.6
Publishing, printing and reproduction of recorded media	0.3	1.0
Manufacture of coke, refined petroleum products and nuclear fuel	9.1	13.2
Manufacture of chemicals and chemical products	3.2	19.8
Manufacture of rubber and plastics products	3.3	42.2
Manufacture of other non-metallic mineral products	3.7	32.8
Manufacture of basic metals	5.6	22.4
Manufacture of fabricated metal products, except machinery and equipment	2.3	25.0
Manufacture of machinery and equipment	4.3	23.6
Manufacture of office, accounting and computing machinery	0	0
Manufacture of electrical machinery and apparatus	4.5	14.0
Manufacture of radio, television and communication equipment and apparatus	3.0	10.7
Manufacture of medical, precision and optical instruments, watches and clocks	3.0	4.6
Manufacture of motor vehicles, trailers and semi-trailers	11.8	21.0
Manufacture of other transport equipment	2.0	2.6
Manufacture of furniture	1.7	17.9
Manufacture of gas	0.07	89.7

Note: The manufacturing sector is at the ISIC 2-digit.

We begin with the MFN tariff cuts implemented by Vietnam to enter the WTO. Tariff cuts are defined as the inverse first differences for each industry i, i.e. $MFN_{i,t-1} - MFN_{i,t}$, with larger values implying greater trade liberalization. The data are collected using the HS trade categorization at the six-digit level and come from WITS (2014). The first thing to notice in Figure 1 is that with the exception of the year 2012 the MFN tariff cuts faced by POE-dominated sectors were roughly comparable to the MFN tariff cuts faced by SOE-dominated sectors. This result mitigates concerns that multilateral trade liberalization is endogenous to the type of ownership. The second thing to notice is that there is a great deal of variation across industry types in terms of tariff reduction. Digging inside our two macro sectors, we look at the variation of tariff cuts across 2-digit industries.[12] There is evidence

[12]Since the macro POE and SOE sectors are defined at the 4-digit level, in the same 2-digit industries there might be both POE-dominated and SOE-dominated sectors at the ISIC four-digit level.

that POE-dominated sectors faced larger tariff cuts than SOE-dominated sectors in the following industries: food processing, textiles, wood and precision instruments (Appendix Figure A2). The furniture industry appears to be the only one in which the SOE-dominated sector faced larger MFN cuts than the POE-dominated sector. The final thing to notice is that MFN tariff cuts are relatively small. Since we use tariff cuts as one of our main covariates in the econometric analysis, our empirical exercise is in line with the one implemented by Trefler (2004).

Figure 1: MFN tariff cuts after WTO accession over time.

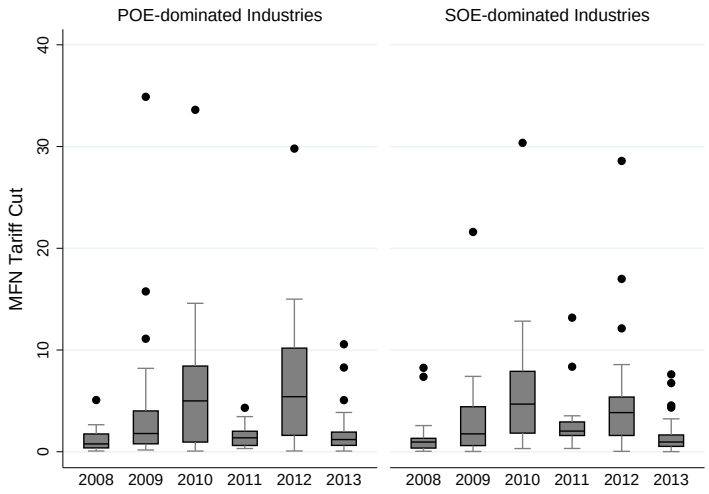


Table 3: SOE vs POE: Firm characteristics in Vietnam before and after WTO accession.

Statistics	2006-2007		2008-2010		2011-2013	
	SOEs	POEs	SOEs	POEs	SOEs	POEs
Exit (% of firms)	1.5	6.1	7.1	15.9	3.3	9.1
Entry (% of firms)	0	0	5.5	30.1	4.9	19.3
Mean Productivity	5.2	4.5	5.6	4.6	4.9	4.8
Std. Productivity	1.2	1.4	1.4	1.7	1.9	1.9
Mean Markup (% of total)	1.4	1.1	1.6	0.9	1.5	1.0
Mean Employment (logs)	5.8	3.1	5.6	2.9	3.8	2.8

Note: in Table 1 the unit of analysis is the firm rather than the sector.

Next, we turn to a descriptive account of the implications of these tariff rates for private sector performance, which we explore more rigorously in our econometric analysis. Because we use both firms and our SOE and POE macro sectors as our units of analysis, we provide here descriptive statistics at

the firm level and the breakdown between public and private is simply defined by firm ownership.[13] Table 3 shows POE and SOE performance in the pre- and post-WTO periods. First, we can see that POEs are more likely to enter and exit the market than SOEs both before and after the WTO accession.[14] In addition to the probability of market exit and entry, we are also interested in changes in firm productivity and size after the WTO accession. Before trade liberalization, SOEs are on average more productive than POEs, but, interestingly, a few years after WTO entry the gap disappears. This is due to a striking increase in productivity among private firms and a similarly substantial reduction in productivity among SOEs. Figure 2 provides a more suggestive picture of this change. In the period 2006-2007 there is a wide productivity dispersion for both types of firms, and a substantial overlap between the two productivity distributions. SOEs are on average more productive prior to the WTO accession. In the post-WTO years, the distribution for POEs progressively shifts to the right, completely erasing the technology gap with SOEs.

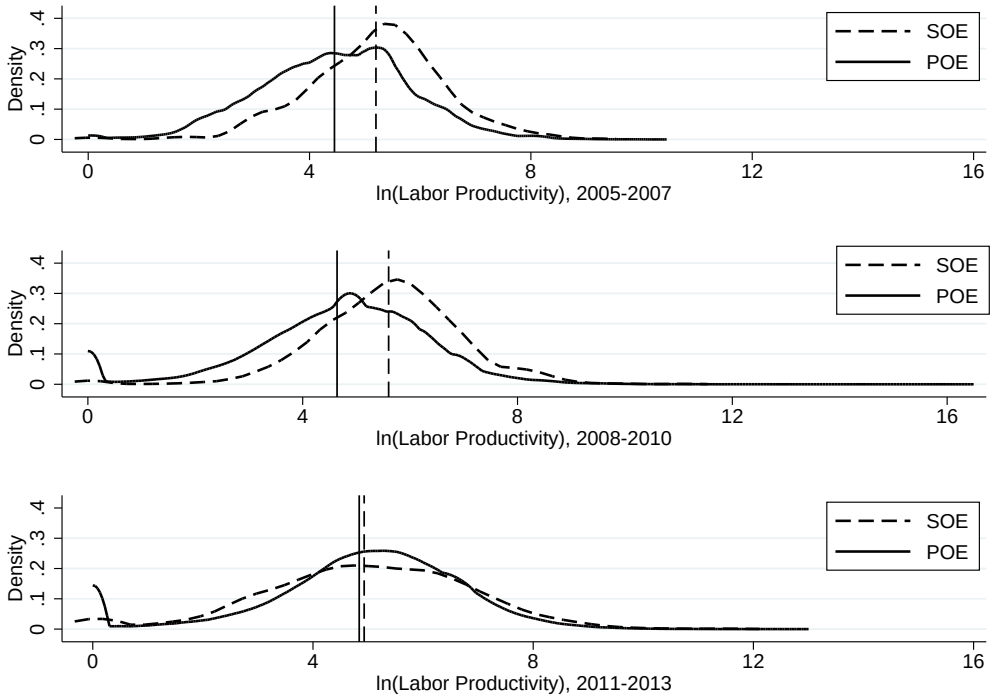
It is also worth noticing that when we measure productivity at the firm level SOEs turn out to be more productive than POEs on average, while the sectoral data in Table 1 shows the opposite. This is most likely due to the probability that SOE-dominated sectors are more protected and therefore feature less productive firms. As mentioned above, in the empirical analysis we use both sector-level and firm-level specifications of SOE and POE performance; hence, we include both in this descriptive analysis. Finally, we also find that the average firm size is fairly stable for POEs but declines dramatically for SOEs. Moreover, there is a reduction of the price-cost margin among POEs, whereas there is a small increase among SOEs.

Barriers to entry in SOE-dominated sectors. Both the simple theoretical model presented below and the empirical analysis that follows rest on the idea that on the eve of WTO access Vietnamese SOEs, despite being corporatised and drastically reformed, were still enjoying several forms of protection which represented de facto barriers against entry for their competitors. Although our data do not

[13] The sectoral breakdown used in Table 1 delivers similar predictions.

[14] Digging deeper into these patterns, we explore the firm and industry characteristics of the SOEs that exit the market during the period under investigation. Table A1 in the Appendix shows that SOEs tend to leave the market in industries in which *SOE HHI* is relatively low and in which there are many POEs and foreign firms. Interestingly, SOEs are more likely to exit in those industries in which tariff cuts are relatively small and MFN tariffs remain quite high. Moreover, exiting SOEs do not generally have low productivity levels.

Figure 2: Distribution of POE labor productivity and SOE labor productivity pre- and post-WTO accession.

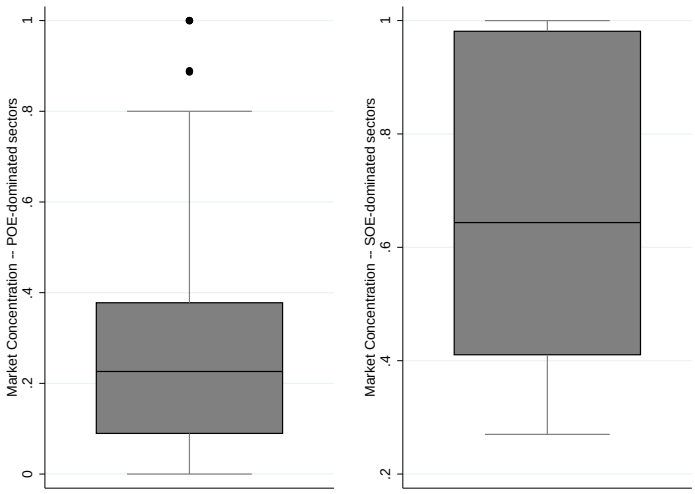


allow us to directly document entry barriers, we look at market concentration measures, which can be interpreted as the consequences of barriers to entry. In Figure 3, we show that sectors dominated by SOEs have remarkably higher Herfindahl indices than POE-dominated sectors.

The literature documenting barriers to entry in SOE-dominated sectors in Vietnam focuses on five factors. First, certain sectors face formal restrictions for purported national security reasons. These sectors, known as "Group A" projects, require special approval from the Prime Minister's Office to receive an investment entry license. While provinces can locally register any investment up to a specified amount, Group A projects still require central approval and the Prime Minister's signature (Malesky et al. 2014). One frustration for POEs is that SOEs have been able to use these protected enclaves to cross-subsidize their expansion into mixed sectors. For instance, Vinashin, the state shipbuilding firm, has 445 subsidiary businesses and twenty joint ventures, which range from real estate to hotels to karaoke bars. These sideline businesses crowd out entrepreneurial businesses (Nguyen and Freeman 2009).

Second, as in China (Song et al. 2011), many SOEs operate in capital-intensive sectors for which

Figure 3: Average Herfindal index (revenue): POE-dominated vs. SOE-dominated industries.



private firms currently do not have the scale or access to capital necessary to compete. Utilities, shipbuilding, steel and cement production are all industries that are formally open but actually feature little private activity (Phan and Coxhead 2013). Third, it has been shown that access to credit is greater when firms have close connections to the party and government (Malesky and Taussig, 2008). Even in 2013, after the dramatic growth of the private sector, roughly 60% of lending by the state-owned banking sector went to SOEs. Fourth, market access is easier for SOEs than for private firms (Nguyen and Freeman 2009). This is particularly true for government procurement. "Government agencies and state-owned enterprises prefer to do business with SOEs, which forces private firms to sub-contract to SOEs rather than sell directly" (Pincus et al., 2012: 10). Fifth, previous studies have found that for land use right certificates, private firms face processing times that are two hundred times greater than those faced by SOEs (Tenev et al., 2003, and Pincus et al., 2012).

We can get a sense of these informal barriers to SOE entry by looking at the annual Provincial Competitiveness Index (PCI) survey, a survey of 8,500 firms which is conducted annually in Vietnam by the Vietnamese Chamber of Commerce and Industry in order to assess the business environments of Vietnamese provinces[15]. Responses to a battery of questions in the PCI survey suggest a bias toward state-owned firms in Vietnamese policy-making. In particular, we find the biggest bias toward

[15]The PCI is performed annually in Vietnam by the Vietnamese Chamber of Commerce with the goal of documenting the investment environment nationally and within individual provinces. For further information, see at `www.pcivietnam.org`.

SOEs in public procurement and access to credit (see Figures A3 and A4 in the Appendix).

Taking stock, the stylized facts presented here suggest that SOEs are dominating presence outside manufacturing and a strong presence in the manufacturing. SOEs are on average fairly productive and the data also show some entry and exit of these type of firms. The key differences between SOEs and POEs is that the former have lower exit probability and stronger market power.

3 A simple model economy

Motivated by the stylized facts discussed above, we set up a simple model the main purpose of which is to provide a guide for the empirical analysis and to offer some economic intuitions for its results. In order to highlight the implications of heterogeneity in firm productivity and in ownership as transparently as possible, we focus on a static (one-period) model.

Economic environment. The economy is populated by a continuum of identical consumers of measure one. The preferences of the representative consumer are $U = \ln X + \beta \ln O$, where O is a homogeneous good and X is a differentiated good. The homogeneous good is the numeraire. Consumers are endowed with a unit flow of labor, which can be transformed one-to-one into the homogeneous good. This implies that equilibrium wages are equal to one. Without loss of generality, the total size of the population, and therefore of the labor force, is set at one.

The differentiated good sector X is an aggregate of the sets of goods produced by POEs and SOEs: $X = G^{\gamma} Y^{1-\gamma}$. Differentiated goods have the following CES structure:

$$G = \left(\int_0^{M_g} g_j^{\alpha} \, \mathrm{d}j \right)^{\frac{1}{\alpha}}, \qquad Y = \left(\int_0^{M_y} y_j^{\alpha} \, \mathrm{d}j \right)^{\frac{1}{\alpha}} \tag{1}$$

where g_j represents a product line j produced by public firms, and y_j is a product line j produced by private firms. Each product line in G and Y respectively is produced by n_g and n_y identical oligopolistic firms, using labor to cover a fixed production cost $\lambda > 0$ and a variable cost. This market structure follows the "small in the large and large in the small" approach to model oligopoly trade in general equilibrium (e.g. Neary, 2003). We assume that each oligopolistic firm is small in the whole economy, and large and powerful within its product line. We also assume that firms are

heterogeneous in productivity across product lines. A firm with productivity $\tilde{z}$ has the following production technology $\tilde{z}_j^{-1} q_j + \lambda = l_j$, where l represents labor input and $q = y, g$ is the quantity produced of a POE and a SOE variety respectively.

Motivated by the previous insights into the nature of modern Vietnamese SOEs, in our model private and state-owned firms only differ along one dimension: entry barriers or the degree of product market competition. Larger barriers to entry in SOE product lines imply that the number of firms competing in each public product line g_j is lower than that in private sector product lines y_j.

Assumption 1 (restricted entry). The number of firms per product line is lower in SOE than in POE sectors: $n_g < n_y$.

This is a reduced form way to introduce barriers to entry in SOE sectors. A more general formulation would postulate different entry costs, which would lead to a different equilibrium number of firms in the two sectors. Modeling entry in oligopoly models is notoriously hard due to the well-known 'integer problem': analyzing markets with a variable but finite number of firms is difficult because we cannot use infinitesimal calculus, a fundamental tool in economic analysis (Neary, 2010). Consequently, it is standard in the literature on oligopoly and trade to work with a fixed number of firms.[16] In line with the literature, we keep the number of oligopolistic firms within a product line n_g and n_y constant, but, as we will discuss later, we allow for horizontal entry, that is entry of new product lines. Finally, notice that in our overview of Vietnamese firms we have seen that SOEs operate in a large number of sectors competing head to head with private firms. Our stylized model does not allow for vertical competition between SOEs and POEs, so it cannot accommodate this feature of the data.

The global economy is populated by two symmetric countries with the same technologies, preferences, and endowments. We assume full symmetry across countries, implying that domestic private firms compete with foreign private firms, and similarly for SOEs. Trade costs are of the iceberg type: $\tau > 1$ units of goods must be shipped abroad for each unit finally consumed. Costs τ can represent transportation costs or trade barriers created by policy. For simplicity, we assume that all sectors,

[16] Several papers have introduced entry in trade and oligopoly models ignoring the integer problem (e.g. Brander and Krugman, 1983, Markusen and Venables, 1988, and Head, Mayer, and Ries, 2002). Introducing entry but keeping a continuum of firms has been criticized for leading to market structures not sufficiently different to monopolistic competition. Some preliminary attempts to deal with the integer problem in models of trade and oligopoly are discussed in Neary (2010).

public and private, and all goods within each sector are subject to the same iceberg trade costs. Finally, for simplicity, we focus on an economy in which all operative firms sell both to the domestic and foreign markets.[17] Two-way trade in similar products takes place in this economy for the same reasons as in Brander (1981) and Brander and Krugman (1983).

Firm behavior: production. Since the two countries are perfectly symmetric, we can focus on one of them. Moreover, the optimal production choice of POEs and SOEs is similar, hence it suffices to derive only one of them in detail. The household problem is straightforward and it is described in the appendix; here we go directly to optimal firm behavior. The POE firm problem yields the following expression for variable costs:

$$\tilde{z}^{-1}\left(q+\tau\breve{q}\right)=\theta_{\tau,y}\left(1-\gamma\right)\frac{E}{n_y M_y}\,\frac{z}{\bar{z}_y}, \tag{2}$$

where $z\equiv\tilde{z}^{\frac{\alpha}{1-\alpha}}$, $\bar{z}_g\equiv\frac{1}{M_g}\int_0^{M_g} z_j \mathrm{d}j$ is the average productivity, q and $\breve{q}$ are the quantities sold by a POE in the domestic and in the export markets, $y=n\left(q+\breve{q}\right)$ is the total quantity sold in a market, $E=P_gG+P_yY$ is the total expenditure in the differentiated goods sector X, and

$$\theta_{\tau,y}=\frac{2n_y-1+\alpha}{n_y\left(1+\tau\right)^2\left(1-\alpha\right)}\left[\tau^2\left(1-n_y-\alpha\right)+n_y\left(2\tau-1\right)+\left(1-\alpha\right)\right] \tag{3}$$

is the inverse of the average markup charged by a firm in both the domestic and foreign markets. Since SOEs solve an identical problem, their markup $\theta_{\tau,g}$ has the same structure as $\theta_{\tau,y}$, with n_g in place of n_y. By assumption 1, $n_g\geq n_y$. Hence, from (3) it follows that $\theta_{\tau,y}>\theta_{,g}$, which in turn implies that the markup for SOEs is higher than for POEs. The amount of labor resources allocated to a firm in (2) is the product of the average expenditure per firm, the inverse of the markup and the relative productivity of the variety the firm produces. When the environment becomes more competitive, θ increases, prices lower, the quantities produced increase, and firms demand more inputs.

[17] In an oligopolistic economy, due to the presence of endogenous markups, the extensive margin of export can be obtained even without fixed export costs. As we can see in Impullitti and Licandro (2014 and 2015), introducing the extensive margin reduces the tractability of these models. Since the extensive margin would not add much to the key mechanism we want to explore here, and in the interest of tractability, we abstract from it.

Entry and exit. In each product line and in each sector, at entry firms draw a productivity z from a distribution $\Gamma(z)$ common for both SOEs and POEs. To keep the model tractable, we assume that when a product line z is created, all n_i, $i = g, y$, oligopolistic firms enter together. Due to the presence of fixed operating costs, there exists a cutoff productivity (product line) z_i^* below which firms do not break even and therefore exit. Similar to entry, exit takes place simultaneously, that is, the oligopolistic firms whose productivity is below the survival cutoff all exit together.[18] We assume that there is mass one of potential product lines entering; hence, the mass of active lines is $M(\ z_i^*) = 1 - \Gamma(z_i^*)$, an inverse function of the productivity cutoff.

The productivity cutoff is determined by the exit condition

$$(1-\gamma)E = \frac{\overline{\frac{\lambda}{z_y^*/\bar{z}(z_y^*)}}}{1-\theta_{\tau,y}} n_y M_y. \tag{EC}$$

Proceeding similarly for SOEs, we obtain the cutoff condition

$$\gamma E = \frac{\overline{\frac{\lambda}{z_g^*/\bar{z}(z_g^*)}}}{1-\theta_{\tau,g}} n_g M_g, \tag{EC$_g$}$$

where $\theta_{\tau,g}$ has the same structure as $\theta_{\tau,y}$ in (3) with n_g replacing n_y. Let us denote by $\mu(z)$ the equilibrium density distribution defined on the z domain. The exit process related to the cutoff point z^* implies that $\mu(z) = 0$ for all $z < z^*$. Consequently, the equilibrium distribution is a truncation of the entry distribution, $\mu_i(z) = f(z)/(1-\Gamma(z_i^*))$, for $z \geq z_i^*$, with $i = g, y$, where f is the density associated with the entry distribution Γ. We can write $\bar{z}$ as a function of z^*, $\bar{z}_i(z^*) = \int_{z_i^*}^{\infty} z\mu_i(z)\ \mathrm{d}z$.

Labor market clearing and equilibrium. To close the model, we need to consider the labor market clearing condition:

$$n_g M_g \int_{z_g^*}^{\infty} \left(\theta_{\tau,g} \frac{\gamma E}{n_g M_g} \frac{z}{\bar{z}_g} + \lambda\right)\ \mu_g(z)dz + n_y M_y \int_{z_y^*}^{\infty} \left(\theta_{\tau,y} \frac{(1-\gamma)E}{n_y M_y} \frac{z}{\bar{z}_y} + \lambda\right)\ \mu_y(z)dz + \beta E = 1,$$

where we use the equilibrium labor demands derived above. The total labour endowment is allocated to production of the composite goods by SOEs and POEs, and to the homogeneous good βE. Since

[18] The assumption of simultaneous exit and entry in oligopostic trade models with firm heterogeneity is removed in Impullitti and Licandro (2015). This extension severely affects the model's tractability, and does not change the key selection effects we focus on here.

$\int_{z^*}^{\infty} \mu(z)\,\mathrm{d}z = \int_{z^*}^{\infty} z/\bar{z}\,\mu(z)\,dz = 1$, after integrating over all sectors we obtain

$$E = \frac{1 - \lambda\left(n_g M_g(z_g^*) + n_y M_y(z_y^*)\right)}{[\gamma\theta_{\tau,g} + (1-\gamma)\theta_{\tau,y}] + \beta}. \tag{MC}$$

Equations (EC)-(EC$_g$) and (MC) yield the equilibrium vector (E, z_g^*,z_y^*) in this economy. In order to obtain a clear characterization of the equilibrium properties and of the effects of trade liberalization we now specify the initial productivity distribution.

Assumption 2. At entry, firms draw from a Pareto distribution of productivities, with scale $z_{\min}$, and shape κ.

This assumption implies that equilibrium productivity density is $\mu_i(z) = \kappa z_i^{*\kappa} z^{-\kappa-1}$ and the mass of firms $M(\ z_i^*) = (z_i^*/z_{\min})^{-\kappa}$. The equilibrium cutoff conditions (EC) and (EC$_g$) become

$$(1-\gamma)E = \frac{\kappa}{\kappa-1}\frac{\lambda n_y}{1-\theta_{\tau,y}}\left(\frac{z_{\min}}{z_y^*}\right)^{\kappa} \tag{4}$$

$$\gamma E = \frac{\kappa}{\kappa-1}\frac{\lambda n_g}{1-\theta_{\tau,g}}\left(\frac{z_{\min}}{z_g^*}\right)^{\kappa}, \tag{5}$$

and the market clearing condition is

$$E = \left[\beta + \frac{\gamma\theta_{\tau,g}}{\kappa} + \frac{(1-\gamma)\,\theta_{\tau,y}}{\kappa} + \frac{\kappa-1}{\kappa}\right]^{-1}. \tag{6}$$

Combing these three equations we can obtain closed-form expressions for the equilibrium cutoffs and total expenditure E. We do not report them because, as will become clear below, the effects of trade liberalization can be better understood using the above equations one at the time.

Trade liberalization. When countries are symmetric, trade openness does not affect firms' market shares because the reduction in local market sales due to foreign competition is offset by increased participation in the foreign market. Equations (4), (5) and (6) show that a change in trade costs only affects equilibrium selection through its effect on markups.

In (3) we can see that $\theta_{\tau,y}$ is decreasing in variable trade costs τ, with $\theta_{\tau,y}$ reaching its maximum value $\theta_{\tau,y\max} \equiv (2n_y - 1 + \alpha)/2n_y$ when $\tau = 1$, the polar case of no iceberg trade costs. The autarky value $\theta_{\tau,y}^A = (n_y - 1 + \alpha)/n_y$ is reached when $\tau = \bar{\tau} \equiv n_y/(n_y + \alpha - 1)$, the alternative polar case of

prohibitive trade costs, implying that neither economy has any incentive to trade. An economy with costly trade is characterized by a level of product market competition higher than in autarky, with $\theta_{\tau,y} > \theta^A_{\tau,y}$ for both POEs and SOEs, due to the participation of foreign firms in the domestic market. Differentiating $\theta_{\tau i}$ with respect to τ we obtain

$$\frac{\partial \theta_{\tau,i}}{\partial \tau} = -\frac{2(\tau-1)\left(2n_i - 1 + \alpha\right)^2}{n_i\left(1+\tau\right)^3(1-\alpha)} \leq 0,$$

which shows that incremental trade liberalization increases product market competition. When trade is completely free, $\tau = 1$ and product market competition reaches its maximum level, $\theta_{\tau,i\max} \equiv (2n_i - 1 + \alpha)/2n_i$, with $i = y, g$. Notice that $\theta_{\tau,i\max}$ has the same functional form as the inverse of the markup in autarky but with the number of firms doubled.

Although trade affects POEs and SOEs similarly, the strength of the pro-competitive effect of trade depends on the pre-liberalization level of competition. The trade costs elasticity of markups is increasing in n, and is higher for POEs then for SOEs. For extremely high degrees of restricted entry, $\underline{n} \leq (1-\alpha)/2$, lowering trade costs has no effect on markups. Differentiating the absolute value of (3) with respect to n we obtain

$$\frac{\partial\left(\left|\partial\theta_{\tau,i}/\partial\tau\right|\right)}{\partial n_i} = \frac{2(\tau-1)}{n_i^2\left(1+\tau\right)^3(1-\alpha)}\left[4n_i^2 - (1-\alpha)^2\right] \geq 0. \tag{7}$$

Hence, reductions in trade costs produce stronger competition effects the lower the oligopolistic inefficiency in the product line. Let $\varepsilon_i \equiv \left|\partial\theta_{\tau i}/\partial\tau\right|$ be the elasticity of markups to the trade cost. Our restricted entry assumption implies $\varepsilon_y > \varepsilon_g$: trade liberalization has a stronger pro-competitive effects for POEs than for SOEs. Equation (7) shows that for very high values of restricted entry, a number of firms $\underline{n} = (1-\alpha)/2$, the selection effect of trade vanishes and $\varepsilon_g = 0$.[19]

What is the economic mechanism driving this result? This effect rests on the interaction between trade costs and entry barriers. Let us assume for a moment that we allow entry in each product line in our economy, and that the different numbers of POE and SOE firms is the equilibrium result of different entry barriers. Lower trade costs produce an increase in firm's potential market size which

[19]Notice that in this model the number of firms is defined on a continuum. Hence, a value of n equal to one does not represent monopoly.

leads to larger expected profits, thereby increasing the incentive for new firms to enter the market. With high barriers to entry, the increase in potential profits brought about by trade liberalization is likely to be of second order compared to the size of the entry barriers. Hence, trade liberalization would trigger little or no entry, leading to a small reduction in markups. Our reduced-form modeling of entry barriers (fixed n) is a simple way to embed this mechanism in a tractable framework. Fully modeling entry barriers through a free entry condition would make this mechanism more transparent at the cost of reducing tractability.

Having established the effects of trade on markups, we need to analyze the role of trade-induced markup changes on the survival cutoffs. Expression (6) shows that trade liberalization, by reducing markups (increasing $\theta_{\tau,g}$ and $\theta_{\tau,y}$), reduces the total nominal expenditure on the differentiated good E. Turning to the cutoff conditions (4) and (5), we can see that trade liberalization increases equilibrium cutoffs z_y^* and z_g^* through a *direct effect* and through an *indirect general equilibrium effect*. Taking the logs of (4) and (5) and differentiating with respect to τ, we obtain:

$$\frac{dz_i^*}{d\tau}\frac{1}{z_i^*} = \frac{1}{\kappa}\left(\underbrace{\frac{1}{1-\theta_{\tau,i}}\frac{d\theta_{\tau,i}}{d\tau}}_{\texttt{Direct}} - \underbrace{\frac{dE}{d\tau}\frac{1}{E}}_{\texttt{Indirect}}\right) \text{ for } i = y, g.$$

The first element in this equation is the direct impact of the reduction in SOE and POE markups on the survival cutoffs. The second is the general equilibrium effect through the reduction in spending E. Intuitively, an increase in product market competition in a sector leads to tougher selection in this sector. As a result both of lower markups and of stronger firm selection in that sector, the aggregate price index in the economy drops, thereby increasing the real wage.[20] A higher real wage, in turn, leads to an increase in production costs for all firms across sectors and triggers selection in all sectors.

Since, as we saw above, the effect of a reduction in trade costs on the markup is stronger for POEs than for SOEs ($\varepsilon_y > \varepsilon_g$), the direct effect will be stronger for private firms. In the extreme case where barriers to entry are very high in SOE sectors, $n_y = \underline{n}$, the direct effect is zero for these firms. As a consequence, the effect of trade liberalization on markups and on selection will be stronger for POEs than for SOEs. Moreover, (6) shows that since SOE markups are less responsive to reductions in

[20] Recall that the nominal wage is pinned down by the price of the homogeneous good, the numeraire of this economy.

trade costs, the indirect effect is weaker the larger the share of total expenditure going to SOEs is, γ. We can then conclude that trade-induced selection increases average productivity in both the SOE- and POE-dominated sectors, $\bar{z}_i = [\kappa/(\kappa-1)]\, z_i^*$, thus generating efficiency gains for the aggregate economy. However, the stronger the presence of SOEs in the economy and the higher the barriers to entry in state-owned sectors, the lower the aggregate efficiency gains from trade liberalization.

Here we summarize the predictions of the stylized model that we will test in the empirical analysis. As multilateral trade liberalization kicks in:

H1: The probability of exiting the market increases more for POEs than SOEs.

H2: The probability of exiting the market scales with productivity more for POEs than SOEs.

H3: Average productivity increases more in POE-dominated sectors than SOE-dominated sectors

H4: Markups decrease in POE-dominated sectors, but to a lesser extent or not at all for SOEs.

4 Empirical analysis

In what follows, we test the main propositions of our model using the Vietnamese sector- and firm-level data described in Section 2. Data cover only manufacturing industries. We first focus on firm exits observed at the firm level. Then, we test the general equilibrium effect by looking at two outcomes productivity and price-cost margins observed at the industry level.

4.1 Firm-Level Analysis

In line with our first two hypotheses, we have one dependent variable, *Exit*, described in the second section. Our main independent variable is a dummy scoring one if a firm is private and we are in the post-WTO accession period, i.e. after 2007. Formally, our main explanatory variable is given by $POE_{fi,t} \times PostWTO_t$. We then interact $POE_{fi,t} \times PostWTO_t$ with MFN tariff cuts, labeled $\Delta\tau_{i,t}$, which are the MFN tariff cuts implemented by the Vietnamese government after the accession to the WTO. Not all tariff cuts were implemented in the same year as the accession, and a tariff transition period was granted to many industries. Therefore, MFN tariff cuts vary over time in the post-WTO period. We expect POE exits to increase as MFN tariff cuts increase, whereas we expect the relationship between exits and tariff cuts to be weaker or even not statistically significant for

SOEs. Furthermore, we interact $POE_{fi,t} \times PostWTO_t$ with $Labor\ Productivity_{,fi,t}$. According to our theory, *Exit* should be higher for less productive POEs but not necessarily for SOEs.

For a better understanding of the effect of trade liberalization on firm exits, we also interact MFN cuts and productivity with a dummy that scores one if a firm is private in each of the years after Vietnam's accession to the WTO. Following Autor (2003), we include five dummies on the right-hand side and also their interaction with MFN cuts and productivity. By doing this we are able to assess whether the effect of trade liberalization materializes in the short term or later down the line.

We control for a set of confounding factors which might affect our outcome variables. Importantly, we control for a dummy that scores one if a firm is private ($POE_{fi,t}$).[21] At the product level (4-digit), we include (logged) values of imports and exports, a variable capturing market share, calculated using the Herfindal index, and preferential tariff cuts implemented in the bilateral trade agreement (BTA) between the US and Vietnam. Some have argued that the BTA was used as a stepping stone for Vietnam's accession to the WTO.[22]

At the firm level, we control for the logged number of employees, which is a proxy for size, the log of assets, and the capital-labor ratio, which are proxies for capital intensity. Moreover, we include a variable measuring the number of years since a given firm entered the market and began business operations. Furthermore, we include dummies for foreign firms. Finally, we include *Entry* as control variable.[23] Table A2 in the Appendix shows descriptive statistics of all the variables described above.

Model Specifications. Our model specification boils down to difference-in-differences with elasticities. In line with Bernard et al. (2006), for the exit probability of firm f in industry i at time $t+1$ we estimate the following two main models:

$$\begin{aligned} Pr(Exit_{fi,t+1} = 1) = \beta_0 + \beta_1 POE_{fi,t} + \beta_2 POE_{fi,t} \times PostWTO_t + \beta_3 \Delta\tau_{i,t} \\ + \beta_4 POE_{fi,t} \times PostWTO_t \times \Delta\tau_{i,t} + \beta_5 X_{fi,t} + \beta_6 W_{i,t} + \delta_i + \delta_t + \epsilon_{i,t} \end{aligned} \tag{8}$$

[21] Since we include year fixed effects, we are unable to include a dummy for the post-treatment period due to multicollinearity.

[22] See what the US Ambassador in Vietnam Michael W. Marine says on this issue. The document is available at `http://www.vietnamembassy-algerie.org/en/vnemb.vn/tin_hddn/ns060705093904`.

[23] We do not control for markup, since this variable is an endogenous in our model. By including markup, results are unchanged (see Tables A7 and A8).

$$Pr(Exit_{fi,t+1} = 1) = \beta_0 + \beta_1 POE_{fi,t} + \beta_2 POE_{fi,t} \times PostWTO_t + \beta_3 Labour\ Productivity_{fi,t} + \beta_4 POE_{fi,t} \times PostWTO_t \times Labour\ Productivity_{fi,t} + \beta_5 X_{fi,t} + \beta_6 W_{i,t} + \delta_i + \delta_t + \epsilon_{i,t} \quad (9)$$

where X and W are vectors including respectively firm-level and industry-level covariates, δ_i are industry (HS 2-digit) fixed effects to account for heterogeneity across products, and δ_t are year fixed effects. We estimate a sample of 52,488 Vietnamese firms between 2005 and 2012 for *Exit*.[24] We analyze the effect of trade liberalization on up to 118 manufacturing products (ISIC 4-digit) for which tariff data are available. All our models are estimated using OLS regression with robust standard errors, clustered by industry at ISIC 4-digit level.

Econometric Strategy. First, there are the large differences in the covariates observed between private firms and SOEs. Indeed, our preliminary look at the data in Section 2 has shown that the public sector differs substantially from the private sector. For instance, SOEs tend to be larger and operate in more capital-rich industries than private firms. In econometric terms, the observations are unbalanced with respect to the dummy variable *SOE*.[25] This poses a threat to our conclusions if these observed differences are also correlated with differences in the probability of exiting the market, or if they proxy for unobserved differences that might drive the correlation. To overcome this issue, we rely on propensity score matching (PSM). By using PSM, the observations are re-weighted with respect to the dummy *POE*) so that all the relevant covariates are balanced out. In econometric terms, we run a probit regression to generate a propensity score that is the probability of a unit being assigned to the POE category, given a set of observed covariates. PSM then uses these scores to identify structurally similar observations across groups with the same probability of selection, dropping observations that do not have an analogue between SOEs and POEs, to statistically generate a region of common support where private and public companies are comparable on structural covariates.[26] The net result is that

[24] For *Exit* we are unable to include the year 2013 since we do not have data from 2014. Therefore, we would not know which firms exit in 2013, i.e. which firms operate in 2013, but not in 2014.

[25] Table A3 in the Appendix shows how the relevant covariates are unbalanced between POEs and SOEs.

[26] We use the Stata 13 command 'PSMATCH2', which implements full Mahalanobis matching (Leuven and Sianesi 2003). We use the single nearest-neighbor (without caliper) matching method and rely on standard errors as in Abadie and Imbens (2006).

we compare POEs only to comparable counterfactual SOEs.[27]

Second, following Angrist and Pischke (2009), we include an industry-specific (2-digit) time trend to check if the parallel trend assumption holds. The inclusion of such variables accounts for sectoral growth trends which might be related to MFN tariff cuts. For instance, declining industries with a large number of firms exiting might have higher tariffs and hence deep MFN cuts.

Third, in order to further account for sources of industry-level heterogeneity, we include time-varying industry (2-digit) fixed effects to control for time-varying unobserved factors. Such fixed effects account for industry-specific demand and supply shocks, which in turn might affect the probability of exiting the market.

Fourth, following Trefler (2004), we include controls of business condition built at the industry level to account for the 2008 global economic crisis. Specifically, these controls are built by regressing the number of exiting firms in sector i at time t, which is the number of firms exiting from the industry i in time t, over Vietnam's GDP and Vietnam's real interest rate, including industry and year fixed effects.[28] These regressions generate a time-varying industry-specific prediction ($\widehat{Exit}$) of the effect of business conditions on the WTO-period probability of exiting for firm f. We include these predicted values on the right-hand side of some models and bootstrap standard errors to address the fact that the predicted values have standard errors that are not asymptotically efficient.

Results. Table 4 shows three key findings across all the models. First, other things being equal, POEs are more likely than SOEs to exit the market after Vietnam's accession to the WTO, i.e. $POE_{fi,t} \times PostWTO_t$ is positive and statistically significant (Model 1).[29] Second, the probability of exiting the market scales with MFN tariff cuts for POEs, whereas it does not for SOEs, as can be observed from the positive interaction effect between the two terms (see Models 3, 5, 6, 9 and 11). Third, the short-term effect is larger than the long-term effect (see Models 4, 7, 8, 10 and 12). In other words, POEs are more likely than SOEs to exit the market soon after the WTO accession, i.e. in 2008 and 2009, whereas $POE_{fi,t} \times PostWTO_t \times \Delta\tau_{i,t}$ are not statistically significant in the long run, i.e. in

[27] Our results are similar if we use entropy balancing (Hainmueller, 2011) instead of PSM. See Tables A4 and A6.
[28] We are unable to use the real exchange rate instead of the real interest rate due to a lack of data.
[29] See Figure A5 for the effect of $POE_{fi,t} \times PostWTO_t$ over time, i.e. between 2008 and 2012.

2010, 2011, and 2012. To ease the interpretation of the interaction terms, we rely on Figure 4, which shows the probability of exiting the market in 2008 for POEs and SOEs at different levels of tariff cuts. While the exit rate for POEs increases with the magnitude of the MFN cuts, the same is not true for SOEs, which display a flat slope.[30] Therefore, our empirical findings are more pronounced than our theory's prediction, which would expect a positive slope even for SOEs (but less steep than for POEs). All in all, these results strongly validate our first hypothesis.

Figure 4: POE*Post-WTO vs. SOE*Post-WTO: The effect of MFN tariff cut on firm's exit. Note: the histogram shows the distribution of $\Delta\tau$.

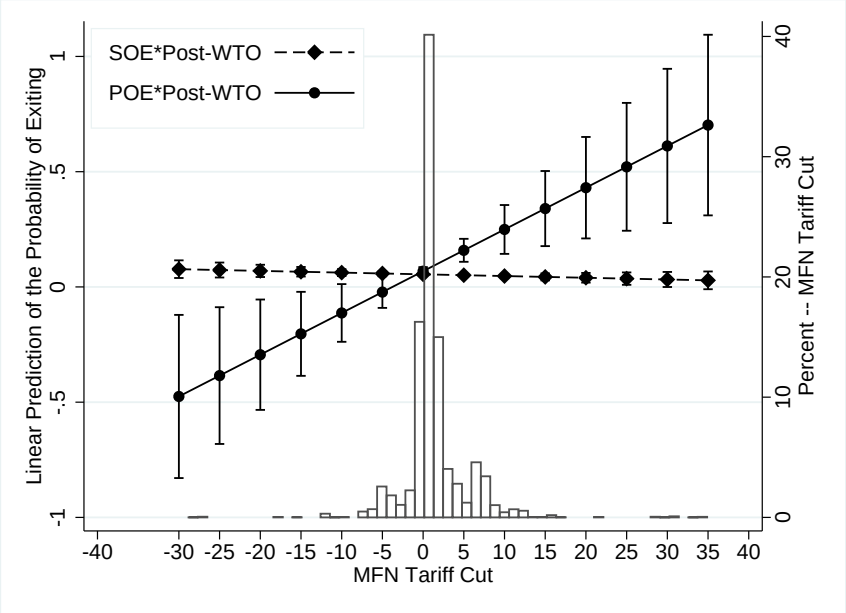


Table 5 shows a similar pattern when we interact $POE_{fi,t} \times PostWTO_t$ with labor productivity. The coefficient of this interaction is negative and statistically significant as expected, indicating that after the WTO accession the least productive POEs exit the market. The result for the year 2008, which stands out as an exception, is difficult to explain. Figure 5 shows that the probability of exiting the market scales with productivity for POEs significantly more than for SOEs. Importantly, the slope is also negative for SOEs, i.e. unproductive SOEs leave the market more than productive SOEs. Unlike the previous results for tariff cuts, there is no evidence that the short-term effects are larger than the

[30]Negative tariffs might be explained by the fact that countries are allowed to increase MFN tariffs up to the level of Bound tariffs without being in violation of WTO regulations. The difference between Bound and MFN tariffs is named binding overhang and it is a flexibility device, upon which especially developing countries rely in period of economic distress (Pelc, 2011). For further details, see `http://wits.worldbank.org/wits/wits/witshelp/Content/Data_Retrieval/P/Intro/C2.Types_of_Tariffs.htm`.

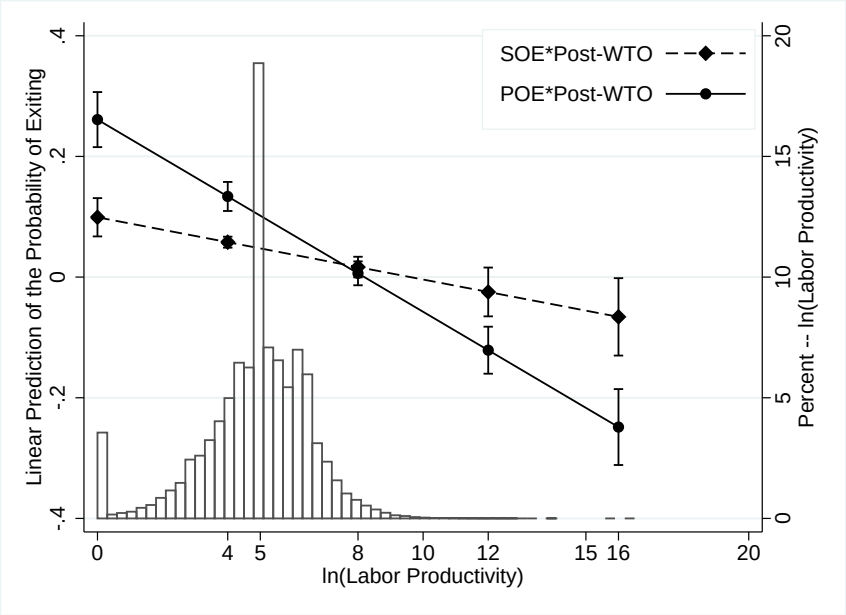
Table 4: Exit and MFN cut: OLS regression with PSM and standard errors clustered by HS 2-digit.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)
POE*Post-WTO	0.026***		0.019***		0.030***	0.031***			0.036***		0.037***	
	(0.007)		(0.007)		(0.007)	(0.009)			(0.005)		(0.006)	
POE*Post-WTO 2008		0.036***		0.017			0.019	0.014		0.023*		0.023**
		(0.013)		(0.013)			(0.013)	(0.016)		(0.013)		(0.011)
POE*Post-WTO 2009		0.047***		0.025			0.014	0.011		0.017		0.019
		(0.013)		(0.016)			(0.014)	(0.015)		(0.014)		(0.013)
POE*Post-WTO 2010		0.063***		0.067***			0.062***	0.063***		0.082***		0.067***
		(0.010)		(0.015)			(0.020)	(0.023)		(0.012)		(0.020)
POE*Post-WTO 2011		-0.029**		-0.025*			-0.012	-0.004		-0.003		-0.004
		(0.014)		(0.015)			(0.014)	(0.016)		(0.013)		(0.014)
POE*Post-WTO 2012		0.041***		0.046***			0.094***	0.099***		0.088***		0.094***
		(0.013)		(0.014)			(0.014)	(0.016)		(0.014)		(0.013)
MFNTariff Cut			-0.002**	-0.001	-0.003***	-0.004***	-0.002**	-0.002**	-0.002***	-0.001	-0.003***	-0.002**
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
POE*Post-WTO*MFN Cut			0.004***		0.005***	0.005***			0.005***		0.004***	
			(0.001)		(0.001)	(0.001)			(0.001)		(0.001)	
POE*Post-WTO*MFN Cut 2008				0.020***			0.019***	0.019**		0.017***		0.019***
				(0.008)			(0.007)	(0.008)		(0.006)		(0.007)
POE*Post-WTO*MFN Cut 2009				0.010*			0.007	0.008		0.008*		0.008
				(0.005)			(0.005)	(0.005)		(0.005)		(0.005)
POE*Post-WTO*MFN Cut 2010				-0.001			0.001	0.001		-0.002		0.000
				(0.002)			(0.002)	(0.002)		(0.001)		(0.002)
POE*Post-WTO*MFN Cut 2011				0.002			0.002	0.003		0.003		0.002
				(0.001)			(0.001)	(0.002)		(0.002)		(0.002)
POE*Post-WTO*MFN Cut 2012				-0.002			-0.001	-0.001		0.000		-0.001
				(0.001)			(0.001)	(0.002)		(0.002)		(0.001)
POE	0.039***	0.033***	0.036***	0.034***	0.008	0.015	-0.008	-0.007	0.005	-0.008	0.003	-0.011
	(0.012)	(0.013)	(0.011)	(0.012)	(0.008)	(0.010)	(0.006)	(0.009)	(0.009)	(0.007)	(0.009)	(0.007)
Foreign Firm	0.001	-0.007	-0.004	-0.005	0.002	0.019	-0.015	-0.005	0.005	-0.010	0.003	-0.013
	(0.010)	(0.011)	(0.009)	(0.011)	(0.013)	(0.013)	(0.009)	(0.010)	(0.013)	(0.009)	(0.013)	(0.009)
Constant			-0.037***	-0.034***	0.056	0.141***	0.069*	0.141***	0.093	0.120	0.100**	0.108**
			(0.008)	(0.007)	(0.043)	(0.031)	(0.041)	(0.028)	(53.465)	(13.318)	(0.049)	(0.048)
Controls	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Business conditions control	no	no	no	no	no	yes	no	yes	no	no	no	no
PS Matching on POE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit) fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit)-year fixed effects	no	no	no	no	no	no	no	no	yes	yes	no	no
Industry trend specific fixed effects	no	no	no	no	no	no	no	no	no	no	yes	yes
Observations	239,508	239,508	239,508	239,508	239,508	215,692	239,508	215,692	239,508	239,508	239,508	239,508
R-squared	0.089	0.093	0.032	0.037	0.070	0.075	0.074	0.078	0.080	0.084	0.073	0.076
rmse	0.234	0.234	0.234	0.233	0.229	0.234	0.229	0.233	0.228	0.228	0.229	0.229

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

long-term effects. Finally, we note that the coefficient of productivity is negative and statistically significant in every model, adding further plausibility to our results. Taken together, these findings are largely in line with our second hypothesis.

Figure 5: POE*Post-WTO vs. SOE*Post-WTO: The effect of productivity on firm exits. Note: the histogram shows the distribution of *Labor Productivity*.



4.2 Industry-Level Analysis

We have two outcome variables for the industry-level analysis. The first variable is *Labor Productivity* in industry i. We calculate this as the average value of the labor productivity for all the firms f operating in industry i in time t. Similarly to *Labor Productivity*, the *Price-Cost Margin* in industry i is the average value of the price-cost margin of all the firms f in industry i in time t.

Our main independent variables are MFN tariff cuts, a variable capturing SOE market power, and their interaction. While we have already described the first variable, i.e. $\Delta\tau_{i,t}$, SOE market power is captured by the Herfindahl-Hirschman index of SOE revenue in each industry i. The intuition behind this operationalization is that larger SOE market concentration implies the stronger SOE market power which implies higher the entry costs. As we showed above, both POEs and SOEs operate in the vast majority of industries. Therefore, we are unable to compare industries in which only SOEs operate and for which we have data, as we would be left with fewer than 30 industries.[31]

[31] *SOE HHI* correlates heavily and statistically significantly with the share of SOE revenue in industry i.

Table 5: Exit and labor productivity: OLS regression with PSM and standard errors clustered by HS 2-digit.

VARIABLES	(1) OLS Pr(Exit=1)	(2) OLS Pr(Exit=1)	(3) OLS Pr(Exit=1)	(4) OLS Pr(Exit=1)	(5) OLS Pr(Exit=1)	(6) OLS Pr(Exit=1)	(7) OLS Pr(Exit=1)	(8) OLS Pr(Exit=1)	(9) OLS Pr(Exit=1)	(10) OLS Pr(Exit=1)
POE*Post-WTO	0.089***		0.081***	0.074***			0.089***		0.087***	
	(0.023)		(0.022)	(0.025)			(0.022)		(0.022)	
POE*Post-WTO 2008		-0.152***			-0.107***	-0.124***		-0.118***		-0.106***
		(0.030)			(0.027)	(0.027)		(0.028)		(0.027)
POE*Post-WTO 2009		0.097**			0.068*	0.058		0.082**		0.074**
		(0.039)			(0.035)	(0.036)		(0.034)		(0.035)
POE*Post-WTO 2010		0.174***			0.159***	0.147***		0.170***		0.163***
		(0.027)			(0.027)	(0.030)		(0.024)		(0.027)
POE*Post-WTO 2011		-0.012			-0.007	-0.007		-0.004		0.000
		(0.028)			(0.029)	(0.032)		(0.027)		(0.028)
POE*Post-WTO 2012		0.167***			0.174***	0.171***		0.172***		0.176***
		(0.027)			(0.024)	(0.026)		(0.023)		(0.023)
ln(Labor Productivity)	-0.009*	-0.010**	-0.011**	-0.012**	-0.011**	-0.012**	-0.011**	-0.011**	-0.011**	-0.011**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
POE*Post-WTO*ln(Labor Productivity)	-0.012***		-0.009**	-0.008*			-0.010**		-0.009**	
	(0.004)		(0.004)	(0.005)			(0.004)		(0.004)	
POE*Post-WTO*ln(Labor Productivity) 2008		0.038***			0.028***	0.031***		0.032***		0.029***
		(0.006)			(0.006)	(0.006)		(0.006)		(0.006)
POE*Post-WTO*ln(Labor Productivity) 2009		-0.012*			-0.008	-0.007		-0.009		-0.008
		(0.007)			(0.006)	(0.007)		(0.006)		(0.006)
POE*Post-WTO*ln(Labor Productivity) 2010		-0.024***			-0.020***	-0.018***		-0.020***		-0.020***
		(0.005)			(0.004)	(0.005)		(0.004)		(0.004)
POE*Post-WTO*ln(Labor Productivity) 2011		-0.003			-0.002	-0.000		-0.001		-0.001
		(0.004)			(0.004)	(0.005)		(0.004)		(0.004)
POE*Post-WTO*ln(Labor Productivity) 2012		-0.023***			-0.018***	-0.016***		-0.018***		-0.018***
		(0.005)			(0.005)	(0.005)		(0.005)		(0.005)
POE	0.037**	0.029**	0.014	0.021*	-0.005	-0.004	0.010	-0.006	0.007	-0.009
	(0.014)	(0.013)	(0.009)	(0.011)	(0.005)	(0.009)	(0.009)	(0.007)	(0.009)	(0.006)
Foreign Firm	0.008	-0.001	0.005	0.021	-0.014	-0.005	0.008	-0.009	0.006	-0.013
	(0.014)	(0.012)	(0.015)	(0.014)	(0.009)	(0.010)	(0.014)	(0.009)	(0.015)	(0.009)
Constant	0.007	0.015	0.037	0.124***	0.057	0.135***	0.060	0.091	0.073	0.092*
	(0.023)	(0.021)	(0.045)	(0.033)	(0.045)	(0.034)	(34.578)	(.)	(0.052)	(0.052)
Controls	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Business conditions control	no	no	no	yes	no	yes	no	no	no	no
PS Matching on POE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit) fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit)-year fixed effects	no	no	no	no	no	no	yes	yes	no	no
Industry trend specific fixed effects	no	no	no	no	no	no	no	no	yes	yes
Observations	239,508	239,508	239,508	215,692	239,508	215,692	239,508	239,508	239,508	239,508
R-squared	0.044	0.054	0.069	0.073	0.077	0.081	0.080	0.088	0.072	0.080
rmse	0.232	0.231	0.229	0.234	0.228	0.233	0.228	0.227	0.229	0.228

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

At the industry level (4-digit), we control for all the variables included in the firm-level analysis: (logged) values of imports, (logged) values of exports, and preferential tariff cuts implemented by the bilateral trade agreement (BTA) between the US and Vietnam. At the firm level, we control for the number of POEs, SOEs, and foreign firms operating in each industry. Moreover, we include the numbers of firm exits and entries in each industry. Finally, we control for the logged number of employees, for the log of assets, and for the capital-labor ratio, which are calculated as average values for all the firms operating in a given industry i. For all these variables we use first differences.[32] Table A2 in the Appendix shows descriptive statistics of all the variables described above.

Model Specification. In line with previous studies (Trefler, 2004; Bustos, 2011), we use the first differences of the two outcome variables so that we do not have to worry about dynamic panel estimation problems (Arellano and Honoré, 2001). Moreover, first differencing eliminates time-invariant industry heterogeneity. Formally, we estimate the following two models:

$$\begin{aligned}\Delta Labor\ Productivity_{i,t} = \beta_0 + \beta_1 SOE\ HHI_{i,t-1} + \beta_2 \Delta\tau_{i,t} + \beta_3 SOE\ HHI_{i,t} \times \Delta\tau_{i,t} + \\ + \beta_5 \Delta X_{i,t} + \delta_i + \delta_t + \epsilon_{i,t}\end{aligned} \tag{10}$$

$$\begin{aligned}\Delta Price - Cost\ Margin_{i,t} = \beta_0 + \beta_1 SOE\ HHI_{i,t} + \beta_2 \Delta\tau_{i,t} + \beta_3 SOE\ HHI_{i,t} \times \Delta\tau_{i,t} + \\ + \beta_5 \Delta X_{i,t} + \delta_i + \delta_t + \epsilon_{i,t},\end{aligned} \tag{11}$$

where δ_i are industry (HS 2-digit) fixed effects to account for heterogeneity across products (affecting *SOE HHI*) and δ_t are year fixed effects. We estimate a sample of 665 products (ISIC 4-digit) between 2005 and 2013 for which data on tariffs are available. All our models are estimated using OLS regression, and we use robust standard errors clustered by industry at ISIC 4-digit level.

Econometric Strategy. The challenges we face in the industry-level analysis are similar to those we faced in the firm-level analysis. A first concern is that there are differences in the covariates observed between SOE-dominated industries and POE-dominated industries, as shown in the descriptive section.

[32] The results are similar if we use lagged values (see Tables A12 and A13 in the Appendix).

For instance, compared to POE-dominated industries, SOE-dominated industries tend (1) to be more capital-rich industries; (2) to have a significantly lower number of firms; and (3) to face significantly smaller rates of entry and exit. To tackle this issue, we again rely on propensity score matching (PSM). By using PSM, the comparison units are selected by regressing a dummy capturing industries with high SOE market concentration on a set of covariates. The score is used to identify matching cases in the control group. By doing this, all the relevant covariates are balanced with respect to this dummy. We can thus compare SOE-dominated sectors with a comparable counterfactual of POE-dominated sectors, running our main models with the weights obtained from PSM.[33]

A second concern is about time-varying unobserved factors that potentially correlate with our outcome variables. We include time-varying industry (2-digit) fixed effects as controls. These fixed effects account for industry-specific demand and supply shocks which might affect productivity and markups. A third concern is about the global economic crisis, which hit Vietnam in 2009. Similarly to the firm-level analysis, we include Trefler (2004) business condition controls. In this case, the business conditions controls are built by regressing $LaborProductivity_{i,t}$ and $Price - CostMargin_{i,t}$ over Vietnam's GDP, and the real interest rate, including industry and year fixed effects. These regressions generate time-varying industry-specific prediction ($\widehat{LaborProductivity}$ and $Price - \widehat{CostMargin}$) of the effect of business conditions on the WTO-period productivity and markups. Hence, we include these values on the right-hand side of the models with bootstrapped standard errors.

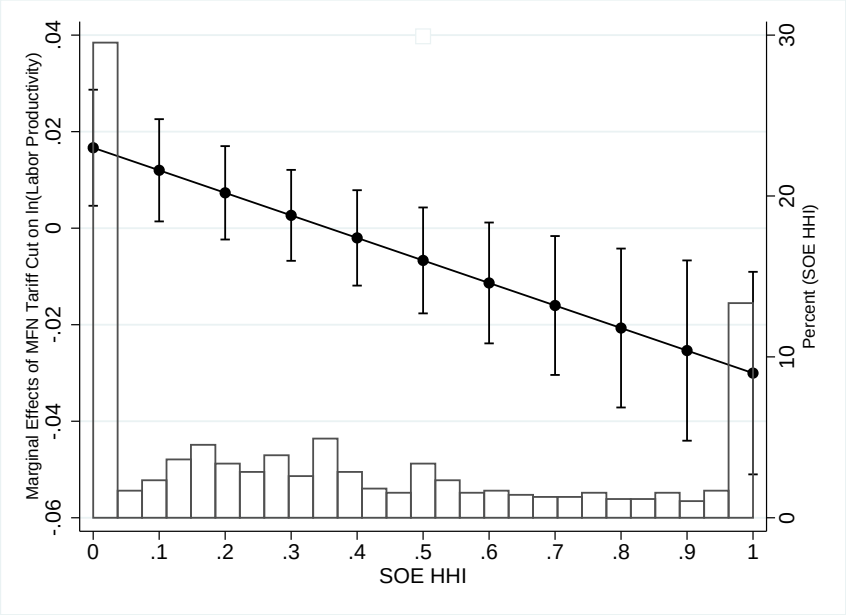
Finally, before proceeding with the results of the industry-level analysis, we address the concern of a possible endogeneity of MFN tariff cuts, which could potentially invalidate our empirical strategy. In line with Topalova and Khandelwa (2011), we show that labor productivity and markups do not predict MFN tariff cuts, i.e. neither productivity nor markups are statistically significant in estimations in which MFN cuts are the outcome variable (see Table A8 in the Appendix). This is the case even when we interact both productivity and markups with *SOE HHI*. Hence, it does not seem to be the case that trade liberalization is greater in industries in which the anticipated gains from trade are higher. These results seem to indicate that Vietnam had to meet externally imposed benchmarks in order to join the WTO, requiring the implementation of a demanding trade liberalization (Pelc, 2011). The

[33] Our results are similar if we use entropy balancing (Hainmueller, 2011) instead of PSM.

strong bargaining power of the WTO paired with the relatively weak bargaining position of Vietnam mitigates concerns that MFN cuts are endogenous to firm-level and industry-level characteristics.

Results. We first discuss the results for *Labor Productivity*, then those for *Price-Cost Margin*. Here we show only graphs for the interaction terms, whereas tables are reported in the Appendix. Specifically, the interaction between *SOE HHI* and MFN tariff cuts is always negative and statistically significant in every model (see Table A9). Importantly, the coefficient of $\Delta\tau$ is always positive and the coefficient of *SOE HHI* is always negative. Figure 6 shows the marginal effect of MFN cuts for different levels of SOE market power. In industries in which SOEs do not operate, multilateral trade liberalization increases labor productivity. On the contrary, as *SOE HHI* increases, the marginal effect of MFN cuts decreases and even becomes negative, but never statistically significant. In other words, in SOE-dominated sectors gains from trade are absent. This is completely in line with our third hypothesis. Moreover, our findings demonstrate that the effects of trade liberalization diverge strikingly from the predictions of Melitz's model when a large chunk of the economy is owned by the state.[34]

Figure 6: POE-dominated sectors vs. SOE-dominated sectors: The effect of MFN tariff cuts on firm productivity. Note: The histogram shows the distributionof $SOE\ HHI$.



[34]We also run error correction models to distinguish the short-term effect from the long-term effect (see Appendix A2 for further details). In line with Trefler (2004), our results show that the effect of tariff cuts materializes in the long-term for productivity (see Table A11).

The results are similar in the case of markups (see Table A10). Specifically, the interaction between *SOE HHI* and MFN tariff cuts is always positive and statistically significant in every model. Importantly, the coefficient of $\Delta\tau$ is always negative and the coefficient of *SOE HHI* is always positive, but never statistically significant. To ease the interpretation of the interaction term we rely on Figure 7. In industries in which SOEs do not operate, MFN cuts decrease markups due to greater competition. However, as *SOE HHI* increases, the marginal effect of MFN cuts increases. Indeed, in SOE-dominated sectors, trade liberalization does not trigger higher product market competition. In fact, the positive effect of trade liberalization on markups becomes statistically significant when *SOE HHI* is roughly 0.5. This result validates our fourth hypothesis, showing that the pro-competitive and selection effects of trade are hampered by the presence of powerful SOEs. The empirical evidence actually goes further than the model, predicting that trade liberalization might even have an anti-competitive effect when the presence of SOEs is very strong.

Figure 7: POE-dominated industries vs. SOE-dominated industries: The effect of MFN tariff cuts on firm markups. Note: The histogram shows the distribution of $SOE\ HHI$.

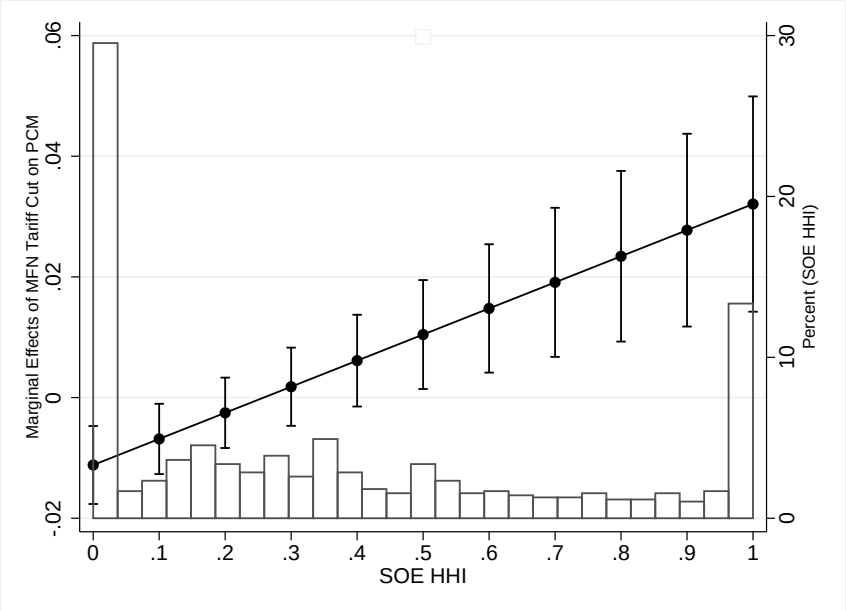


Table 6 shows the gains in trade from Vietnam's accession to the WTO. We follow Trefler (2004) and Lileeva and Trefler (2010). Specifically, we rely on our full model specification (Model 4 in table A9) and keep all the covariates at their average values. We then estimate the predicted values for those industries that face positive MFN tariff cuts. The average effect of multilateral trade liberalization

on the growth in labor productivity at the 4-digit industry level in Vietnam is 6.2.[35] In line with Lileeva and Trefler (2010), we calculate the impact on Vietnam's manufacturing productivity. Note that the average 6.2 percent rise occurs in industries that account for about 70 percent of Vietnam's manufacturing output. Therefore, the 6.2 percent rise in labor productivity raised Vietnam's overall manufacturing productivity by 4.3 percent, i.e. 6.2×0.696. This result is in line with Trefler and Lileeva (2010), who explore a longer time span than ours.

Counterfactuals. To get a sense of the loss of efficiency produced by high SOEs market power, we implement the following simulations. First, we use the coefficients of our full model (Model 4 in Table A9) to calculate the predicted values when *SOE HHI* equals one. This choice is perfectly in line with our theory, which describes an economy with two non-overlapping sectors: private and public. Moreover, focusing on *SOE HHI*=1 represents a conservative estimate of the loss of productivity gains, since it does not account for SOEs operating in the private sector.

For *MFN Tariff Cut* we look at all those industries facing positive tariff cuts (i.e. $\Delta\tau > 0$). For the other covariates we use their average values. Next, we build our counterfactual by replacing the value of *SOE HHI* with zero, keeping all the other covariates at the same level. In other words, we estimate what, according to our empirical model, would be the effect of trade liberalization on labor productivity if the industries with high SOE market power were replaced by the same industries but without the presence of SOEs. Finally, we take the ratio of the two predicted values (i.e. when *SOE HHI*=1 and *SOE HHI*=0) to capture the lower gains from trade in the presence of SOEs with high market power.

Table 6: Gains from trade for the Vietnamese economy with and without high SOE market power.

	Gains from Trade		
	$\Delta\tau > 0$	Output ($\Delta\tau > 0$)	Aggregate productivity gains
Productivity gains	6.2%	69.6%	4.3%
t-statistics	1.7		
	Couterfactual analysis		
	SOE HHI $= 0 \rightarrow$ *SOE HHI* $= 1$	Output (*SOE HHI* $= 1$)	Aggregate productivity gains
Productivity gains	-23.4%	7.8%	-1.8%
t-statistics	1.9		

[35] From the t-statistics this increase is statically significant (p-value<0.1).

Table 6 shows the result of this simulation. The average loss of productivity is 23.4%. Industries in which *SOE HHI* is equal to 1 account for 7.8 percent of Vietnam's manufacturing output. Hence, the 23.4 percent loss in productivity gains decreases Vietnam's overall manufacturing productivity by 1.8 percent. If we compare this 1.8 percent loss with the 4.3 percent gain in productivity above, we see that the overall productivity gains would have been more than 40 percent larger if heavily SOE-dominated industries had been replaced by completely POE-dominated industries.

5 Concluding Remarks

In this paper we have presented a theory of trade with firm heterogeneity in productivity and ownership to study the effects of trade liberalization in an economy with a strong presence of state-owned enterprises. Our model suggests that SOEs can hamper the selection effects of trade, thereby severely reducing the efficiency gains brought about by trade-induced selection and reallocation of market shares. We have tested the model's prediction using a new data set of Vietnamese firms to assess the effects of the 2007 WTO entry on Vietnam's economy. Our empirical analysis shows that the post-WTO probability of exiting the market is much larger for private firms than for state firms. Moreover, the selection effect scales with productivity for POEs, whereas it does not for SOEs. We have also shown that trade-induced selection leads to sizable productivity gains in SOE-dominated industries, while productivity does not increase in SOE-dominated industries. Similarly, pro-competitive effects of trade, measured by reductions in markups, are significant for private firms but negligible or absent for state-owned firms. Finally, with a counterfactual exercise we have shown that the presence of SOEs leads to sizable reductions in the aggregate productivity gains from trade, amounting to roughly 40% of the potential gains. Our results suggest that heterogeneity in firm ownership should be a key ingredient when we attempt to measure the gains from trade liberalization in emerging markets with a strong presence of SOEs.

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Appendix: for Online Publication

A1: Model derivations and proofs

Households problem. Households maximize utility subject to its budget constraint. The consumer problem can be separated in three problems: the choice between X and O, the choice between G and Y, and the allocation of expenditures across different product lines within G and Y. Standard utility maximization problems lead to the following equilibrium demand choice

$$\begin{aligned} O &= \beta E, \\ G &= \gamma E / P_g \\ Y &= (1-\gamma) E / P_y \\ p_{g,j} &= \frac{\gamma E}{G^\alpha}\, g_j^{\alpha-1}, \\ p_{y,j} &= \frac{(1-\gamma) E}{Y^\alpha}\, y_j^{\alpha-1}, \end{aligned}$$

where $p_{i,j}$ is the price of good j in sector i, P_i is the price index of sector i, $E = P_g G + P_y Y$ is total expenditure on the differentiated goods sector X. Because of log preferences, total spending in the homogeneous good is β times total spending in the differentiated good, this is shown in the first condition. The second and third conditions simply show the Cobb-Douglas demand for the public and private aggregate of differentiated goods. The final two conditions show the inverse demand for each differentiated good in the two sectors.

Firm problem in open economy. Each POE firm producing the same variety with productivity $\tilde{z}$ behaves non-cooperatively and maximizes its net cash flow, subject to a demand and a quantity constraint. Each firm solves the following problem:

$$\begin{aligned} V = \max_{q_D^D, q_D^F} & \left[\left(p_D - \frac{1}{\tilde{z}} \right) q_D^D + \left(p_F - \frac{\tau}{\tilde{z}} \right) \right] q_D^F - \lambda \\ s.t. & \\ p_D = \frac{E_D}{Y_D^\alpha}\, y_D^{\alpha-1} & \qquad and \quad p_F = \frac{E_F}{Y_F^\alpha}\, y_F^{\alpha-1} \\ y_D = \hat{y}_D^D + q_D^D + y_F^D & \quad and \quad x_F = \hat{y}_D^F + q_D^F + y_F^F \end{aligned}$$

where p_j, E_j and Y_j are the domestic price, expenditure and total quantity of the composite good respectively for country $j = D, F$. The first constraint is the indirect consumer demand for each differentiated good in countries D and F, and $E = P_g G + P_y Y$ is the total expenditure in the differentiated goods sector X. The second is the quantity constraint: each firm shares the global market with its domestic and foreign competitors. The total quantity sold in market D, y_D, is the sum of q_D^D, the quantity sold to destination country D from a firm in source country D. $\hat{y}_D^D$ is the quantity sold to destination D by the other $n_y - 1$ firms in country D, and y_F^D is the quantity sold

to D by firms from country F. The quantity constraint in market F is defined similarly. Since the two countries are symmetric, $q_D^D = q_F^F \equiv q$, $q_D^F = q_F^D \equiv \breve{q}$, $y_D = y_F \equiv y$, $E_D = E_F$, $Y_D = Y_F$, and $p_D = p_F$. As q and $\breve{q}$ are the quantities sold by a POE in the domestic and in the export markets, $y = n\left(q + \breve{q}\right)$ is the total quantity sold in a market. The first order conditions are

$$\left[(\alpha - 1)\frac{q_D^D}{y_D} + 1\right] p_D = \frac{1}{\tilde{z}_D} \tag{12}$$

$$\left[(\alpha - 1)\frac{q_D^F}{y_D} + 1\right] p_F = \frac{\tau}{\tilde{z}_D} \tag{13}$$

Since the two countries are symmetric, $q_D^D = q_F^F \equiv q$, $q_D^F = q_F^D \equiv \breve{q}$, $y_D = y_F \equiv y$, $E_D = E_F$, $Y_D = Y_F$, $p_D = p_F$. From (12) and (13) and using $q/y + \breve{q}/y = 1/n$ yields

$$\left[(\alpha - 1)\frac{q}{y} + 1\right] = \frac{2n_y - 1 + \alpha}{n_y\left(1 + \tau\right)} \equiv \theta_D \tag{14}$$

$$\left[(\alpha - 1)\frac{\breve{q}}{y} + 1\right] = \tau\frac{2n_y - 1 + \alpha}{n_y\left(1 + \tau\right)} \equiv \theta_F = \tau\theta_D \tag{15}$$

which allows us to rewrite (12) and (13) as follows

$$\theta_D \frac{(1-\gamma)E}{Y^\alpha}\ y^{\alpha-1} = \frac{1}{\tilde{z}} \text{ and } \tau\theta_D \frac{(1-\gamma)E}{Y^\alpha}\ y^{\alpha-1} = \frac{\tau}{\tilde{z}}.$$

Multiplying the above equations by q and $\breve{q}$ and summing up we obtain

$$\frac{q + \tau\breve{q}}{\tilde{z}} = n_y\left[\theta_D\frac{q}{y} + \tau\theta_D\frac{\breve{q}}{y}\right]\frac{(1-\gamma)E}{n_y}\left(\frac{y}{Y}\right)^\alpha.$$

Using $y = \left\{\left[1/\tilde{z}\right]\left(Y^\alpha/\left(\theta_D(1-\gamma)E\right)\right)\right\}^{\frac{1}{\alpha-1}}$, it is easy to prove that $\left(y/Y\right)^\alpha = \tilde{z}$. From (14) and using $q/y + \breve{q}/y = 1/n_y$ we obtain

$$\frac{q + \tau\breve{q}}{\tilde{z}} = \theta_{\tau,y}\frac{(1-\gamma)E}{n_y M_y}\frac{z}{\tilde{z}_y} \tag{16}$$

where

$$\theta_{\tau,y} = \frac{2n_y - 1 + \alpha}{n_y\left(1+\tau\right)^2\left(1-\alpha\right)}\left[\tau^2\left(1 - n_y - \alpha\right) + n_y\left(2\tau - 1\right) + 1 - \alpha\right]$$

is the inverse of the markup in the open economy.

Exit in open economy. The productivity cutoff is determined solving the following equation

$$\pi(z^*) = \left(p - \frac{1}{\tilde{z}^*}\right)q + \left(p - \frac{\tau}{\tilde{z}^*}\right)\breve{q} = 0$$

Using $p = 1/\left(\theta_D z\right)$ obtained from (12) and (14) yields

$$\frac{1}{\theta_D}\frac{q + \breve{q}}{\tilde{z}_y^*} - \left(\frac{q + \tau\breve{q}}{\tilde{z}^*}\right) - \lambda = 0.$$

With the same procedure used to derive (16) we obtain

$$\frac{q+\breve{q}}{\tilde{z}_y^*} = \theta_{D,y}\frac{(1-\gamma)E}{n_y M_y}\, z/\bar{z}_y$$

which, together with (16), yields

$$\left[1-\theta_{\tau,y}\right]\frac{(1-\gamma)E}{n_y M_y} z_y^*/\bar{z}_y - \lambda = 0.$$

A2: Short and long-run gain

In line with the firm-level analysis, we also aim to explore the dynamics of the impact of trade liberalization on productivity. Therefore, we run ECMs to distinguish the short-term effect from the long-term effect. Formally, we estimate the following equation:

$$\begin{aligned}\Delta Labor\ Productivity_{i,t} = \beta_0 + \beta_1 \Delta SOE\ HHI_{i,t} + \beta_2 SOE\ HHI_{i,t-1} + \beta_3 \Delta \tau_{i,t} + \beta_4 \tau_{i,t-1} + \\ \beta_5 \Delta SOE\ HHI_{i,t} \times \Delta \tau_{i,t} + \beta_6 SOE\ HHI_{i,t-1} \times tau_{i,t-1} + \beta_7 \Delta X_{i,t} + \\ \beta_8 X_{i,t-1} + \beta_9 Labor\ Productivity_{i,t-1} + \epsilon_{i,t}.\end{aligned} \tag{17}$$

In short, each explanatory variable appears as first-differences and lagged values. In addition, the model includes the lagged dependent variable, the coefficient of which has to be negative to meet stationary conditions. The coefficients of the first differences provide the short-term effect, whereas the long term effect is given by $\frac{\beta_2}{\beta_9}$ (De Boef and Keele, 2008). Table A12 shows that the effect of tariff cuts materializes in the long-term for productivity. This can be seen from the sign and significance of the long-term multiplier. Indeed, the short-term effect is never statistically significant, as can be seen from the coefficients of $\Delta SOE\ HHI_{i,t-1} \times \Delta \tau_{i,t-1}$. The result is in line with previous studies showing that trade liberalization has a long-term effect on productivity (Trefler, 2004).

A3: Data

The data sources have been already described in the text, but we add some further details here.

- **General Statistics Office of Vietnam** : data include the entire sample of Vietnamese firms that report their information to the GSO. The data do not include firms that operate in the informal economy. The variables are reported in Vietnamese language and translated in English by us. The trade categorization of the survey follows ISICv4. We created a cross-walk from the four-digit Vietnam Standard Industrial Classiffication (VSIC) and ISIC revision 3, and then from ISIC revision 3 to 6-giti HS to merge the GSO data with tariff data.
- **Import and export** : data come from COMTRADE and are at the HS 6-digit level. To merge 6-digit COMTRADE data with 4-digit Vietnamese firm-level data, we take the average value of import and export.
- **MFN** : data come from TRAINS (WITS) and are at the HS 6-digit level. To merge 6-digit WTITS data with 4-digit Vietnamese firm-level data, we take the average value of MFN tariffs.
- **US – Vietnam BTA** : data come from TRAINS (WITS) and are at the HS 6-digit level. To merge 6-digit COMTRADE data with 4-digit Vietnamese firm-level data, we take the average value of preferential tariffs.

A4: Other Figures and Tables

Figure A1: Correlation between *SOE HHI* and *US HHI* at the ISIC 2-digit level, i.e. $\rho = 0.06$.

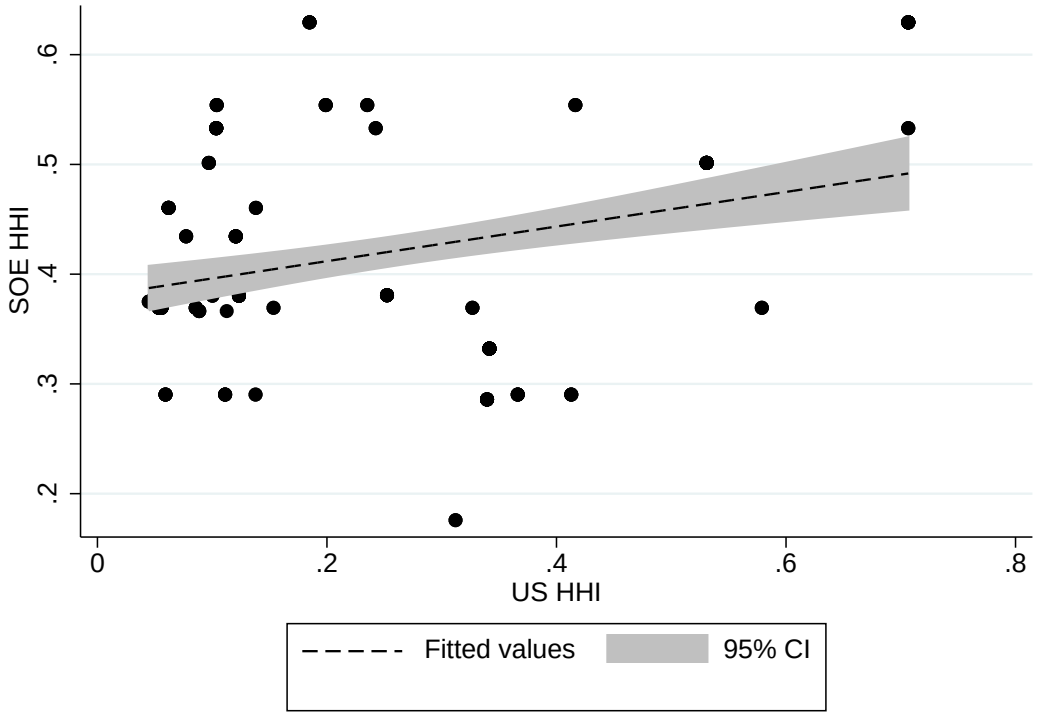

Figure A2: MFN tariffs after WTO accession by 2-digit industries.

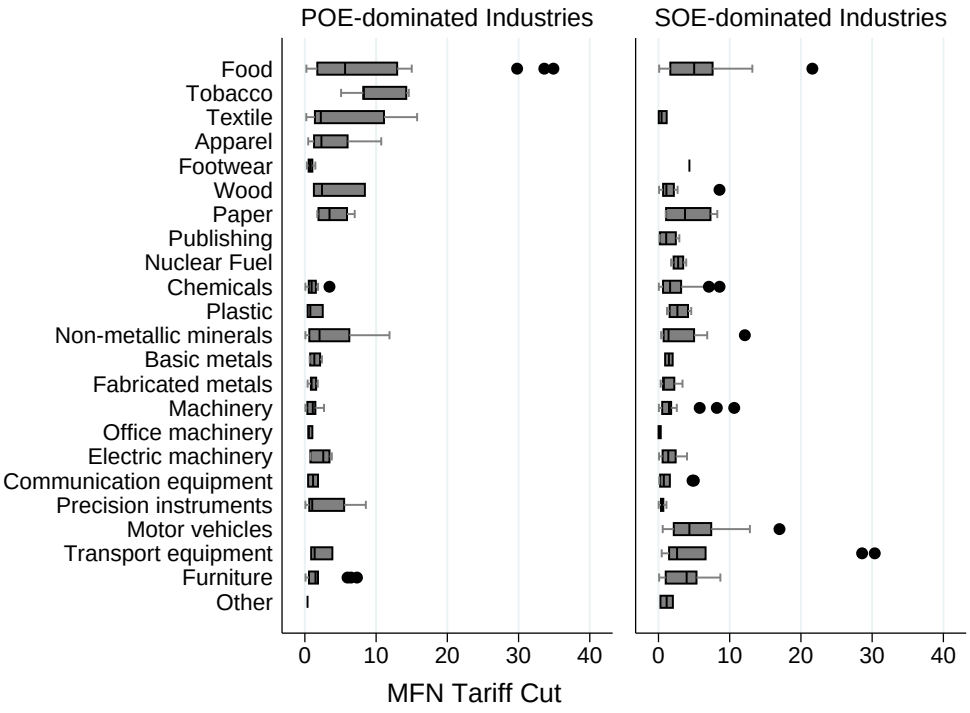

Figure A3: Bias toward SOEs.

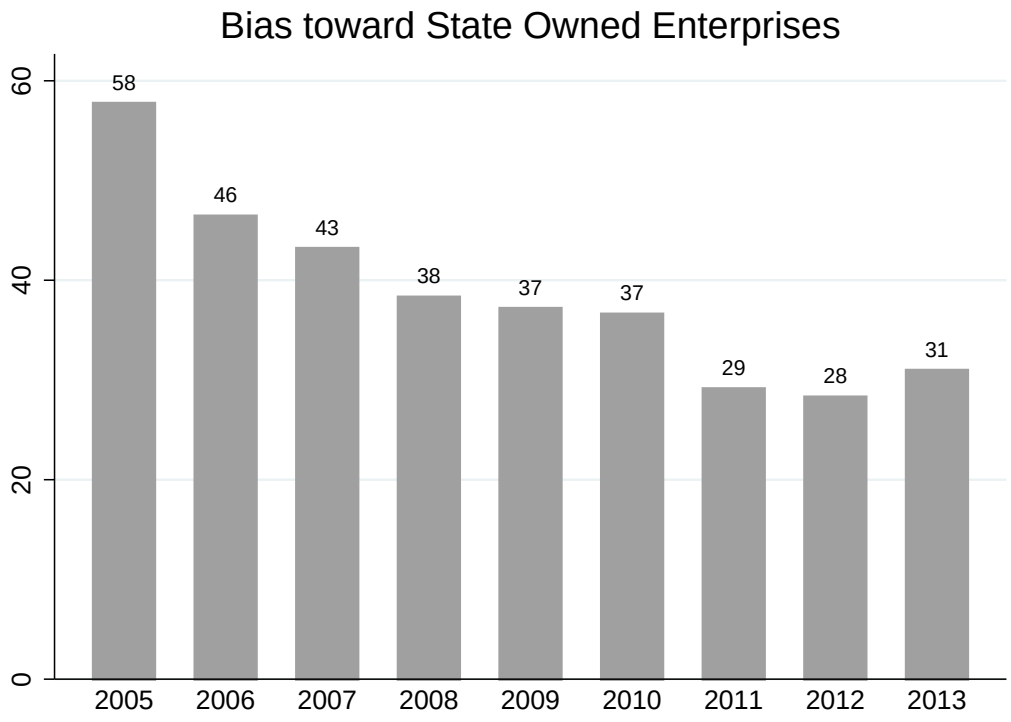

Figure A4: Types of bias toward SOEs.

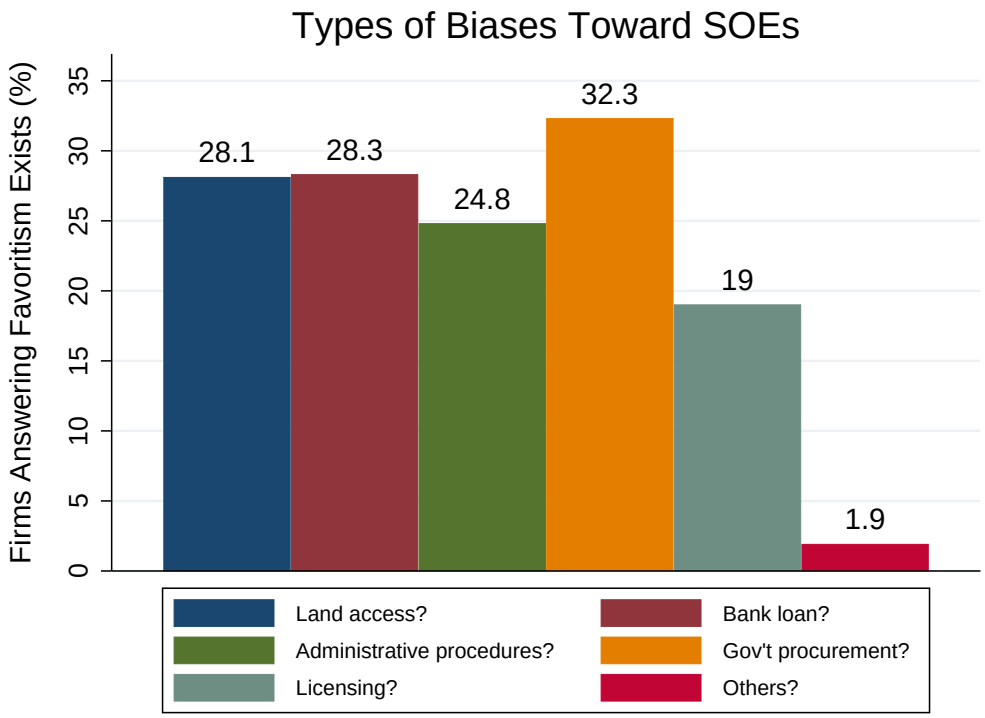

Figure A5: POEs vs. SOEs: The effect of Vietnam accession to the WTO on firm's exit over time.

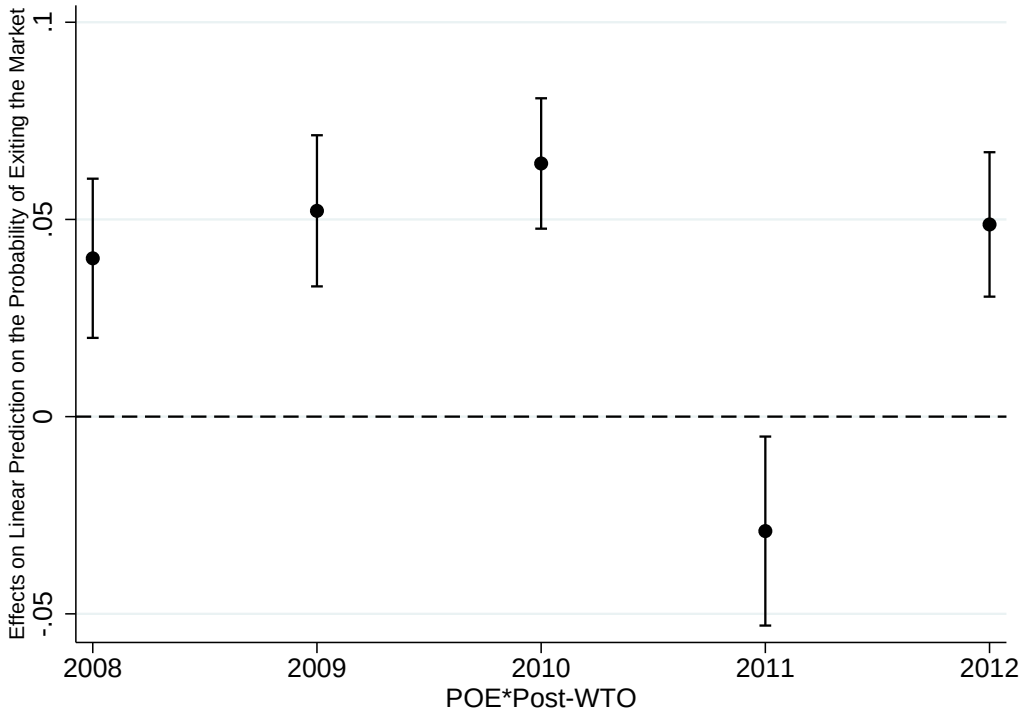

Table A1: Firm and industry characteristics of SOEs exiting the market.

Year	Firm ID	Industry	Industry Name	ln(Labour Productivity)	Markup	MFN	MFN Cut	K\L	ln(Number of Employees)	ln(Assets)	ln(Imports)	ln(Exports)
2006	8	2912	Pumps, compressors, taps and valves	5.08	2.58	6.69	-0.38	4.86	5.76	10.99	18.95	17.47
2006	23	3210	Electronic valves, tubes, etc.	5.21	0.09	3.45	0.44	4.80	6.15	11.28	20.30	19.22
2006	37	2720	Basic precious and non-ferrous metals	5.69	0.11	1.87	-0.04	6.37	5.86	12.51	21.33	18.84
2006	91	1552	Wines	5.33	1.60	91.39	-3.95	6.71	5.19	12.19	15.13	16.37
2006	95	2812	Tanks, reservoirs and containers of metal	5.18	1.97	7.00	0.45	4.94	4.55	9.43	18.85	18.50
2006	479	1551	Distilling, rectifying & blending of spirits	6.49	3.25	81.21	-2.81	5.53	6.16	12.72	16.93	17.39
2006	638	1544	Macaroni, noodles & similar products	5.31	2.28	24.84	0.66	4.82	6.24	10.95	18.63	19.66
2006	853	2813	Steam generators	5.89	1.53	1.77	-0.41	5.60	4.85	10.27	18.79	18.47
2007	1	1520	Dairy products	6.74	1.92	20.03	0.05	6.03	5.55	11.49	18.10	20.56
2007	8	3311	Medical, surgical and orthopaedic equipment	6.11	2.68	1.55	0.23	6.03	5.34	11.54	19.80	19.44
2007	10	2222	Service activities related to printing	4.11	0.72	0.79	-0.63	4.86	4.16	8.67	0.00	0.00
2007	52	2413	Plastics in primary forms; synthetic rubber	5.66	1.01	2.58	0.04	4.54	5.90	10.38	20.05	17.94
2007	58	2812	Tanks, reservoirs and containers of metal	5.84	1.42	6.45	0.55	5.79	4.53	9.94	18.85	18.50
2007	119	2696	Cutting, shaping & finishing of stone	6.63	2.82	14.15	0.88	7.24	5.84	13.06	17.02	18.04
2007	638	1544	Macaroni, noodles & similar products	6.36	1.45	26.63	-1.79	4.72	6.36	11.22	18.63	19.66
2007	734	3693	Sports goods	5.77	1.37	6.40	0.00	4.76	5.80	10.71	19.55	20.77
2007	853	2813	Steam generators	5.84	1.54	1.21	0.56	5.35	4.95	10.68	18.73	18.43
2007	90007	3313	Industrial process control equipment	4.35	1.91	5.50	-1.06	5.43	5.00	10.54	18.87	19.17
2008	5	2913	Bearings, gears, gearing & driving elements	6.46	0.59	8.32	0.06	6.02	6.19	12.31	19.16	18.26
2008	8	2912	Pumps, compressors, taps and valves	5.34	2.38	5.93	0.13	5.24	5.77	11.05	18.93	17.50
2008	8	3311	Medical, surgical and orthopaedic equipment	5.91	2.27	1.49	0.06	6.21	5.20	11.32	19.80	19.44
2008	10	2222	Service activities related to printing	4.37	0.70	0.57	0.22	4.54	4.14	8.79	17.79	16.98
2008	23	3210	Electronic valves, tubes, etc.	5.80	1.72	3.16	0.13	5.57	6.00	11.74	20.37	19.21
2008	58	2812	Tanks, reservoirs and containers of metal	6.00	0.40	6.94	-0.49	5.66	4.29	10.10	18.85	18.50
2008	217	3599	Other transport equipment n.e.c.	5.82	0.04	19.07	2.38	6.25	5.59	11.08	0.00	19.28
2008	853	2813	Steam generators	6.96	0.73	1.54	-0.33	5.68	5.08	11.08	18.73	18.43
2008	90007	3313	Industrial process control equipment	4.35	1.91	4.92	0.59	5.43	5.00	10.54	19.58	19.17
2008	283829	3420	Automobile bodies, trailers & semi-trailers	5.40	1.36	9.73	0.95	3.93	3.58	7.53	19.89	19.03
2009	3	2913	Bearings, gears, gearing & driving elements	6.38	0.59	6.58	1.73	6.08	6.72	12.85	19.22	18.29
2009	8	3311	Medical, surgical and orthopaedic equipment	6.25	2.71	0.81	0.68	6.13	5.03	11.38	19.80	19.44
2009	10	2222	Service activities related to printing	4.28	1.04	0.42	0.15	4.67	4.22	8.88	0.00	0.00
2009	58	2812	Tanks, reservoirs and containers of metal	6.24	0.59	6.19	0.75	5.81	4.29	10.38	18.85	18.50
2009	638	1544	Macaroni, noodles & similar products	6.47	1.72	25.07	4.91	4.98	6.32	11.43	18.63	19.88
2009	734	3693	Sports goods	5.62	1.25	6.68	-0.37	4.84	5.71	10.51	19.55	20.77
2009	853	2813	Steam generators	6.53	1.04	1.97	-0.42	6.06	5.01	10.82	18.83	18.43
2009	5022	3512	Building/repairing of pleasure/sport. boats	5.24	-1.93	5.13	1.49		2.40	6.18	18.45	18.87
2009	90007	3313	Industrial process control equipment	4.35	1.91	4.56	0.35	5.43	5.00	10.54	19.58	19.17
2009	283829	3420	Automobile bodies, trailers & semi-trailers	5.76	1.30	11.43	-1.70	3.94	3.64	8.47	19.88	19.03
2010	8	2912	Pumps, compressors, taps and valves	5.87	2.20	3.70	1.64	5.25	5.84	11.18	19.04	17.85
2010	8	3311	Medical, surgical and orthopaedic equipment	6.51	2.36	1.68	-0.87	6.36	4.92	11.44	19.80	19.44
2010	17	3520	Railway/tramway locomotives & rolling stock	4.82	1.67	1.43	-0.97	4.91	5.43	10.61	0.00	0.00
2010	23	3210	Electronic valves, tubes, etc.	6.14	1.56	1.08	0.49	5.85	5.99	11.81	19.82	19.09
2010	58	2812	Tanks, reservoirs and containers of metal	6.13	1.55	5.44	0.75	6.14	4.03	10.39	19.03	18.69
2010	66	2413	Plastics in primary forms; synthetic rubber	4.36	0.66	4.77	-2.47	4.22	5.83	10.03	19.60	16.84
2010	331	1511	Processing/preserving of meat	6.75	1.59	7.32	7.25	5.62	8.08	13.60	16.07	18.39
2010	470	2924	Machinery for mining & construction	4.44	1.00	2.17	-1.23	6.58	6.88	13.87	18.97	17.28
2010	655	2930	Domestic appliances n.e.c.	6.16	0.94	8.99	10.63	4.84	6.84	12.19	17.82	17.93
2010	675	2929	Other special purpose machinery	5.77	1.51	2.48	-1.54	5.78	7.90	13.84	18.81	18.32
2010	734	3693	Sports goods	6.01	0.26	7.65	-0.97	4.90	5.71	10.41	19.97	21.39
2010	853	2813	Steam generators	6.72	0.96	4.77	-2.80	5.82	4.96	11.11	19.02	18.68
2010	23215	1730	Knitted and crocheted fabrics and articles	4.63	0.73	13.13	0.44	3.44	5.31	8.86	19.59	17.96
2010	283829	3420	Automobile bodies, trailers & semi-trailers	5.79	1.19	8.27	3.16	4.87	3.64	8.60	19.95	16.92
2011	3	2913	Bearings, gears, gearing & driving elements	6.78	0.51	6.13	-1.38	6.26	6.58	12.85	0.00	0.00
2011	4	2927	Weapons and ammunition	5.09	1.77	4.56	-1.78	5.66	6.71	12.66	0.00	0.00
2011	87	2696	Cutting, shaping & finishing of stone	5.30	2.32	9.09	-1.68	5.77	4.74	10.63	0.00	0.00
2011	121	3420	Automobile bodies, trailers & semi-trailers	8.25	1.54	9.65	-1.38	6.79	7.98	15.03	0.00	0.00
2011	675	2929	Other special purpose machinery	6.07	0.74	0.88	1.59	6.24	7.62	13.90	0.00	0.00
2011	734	3693	Sports goods	6.23	0.56	6.64	1.02	4.71	5.73	10.89	0.00	0.00
2011	853	2813	Steam generators	6.89	0.86	1.40	3.37	6.16	5.03	11.02	0.00	0.00
2011	98436	3000	Office, accounting and computing machinery	6.66	1.38	1.86	0.32		4.39	12.98	0.00	0.00
2012	3	2913	Bearings, gears, gearing & driving elements	6.80	0.62	4.45	1.68	6.27	6.59	12.91	0.00	0.00
2012	853	2813	Steam generators	6.86	1.02	4.29	-2.90	6.00	5.09	11.30	0.00	0.00
2012	98436	3000	Office, accounting and computing machinery	3.06	5.17	2.39	-0.53	9.98	4.81	13.44	0.00	0.00
2013	3	2913	Bearings, gears, gearing & driving elements	6.96	0.65	4.06	0.39	6.32	6.40	13.09	0.00	0.00
2013	734	3693	Sports goods	5.75	1.34	7.50	0.09	5.39	5.59	10.69	0.00	0.00
2013	853	2813	Steam generators	7.00	0.97	3.49	0.81	6.21	5.04	11.70	0.00	0.00
2013	3015	2692	Refractory ceramic products	3.94	0.65	2.19	0.52	4.27	2.77	7.08	0.00	0.00
2013	4221	2812	Tanks, reservoirs and containers of metal	5.50	2.12	2.83	2.23	5.15	2.64	7.74	0.00	0.00
2013	7286	3312	Measuring/testing/navigating appliances, etc.	5.50	0.08	1.46	0.74	6.64	1.79	8.26	0.00	0.00
2013	98436	3000	Office, accounting and computing machinery	6.40	2.14	2.38	0.01	8.72	5.32	13.10	0.00	0.00

Table A2: Descriptive statistics.

Firm-level analysis				
Variable	Mean	Std. Dev.	Min	Max
Exit	0.07	0.25	0	1
Entry	0.21	0.41	0	1
MFN Tariff Cut	1.37	3.83	-28.82	34.89
POE*Post-WTO	0.77	0.42	0	1
POE*Post-WTO (2008)	0.10	0.30	0	1
POE*Post-WTO (2009)	0.11	0.32	0	1
POE*Post-WTO (2010)	0.12	0.32	0	1
POE*Post-WTO (2011)	0.13	0.34	0	1
POE*Post-WTO (2012)	0.15	0.35	0	1
POE*Post-WTO (2013)	0.16	0.37	0	1
POE	0.90	0.29	0	1
Foreign firm	0.07	0.26	0	1
ln(Labour Productivity)	4.87	1.65	0	16.49
ln(PCM)	0.74	0.96	-11.19	12.21
HHI	0.12	0.19	0	1.00
ln(Number of Employees)	3.13	1.38	0	11.46
ln(Assets)	8.60	1.76	0	19.35
ln(K\L)	5.32	1.23	0	13.74
ln(Exports)	8.87	9.58	0	21.74
ln(Imports)	8.73	9.35	0	22.27
ln(Age)	3.07	1.64	0	4.20
Preferential Tariff Cut	0.01	0.37	0	20
MFN Tariff	11.20	7.66	0	91.39

Industry-level analysis				
Variable	Mean	Std. Dev.	Min	Max
d.ln(Labour Productivity)	0.03	0.78	-4.48	8.22
d.ln(PCM)	-0.02	0.40	-1.83	1.27
MFN Tariff Cut	1.27	4.77	-28.82	34.89
SOE HHI	0.38	0.36	0	1
d.ln(Number of Employees)	-0.09	0.62	-4.50	4.61
d.ln(K\L)	0.19	0.54	-3.99	4.95
d.Exit	0.52	70.18	-949	487
d.Entry	-15.52	160.73	-1367	1610
d.ln(Exports)	-2.38	6.61	-22.27	18.39
d.ln(Imports)	-2.40	6.50	-21.74	21.74
d.Number of SOEs	1.57	11.11	-15	206
d.Number of POEs	51.62	150.67	-685	1467
d.Number of Foreign Firms	-2.28	56.33	-1133	254
d.ln(Assets)	0.06	0.76	-4.84	5.08
MFN Tariff	9.97	11.08	0	91.39

Table A3: Differences between POEs covariates and SOEs covariates.

		POE			SOE	
Variable	Mean	Variance	Skewness	Mean	Variance	Skewness
ln(Labour Productivity)	4.77	3.14	-0.66	5.53	2.40	-0.39
ln(Labour)	2.89	1.73	1.05	4.82	2.51	0.00
ln(Assets)	8.34	2.92	0.43	10.63	3.54	-0.26
MFN Tariff	10.93	56.45	1.49	13.13	70.46	1.52
ln(Exports)	9.44	90.86	0.07	13.02	84.70	-0.67
ln(imports)	9.34	86.93	0.01	12.63	79.12	-0.70
ln(K/L)	5.39	1.69	-0.69	5.75	2.08	-0.21
PTA Tariff	0.01	0.13	28.10	0.02	0.20	22.48
Entry	0.20	0.16	1.47	0.12	0.11	2.32
Exit	0.07	0.07	3.31	0.01	0.01	9.65
ln(Age)	2.88	2.98	-0.76	3.97	0.24	-5.70

		POE			SOE	
Variable	Mean	Variance	Skewness	Mean	Variance	Skewness
ln(Labour Productivity)	4.77	3.14	-0.66	4.77	4.07	-0.57
ln(Labour)	2.89	1.73	1.05	2.89	1.83	0.67
ln(Assets)	8.34	2.92	0.43	8.34	5.27	-0.73
MFN Tariff	10.93	56.45	1.49	10.93	63.69	1.75
ln(Exports)	9.44	90.86	0.07	9.44	92.77	0.08
ln(imports)	9.34	86.93	0.01	9.34	89.35	0.03
ln(K/L)	5.39	1.69	-0.69	5.39	3.07	-0.67
PTA Tariff	0.01	0.13	28.10	0.01	0.13	27.42
Entry	0.20	0.16	1.47	0.20	0.16	1.47
Exit	0.07	0.07	3.31	0.07	0.07	3.31
ln(Age)	2.88	2.98	-0.76	2.88	2.72	-0.79

Table A4: Exit and MFN: OLS regression with entropy balancing and standard errors clustered by HS 2-digit.

VARIABLES	(1) OLS Pr(Exit=1)	(2) OLS Pr(Exit=1)	(3) OLS Pr(Exit=1)	(4) OLS Pr(Exit=1)	(5) OLS Pr(Exit=1)	(6) OLS Pr(Exit=1)	(7) OLS Pr(Exit=1)	(8) OLS Pr(Exit=1)	(9) OLS Pr(Exit=1)	(10) OLS Pr(Exit=1)	(11) OLS Pr(Exit=1)	(12) OLS Pr(Exit=1)
POE*Post-WTO	0.026***		0.017*		0.023**	0.013			0.035***		0.028***	
	(0.009)		(0.010)		(0.010)	(0.015)			(0.009)		(0.010)	
POE*Post-WTO 2008		0.044***		0.026*			0.009	0.001		0.022**		0.014
		(0.014)		(0.015)			(0.013)	(0.017)		(0.010)		(0.012)
POE*Post-WTO 2009		0.048***		0.025			0.029**	0.019		0.040***		0.034**
		(0.012)		(0.016)			(0.014)	(0.016)		(0.012)		(0.014)
POE*Post-WTO 2010		0.057***		0.058***			0.054**	0.048**		0.077***		0.059***
		(0.014)		(0.019)			(0.021)	(0.024)		(0.014)		(0.021)
POE*Post-WTO 2011		-0.076***		-0.071***			-0.057**	-0.070**		-0.036*		-0.051**
		(0.028)		(0.027)			(0.026)	(0.030)		(0.019)		(0.024)
POE*Post-WTO 2012		0.024		0.024			0.075***	0.070***		0.078***		0.073***
		(0.017)		(0.022)			(0.023)	(0.026)		(0.023)		(0.023)
MFNTariff Cut			-0.002**	-0.001*	-0.003**	-0.003*	-0.001*	-0.002	-0.002**	-0.001	-0.002**	-0.001*
			(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
POE*Post-WTO*MFN Cut			0.004***		0.004***	0.005**			0.004***		0.004***	
			(0.001)		(0.002)	(0.002)			(0.002)		(0.001)	
POE*Post-WTO*MFN Cut 2008				0.020***			0.020***	0.020**		0.016***		0.018***
				(0.007)			(0.007)	(0.008)		(0.005)		(0.007)
POE*Post-WTO*MFN Cut 2009				0.010*			0.007	0.007		0.007		0.007
				(0.005)			(0.005)	(0.005)		(0.004)		(0.005)
POE*Post-WTO*MFN Cut 2010				-0.000			-0.000	0.000		-0.002		-0.000
				(0.002)			(0.002)	(0.002)		(0.001)		(0.002)
POE*Post-WTO*MFN Cut 2011				0.002**			0.002*	0.002		0.003**		0.002
				(0.001)			(0.001)	(0.002)		(0.002)		(0.001)
POE*Post-WTO*MFN Cut 2012				-0.001			-0.001	-0.001		0.000		-0.001
				(0.002)			(0.002)	(0.002)		(0.002)		(0.002)
POE	0.031***	0.032***	0.026**	0.032***	0.034***	0.050***	0.022**	0.033**	0.028***	0.018**	0.030***	0.020**
	(0.010)	(0.008)	(0.010)	(0.008)	(0.010)	(0.016)	(0.009)	(0.014)	(0.010)	(0.009)	(0.010)	(0.009)
Foreign Firm	-0.009	-0.007	-0.015	-0.006	-0.003	0.007	-0.016	-0.011	0.001	-0.011	-0.002	-0.014
	(0.008)	(0.006)	(0.010)	(0.006)	(0.012)	(0.016)	(0.010)	(0.015)	(0.011)	(0.010)	(0.011)	(0.010)
Constant			-0.043***	-0.044***	0.092***	0.077***	0.099***	0.076***	-0.020	-0.028	0.126***	0.135***
			(0.004)	(0.004)	(0.029)	(0.029)	(0.029)	(0.026)	(0.050)	(0.049)	(0.047)	(0.045)
Controls	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Business conditions control	no	no	no	no	no	yes	no	yes	no	no	no	no
PS Matching on POE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit) fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit)-year fixed effects	no	no	no	no	no	no	no	no	yes	yes	no	no
Industry trend specific fixed effects	no	no	no	no	no	no	no	no	no	no	yes	yes
Observations	271,955	271,955	271,955	271,955	271,955	229,007	271,955	229,007	271,955	271,955	271,955	271,955
R-squared	0.092	0.098	0.042	0.048	0.076	0.072	0.081	0.077	0.092	0.096	0.080	0.085
rmse	0.221	0.221	0.221	0.221	0.217	0.239	0.217	0.238	0.215	0.215	0.217	0.216

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A5: Exit and Labour Productivity: OLS regression with entropy balancing and standard errors clustered by HS 2-digit.

VARIABLES	(1) OLS Pr(Exit=1)	(2) OLS Pr(Exit=1)	(3) OLS Pr(Exit=1)	(4) OLS Pr(Exit=1)	(5) OLS Pr(Exit=1)	(6) OLS Pr(Exit=1)	(7) OLS Pr(Exit=1)	(8) OLS Pr(Exit=1)	(9) OLS Pr(Exit=1)	(10) OLS Pr(Exit=1)
POE*Post-WTO	0.097***		0.096***	0.065**			0.108***		0.101***	
	(0.021)		(0.019)	(0.033)			(0.017)		(0.019)	
POE*Post-WTO 2008		-0.126***			-0.086***	-0.101***		-0.098***		-0.083***
		(0.031)			(0.030)	(0.033)		(0.028)		(0.031)
POE*Post-WTO 2009		0.112***			0.099***	0.088***		0.118***		0.105***
		(0.038)			(0.032)	(0.032)		(0.030)		(0.032)
POE*Post-WTO 2010		0.176***			0.170***	0.160***		0.185***		0.175***
		(0.026)			(0.025)	(0.029)		(0.022)		(0.025)
POE*Post-WTO 2011		-0.043			-0.032	-0.039		-0.017		-0.021
		(0.035)			(0.034)	(0.040)		(0.025)		(0.031)
POE*Post-WTO 2012		0.163***			0.169***	0.160***		0.175***		0.171***
		(0.024)			(0.026)	(0.030)		(0.023)		(0.025)
ln(Labor Productivity)	-0.008**	-0.007**	-0.008***	-0.008	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.007***
	(0.003)	(0.003)	(0.003)	(0.006)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
POE*Post-WTO*ln(Labor Productivity)	-0.014***		-0.014***	-0.011*			-0.014***		-0.014***	
	(0.004)		(0.003)	(0.006)			(0.003)		(0.003)	
POE*Post-WTO*ln(Labor Productivity) 2008		0.033***			0.023***	0.024***		0.027***		0.023***
		(0.006)			(0.006)	(0.005)		(0.005)		(0.005)
POE*Post-WTO*ln(Labor Productivity) 2009		-0.015**			-0.012**	-0.012**		-0.014**		-0.013**
		(0.007)			(0.006)	(0.006)		(0.005)		(0.006)
POE*Post-WTO*ln(Labor Productivity) 2010		-0.027***			-0.024***	-0.023***		-0.025***		-0.025***
		(0.004)			(0.003)	(0.003)		(0.003)		(0.003)
POE*Post-WTO*ln(Labor Productivity) 2011		-0.006**			-0.007**	-0.007**		-0.006**		-0.007**
		(0.003)			(0.003)	(0.003)		(0.003)		(0.003)
POE*Post-WTO*ln(Labor Productivity) 2012		-0.026***			-0.022***	-0.022***		-0.022***		-0.023***
		(0.003)			(0.003)	(0.004)		(0.003)		(0.003)
POE	0.032***	0.030***	0.039***	0.035***	0.026***	0.037***	0.032***	0.021***	0.034***	0.024***
	(0.011)	(0.009)	(0.010)	(0.012)	(0.008)	(0.013)	(0.009)	(0.008)	(0.009)	(0.008)
Foreign Firm	-0.001	-0.005	-0.000	0.010	-0.013	-0.009	0.002	-0.008	-0.000	-0.011
	(0.009)	(0.007)	(0.012)	(0.015)	(0.009)	(0.014)	(0.011)	(0.009)	(0.011)	(0.009)
Constant	-0.009	-0.010	0.064**	0.061*	0.070***	0.054**	-0.052	-0.037	0.086*	0.093**
	(0.014)	(0.013)	(0.025)	(0.035)	(0.026)	(0.025)	(0.040)	(0.042)	(0.044)	(0.044)
Controls	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Business conditions control	no	no	no	yes	no	yes	no	no	no	no
PS Matching on POE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit) fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit)-year fixed effects	no	no	no	no	no	no	yes	yes	no	no
Industry trend specific fixed effects	no	no	no	no	no	no	no	no	yes	yes
Observations	271,955	271,955	271,955	162,571	271,955	229,007	271,955	271,955	271,955	271,955
R-squared	0.053	0.065	0.077	0.070	0.086	0.082	0.093	0.101	0.081	0.090
rmse	0.220	0.219	0.217	0.207	0.216	0.237	0.215	0.214	0.217	0.216

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A6: Exit and MFN (controlling for markup): OLS regression with PSM and standard errors clustered by HS 2-digit.

VARIABLES	(1) OLS Pr(Exit=1)	(2) OLS Pr(Exit=1)	(3) OLS Pr(Exit=1)	(4) OLS Pr(Exit=1)	(5) OLS Pr(Exit=1)	(6) OLS Pr(Exit=1)	(7) OLS Pr(Exit=1)	(8) OLS Pr(Exit=1)	(9) OLS Pr(Exit=1)	(10) OLS Pr(Exit=1)	(11) OLS Pr(Exit=1)	(12) OLS Pr(Exit=1)
POE*Post-WTO	0.033***		0.028***		0.030***	0.029***			0.037***		0.036***	
	(0.006)		(0.007)		(0.007)	(0.010)			(0.006)		(0.007)	
POE*Post-WTO 2008		0.045***		0.028***			0.028***	0.025*		0.036***		0.032***
		(0.009)		(0.009)			(0.011)	(0.014)		(0.010)		(0.009)
POE*Post-WTO 2009		0.043***		0.026			0.014	0.011		0.025**		0.018
		(0.015)		(0.016)			(0.014)	(0.016)		(0.012)		(0.014)
POE*Post-WTO 2010		0.068***		0.077***			0.057***	0.057**		0.071***		0.061***
		(0.010)		(0.015)			(0.018)	(0.022)		(0.012)		(0.018)
POE*Post-WTO 2011		-0.013		-0.010			-0.006	-0.008		0.001		0.000
		(0.014)		(0.014)			(0.014)	(0.018)		(0.012)		(0.013)
POE*Post-WTO 2012		0.041***		0.051***			0.091***	0.104***		0.091***		0.090***
		(0.009)		(0.011)			(0.013)	(0.015)		(0.014)		(0.013)
MFNTariff Cut			-0.001	-0.000	-0.002	-0.001	-0.000	0.000	-0.002*	-0.001	-0.001	-0.000
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
POE*Post-WTO*MFN Cut			0.003**		0.003**	0.002			0.003**		0.003*	
			(0.001)		(0.001)	(0.002)			(0.001)		(0.001)	
POE*Post-WTO*MFN Cut 2008				0.018**			0.017**	0.017**		0.014***		0.016**
				(0.007)			(0.007)	(0.008)		(0.005)		(0.006)
POE*Post-WTO*MFN Cut 2009				0.008			0.005	0.004		0.005		0.005
				(0.005)			(0.005)	(0.005)		(0.005)		(0.005)
POE*Post-WTO*MFN Cut 2010				-0.002			-0.001	-0.002		-0.002		-0.001
				(0.002)			(0.002)	(0.002)		(0.001)		(0.002)
POE*Post-WTO*MFN Cut 2011				0.001			0.002	0.001		0.002		0.001
				(0.002)			(0.001)	(0.002)		(0.002)		(0.002)
POE*Post-WTO*MFN Cut 2012				-0.003*			-0.003*	-0.004*		-0.002		-0.003
				(0.001)			(0.002)	(0.002)		(0.002)		(0.002)
POE	0.021**	0.017*	0.018*	0.017*	0.003	0.006	-0.013	-0.019	-0.004	-0.018*	-0.003	-0.016
	(0.010)	(0.009)	(0.011)	(0.009)	(0.010)	(0.014)	(0.010)	(0.014)	(0.009)	(0.010)	(0.010)	(0.010)
Foreign Firm	-0.020*	-0.026***	-0.023**	-0.024**	-0.020**	-0.013	-0.036***	-0.039***	-0.019**	-0.034***	-0.020**	-0.035***
	(0.010)	(0.009)	(0.012)	(0.010)	(0.009)	(0.012)	(0.009)	(0.012)	(0.009)	(0.010)	(0.009)	(0.009)
Constant			-0.031***	-0.027***	0.079*	0.150***	0.089**	0.151***	0.011	0.063	0.112**	0.122***
			(0.008)	(0.008)	(0.041)	(0.032)	(0.039)	(0.030)	(.)	(.)	(0.045)	(0.044)
Controls	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Business conditions control	no	no	no	no	no	yes	no	yes	no	no	no	no
PS Matching on POE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit) fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit)-year fixed effects	no	no	no	no	no	no	no	no	yes	yes	no	no
Industry trend specific fixed effects	no	no	no	no	no	no	no	no	no	no	yes	yes
Observations	239,409	239,409	239,409	239,409	239,409	215,640	239,409	215,640	239,409	239,409	239,409	239,409
R-squared	0.090	0.093	0.033	0.037	0.067	0.069	0.070	0.073	0.079	0.081	0.070	0.073
rmse	0.233	0.233	0.233	0.233	0.229	0.235	0.229	0.234	0.228	0.227	0.229	0.228

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A7: Exit and Labour Productivity (controlling for markup): OLS regression with PSM and standard errors clustered by HS 2-digit.

VARIABLES	(1) OLS Pr(Exit=1)	(2) OLS Pr(Exit=1)	(3) OLS Pr(Exit=1)	(4) OLS Pr(Exit=1)	(5) OLS Pr(Exit=1)	(6) OLS Pr(Exit=1)	(7) OLS Pr(Exit=1)	(8) OLS Pr(Exit=1)	(9) OLS Pr(Exit=1)	(10) OLS Pr(Exit=1)
POE*Post-WTO	0.102***		0.095***	0.091***			0.103***		0.099***	
	(0.019)		(0.020)	(0.022)			(0.018)		(0.019)	
POE*Post-WTO 2008		-0.127***			-0.075***	-0.085***		-0.089***		-0.076***
		(0.029)			(0.027)	(0.027)		(0.023)		(0.026)
POE*Post-WTO 2009		0.102***			0.075**	0.069**		0.092***		0.080**
		(0.037)			(0.033)	(0.033)		(0.030)		(0.033)
POE*Post-WTO 2010		0.185***			0.163***	0.153***		0.175***		0.167***
		(0.025)			(0.025)	(0.029)		(0.023)		(0.025)
POE*Post-WTO 2011		0.011			0.016	0.016		0.023		0.022
		(0.024)			(0.024)	(0.029)		(0.021)		(0.023)
POE*Post-WTO 2012		0.174***			0.179***	0.186***		0.180***		0.180***
		(0.020)			(0.024)	(0.026)		(0.024)		(0.024)
ln(Labor Productivity)	-0.007**	-0.008***	-0.009***	-0.008**	-0.009***	-0.008**	-0.008**	-0.008***	-0.009***	-0.009***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
POE*Post-WTO*ln(Labor Productivity)	-0.014***		-0.012***	-0.012***			-0.013***		-0.012***	
	(0.003)		(0.003)	(0.003)			(0.003)		(0.003)	
POE*Post-WTO*ln(Labor Productivity) 2008		0.034***			0.023***	0.025***		0.028***		0.024***
		(0.006)			(0.005)	(0.005)		(0.005)		(0.005)
POE*Post-WTO*ln(Labor Productivity) 2009		-0.014**			-0.011*	-0.010*		-0.012**		-0.011*
		(0.006)			(0.006)	(0.006)		(0.005)		(0.006)
POE*Post-WTO*ln(Labor Productivity) 2010		-0.026***			-0.023***	-0.022***		-0.023***		-0.023***
		(0.004)			(0.003)	(0.004)		(0.003)		(0.004)
POE*Post-WTO*ln(Labor Productivity) 2011		-0.005*			-0.005	-0.005		-0.005*		-0.005
		(0.003)			(0.003)	(0.003)		(0.003)		(0.003)
POE*Post-WTO*ln(Labor Productivity) 2012		-0.025***			-0.021***	-0.020***		-0.021***		-0.021***
		(0.003)			(0.003)	(0.004)		(0.003)		(0.003)
POE	0.022**	0.016	0.005	0.008	-0.011	-0.017	-0.002	-0.015	-0.001	-0.014
	(0.011)	(0.010)	(0.009)	(0.013)	(0.010)	(0.014)	(0.008)	(0.010)	(0.009)	(0.010)
Foreign Firm	-0.015	-0.023**	-0.018**	-0.012	-0.034***	-0.038***	-0.018**	-0.032***	-0.019**	-0.034***
	(0.010)	(0.009)	(0.009)	(0.010)	(0.009)	(0.012)	(0.009)	(0.010)	(0.008)	(0.009)
Constant	0.003	0.009	0.052	0.124***	0.068	0.136***	-0.030	0.009	0.084*	0.097**
	(0.015)	(0.016)	(0.043)	(0.032)	(0.042)	(0.034)	(.)	(.)	(0.047)	(0.046)
Controls	no	no	yes	yes	yes	yes	yes	yes	yes	yes
Business conditions control	no	no	no	yes	no	yes	no	no	no	no
PS Matching on POE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit) fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry (2-digit)-year fixed effects	no	no	no	no	no	no	yes	yes	no	no
Industry trend specific fixed effects	no	no	no	no	no	no	no	no	yes	yes
Observations	239,409	239,409	239,409	215,640	239,409	215,640	239,409	239,409	239,409	239,409
R-squared	0.044	0.053	0.068	0.070	0.075	0.077	0.080	0.086	0.071	0.078
rmse	0.232	0.231	0.229	0.234	0.228	0.234	0.227	0.227	0.228	0.228

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A8: Explaining MFN tariff cuts: OLS with robust standard errors by HS 2-digit.

VARIABLES	(1) MFN Tariff Cut	(2) MFN Tariff Cut	(3) MFN Tariff Cut	(4) MFN Tariff Cut
l.MFN	0.232***	0.232***	0.232***	0.231***
	(0.026)	(0.026)	(0.026)	(0.026)
ln(Labour Productivity)	0.233	0.178	0.236	0.164
	(0.157)	(0.241)	(0.159)	(0.254)
SOE HHI	-0.431	-1.258	-0.619	-1.844
	(0.267)	(2.271)	(0.926)	(3.282)
ln(Labour Productivity)*SOE HHI		0.169		0.222
		(0.450)		(0.522)
Markup	-0.070	-0.063	-0.123	-0.153
	(0.395)	(0.397)	(0.480)	(0.494)
Markup*SOE HHI			0.181	0.315
			(0.926)	(1.054)
Constant	-4.910**	0.337	0.125	0.497
	(1.885)	(1.239)	(0.918)	(1.445)
Controls	yes	yes	yes	yes
Industry (2-digit) fixed effects	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes
Observations	592	592	592	592
R-squared	0.375	0.375	0.375	0.376
rmse	3.945	3.948	3.948	3.952

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A9: Labour productivity and MFN cut (industry-level): OLS regression with PSM and standard errors clustered by HS 2-digit.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	d.ln(Labor Productivity)	d.ln(Labor Productivity)	d.ln(Labor Productivity)	d.ln(Labor Productivity)	d.ln(Labor Productivity)	d.ln(Labor Productivity)
MFN Tariff Cut	0.015	0.019	0.016	0.017	0.011	0.008
	(0.014)	(0.016)	(0.014)	(0.012)	(0.008)	(0.008)
SOE HHI	-0.048	-0.116	-0.049	-0.059	-0.047	-0.144
	(0.207)	(0.188)	(0.186)	(0.171)	(0.085)	(0.087)
MFN Tariff Cut*SOE HHI	-0.048**	-0.042*	-0.038*	-0.038*	-0.035**	-0.042**
	(0.023)	(0.023)	(0.022)	(0.020)	(0.016)	(0.018)
Constant	0.055	0.275	2.788***	3.965***	3.448***	1.697**
	(0.145)	(0.343)	(0.792)	(0.934)	(0.755)	(0.647)
Controls (lagged)	no	no	yes	yes	yes	yes
Business conditions control	no	no	no	no	yes	no
PS Matching on POE	yes	yes	yes	yes	yes	yes
Industry (2-digit) fixed effects	no	yes	no	yes	yes	yes
Year fixed effects	no	yes	no	yes	yes	yes
Industry (2-digit)-year fixed effects	no	no	no	no	no	yes
Observations	480	480	480	480	477	477
R-squared	0.004	0.212	0.117	0.317	0.556	0.802
rmse	1.102	1.011	1.048	0.952	0.677	0.546

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A10: Markup and MFN cut (industry-level): OLS regression with PSM and standard errors clustered by HS 2-digit.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	d.ln(PCM)	d.ln(PCM)	d.ln(PCM)	d.ln(PCM)	d.ln(PCM)	d.ln(PCM)
MFN Tariff Cut	-0.016***	-0.012**	-0.014***	-0.011**	-0.012***	-0.018***
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.006)
SOE HHI	0.075	0.096	0.084	0.087	0.053	0.033
	(0.069)	(0.060)	(0.062)	(0.057)	(0.054)	(0.067)
MFN Tariff Cut*SOE HHI	0.031***	0.041***	0.034***	0.037***	0.040***	0.043**
	(0.011)	(0.013)	(0.012)	(0.013)	(0.013)	(0.021)
Constant	-0.070	0.063	-0.127	0.365	0.309	0.088
	(0.043)	(0.082)	(0.433)	(0.483)	(0.471)	(0.387)
Controls	no	no	yes	yes	yes	yes
Business conditions control	no	no	no	no	yes	no
PS Matching on POE	yes	yes	yes	yes	yes	yes
Industry (2-digit) fixed effects	no	yes	no	yes	yes	yes
Year fixed effects	no	yes	no	yes	yes	yes
Industry (2-digit)-year fixed effects	no	no	no	no	no	yes
Observations	483	483	483	483	483	483
R-squared	0.019	0.132	0.058	0.169	0.195	0.482
rmse	0.511	0.496	0.506	0.491	0.484	0.468

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A11: Productivity and MFN cut (industry-level): ECM with PSM and standard errors clustered by HS 2-digit.

VARIABLES	(1) ECM d.ln(Labor Productivity)	(2) ECM d.ln(Labor Productivity)
MFN tariff (lagged)	0.001	0.000
	(0.008)	(0.008)
SOE HHI (lagged)	0.168	0.120
	(0.188)	(0.121)
MFN tairff (lagged) * SOE HHI (lagged)	-0.014*	-0.012
	(0.008)	(0.008)
d.MFN	0.000	-0.007
	(0.005)	(0.010)
d.SOE HHI	-0.221*	-0.165
	(0.118)	(0.108)
d.MFN*d.SOE HHI	-0.029	0.016
	(0.038)	(0.032)
Labor Producitivity (lagged)	-0.579***	-0.722***
	(0.105)	(0.104)
Constant	2.908***	0.532
	(0.540)	(0.480)
Long-term multiplier	**-0.024***	**-0.015***
	(0.014)	(0.009)
Controls	no	yes
PS Matching on POE	yes	yes
Observations	487	487
R-squared	0.328	0.585
rmse	0.772	0.618

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A12: Labour productivity and MFN cut (industry-level): OLS regression with lagged controls, PSM, and standard errors clustered by HS 2-digit.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	d.ln(Labor Productivity)	d.ln(Labor Productivity)	d.ln(Labor Productivity)	d.ln(Labor Productivity)	d.ln(Labor Productivity)	d.ln(Labor Productivity)
MFN Tariff Cut	0.015	0.019	0.017**	0.020**	0.017**	0.016*
	(0.014)	(0.016)	(0.008)	(0.009)	(0.007)	(0.008)
SOE HHI	-0.048	-0.116	-0.198	-0.243	-0.086	-0.171**
	(0.207)	(0.188)	(0.138)	(0.157)	(0.084)	(0.083)
MFN Tariff Cut*SOE HHI	-0.048**	-0.042*	-0.049***	-0.043**	-0.047***	-0.042**
	(0.023)	(0.023)	(0.018)	(0.018)	(0.016)	(0.019)
Constant	0.055	0.275	0.074	0.134	-0.282**	-0.322***
	(0.145)	(0.343)	(0.160)	(0.419)	(0.119)	(0.112)
Controls	no	no	yes	yes	yes	yes
Business conditions control	no	no	no	no	yes	no
PS Matching on POE	yes	yes	yes	yes	yes	yes
Industry (2-digit) fixed effects	no	yes	no	yes	yes	yes
Year fixed effects	no	yes	no	yes	yes	yes
Industry (2-digit)-year fixed effects	no	no	no	no	no	yes
Observations	480	480	480	480	477	477
R-squared	0.004	0.212	0.311	0.458	0.641	0.837
rmse	1.102	1.011	0.926	0.848	0.609	0.495

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A13: Markup and MFN cut (industry-level): OLS regression with lagged controls, PSM, and standard errors clustered by HS 2-digit.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	d.ln(PCM)	d.ln(PCM)	d.ln(PCM)	d.ln(PCM)	d.ln(PCM)	d.ln(PCM)
MFN Tariff Cut	-0.016***	-0.012**	-0.013**	-0.010**	-0.011***	-0.015**
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.006)
SOE HHI	0.075	0.096	0.054	0.051	0.006	-0.002
	(0.069)	(0.060)	(0.062)	(0.052)	(0.048)	(0.067)
MFN Tariff Cut*SOE HHI	0.031***	0.041***	0.033***	0.040***	0.043***	0.049***
	(0.011)	(0.013)	(0.011)	(0.012)	(0.012)	(0.018)
Constant	-0.070	0.063	-0.047	0.229**	0.205*	0.444***
	(0.043)	(0.082)	(0.058)	(0.115)	(0.109)	(0.062)
Controls	no	no	yes	yes	yes	yes
Business conditions control	no	no	no	no	yes	no
PS Matching on POE	yes	yes	yes	yes	yes	yes
Industry (2-digit) fixed effects	no	yes	no	yes	yes	yes
Year fixed effects	no	yes	no	yes	yes	yes
Industry (2-digit)-year fixed effects	no	no	no	no	no	yes
Observations	483	483	483	483	483	483
R-squared	0.019	0.132	0.124	0.238	0.272	0.541
rmse	0.511	0.496	0.488	0.470	0.460	0.440

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1