CESifo WORKING PAPERS

6618
2017

August 2017

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

Leonardo Baccini, Giammario Impullitti, Edmund J. Malesky

CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editors: Clemens Fuest, Oliver Falck, Jasmin Gröschl
www.cesifo-group.org/wp

An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
· from the RePEc website: www.RePEc.org
· from the CESifo website: www.CESifo-group.org/wp

CESifo *Working Paper No. 6618*
Category 8: Trade Policy

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

Abstract

What do state-owned enterprises (SOEs) do? How do they respond to market incentives? Can we expect substantial efficiency gains from trade liberalization in economies with a strong presence of SOEs? Using a new dataset of Vietnamese firms we document a set of empirical regularities distinguishing SOEs from private firms. We embed some of these features characterizing SOEs operations in a model of trade with firm heterogeneity and show that they can hinder the selection effects of openness and tame the aggregate productivity gains from trade. We empirically test these predictions analyzing the response of Vietnamese firms to the 2007 WTO accession. Our result show that WTO accession is associated with higher probability of exit, lower markups, and substantial increases in productivity for private firms but not for SOEs. Domestic barriers to entry and preferential access to credit are key drivers of the different response of SOEs to trade liberalization. Our estimates suggest that the overall productivity gains would have been about 66% larger in a counterfactual Vietnamese economy without SOEs.

JEL-Codes: F120, F130, F140, P310, P330.

Keywords: state capitalism, state-owned enterprises, trade liberalization, heterogeneous firms, gains from trade, WTO, Vietnam.

Leonardo Baccini
McGill University
Canada - Montreal, Quebec, H3A 2T7
leonardo.baccini@mcgill.ca

Giammario Impullitti
University of Nottingham
United Kingdom - NG7 2RD Nottingham
Giammario.Impullitti@nottingham.ac.uk

Edmund J. Malesky
Duke University
USA - Durham, NC 27708
ejm5@duke.edu

July 26, 2017
A previous version of this paper was circulated under the title “Trade Liberalization and State-Owned Enterprises: Evidence from Vietnam’s Accession to the WTO.” We thank Dirk Krueger and five referees for their insightful comments and suggestions. We would also like thank Emily Blanchard, Paola Conconi, Swati Dhingra, Paola Giuliano, Dominik Hangartner, Colin Hottman, In Song Kim, Lucas Leemann, Omar Licandro, Giovanni Maggi, Gianluca Orefice, Gianmarco Ottaviano, Nina Pavcnik, Priya Ranjan, Peter Rosendorff, Thomas Sampson, Kostas Tatsiramos, Johannes Urpelainen and participants at the Royal Economic Society 2015, at the 2015 Peking University-University of Chicago Summer Institute, SEAT 2015 (Cambridge University), GEP 2016 conference Nottingham Ningbo, RMET 2017 conference (University of Calgary), ITSG 2017 (University of Bergamo), and seminar participants at ECARES Bruxelles and LSE. The usual disclaimers apply.

1 Introduction

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 2,000 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, and Egeland, 2013).[1] 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). Although they are at the center stage of this debate, little is known about this form of enterprises. What do SOEs do? What are their distinguishing features? How do they respond, if at all, to market forces and reforms? Using a new rich data set of Vietnamese firms, we first document a set of empirical regularities distinguishing SOEs operations from those of private firms. Second, we embed these characteristics in a simple model featuring both SOEs and privatly owned enterprises (POEs), and analyze the response of these different firms to trade liberalization. Third, we use the predictions of the model as a guideline for an empirical assessment of the effects of Vietnam's 2007 accession to the WTO.

Vietnam represents an ideal country for our research purposes, since more than one-third of its economy is still state owned and the 2007 WTO accession represents one of the largest market reforms, possibly the largest, in Vietnam's history. We rely on data from the General Statistics Office (GSO), which covers the entire spectrum of Vietnamese firms over the period 2006-2012. Two features seem to stand out in characterizing the nature of SOEs operations compared to POEs: State-owned firms tend to enjoy a stronger market power, as suggested by their substantially larger markups and the higher degree of market concentration characterizing the sectors with a dominant presence of SOEs. Second, external (borrowed) capital constitutes a substantially larger fraction of total capital for state-owned firms than for private firms, suggesting privileged access to credit for the former.

Our model economy embeds these two key features distinguishing SOEs from private firms. First, larger barriers to entry allow SOEs to have stronger market power; second, SOEs enjoy easier access

[1] Based on Country SOE Share (CSS), an index of weighted averages of SOE shares of sales, assets, and market values among countries' top 10 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.

to credit. Moreover, both types of firms can be heterogeneous in their productivity and have access to foreign markets. All firms compete in oligopolistic markets, where their market power (i.e., markups) is affected by the number of competitors, and responds endogenously to changes in trade costs. 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. All firms must borrow to finance part of their fixed operation costs, and we assume that credit markets are frictional. Although all firms interact with the same financial intermediaries, SOEs enjoy a preferential access to credit, which makes them less financially constrained than private firms. Stronger market power and lower credit constraints imply that surviving is easier for SOEs than for POEs.

Trade liberalization 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 can 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. Similarly, easier access to credit makes SOEs more resilient to foreign competition, thereby further reducing the selection effects of trade liberalization. Selection and reallocation lead to increases in average productivity in POE-dominated sectors, while this efficiency effect is lower 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 predictions 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. Using a difference-in-differences approach, we directly estimate the impact of the reduction in Vietnam's Most Favored National (MFN) tariffs on the probability of exit of private firms in comparison to SOEs. We also explore the role of credit constraints in shaping the differential response of private and state-owned firms to trade liberalization, and assess the impact of MFN cuts on firms' market power, measured by their markups. In addition to analysis at the firm level, we study the impact of MFN cuts on average productivity at the industry level, exploiting the cross-industry variation of SOEs' presence. 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 entropy balancing to establish a reasonable comparison group between POEs and SOEs with respect to a battery of firm-level and industry-level confounding factors. A large set of robustness tests is also run to account for possible confounding factors and specification issues.

Our reduced-form econometric analysis produces four main empirical findings. First, we only find strong evidence of trade-induced selection for POEs and less so for SOEs: Private firms are significantly more likely to exit the market compared to SOEs after Vietnam's accession to the WTO. Second, we find that SOEs with large debt-to-capital ratios, our proxy for access to credit, are less likely to exit the market after trade liberalization, while the opposite happens with private firms. Hence, debt helps SOEs to weather competitive pressures, while it is a drag for private firms. This suggests that advantageous credit conditions - lower cost of credit - is a key factor in sheltering SOEs from trade-induced increases in competition. Third, we find that POEs markups decrease after WTO accession, whereas we do not observe any pro-competitive effects of trade for SOEs. Fourth, productivity increases in industries with a negligible presence of SOEs as a result of multilateral trade liberalization, whereas this effect disappears as the presence of SOEs becomes substantial.

The overall productivity gains have been lower than expected. We show that WTO access tariff cuts are associated with an annual average increase in manufacturing productivity of 3.8% during the period 2008-2012. Given that the Vietnamese economy featured a robust growth in the pre-WTO period, but far behind the East Asia miracle pace, larger gains were expected from a small, fairly closed economy like Vietnam joining the WTO.[2] Trefler (2004), finds that larger and less closed economies like Canada and the US obtained similar gains from their bilateral trade agreement.[3] We show that the presence of SOEs can partially account for the missing productivity gains. We do this

[2]Vietnam's GDP grew at about 5.5% between 1985 and 2007, and increases to about 6% in the post WTO period till 2016. Per-capita GDP growth is 3.8% pre-WTO and 4.8% post.

[3]Trefler (2004) shows that the reduction in Canadian tariffs following the US-Canada free trade agreement triggered a selection effect resulting in a 4.3% increase in Canadian manufacturing productivity. Lileeva and Trefler (2010) find that the reduction in US tariffs associated with the free trade agreement shifted market shares toward highly productive Canadian exporters, leading to an increase in productivity of 4.1%.

by simulating a counterfactual scenario in which we measure the productivity gains that would have been brought about by WTO accession had SOEs not been a strong presence in the economy. This exercise suggests that in the period between 2008 and 2012 the overall productivity gains would have been 66% larger in a counterfactual economy where POEs replace SOEs.[4] Hence, the annual average increase in manufacturing productivity would have been an extra 0.9% (out of 3.8%) without a strong presence of SOEs. In sum, 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). A stream of theoretical papers have explored the aggregate effects and transmission channels of trade liberalization in the presence of firm heterogeneity.[5] Although this literature analyzes several dimensions of firm and plant heterogeneity, little attention is given to their ownership structure. Our paper fills the gap, providing a simple model tackling the following questions: Does a strong presence of SOEs affect the consensus predictions of new trade models with heterogeneous firms? Can we still expect the productivity gains from trade-induced selection described in these models? If not, what are the key features of SOEs shaping new adjustment mechanisms and final outcomes? Our model borrows from the literature on *oligopoly trade* (Neary, 2003)[6] and its more recent extensions to heterogeneous firms economies (e.g., Van Long, Raff, and Stahler, 2011; Impullitti and Licandro, 2017; Impullitti, Licandro, and Rendhal 2017; Bekkers and Francois 2013). Moreover, our approach to modeling credit constraints in heterogeneous firm trade economies is related to Manova (2013) and Bonfiglioli, Crino, and Gancia (2016), among others.

Several empirical papers have documented the positive effects of trade on industry productivity through tougher selection and market share reallocation.[7] Pavcnik (2002), Trefler (2004), Bernard, Jensen, and Scott (2006), and Topalova and Khandelwal (2011), among others, analyze the effects of

[4] 66% is given by an annual increase in productivity of 13.2% multiplied by the 5 years in which Vietnam has been a WTO member, i.e., 2008-2012.

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

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

[7] 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).

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 selection and intra-industry reallocations. Our paper contributes to this literature by assessing the productivity gains from trade through inter-firm reallocation in an economy with a non-negligible share of firms owned by the state. This is a first step in understanding and measuring productivity gains from trade under state capitalism.

Recently, preferential trade agreements have begun to involve discussions about *behind-the-border barriers*. These include domestic regulations on the environment, health, safety and labor standards, and domestic taxation, which often generate non-tariff barriers behind national borders. As discussed in Ederington and Ruta (2016), the WTO is taking its first steps in the direction of eliciting cooperation on this type of barriers, especially regarding product and process standards. The empirical and theoretical literature are also making early moves in trying to understand the nature of these barriers and the mechanisms through which they affect the costs and benefits of international trade agreements. Recent research has shown that commitment issues (Brou and Ruta, 2013), bilateral bargaining over prices (Antras and Steiger, 2012) and coordination externalities (Costinot, 2008) can motivate the need for "deep integration,"going beyond tariff reductions to include coordination of domestic policies.[8] Our paper suggests that entry barriers and credit frictions can function as de facto behind-the-border barriers and hamper gains from "shallow" integration essentially limited to tariff reduction. We contribute to this literature first by suggesting that, besides standards and taxation, entry and credit distortions can be important sources of behind-the-border barriers. Moreover, we show that these new barriers contribute to shape the gains from economic integration in a world with firm heterogeneity.

Finally, 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 entry of more productive private firms and shelter sluggish SOEs from competition. Economic reforms reduce the cost wedges between the two types of firms

[8]Horn, Maggi, and Staiger (2010) shed a skeptical light noting that removing behind-the-border barriers is more costly than removing border measures, because the former are less transparent than the latter.

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 started in the late 1990s led to the privatization or closure of small and inefficient firms, while large firms were corporatized and kept under state control. They find that the labor productivity of these large SOEs has converged to that of private firms, and SOEs were responsible for about a fifth of aggregate TFP growth during 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.[9] Crucially, we show that cost wedges, such as those created by credit constraints, can hamper the efficiency gains of trade reforms by taming their beneficial effect on misallocation.

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 implement some robustness checks to further validate our findings. A final section concludes.

2 Market Reforms and Vietnamese Firms

In this section we document the reduction in trade barriers brought about by Vietnam's WTO accession, provide a brief discussion of the SOE reforms which started before the accession, and report

[9]Another point of difference is our focus on Vietnam instead of China. 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.

several stylized facts on Vietnamese firms, mainly aimed at highlighting the different natures of SOEs and POEs operations.

Data. Before presenting the stylized facts, we describe the data and the main variables of interest. Our data come from the annual Enterprise Census of firms performed by Vietnam's GSO for the period 2006-2012. They include the entire universe of Vietnamese firms that have at least 10 employees, and contain a rich set of firm-level characteristics.[10] We follow the classification of firm ownership employed in Vietnamese statistical 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 sectorial pattern of SOE participation than analyses that 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 the WTO tariff data. All the sources report the same tariff rates. We merge the tariff data at 6-digit level with the 4-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

[10]The Enterprise Census includes a random sample of firms under 10 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.

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. *Exit* is defined as the probability of exit for firm f in industry i between year t and $t+1$. Formally, $Exit = Pr(Exit_{fi,t} = 1)$. 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 previous studies (Pavcinik, 2002; Topalova and Khandelwal, 2011), we use revenue-based total factor productivity *TFPR*.[11] Moreover, 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.[12] Furthermore, the logged number of employees is a proxy for size and the capital-labor ratio is a proxy for capital-intensive sectors. Finally, *Firm's Debt* is the difference between total capital *used* by firms and capital *owned* by firms divided by capital used.[13] We use this variable as a proxy for access to credit granted to firms. The higher the debt is, the larger the access to credit is.

WTO accession. We start documenting the characteristics of the tariff cuts brought about by WTO entry. 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 6-digit level and come from WITS (2014). Since our tariff data are at the sectorial 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 refer to an ISIC 4-digit sector

[11] TFPR is calculated using simple firm-level Solow residuals. We calculate TFPR for each firm-year by regressing the firm-level log of revenue on firm-level physical assets, employment, year and 4-digit industry fixed effects. The residuals of this regression, which might also be negative, are our time-varying measures of firm productivity. As we show below, results are robust to alternative measures of productivity such as labor productivity.

[12] We exclude from the sample firms that have negative markups and markups higher than one. The difference in mean between POE and SOE is not significant for markups lower than zero and higher than one. Our results are not subtantively different if we include these observations. Ideally, we would have liked to use more sophisticated measures of markups, such as those in De Loecker and Warzynski (2012). Unfortunately, our data do not include accurate pricing data on inputs and we are therefore unable to derive output elasticity.

[13] We use a ratio to avoid over-estimating capital-intensive sectors, in which SOEs tend to operate. Another option would be to use a ratio between liabilities and revenue. However, POEs tend to under-report sales to evade taxes (whereas SOEs do not). Thus, weighting liabilities over revenue would lead to overestimate POEs' debt. The variable *Firm's Debt* is available only for the period 2006-2010.

as SOE-dominated if the SOE labor share is larger than 40%, which is the upper quartile, i.e., 75^{th} percentile. In the analysis that follows this is a dummy variable labeled *SOE-dominated Sector*.[14]

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 (see Figure A1 in the appendix).[15] There is evidence that POE-dominated sectors faced larger tariff cuts than SOE-dominated sectors in the following industries: food processing, textiles, wood, and precision instruments (see Figure A2 in the appendix). 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.

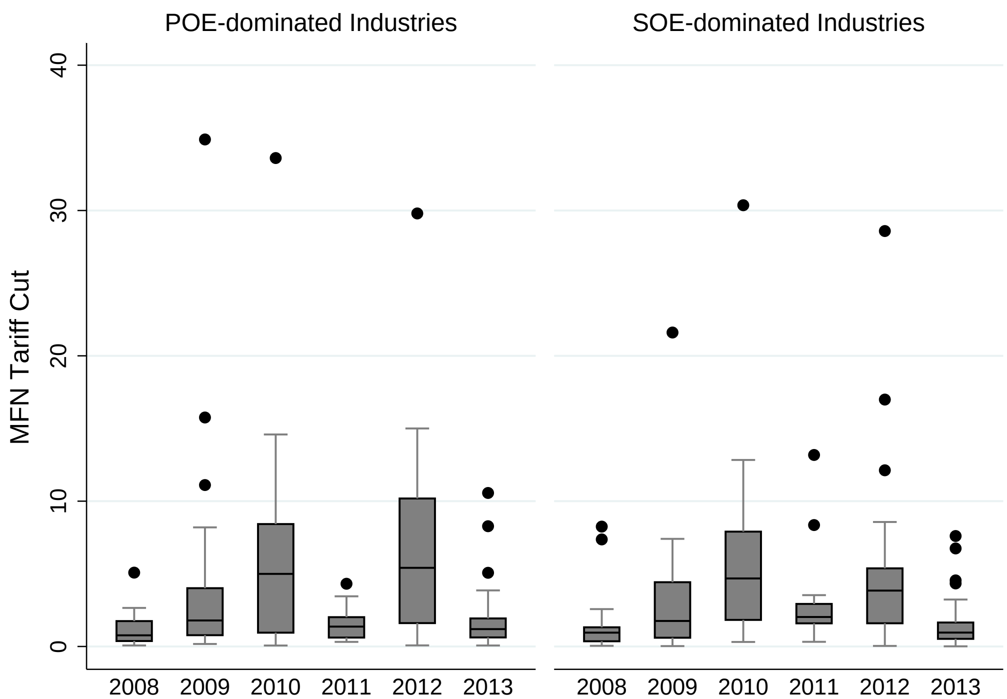
The SOE reform. In 1986, the Vietnamese government launched *Doi Moi* (Renovation), an ambitious program of economic reforms which resulted in dismantling most instruments of control over the economy. Among the most critical pillars of Doi Moi was a separation of SOE business operations from state planning in Decision 217/HDBT of 1987. The 12,000 SOEs that existed at the time were given general guidelines as part of the government's 10-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.[16] In 1995, the hiving off of SOE business operations was

[14] Results are not sensitive to this threshold and are similar if we use fractions of SOEs over total number of firms in a industry, SOE revenue share, and fraction of SOE capital in each industry.

[15] 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 4-digit level.

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

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



Note: The box plots show the distribution of tariff cuts in different years. The bars represent the lower and upper quartiles of each distribution, whereas the dots are outliers.

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.[17] 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 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.[18]

[17]A similar reform process took place in China in the 1990s, in which SOEs were "corporatized" and merged into large state-owned conglomerates. See Hsieh and Song (2015) for details.

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

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).

Table 1 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 1 also shows the distribution of SOE activity (i.e., percentage of firms and percentage 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 absent only from the computer industry.

Next, we document some key features of SOEs and POEs both before and after WTO access. In Table 2 we can see that although SOEs do exit, the probability of this event is substantially lower for them than for private firms. Although WTO access increases the exit hazard for both firms, their difference persists. A second remarkable difference is that SOEs have a strikingly stronger market power, as their average markup is significantly larger than that of POEs in our sample periods. Moreover, while we observe substantial markup reductions for POEs post-WTO, markups seem to

Table 1: 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.

slightly increase for SOEs.

Another remarkable feature is the size and productivity difference. SOEs are larger and less productive than POEs. Figure 2 provides a more suggestive picture of the productivity difference and its change over time. During the period 2006-2007 there is a wide productivity dispersion for both types of firms, and a substantial overlap between the two productivity distributions. However, POEs are on average more productive than SOEs even prior to the WTO accession. In the post-WTO years, the distribution for POEs progressively shifts to the right and, as a result, the productivity gap between POEs and SOEs widens. Moreover, we also find that the average firm size is fairly stable for POEs but declines dramatically for SOEs. Finally, Table 2 shows that SOEs have a substantially higher debt ratio, suggesting easier access to the credit market.

Table 2: SOE vs POE: Firm characteristics in Vietnam before and after WTO accession.

Statistics	2006-2007		2008-2010		2011-2012	
	SOEs	POEs	SOEs	POEs	SOEs	POEs
Exit* (% of firms)	0.7	3.3	3.8	10.2	2.4	10.1
Mean Productivity	-0.10	0.02	-0.17	-0.01	-0.40	0.01
Std. Productivity	1.1	1.1	1.3	1.8	1.6	1.8
Mean Markups	0.06	0.04	0.07	0.04	0.08	0.04
Mean Employment (logs)	5.8	3.1	5.7	2.9	4.9	2.7
Mean Firm's Debt	0.47	0.25	0.45	0.32		

Note: the difference between SOE and POE is statistically significant ($p<.05$) for each covariate.

What is special about SOEs? The descriptive statistics presented above suggest that on the eve of WTO access Vietnamese SOEs, despite being corporatized and drastically reformed, were still more protected from competition along both the entry and the exit margin, as indicated by the wider availability of credit and the higher market power. Here we dig deeper into these barriers to competition characterizing SOE operations, using our data when possible but also referring to other work in order to provide a more comprehensive view.

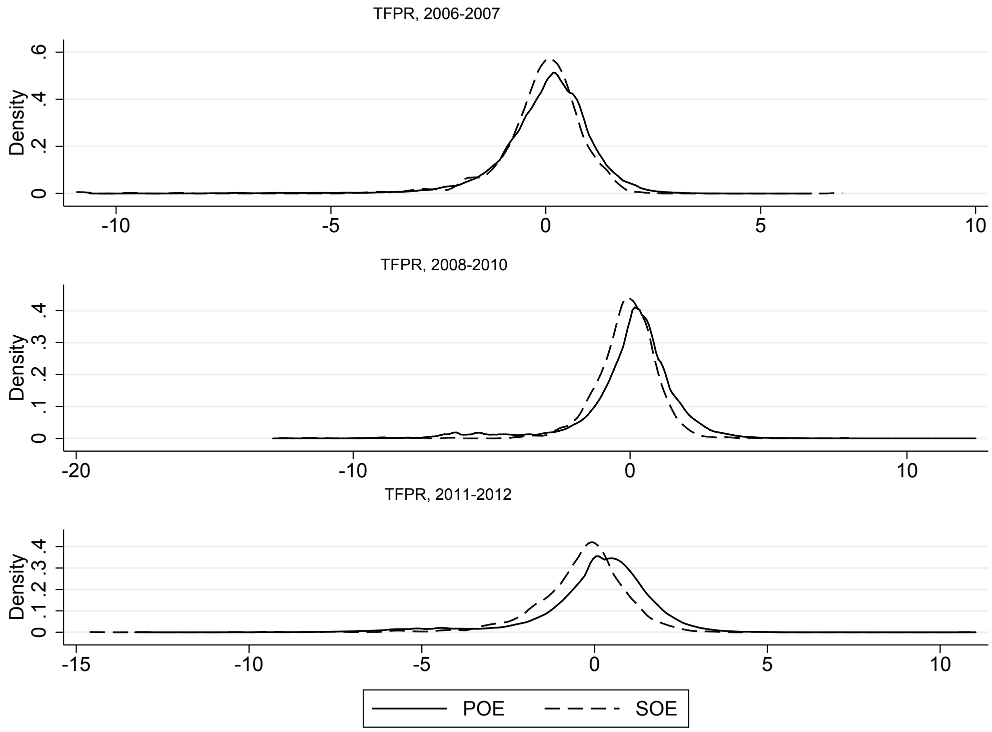
First, we look at market concentration measures, which can be interpreted as the consequences of barriers to entry. In Figure 3, we show that sectors dominated by SOEs have remarkably higher Herfindahl indices and lower import penetration than POE-dominated sectors.[19]

The literature documenting barriers shielding Vietnamese SOEs from competition focuses on several factors. Some of them constitute explicit or implicit barriers to entry; others are de facto subsidies helping incumbent firms avoid exit when competitive pressure rises. Among the barriers to entry we have: 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).[20] Second, as in China (Song et al., 2011), many SOEs operate in capital-intensive sectors

[19]The Herfindahl index is calculated using revenue. Import penetration is defined as ratio of total import over revenue by sector (4-digit industry level) and for each year.

[20]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 ship-building firm, has 445 subsidiary businesses and 20 joint ventures, which range from real estate to hotels to karaoke bars. These sideline businesses crowd out entrepreneurial

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



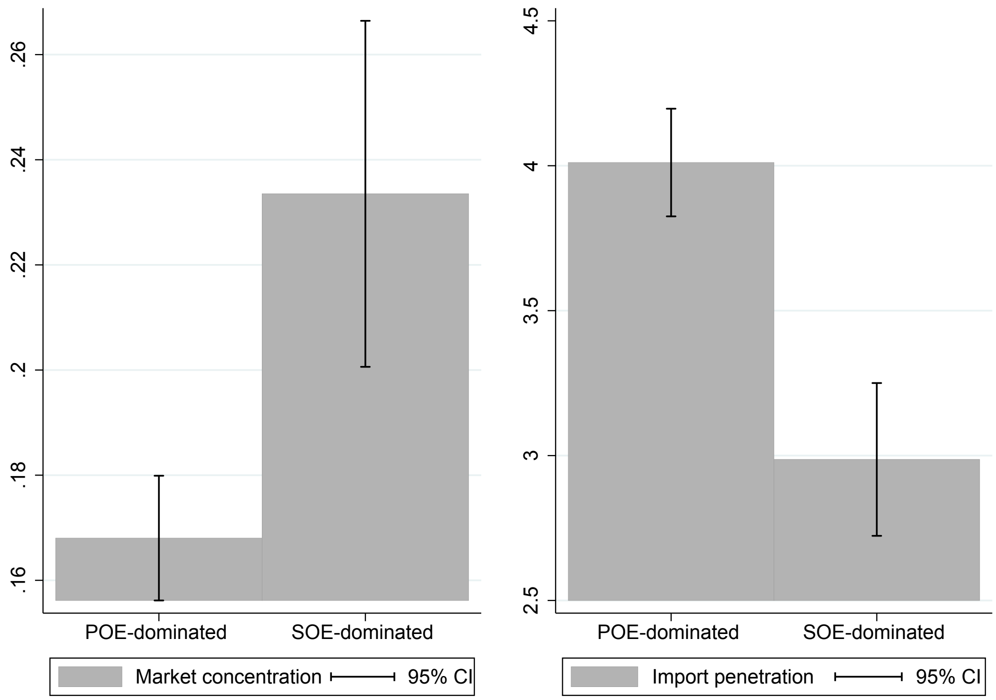
Note: the difference between TFPR of SOE and TFPR of POE is statistically significant ($p<.05$) in 2011-2012.

for which 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).

Other SOEs privileges help them dealing with competition on both the entry and the exit margin. First, it has been shown that access to credit is greater when firms have close connections to the party and government (Malesky and Taussig, 2009). Even in 2013, after the dramatic growth of the private sector, roughly 60% of lending by the state-owned banking sector went to SOEs. In line with these arguments, our data in Table 2 above shows that SOEs have significantly higher debt ratios, which suggests a potentially easier access to credit. Second, market access is easier for SOEs than for private firms (Nguyen and Freeman, 2009). This is particularly true for government procurement (Pincus et al., 2012). Third, previous studies have found that for land use rights certificates, private firms face processing times that are 200 hundred times greater than those faced by SOEs (Tenev et al., 2003; Pincus et al., 2012). We can get an overall sense of the barriers to competition protecting SOE

businesses (Nguyen and Freeman, 2009).

Figure 3: POE-dominated vs. SOE-dominated industries: Average Herfindal index (firm revenue) and average (log of) import penetration ($\frac{import}{revenue}$).



activity by looking at the annual Provincial Competitiveness Index (PCI) survey, a survey of 8,500 firms which is conducted annually by the Vietnamese Chamber of Commerce and Industry in order to assess the business environments of Vietnamese provinces.[21] 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 SOEs in public procurement and access to credit (see Figures A2 and A3 in the appendix).

Taking stock, we have shown that barriers to competition seem to be key in differentiating SOEs and POEs operations. Our firm-level data suggest that Vietnamese SOEs enjoy higher market power, possibly deriving from several sources of entry barriers, and barriers to exit likely related to easier access to credit. These two elements of entry and exit restriction will characterize our theoretical and empirical analysis of SOE operations and their response to the WTO access, which follows.

[21] For further information, see `www.pcivietnam.org`.

3 An Illustrative Model Economy

Next, we set up a simple model, the main purpose of which is to provide a guide for the empirical analysis, and offer some economic intuitions for its results. The model introduces SOEs, POEs, and credit constraints in a version of the Impullitti and Licandro (2017) economy. 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.

3.1 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 of labor supplied inelastically, which can be transformed one-to-one into the homogeneous good. This implies that the equilibrium wage is 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 variable costs. 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 an SOE variety respectively. This technology is similar to the one in Melitz (2003), where an industry with a CES aggregate of differentiated varieties features different technologies across varieties. The key difference is that in Melitz a variety is produced by one firm, while here it is produced by a small number of firms with very similar technologies, which we assume to be identical for simplicity. As in Melitz, each firm competes horizontally with the many other firms producing imperfectly substitutable goods with different efficiencies, but in addition to that it also competes vertically with a few other similar firms in its product line. Interpreting this as a model of heterogeneous industries would not be consistent with the fact that empirically, even at the finest level of classification, sectors consist of many different goods produced by many different firms, and no single product line or variety with an empirical counterpart is produced by one single firm.[22] Hence, we interpret X as a sector populated with SOE and POE varieties, each produced by firms with different efficiencies.[23] Within each variety a few identical firms compete strategically.[24]

Next, we define the entry technology. There is a unit mass of potential varieties. At entry each variety is introduced by the n firms associated to it, which jointly draw productivity from an initial distribution. Because of the presence of the fixed operating cost, only a fraction of product lines $M \in (0, 1)$, and the associated firms, survives. Motivated by the previous insights on the nature of modern Vietnamese SOEs, we assume that due to higher entry barriers SOEs enjoy greater market power than POEs. 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 for SOE than in POE product lines: $n_g < n_y$.

This is a reduced-form way to introduce barriers to entry in SOE sectors. A more general formu-

[22] 6-digit NAICS sectors, as, for instance, Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing, comprise more than 30 sectors spacing from satellites antennas to cellular phones and televisions. We can think of variety in our own economy as one particular product line in this (or other sectors), for instance, smart phones, where two or three global leaders such as Apple, Samsung, and Sony compete strategically using similar technologies.

[23] The multisector economy version of this model would feature utility

$$U = \ln\left(\prod_{i=1}^{I} X_i^{\beta_i}\right) + \beta \ln O,\ \beta_i > 0 \text{ and } \sum_{i=1}^{I} \beta_i = 1,$$

where each differentiated good industry $X_i = G_i^{\gamma} Y_i^{1-\gamma}$, $i \in (1, ...I)$ features the same CES preferences for SOE and POE varieties as in (1). This generalization does not affect the key qualitative properties of the economy.

[24] Introducing some heterogeneity between the few firms within the same product line would generalize the model without affecting the fundamental results but with the drawback of making the model analytically untractable. See, for instance, Atkeson and Burstein (2008) and Edmond, Midrigan, and Xu (2016).

lation 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 (Neary, 2010; Friedman, 1993). Consequently, it is standard in the literature on oligopoly and trade to work with a fixed but small number of large firms, which allows us to model in a simple way economies where firms have strong market power.[25] In line with the literature, we keep the number of oligopolistic firms within a product line n_g and n_y constant.

The global economy is populated by two symmetric countries with the same technologies, preferences, and endowments. For simplicity we assume full symmetry across countries, implying that domestic private firms compete with foreign private firms, and similar 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, public and private, and all goods within each sector, are subject to the same iceberg trade costs. Finally, we focus on an economy in which all operative firms sell to both the domestic and the foreign markets.[26] Two-way trade in similar products takes place in this economy for the same reasons as in Brander (1981) and Brander and Krugman (1983).

In order to introduce credit constraints, we follow Manova (2013) and assume that while variable costs can be funded internally, firms must pay a fraction $d \in (0, 1)$ of their fixed operating costs λ upfront. In order to cover this upfront cost, firms borrow from financial institutions pledging a fraction $t \in (0, 1)$ as collateral.[27] Higher d and lower t indicate stronger *financial vulnerability* of the firm or sector. We assume that there is neither cross-sector nor cross-firm heterogeneity along this dimension. Because of imperfect financial contractibility credit institutions can expect to be repaid by firms with probability $\delta_y, \delta_g \in (0, 1)$, which embodies the strength of financial institutions or their willingness to

[25]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 from monopolistic competition. Some preliminary attempts to deal with the integer problem in models of trade and oligopoly are discussed in Neary (2010).

[26]As we can see in Impullitti and Licandro (2017) and in Impullitti et al. (2017), introducing the extensive margin of export reduces the tractability of oligopoly models with firm heterogeneity. 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.

[27]In purchasing intermediate inputs, paying salaries to workers, and paying rents for land use and equipment, firms often have to incur in expenses previous to production and sales.

enforce credit contracts.

Assumption 2 (credit constraint). Credit constraints are stronger for POEs than for SOEs: $\delta_y < \delta_g$.

This assumption conveys the idea that financial institutions are more soft in enforcing credit contracts with SOEs, which, as we show later, results in cheaper access to credit for these firms compared to POEs.

3.2 Equilibrium analysis

Next we derive the equilibrium properties of the model and analyze the effects of trade liberalization.

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. For simplicity we focus on POEs. The household problem is straightforward and is described in the appendix; here we go directly to the optimal firm behavior. Each POE firm producing the same variety with productivity $\tilde{z}$ behaves non-cooperatively and maximizes its net cash flow, subject to demand and quantity constraint. Each firm solves the following problem:

$$\begin{aligned}
\max_{q_D^D, q_D^F, F} \pi_y(\tilde{z}) = &\left(p_D - \frac{1}{\tilde{z}}\right) q_D^D + \left(p_F - \frac{\tau}{\tilde{z}}\right) q_D^F - (1-d)\lambda - \delta_y F(\tilde{z}) - (1-\delta_y) t\lambda \\
& s.t. \\
& p_D = \frac{(1-\gamma) E_D}{Y_D^\alpha} y_D^{\alpha-1} \quad \text{and} \quad p_F = \frac{(1-\gamma) E_F}{Y_F^\alpha} y_F^{\alpha-1}, \\
& y_D = \hat{y}_D^D + q_D^D + y_F^D \quad \text{and} \quad y_F = \hat{y}_D^F + q_D^F + y_F^F, \\
LC: \quad & \left(p_D - \frac{1}{\tilde{z}}\right) q_D^D + \left(p_F - \frac{\tau}{\tilde{z}}\right) q_D^F - (1-d)\lambda \geq F(\tilde{z}) \\
PC: \quad & -d\lambda + \delta_y F(\tilde{z}) + (1-\delta_y) t\lambda \geq 0
\end{aligned} \tag{2}$$

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 profit function shows that only a fraction $(1-d)$ of the fixed cost is financed internally, and that if the contract is enforced firms must pay $F(\tilde{z})$ to the financial institution, while in case of default firms lose the collateral. 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 D from a firm in source country D, $\hat{y}_D^D$, which is the quantity sold to destination D by the other $n_y - 1$ firms in country D, and y_F^D representing 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, $q_D^D = q_F^F \equiv q$, $q_D^F = q_F^D \equiv \check{q}$, $y_D = y_F \equiv y$, $E_D = E_F = E$, $Y_D = Y_F = Y$, and $p_D = p_F = p_y$. As q and $\check{q}$ are the quantities sold by a POE in the domestic and in the export markets, $y = n\,(q + \check{q})$ is the total quantity sold in a market. Moreover, the liquidity constraint (LC) implies that in case of repayment firms can pay up to their net revenues. Finally, the participation constraint (PC) implies that the financial institution is willing to enter the contract only if the net expected returns exceed the outside option, which for simplicity is normalized to zero. Notice that the lower the probability that the financial institution attaches to being repaid δ, the higher the cost of borrowing $F(\tilde{z})$, and hence the stronger the credit constraints faced by the firm.

The solution to the firm problem (2) yields the following equilibrium price:

$$p_y = \frac{\tilde{z}^{-1}}{\theta_{d,y}} = \frac{\tau \tilde{z}^{-1}}{\theta_{f,y}}, \tag{3}$$

where $\theta_{d,y} = (2n + \alpha - 1)\,/n\,(1 + \tau)$ and $\theta_{f,y} = \tau\theta_{d,y}$, are the inverse of the markups charged in the domestic and foreign markets. A reduction in trade costs τ raises $\theta_{d,y}$ because foreign competition makes the domestic market more competitive, but reduces $\theta_{f,y}$ because shipping goods abroad becomes cheaper. As the trade cost declines, firms reduce their domestic markup and increase their export markup. Intuitively, a reduction in trade costs implies that exporters face a cost reduction while their direct local competitors in the foreign market do not experience any cost change. Hence, exporters can afford not to pass on the whole cost reduction due to lower trade costs to foreign consumers. The ratio of production to consumption,

$$\frac{q + \tau\check{q}}{q + \check{q}} = \frac{(1 - n - \alpha)\,(1 + \tau^2) + 2n\tau}{(1 - \alpha)(1 + \tau)} \equiv \mathcal{A} > 1, \tag{4}$$

measures losses associated to trade due to iceberg costs and Cournot competition. Let us define the average markup a firms makes on the export and domestic market,

$$\theta_{\tau,y} \equiv \frac{q_d \theta_{d,y} + q_f \theta_{f,y}}{q_d + q_f} = \mathcal{A}_y \ \theta_{d,y}. \tag{5}$$

Using the above results, the equilibrium variable cost, or the variable firm size, can be written as

$$\tilde{z}^{-1} \left(q + \tau \breve{q}\right) = \theta_{\tau,y} \left(1 - \gamma\right) \frac{E}{n_y M_y} \ \frac{z}{\bar{z}_y}, \tag{6}$$

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, and

$$\theta_{\tau,y} = \mathcal{A}_y \ \theta_{d,y} = \frac{2n_y - 1 + \alpha}{n_y \left(1 + \tau\right)^2 \left(1 - \alpha\right)} \left[\tau^2 \left(1 - n_y - \alpha\right) + n_y \left(2\tau - 1\right) + \left(1 - \alpha\right)\right]. \tag{7}$$

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, $n_g \geq n_y$, and from (7) it follows that $\theta_{\tau,y} > \theta_{\tau,g}$, which in turn implies that the markup for SOEs is higher than for POEs. The variable cost part of a firm's size in (6) 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, $\theta_{\tau,i}$ increase, prices lower, the quantities produced increase, and firms demand more inputs.

We now turn to explore the role of credit constraints. The optimal decision of firms is to adjust their payment F to take the investors to their participation constraint, which in equilibrium holds with equality. Substituting this into the LC and using (6), we can determine the following cutoff condition for POEs:

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

where $\hat{\lambda}_y = \left[1 + \frac{1-\delta_y}{\delta_y} \left(d - t\right)\right] \lambda$ captures the additional cost of financing firms' fixed operations in an environment with credit constraints. Proceeding similarly for SOEs, we obtain the cutoff condition

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

As an implication of stronger credit constraints, POEs end up paying larger fixed operating costs,

$\hat{\lambda}_y > \hat{\lambda}_g$. Thus, easier access to credit for SOEs represents a de facto subsidy on the cost of their fixed operations. Although the amount d firms borrow is the same, due to the difference in credit constraints the cost of borrowing is different for the two types of firms.

Entry. In each product line and in each sector, at entry firms draw a productivity z from a distribution $\Gamma(z)$ common to 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 firms whose productivity at entry is below the survival cutoff all exit together.[28] We assume that there is a 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.

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^*, $\bar{z}_i(z^*) = \int\limits_{z_i^*}^{\infty} z\mu_i(z)\, \mathrm{d}z$.

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

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

where we use the equilibrium labor demands derived above. The total labor endowment is allocated to production of composite goods by SOEs and POEs, and to the homogeneous good βE. Since $\int_{z^*}^{\infty} \mu(z)\, \mathrm{d}z = \int_{z^*}^{\infty} z/\bar{z}\, \mu(z)\, dz = 1$, after integrating we obtain

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

[28] The assumption of simultaneous exit and entry in oligopostic trade models with firm heterogeneity is removed in Impullitti et al. (2017). This extension severely affects the model's tractability, and does not change the key selection effects we focus on here.

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 3. 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 $\mu_i(z) = \kappa z_i^{*\kappa} z^{-\kappa-1}$, the mass of firms is $M(\ z_i^*) = (z_i^*/z_{\min})^{-\kappa}$, and the average productivity is $\bar{z}_i = [\kappa/\left(\kappa-1\right)] \, z_i^*$. For simplicity let us normalize $z_{\min}$ to one. The equilibrium cutoff conditions (EC) and (EC$_g$) become

$$(1-\gamma)E = \frac{\kappa}{\kappa-1}\frac{\hat{\lambda}_y n_y}{1-\theta_{\tau,y}} z_y^{*-\kappa} \tag{8}$$

$$\gamma E = \frac{\kappa}{\kappa-1}\frac{\hat{\lambda}_g n_g}{1-\theta_{\tau,g}} z_g^{*-\kappa}. \tag{9}$$

Dividing these equations we obtain the ratio of the two cutoffs,

$$\left(\frac{z_y^*}{z_g^*}\right)^{\kappa} = \frac{\hat{\lambda}_y n_y}{\hat{\lambda}_g n_g}\frac{1-\theta_{\tau,g}}{1-\theta_{\tau,y}} > 1, \tag{10}$$

where the inequality follows from the stronger market power of SOEs coming from the restricted entry assumption, $n_y > n_g$ and $\theta_{\tau,y} > \theta_{\tau,g}$, and from the easier access to credit $\hat{\lambda}_g < \hat{\lambda}_y$. Hence barriers to entry and lower credit constraints make SOEs' survival easier, ultimately leading to lower average productivity compared to POEs. This is in line with the evidence in Figure 2.

Substituting (8) and (9) into the labor market clearing condition (MC) we obtain a closed form expression for expenditure:

$$E = \left[\beta + \frac{\gamma\theta_{\tau,g}}{\kappa} + \frac{\left(1-\gamma\right)\theta_{\tau,y}}{\kappa} + \frac{\kappa-1}{\kappa}\right]^{-1}. \tag{11}$$

Next, we use these equilibrium conditions to characterize the selection and productivity effects of trade liberalization.

Trade liberalization. Equations (8), (9) and (11) show that a change in trade costs affects equilibrium selection only through its effect on markups. In (7) we can see that $\theta_{\tau,y}$ is decreasing in variable trade costs τ, 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. 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. The autarky value $\theta^A_{\tau,y} = (n_y - 1 + \alpha)/n_y$ 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

$$\frac{\partial \theta_{\tau,i}}{\partial \tau} = -\frac{2(\tau-1)(2n_i - 1 + \alpha)^2}{n_i (1+\tau)^3 (1-\alpha)} \leq 0, \tag{12}$$

which shows that incremental trade liberalization increases product market competition.

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 than for SOEs. Differentiating the absolute value of (12) with respect to n we obtain

$$\frac{\partial \left(|\partial \theta_{\tau,i}/\partial \tau|\right)}{\partial n_i} = \frac{2(\tau-1)}{n_i^2 (1+\tau)^3 (1-\alpha)} \left[4n_i^2 - (1-\alpha)^2\right] \geq 0. \tag{13}$$

Hence, reductions in trade costs produce stronger competition effects the lower the oligopolistic inefficiency in the product line. Let $\varepsilon_i \equiv |\partial \theta_{\tau i}/\partial \tau|$ 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 (13) shows that for very high values of restricted entry, a number of firms $\underline{n} = (1-\alpha)/2$, the pro-competitive effect of trade vanishes and $\varepsilon_g = 0$. This result is summarized in the proposition below.

Proposition 1 *Trade liberalization has a pro-competitive effect through the reduction of markups. Due to lower domestic barriers to entry, this effect is stronger for POEs than for SOEs.*

In our simple economy where the number of firms is fixed, a reduction in trade costs reduces domestic markups not because more firms enter the market but because the same number of foreign firms represents a bigger competitive threat for home firms in their market. In our symmetric country world, this effect is bigger the more competitive are both the domestic and the foreign markets. When foreign firms can reach the home market with lower priced goods, they will have a stronger pro-competitive effect if the domestic market is not stiff, that is if there are no barriers protecting the rents of local firms. If there are barriers protecting local firms market shares and profits, the pro-competitive and selection effect will be lower. As we explain more in detail in the discussion in Section 3.3., this effect would hold even in an asymmetric country version of the model as long as in the home country SOEs rents and market shares are more protected than those of private firms.

In a more sophisticated version of this model, where the number of firms is pinned down by free entry, higher barriers to entry would lead to a lower equilibrium number of firms. Trade liberalization would generate a stronger pro-competitive effect on the economy with lower barriers, because trade would induce more new firms to enter (both foreign and domestic). This can be shown numerically in a more sophisticated version of this class of models (see Impullitti and Licandro, 2017, and Impullitti et al., 2017). Our reduced-form modeling of entry barriers (fixed n) is a simple way to provide a version of this mechanism in a tractable framework. Fully modelling entry barriers through a free entry condition would make the key mechanism behind the link between domestic competition and the pro-competitive and selection effects of trade 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 (11) shows that trade liberalization, by reducing markups, reduces the total nominal expenditure on the differentiated good E. Turning to the cutoff conditions (8) and (9), we can see that trade liberalization increases equilibrium cutoffs z_y^* and z_g^*,

$$-\frac{\partial\left(z_y^*\right)^{\kappa}}{\partial\tau} = \frac{\kappa}{(1-\gamma)E(\kappa-1)}\frac{\hat{\lambda}_y n_y}{1-\theta_{\tau,y}}\left(\underbrace{\frac{\partial E}{\partial\tau}\frac{1}{E}}_{\texttt{Indirect}} - \underbrace{\frac{1}{1-\theta_{\tau,y}}\frac{\partial\theta_{\tau,y}}{\partial\tau}}_{\texttt{Direct}}\right) > 0 \tag{14}$$

$$-\frac{\partial\left(z_g^*\right)^{\kappa}}{\partial\tau} = \frac{\kappa}{\gamma E(\kappa-1)}\frac{\hat{\lambda}_g n_g}{1-\theta_{\tau,g}}\left(\underbrace{\frac{\partial E}{\partial\tau}\frac{1}{E}}_{\texttt{Indirect}} - \underbrace{\frac{1}{1-\theta_{\tau,y}}\frac{\partial\theta_{\tau,y}}{\partial\tau}}_{\texttt{Direct}}\right) > 0, \tag{15}$$

where the inequality signs come from $\partial E/\partial\tau > 0$ and $\partial\theta_{\tau,y}/\partial\tau < 0$. The second element in brackets is the direct impact of the reduction in SOE and POE markups on the survival cutoffs. 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. Hence, trade liberalization reduces the survival probability and increases the probability of exit $\Gamma(z_i^*)$ for POEs more than for SOEs. 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. Hence, due to weaker domestic barriers trade generates triggers stronger increase in competition for POEs than for SOEs, which in turn lead to stronger selection effect for the former type of firm.

The first element in brackets 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.[29] A higher real wage, in turn, leads to an increase in production costs for all firms across sectors and triggers selection in all sectors. Moreover, (11) shows that because SOE markups are less responsive to reductions in trade costs, the indirect effect is weaker the larger the share of total expenditure going to SOEs γ.

Proposition 2 *Due to the different pro-competitive effect, trade liberalization generates more selection and reduction in survival probability for POEs than for SOEs.*

Finally, we analyze how the presence of credit constraints shapes the selection effects of trade liberalization. Let $Z = \left(z_y^*/z_g^*\right)^\kappa$ be a measure of the relative cutoff; from (10) we obtain

$$-\frac{\partial Z}{\partial \tau} = \frac{\hat{\lambda}_y n_y}{\hat{\lambda}_g n_g}\left[\frac{\partial \theta_{\tau,g}/\partial \tau}{(1-\theta_{\tau,g})} - \frac{\partial \theta_{\tau,y}/\partial \tau}{(1-\theta_{\tau,y})}\right] > 0, \tag{16}$$

where the inequality derives from $\theta_{\tau,y} > \theta_{\tau,g}$, $|\partial\theta_{\tau,y}/\partial\tau| > |\partial\theta_{\tau,g}/\partial\tau|$, which clearly shows that $-\partial^2 Z/\left(\partial\tau\partial(\hat{\lambda}_y/\hat{\lambda}_g\right) > 0$. This suggests that the larger the cost wedge produced by credit frictions for POEs, $\hat{\lambda}_y/\hat{\lambda}_g > 1$, the stronger the selection effects of trade liberalization.[30] Larger fixed costs imply that firm survival is more sensitive to the cash flow reductions brought about by trade-induced increases in competition. Intuitively, a reduction in markups induces firms to scale back production

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

[30] Recall that from (10) we know that $z_y^*/z_g^* > 1$ and from Proposition 2 that trade liberalization has a positive effect on both cutoffs.

in order to survive, but in the presence of large fixed costs the reduction in variable costs obtained by downsizing is less likely to succeed and firms are more likely to be forced out of the market. It follows that better access to credit allows SOEs to weather international competition better than POEs. Notice also that (14) and (15) suggest that a higher debt ratio (debt to capital) d/λ leads to a stronger selection effect for both POEs and SOEs, but when the cost of credit is very low the effect of debt on selection becomes negligible; that is, for $\delta_i \to 1$ $\hat{\lambda}_i \to \lambda$.

Note that, the two types of firms have the same debt ratio (debt to capital) d/λ, but due to preferential access to credit borrowing is cheaper for SOEs. Therefore, overall fixed costs are lower for these firms compared to POEs. This result is robust to removing the assumption that SOEs and POEs have the same debt ratio and financial fragility. More precisely, if $\delta_g/\delta_y > (d_g - t_g) / (d_y - t_y)$ then $\hat{\lambda}_y > \hat{\lambda}_g$; that is, when SOEs borrow more than POEs, if the difference in the cost of borrowing is large enough POEs will always end up with a higher fixed cost.

Proposition 3 *Due to weaker credit constraints, trade-induced selection is weaker for SOEs than for POEs.*

Finally, it is worth noticing that the other special features of SOEs discussed in Section 2, such as access to land and preferential access to public procurement, would affect trade-induced selection through a similar mechanism. Preferential access to land can reasonably entail lower fixed operating costs and, similar to better access to banks, weaken the selection effects of trade. Preferential access to public procurement and any other subsidy could undo the impact of trade on firms' market shares and total profits, thereby taming the effects of foreign competition.

Proposition 4 *Trade liberalization increases average productivity for POEs more than for SOEs.*

As in most standard models of trade with firm heterogeneity, selection leads to aggregate efficiency gains by increasing the level of aggregate productivity: Average productivity in both the SOE- and POE-dominated sectors, $\bar{z}_i = [\kappa/(\kappa - 1)]\, z_i^*$, increases with the survival cutoff. However, the entry and exit protection (via access to credit) granted to SOEs implies that trade-induced selection is lower for

SOEs than for POEs and, as a consequence, average productivity increases more in POE-dominated sectors than in sectors where SOEs are predominant.

Below we summarize the hypothesis that we test in the empirical analysis which broadly represent the predictions of the model. As multilateral trade liberalization kicks in:

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

H2: Easier access to credit tames the selection effect for SOEs.

H3: Markups decrease for POEs, but to a lesser extent or not at all for SOEs.

H4: Average productivity increases more in POE-dominated sectors than in SOE-dominated sectors.

Proposition 1 in the model suggests that trade has a stronger pro-competitive effect on POEs than on SOEs because of the weaker domestic barriers to entry experienced by private firms, and Proposition 2 posits that due to the stronger pro-competitive effect SOEs experience a larger increase in selection after liberalization. H1 and H3 are the corresponding empirical tests of this result. Proposition 3 in the model suggests that trade-induced selection is weaker for SOEs because of their easier access to credit. H2 provides a direct test of this theoretical link. Finally, H4 is a straightforward test of Proposition 4.

3.3 Discussion

Before moving to the empirical analysis, we briefly discuss the robustness of the theoretical results to removing some simplifying assumptions of the baseline model. First we show that the main results hold in an economy where POEs and SOEs varieties feature an arbitrary degree of substitutability. Second, we explore how removing the assumption of symmetric countries would affect the results. Third, we discuss our modeling choice in the context of other models with variable markups in the literature.

Mixed markets. In the benchmark model, SOE and POE differentiated varieties enter Cobb-Douglas in the utility function, so they feature a unitary elasticity of substitution. Here we briefly extend the model to capture those industries where both types of firms compete more directly for market shares, thereby having an arbitrarily large elasticity of substitution. Intuitively, when SOE and POE goods are more substitutable, we should observe a stronger general equilibrium effect of trade in (14) and (15). The structure of the model remains mostly unchanged, with the sole exception that the differentiated good X is now produced with the following technology:

$$X = \left(\int_0^{M_g} g_j^\alpha \, \mathrm{d}j + \int_0^{M_y} y_j^\alpha \, \mathrm{d}j \right)^{\frac{1}{\alpha}}. \tag{17}$$

We keep the key features distinguishing POEs and SOEs; that is, different market power and access to credit. In line with the benchmark model and following the recent literature on "mixed markets" (e.g., Shimomura and Thisse, 2012, and Parenti, 2016) we do not model entry, and assume the differentiated goods industry is populated by firms with different market power.

In the appendix we show that this version of the model fully preserves the key results: The pro-competitive effect of trade is stronger for POEs than for SOEs, and trade liberalization affects survival more for private firms than for state-owned firms. The model becomes less tractable, but in a special case we can prove that the stronger pro-competitive effect of trade leads to stronger selection for POEs than for SOEs, and this effect is more powerful the more credit constrained are POEs compared to SOEs. Unfortunately we cannot pin down analytically the additional general equilibrium effects that one would expect when SOEs and POEs varieties are more substitutable, and compare with the unit elasticity cases in (14) and (15). Intuitively, though, with high substitutability the stronger pro-competitive effect experienced by POEs should trigger a larger shift of market shares toward these firms, as consumer substitute for cheaper goods, thereby reducing the market share of SOEs. These demand reallocations generate additional selection for SOEs, so that the difference in trade-induced selection between private, and state-owned firms is tamed. However, since the pro-competitive effect is stronger for POEs than for SOEs, the selection effect is always stronger for private firms and this will always be the case as long as SOEs are more protected and have easier access to credit. Hence, we can reasonably expect that this generalization will not affect the key results qualitatively, although it probably would be relevant quantitatively.

Asymmetric countries. In order to keep the model tractable, we assumed that countries are symmetric. This assumption is restrictive because it implies that Vietnamese firms open up to an economy similarly populated with SOEs and POEs. As a consequence, Vietnamese SOEs compete with foreign SOEs, which are similarly protected from entry and enjoy similar preferential access to credit. How would the key results change if we remove this assumption? One could argue that if the foreign country is populated only with private firms operating in highly competitive markets, then the pro-competitive effect of trade on all Vietnamese firms will be high. This would imply amending the model assuming that Vietnam's trading partners are mostly firms from advanced countries with low domestic barriers to entry. Hence, we could assume that the number of foreign firms n^* is larger than the number of domestic firms: $n^* > n_y > n_g$. In this case the pro-competitive effect of trade liberalization would indeed be stronger for both SOEs and POEs in Vietnam compared to our benchmark economy, but as long as we keep the assumption that domestic market entry is more restricted for SOEs than for POEs, $n_y > n_g$, trade liberalization would still have stronger pro-competitive and selection effects on POEs compared to SOEs.

Modeling choice. Finally we discuss our modeling choice, asking how our results would be affected if instead of choosing the "road less traveled" of oligopoly trade, we adopted the standard model of trade and firm heterogeneity with variable markups of Melitz and Ottaviano (2008); (MO henceforth). In this model variable markups are obtained by replacing CES with quadratic preferences in a monopolistically competitive economy. To convey intuition it suffices to introduce credit constraints in the basic MO model and analyze their role together with the role of entry barriers in shaping the selection effect of trade. The full model with POEs and SOEs, where the latter are less credit constrained and are protected by higher entry barriers than the former, would complicate the analysis sensibly without adding much to the key channels.

First we explore the role of entry barriers in the basic MO model. Then we introduce credit constraints which require a few important departures from the basic setup. In order to stay close to the original MO notation let the cost draw of a firm be $c = 1/z$, where z is the firm productivity, and in line with the experience of WTO access of any country, let us focus on multilateral trade liberalization. For simplicity we assume that trade costs of the two countries are symmetric, but let entry costs differ across countries. The survival cost cutoff for firms in the Home country is

$$c_D^H = \left(\frac{\gamma}{L^H}\right)^{\frac{1}{k+2}} \left[\frac{1}{1-\rho^2}\phi^H - \frac{\rho}{1-\rho^2}\phi^F\right]^{\frac{1}{k+2}}, \tag{18}$$

where $\rho \equiv (\tau)^{-k} < 1$ indicates the freeness of trade, and $\phi^j = 2(\kappa+1)(\kappa+2)\,(c_M)^\kappa\, f_E^j$ with $j = H, F$, for the home and foreign countries respectively, embeds the difference in the sunk entry cost f_E^H;[31] $c_M = 1/z_{\min}$, κ is the shape of the Pareto cost/productivity distribution, and L^H is the size of the home country. The cutoff equation (18) shows that trade liberalization, an increase in ρ, has a positive selection effect on home firms; that is, it reduces their survival cost cutoff c_D via the second term in the square brackets. But this outcome can be offset by a negative selection effect through the first term, and this is increasing in home barriers to entry ϕ^H. Hence, if the first effect dominates, trade has the typical selection effect which reduces home firms' survival probability, but this effect is weaker the larger home barriers to entry.

Intuitively, trade induces selection through a pro-competitive effect: Lower trade costs lead to entry of more domestic and foreign firms, which in turn leads to lower markups and more selection. Higher domestic barriers to entry weaken the pro-competitive effect of trade by reducing entry of domestic firms which, in turn, leads to weaker selection.[32] Hence, in line with our results in H1 and H3, the MO model predicts that the selection and the pro-competitive effects of trade is weaker for firms operating in less competitive markets. The economic mechanism is similar to what we would obtain in a version of our model with free entry. As discussed above, in our model with free entry, higher barriers to entry would lead to a lower equilibrium number of firms. Trade liberalization produces a stronger pro-competitive effect when barriers are lower, not only because the number of firms pre-liberalization is lower, but also because trade induces new firms to enter and this effect would be lower the higher the entry barriers. Our model without free entry presents a simple version of this mechanism. Since

[31] This is the asymmetric country version of eq. (23) in MO.

[32] The markup depends negatively on the number of firms in the economy, which is a fuction of the domestic cutoff,

$$N^H = \frac{2\,(k+1)\,\gamma}{\eta}\,\frac{\alpha - c_D^H}{c_D^H}.$$

Higher entry costs imply lower pro-competitive and the selection effect of trade.

the MO stays tractable with free entry, it is helpful to illustrate the full economic mechanism behind the link between entry barriers and the selection effect of trade, but it does not essentially add any new result or intuition.[33]

We now move to the role of credit constraints. In order to do that we need to introduce fixed operating costs into the model. The original MO model does not need fixed operating costs to generate selection because the preference structure produces a finite price, the "choke price", that makes demand zero. This price limit is sufficient to pin down the survival cutoff. If one wants to add fixed costs, the choke price cannot be used to determine the survival cutoff anymore and the model loses its tractability. We develop a version of MO with credit constraints on both the domestic and the export fixed operating costs. Although the model is less tractable and more convoluted, for the case of symmetric countries we are able to perform comparative statics with respect to trade liberalization and also to show that the selection effect of trade is stronger the higher the credit constraints. We leave details to the appendix. Here we show that the free entry condition is

$$b_1 c_D^{k+2} + b_2 \sqrt{\hat{\lambda}} c_D^{k+1} + \rho b_1 \left[c_D + 2\sqrt{\frac{\gamma}{L}} \left(\sqrt{\hat{\lambda}} - \sqrt{\hat{\lambda}_X} \right) \right]^{k+2} + \rho b_2 \sqrt{\hat{\lambda}_X} \left[c_D + 2\sqrt{\frac{\gamma}{L}} \left(\sqrt{\hat{\lambda}} - \sqrt{\hat{\lambda}_X} \right) \right]^{k+1} = f_E,$$

where b_1 and b_2 are a combination of parameters and, as in our model, $\hat{\lambda} = \left[1 + \frac{1-\delta}{\delta}(d-t)\right]\lambda$ is the domestic fixed cost augmented for the cost of financing it externally. For completeness we have added a fixed export cost, which is also subject to constraints, $\hat{\lambda}_X = \left[1 + \frac{1-\delta}{\delta}(d-t)\right]\lambda_X$, but this is not necessary for the key argument. Notice that, different from the benchmark MO model, free entry does not lead to a closed form solution for the surviving cutoff anymore. Nevertheless, using the implicit function theorem we can show,

$$\frac{\partial c_D}{\partial \rho} = -\frac{\frac{\partial F}{\partial \rho}}{\frac{\partial F}{\partial c_D}} < 0,$$

[33] Notice, though, that in order to obtain this result in MO it is important to have asymmetric countries. If we assume that the two countries have the same entry costs (18) becomes

$$c_D^H = \left(\frac{\gamma}{L^H}\right)^{\frac{1}{k+2}} \left[\frac{1}{1+\rho}\phi\right]^{\frac{1}{k+2}},$$

and the selection effect of trade increases in the entry cost.

where F is the free entry condition.[34] Hence the standard selection effect of trade applies. Moreover,

$$\frac{\partial^2 c_D}{\partial\rho\partial\sqrt{\hat{\lambda}}} = -\left(\frac{\frac{\partial^2 F}{\partial\rho\partial\sqrt{\hat{\lambda}}}\frac{\partial F}{\partial c_D} - \frac{\partial^2 F}{\partial c_D\partial\sqrt{\hat{\lambda}}}\frac{\partial F}{\partial\rho}}{\left(\frac{\partial F}{\partial c_D}\right)^2}\right) < 0,$$

which suggests that the selection effect of trade is increasing in the fixed cost and, therefore, increasing in credit constraints. Hence, the result that larger credit constraints on fixed operating costs lead to a stronger selection effect presented in H2 holds also in an appropriately augmented version of MO.

In order to analyze the role of the entry cost in shaping the selection effect of trade, in this version of MO with fixed operating costs and credit constraints it is necessary, as in the case of the standard MO model, to have country asymmetry in the entry costs. Unfortunately, the asymmetric country version of this model is not tractable for our purposes; that is, it is not possible to sign the effect of the entry cost on the selection effect of trade. In the appendix we show that, with symmetric countries $\partial^2 c_D / (\partial\rho\partial f_E) < 0$, the selection effect of trade is stronger the higher the entry costs. As we will see next, our empirical analysis shows that entry barriers reduce instead of magnifying the competition and selection effects of trade. Thus the symmetric countries version of MO with credit constraints has counterfactual predictions on the role of entry costs.

Taking stock, versions of Melitz and Ottaviano (2008) generate the same predictions as our model regarding both the role of entry barriers and that of credit constraints. Compared to our framework, MO remains tractable with free entry and shows more transparently how the pro-competitive and selection effects of trade are weaker when domestic markets are less competitive. Country asymmetries are crucial for this prediction. Unfortunately, introducing fixed costs and credit constraints makes the model untractable for the relevant comparative statics, which can be performed only in the case of symmetric countries, which leads to counterfactual predictions on the role of entry costs. Our key results can be obtained in versions of MO, but our framework is simpler, fully tractable, and, as we see next, delivers empirically robust predictions. These are the reasons for choosing our model for the question at hand.

[34] Function F is defined as, $F = b_1 c_D^{k+2} + b_2\sqrt{\hat{\lambda}}c_D^{k+1} + \rho b_1\left[c_D + 2\sqrt{\frac{\gamma}{L}}\left(\sqrt{\hat{\lambda}} - \sqrt{\hat{\lambda}_X}\right)\right]^{k+2} + \rho b_2\sqrt{\hat{\lambda}_X}\left[c_D + 2\sqrt{\frac{\gamma}{L}}\left(\sqrt{\hat{\lambda}} - \sqrt{\hat{\lambda}_X}\right)\right]^{k+1} - f_E$.

4 Empirical Analysis

In what follows, we test the main propositions of our model using the Vietnamese firm-level data described in Section 2. Data cover only manufacturing industries. The core of the empirics focuses on the firm-level analysis to test H1, H2, and H3. In the last part of the empirics, using industry-level analysis we test the effect of WTO on productivity at the industry level (H4), and by means of a simple counterfactual exercise we provide a first, partial, assessment of the foregone productivity gains from trade due to the presence of SOEs.

4.1 Firm-Level Analysis

Main Variables and Sample. In line with our hypotheses, we have two dependent variables, *Exit* and *Markups*, described in Section 2. Our main independent variables are a dummy scoring one if a firm is private (POE_{fi}), MFN tariff cuts ($\Delta\tau_{i,t}$), which are the tariff cuts implemented by the Vietnamese government after the accession to the WTO, and their interaction. 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. Importantly, we include a dummy for foreign firms in every models so that the baseline is always SOEs.[35] 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 (H1). Similarly, we expect that POE markups decline as MFN tariff cuts increase, whereas we expect the relationship between markups and tariff cuts to be weaker or even not statistically significant for SOEs (H3).

We rely on triple interaction terms. Specifically, we interact $POE_{fi} \times \Delta\tau_{i,t}$ with $Firm's\ Debt_{fi,t}$ to test the role of credit constraints (H2). Because of easier access to credit, we expect that POEs' debt increases their probability of exiting the market, whereas SOEs' debt should have no effect on SOEs' probability of exiting the market.

In our most extensive analysis, we estimate a sample of 46,212 Vietnamese firms between 2006 and 2012 for *Exit*.[36] We analyze the effect of trade liberalization on up to 118 manufacturing products

[35]In the main models we do not include the interaction terms of foreign firms to ease the interpretation of the main coefficients of interest. However, all the main results are virtually the same if we include the interaction terms of foreign firms (see Figures A4, A5, and A8 in the appendix).

[36]Less than 2% of firms in the original sample switches category, e.g., from POE to SOE or from POE to foreign firm.

(ISIC 4-digit) for which tariff data are available. Our main models are estimated using OLS regression with robust standard errors clustered at the firm level.

Econometric Strategy. Our empirical strategy boils down to a difference-in-differences with elasticities. *POE* is our treatment, which distinguishes firms according to the type of ownership. $\Delta\tau$ captures the magnitude of trade liberalization for each industry i, which kicks in after the accession to the WTO, that is, after 2007.

Our firm-level analysis faces several identification challenges. The first threat to inference we face is the large difference in the covariates observed between private firms and SOEs. Indeed, our preliminary look at the data in Section 2 has shown that the SOEs tend to be larger than private firms; we also find that they are more capital intensive and have more assets than the POEs.[37] In econometric terms, the observations are unbalanced with respect to the dummy variable *SOE*. 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 entropy balancing (Hainmueller, 2012). This technique is similar to propensity matching, but it has the welcome feature that unbalanced observations are not dropped from the analysis. Specifically, by using entropy balancing observations are re-weighted with respect to the treatment (i.e., SOE) so that all the relevant covariates are balanced (i.e., they have the same mean). In econometric terms, entropy balancing reweights the observations to statistically generate a region of common support where private and public companies are comparable on structural covariates.[38]

Table A1 (bottom) in the appendix shows the means of private goods and state goods before and after balancing. By using entropy balancing, the difference in means between private goods and state goods is substantially reduced and is never statistically significantly different from zero. Importantly, we balance all the *exogenous* control variables with respect to POE, i.e., Size, Assets, Capital-labor

We drop these observations, since the type of ownership is exogenous in our model. In other words, the dummy *POE* is at its baseline value, a decision that does not affect our results.

[37]Table A1 (top) in the appendix shows how the relevant covariates are unbalanced between POEs and SOEs.

[38]Entropy balancing does this by directly incorporating covariate balance into the weight function that is applied to the sample units. The net result is that we can compare SOEs to a comparable counterfactual of private firms. We perform this exercise using "ebalance" in Stata 14, the software created by Hainmueller (2012). We adjust the covariates, using the first moment, i.e., we set target equal to one.

ratio, MFN tariff, Exports, US PTA, Age, and Age^2. The endogenous variables, e.g., markups and firm's debt, *are not* included in entropy balancing. Then we run our main models using the weights obtained from entropy balancing.

Second, following Angrist and Pischke (2009), we include industry-specific (4-digit) time trends to check if the parallel trend assumption holds. The inclusion of such variables accounts for sectorial 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 conditions 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 industry i at time t over Vietnam's GDP and Vietnam's real interest rate, including industry and year fixed effects.[39] 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.

Finally, we address the concern of a possible endogeneity of MFN tariff cuts, which could potentially invalidate our empirical strategy. In line with Topalova and Khandelwal (2011), we show that TFPR and markups do not predict MFN tariff cuts, that is, neither productivity nor markups are statistically significant in estimations in which MFN cuts are the outcome variable (see Table A2 in the appendix). This is the case even when we interact both productivity and markups with *SOE Labor Share*. 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 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

[39] We are unable to use the real exchange rate instead of the real interest rate due to a lack of data.

industry-level characteristics.[40]

H1: Exit and MFN Tariff Cuts. 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 model:

$$Pr(Exit_{fi,t} = 1) = \beta_0 + \beta_1 POE_{fi} + \beta_2 \Delta\tau_{i,t-1} + \beta_3 POE_{fi} \times \Delta\tau_{i,t-1} + \beta_4 X_{fi,t} + \beta_5 W_{i,t} + \delta_i + \delta_t + \epsilon_{fi,t}, \quad (19)$$

where δ_i are industry (HS 4-digit) fixed effects to account for heterogeneity across products, and δ_t are year fixed effects. The key coefficient of interest is β_3 , which should be positive. X and W are vectors including, respectively, firm-level and industry-level covariates. Following Bernard et al. (2006), we control for a set of confounding factors which might affect *Exit* and are correlated with our main independent variables.[41]

At the firm level, we control for the logged number of employees, which is a proxy for size. We expect that large firms are less likely to exit the market compared to small firms. We also include the log of assets, and the capital-labor ratio, which are proxies for capital intensity. Moreover, as it is customary, we include a variable measuring the number of years since a given firm entered the market and began business operations (i.e., *Age*) and its square value.

At the product level (4-digit), we include (logged) values of exports to capture comparative advantage sectors, which should experience a lower rate of exit. Unfortunately, we do not have data on export activities at the firm level. We also include a variable capturing market power, calculated using the Herfindahl–Hirschman index, and preferential tariff cuts implemented in the bilateral trade agreement (BTA) between the US and Vietnam. It has been argued that the BTA was used as a stepping stone for Vietnam's accession to the WTO.[42] We also include the difference between MFN

[40] Part of the WTO accession requirements was about the reform of SOEs and other corporate governance measures. Details of these reforms can be found at `https://www.wto.org/english/thewto_e/acc_e/a1_vietnam_e.htm`. Since Vietnam accession to the WTO was negotiated for a number of years and firms have started readjusting their operations in advance, we acknowledge that this may pose a threat to our identification strategy. However, since our key independent variables are interaction terms between a dummy for SOEs and other covariates such as tariff cuts, productivity, and markups, it is unlikely that the endogeneity of SOEs affects our results.

[41] Table A3 in the appendix shows descriptive statistics of all the variables described below.

[42] 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`. For a paper showing the effect of the BTA with the US on the Vietnamese economy, see McCaig (2011).

tariff in 1999 and MFN tariff in 2006, 2007, ... 2012 to account for the impact of negotiations to enter the WTO on the outcome of interest. Indeed, it may be that the WTO affected firm's exit in the negotiation period rather than after Vietnam's accession. We label this variable $\Delta\tau_{1999}$.[43] We run OLS regressions with standard errors clustered at the level of the firm.[44]

Table 3 shows the main results of this analysis. We estimate several models as from equation 19. We begin with estimates without controls and weights from entropy balancing (columns 1 and 2) and then we include both of them (Models 3 and 4) together with industry-year fixed effects and industry-specific trends (columns 5 and 6). In our most demanding model specification, we include firm fixed effects to control for firm-specific characteristics (column 7).[45] Results indicate that the probability of exiting the market increases with MFN tariff cuts for POEs, whereas it decreases for SOEs, as can be observed from the positive sign of the coefficient of the interaction term (i.e., POE and $\Delta\tau$). Importantly, the interaction term is significant in every estimates (see columns 1-6).

To ease the interpretation of the interaction terms, we rely on Figure 4, which shows the probability of exiting the market for POEs and SOEs at different levels of tariff cuts.[46] While the exit rate for POEs increases with the magnitude of the MFN cuts, the same is not true for SOEs, which display a negative slope. However, the negative slope of SOE should be taken cautiously. Indeed, there are only 38 SOEs operating in industries with tariff cuts larger than 20 and only seven SOEs left the market in industries with tariff cuts larger than 10. Thus, there is the risk of extrapolating the linear predictions of SOE or, at the very least, there is the risk that only a few observations are driving the results.

To address this concern, we re-run our main models, replacing MFN tariff cuts with a dummy that scores one after Vietnam's accession to the WTO, i.e., after 2007. While results are reported in Table A4 in the appendix, Figure 5 shows the graphical results of the interaction term. The slope of POE

[43]We rely on 1999 MFN since data of pre-1999 tariffs are either unavailable or availble for only a limited number of industries.

[44]Our results are very similar if we rely on logit or probit modes, though we lose some obervations due to incidental parameters. Our results are similar if we cluster standard errors at the level of the industry (4-digit) or if we double-cluster standard errors at the level of the firm and the industry.

[45]We are impeded to include POE, since it does not vary over time.

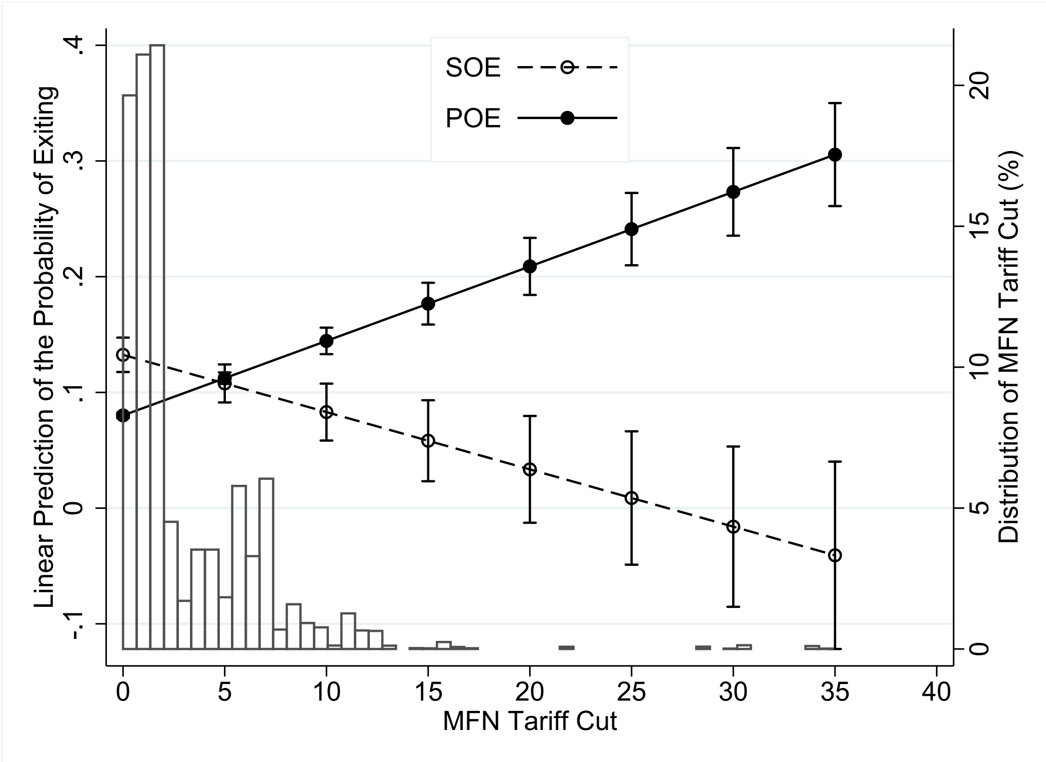
[46]In testing our hypotheses, we always plot the linear predictions of POE and SOE separately. The difference between the two slopes for each value of the moderator would give the marginal effect of the dummy POE on the outcome of interest, which is the coefficient of the interaction terms reported in the tables.

Table 3: POE vs. SOE: exit and MFN tariff cuts. OLS regressions with standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	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)
POE	-0.002***	-0.005***	-0.005***	-0.005***	-0.007***	-0.005***	
	(0.000)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	
MFN Tariff Cut	0.050***	0.018	0.004	0.004	-0.001	0.005	-0.001***
	(0.003)	(0.017)	(0.017)	(0.017)	(0.016)	(0.014)	(0.000)
POE*MFN Tariff Cut	**0.002*** **	**0.015*** **	**0.011*** **	**0.011*** **	**0.011*** **	**0.011*** **	**0.0003* **
	(0.000)	**(0.002)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.000)**
Constant	-0.062***	-0.075***	0.631***	1.928***	0.990***	320.557	
	(0.002)	(0.009)	(0.069)	(0.435)	(0.096)	(882.376)	
Observations	226,050	225,564	224,982	224,982	225,564	224,982	224,982
R-squared	0.038	0.157	0.346	0.346	0.360	0.357	0.672
Controls	NO	NO	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES	YES	NO
Business control	NO	NO	NO	YES	NO	NO	NO
Industry-year FE	NO	NO	NO	NO	YES	NO	NO
Trends	NO	NO	NO	NO	NO	YES	NO
Firm FE	NO	NO	NO	NO	NO	NO	YES

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

Figure 4: POE vs. SOE: the effect of MFN tariff cuts on firm's exit.



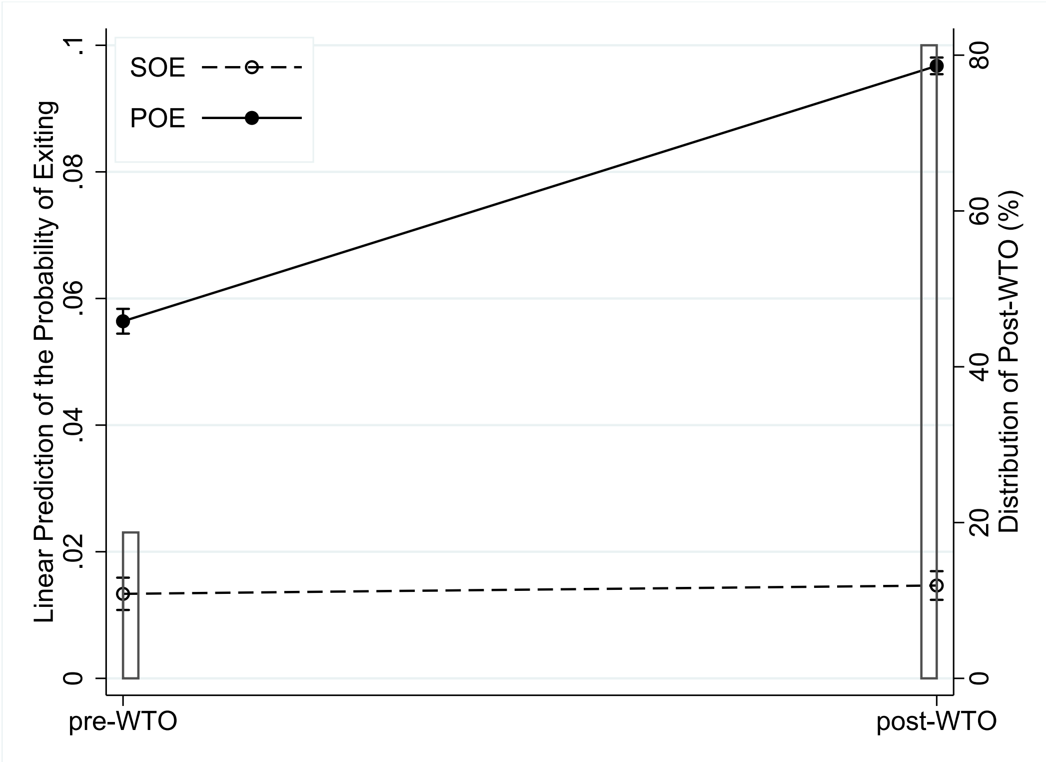
Note: The predictions are plotted from column 3 in Table 3. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered at the firm level. The histogram shows the distribution of $\Delta\tau$.

is positive, whereas the slope of SOE is completely flat.[47] Thus, in line with the theory, Vietnam's WTO accession generate a selection effect for both POE, but not for SOE. All in all, these results strongly validate our first hypothesis.

H2: Exit, MFN Tariff Cut, and Firm's Debt. A key difference between POEs and SOEs is that SOEs have lower credit constraints than POEs. To directly test the mechanism highlighted by the model, we estimate the following model, which includes a triple interaction term between POE, tariff cuts, and firm's debt:

[47]The models do not include year fixed effects as they correlate with the post-WTO accession dummy. Results are similar if we include year fixed effects and drop the post-WTO dummy, leaving its interaction with POE.

Figure 5: POE vs. SOE: the effect of the WTO accession on firm's exit



Note: The predictions are plotted from column 2 in Table A4. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered at the firm level. The histogram shows the distribution of the dummy capturing Vietnam's WTO accession.

$$\begin{aligned} Pr(Exit_{fi,t} = 1) = {} & \kappa_0 + \kappa_1 POE_{fi,t} + \kappa_2 \Delta\tau_{i,t-1} + \kappa_3 ln(Firm's\ Debt)_{fi,t} + \kappa_4 POE_{fi,t} \times \Delta\tau_{i,t-1} \\ & + \kappa_5 POE_{fi,t} \times ln(Firm's\ Debt)_{fi,t} + \kappa_6 \Delta\tau_{i,t-1} \times ln(Firm's\ Debt)_{fi,t} \\ & + \kappa_7 POE_{fi,t} \times \Delta\tau_{i,t-1} \times ln(Firm's\ Debt)_{fi,t} + \kappa_8 X_{fi,t} + \kappa_9 W_{i,t} + \delta_i + \delta_t + \epsilon_{fi,t}, \end{aligned} \quad (20)$$

where the key coefficient of interest is κ_7, which is expected to be positive. As is common practice with a triple interaction term, we include double interaction terms for each combination of POE, $\Delta\tau$, and *Firm's Debt*. Moreover, we include the same controls X and W as in equation 19, since the outcome variable is the same. We run OLS regressions with standard errors clustered at the level of the firm.[48]

Results of equation 20 are reported in Table 4. Before estimating the triple interaction term, we start running a model with a simple interaction term between $\Delta\tau$ and *Firm's Debt*. The coefficient

[48] Our results are very similar if we rely on logit or probit modes, though we lose some obervations due to incidental parameter. Our results are similar if we cluster standard errors the level of the industry (4-digit) or if we double-cluster standard errors at the level of the firm and the industry.

of this interaction term is negative and statistically significant, implying that access to credit reduces the probability of firms exiting the market (column 1). Columns 2-8 show the results of the triple interaction term, which is always positive (as expected) and significant. As for the previous hypothesis, we start running a simple model with no controls and then add them together with weights from entropy balancing. Importantly, our results hold when we include industry-year fixed effects (column 6), trends (column 7), and firm fixed effects (column 8).

The crucial test is reported in Figure 6, which refers to Model 4 and plots the marginal effect of MFN tariff cuts on the probability of exiting. Remember that *Firm's Debt* is our proxy of credit constraints: for the same level of debt POEs face substantively higher costs than SOEs. As expected, *Firm's Debt* increases the probability of POEs leaving the market in case of trade liberalization and the effect is statistically significant. On the contrary, as *Firm's Debt* increases, the probability of SOEs exiting the market remains unchanged. Indeed, the confidence interval of $\Delta\tau = 0$ overlaps with the confidence interval of $\Delta\tau = 35$, meaning that the 2-point estimates have the same probability of occurrence.

Similar to H1, there is the concern that only a few observations are driving the results for *SOE*. The concern is even more severe in this case, because we rely on a triple interaction term, which leaves little variation to explain. To address this concern, we re-run our main models replacing MFN tariff cuts with a dummy scoring one after 2007, i.e., after Vietnam's accession to the WTO. Figure 7 shows the graphical effect of the triple interaction term (Table A5 in the appendix reports the results). In line with our theory, as POEs' debts increases, they are more likely to exit the market in the post-WTO period compared to the pre-WTO period. On the contrary, the slope of *SOE* is flat, i.e., SOEs' debt does not affect their probability of exiting the market differentially in the pre- and post-WTO period. This result is in line with the theoretical model: When trade liberalization kicks in, POEs are more likely to leave the market as they face higher credit constraints and, in turn, higher fixed costs than SOEs do. The negligible effect of debt on exit for SOEs corresponds to $\delta_g \approx 1$ in the model, a situation in which the cost of credit is so low that the level of debt does not affect trade-induced selection.

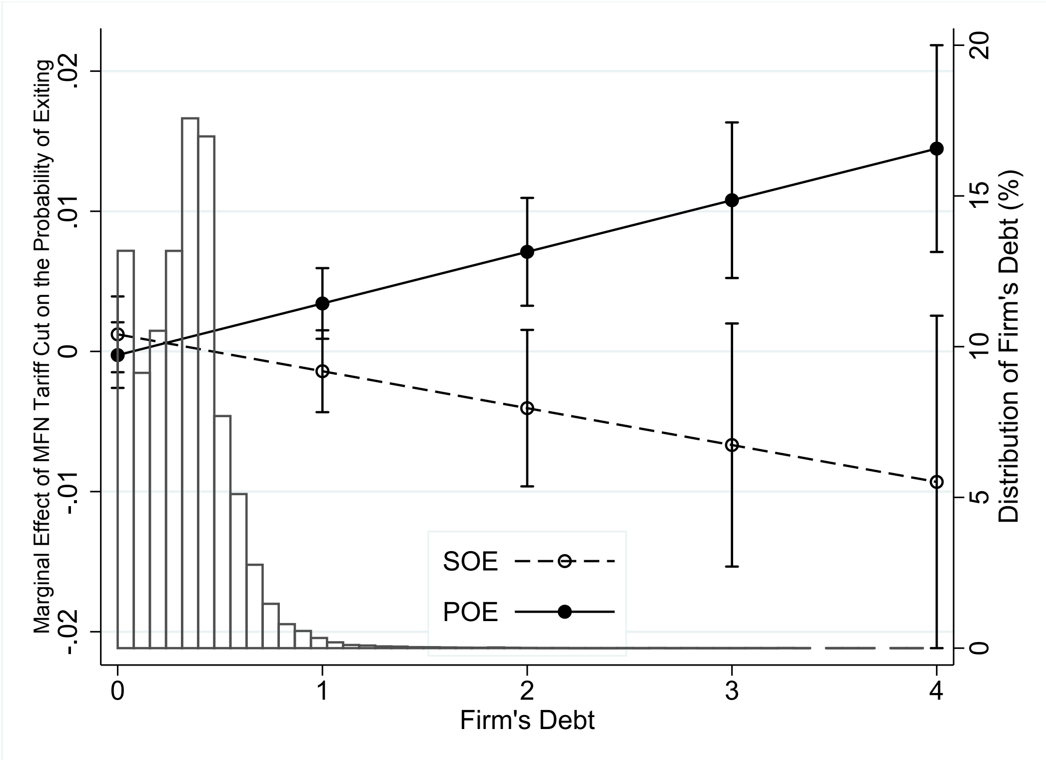
Finally, we include the interactions of both POE and tariff cut and firm's debt and tariff cut on the

Table 4: POE vs. SOE: exit, MFN tariff cuts, and firm's debt. OLS regressions with standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	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)
POE	0.049***	0.078***	0.066***	0.023**	0.023**	0.019*	0.022**		0.048***
	(0.009)	(0.002)	(0.005)	(0.011)	(0.011)	(0.010)	(0.011)		(0.009)
MFN Tariff Cut	0.002	-0.002***	0.001	0.001	0.001	0.001	-0.000	-0.003***	0.002
	(0.001)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.000)	(0.001)
Firm's Debt	0.028***	0.012***	-0.002	0.004	0.004	0.005	0.007	0.010***	0.028***
	(0.009)	(0.004)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.003)	(0.009)
MFN Tariff Cut*Firm's Debt	-0.004***	-0.001	-0.002	-0.003	-0.003	-0.003	-0.003	-0.001	-0.004***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
POE*MFN Tariff Cut		0.000	-0.001	-0.001	-0.001	-0.001	-0.001	0.003***	0.001
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
POE*Firm's Debt		0.044***	0.066***	0.072***	0.072***	0.070***	0.068***	0.000	
		(0.006)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.004)	
POE*MFN Tariff Cut*Firm's Debt		**0.007*** **	**0.007*** **	**0.006*** **	**0.006*** **	**0.006*** **	**0.006*** **	**0.004*** **	
		(0.001)	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**	**(0.001)**	
Constant	-0.011	-0.110***	-0.074***	0.011	0.007	0.054**	10.855		-0.011
	(0.026)	(0.006)	(0.008)	(0.028)	(326.100)	(0.021)	(16.748)		(0.026)
Observations	129,125	129,466	129,459	129,125	129,125	129,459	129,125	129,459	129,459
R-squared	0.099	0.050	0.067	0.101	0.101	0.108	0.111	0.741	0.741
Controls	YES	NO	NO	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	YES	NO	YES	YES	YES	YES	YES	NO	NO
Business control	NO	NO	NO	NO	YES	NO	NO	NO	NO
Industry-year FE	NO	NO	NO	NO	NO	YES	NO	NO	NO
Trends	NO	NO	NO	NO	NO	NO	YES	NO	NO
Firm FE	NO	NO	NO	NO	NO	NO	NO	YES	YES

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

Figure 6: POE vs. SOE: The effect of firm's debt on firm's exit (MFN tariff cuts).

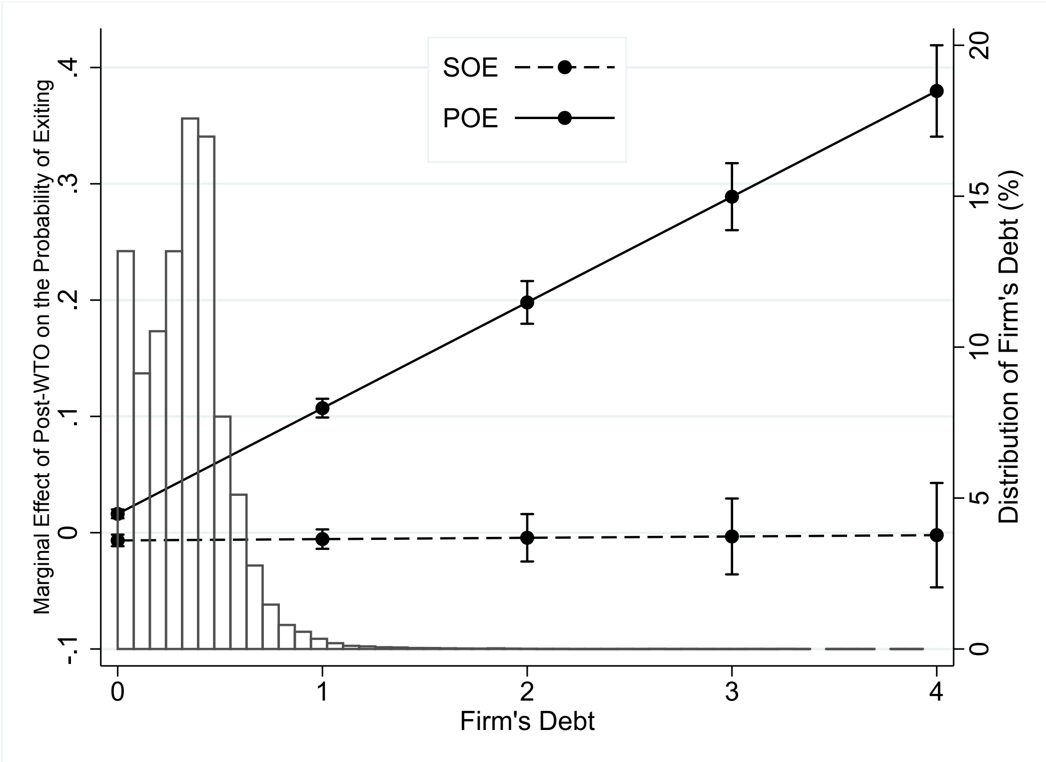


Note: The predictions are plotted from column 4 in Table 4. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered at the firm level. The histogram shows the distribution of $ln(Firm'sDebt)$.

right-hand-side of the model (column 9). The rationale is that we try to "kill" the interaction between POE and MFN tariff cuts with what our model suggests is the mechanism that shelters SOEs from trade liberalization. Indeed, while the coefficient of the interaction between POE and MFN tariff cuts loses significance, the coefficient of the interaction between firm's debt and tariff cut remains negative and significant. This test allows us to pin down the key difference between POEs and SOEs, i.e., access to credit, which generates a diverging selection effect in the case of trade liberalization. Our results strongly validate H2: Access to credit is the mechanism explaining why POEs and SOEs behave differently in the case of trade liberalization.

Robustness Checks. We perform several tests to check the robustness of our results. First, a characteristic of Vietnamese POEs is that the state might own a percentage of their capital. In other words, there are some POEs that rely on exclusive private capital and others that rely on a mix of private and public capital. We re-estimate the main models distinguishing between these two types

Figure 7: POE vs. SOE: The effect of firm's debt on firm's exit (post-WTO).



Note: The predictions are plotted from column 3 in Table A7. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered at the firm level. The histogram shows the distribution of the dummy capturing Vietnam's WTO accession.

of POEs. Results from these models are reported in Tables A6 and A7 in the appendix. Results show that the most significant differences are between SOEs and POEs, whereas there is not much of a difference between completely private firms and private firms partially owned by the state.

Second, we estimate the models with *Exit* as the outcome variable, using survival analysis. Survival analysis allows us to estimate the duration of firms surviving (i.e., not exiting) the market. We expect that both $POE \times \Delta\tau$ and $POE \times \Delta\tau \times Firm's\ Debt$ shorten the survival of firms, i.e., they increase the hazard rate of exit. The main advantage of survival models over OLS is that they have a better handle on the right and left censoring problem.[49] We rely on a parametric survival model using a Weibull distribution, which allows us to estimate accelerated failure time models.[50] Our main results remain unchanged (see Table A8).

Third, our results are similar if we use Propensity Score Matching (PSM), as Tables A9 and A10

[49]Left censoring refers to the fact that firms might have exited the market before 2006, i.e., before our time span begins. Right censoring refers to the fact that firms might have exited the market after 2012, i.e., after the end of our time span.

[50]The Weibull model is the most appropriate model, according to the Akaike information criterion.

show in the appendix.[51] Note that our sample shrinks when we use PSM, which drops unmatched observations. Fourth, we interact each of the controls with the post-accession dummy, i.e. *Post-WTO*.[52] Results are reported in Table A11 (columns 1-4) in the appendix and are very similar to the one showed above.

Finally, we run a placebo test. Specifically, we interact POE with $\Delta\tau_{1999}$, always controlling for $\Delta\tau$. If the WTO accession has an impact on a firm's exit, this interaction should not be significant. On the contrary, if the interaction between POE and $\Delta\tau 1999$ is significant, it would imply that the negotiation period triggered the selection effect prior to the WTO accession. Figures A6 and A7 in the appendix show that the interaction between POE and $\Delta\tau 1999$ is not significant; confidence intervals are wide and overlapping, confirming the specific importance of Vietnam's accession to the WTO and mitigating further concerns of anticipatory effects.

H3: Markups and MFN Tariff Cut. To test H3 we switch the outcome variable from *Exit* to *Markups*. The empirical strategy remains the same, i.e. a difference-in-differences with elasticity. Formally, we estimate the following model:

$$Markups_{fi,t} = \zeta_0 + \zeta_1 POE_{fi} + \zeta_2 \Delta\tau_{i,t-1} + \zeta_3 POE_{fi} \times \Delta\tau_{i,t-1} + \zeta_4 X_{fi,t} + \delta_i + \delta_t + \epsilon_{fi,t}, \qquad (21)$$

where the key coefficient of interest is ζ_3 , which should be negative. We include controls that affect *Markups* and correlate with our main independent variables. More specifically, we include productivity, a measure of capital intensity (capital-labor ratio), a proxy for firm's size (logged number of employees), Age, and Age^2. All these controls are at the firm level. A the industry level, we control for Vietnam's preferential tariff cuts implemented after the trade agreement with the US and for $\Delta\tau_{1999}$.

Since our outcome variable is continous and scores between zero and one, we run fractional outcome regressions, which produce robust specification tests (Papke and Wooldridge, 1996, 2008), with

[51] We use the Stata 14 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).

[52] For a similar approach, see Gentzkow (2006). Results are similar if we interact the control variables with year fixed effects instead of the post-accession dummy.

standard errors clustered at the level of the firm.[53] In particular, fractional outcome regressions avoid mis-specification and dubious statistical validity and capture non-linear relationships, especially when the outcome is close to zero and one.[54]

Not controlling for the lagged level of markups in equation 21 is inconsistent with the assumption that markups follow a Markov process in the estimation of the production function (Topalova and Khandelwal, 2011). Therefore, to address the potential problem of serial correlation in relation to *Markups*, we include a lagged dependent variable on the right-hand side in some estimates. The lagged dependent variable is always significant, as expected (see Table A12 in the appendix). Including a lagged dependent variable with fixed effects in a short time series is problematic (Nickel, 1981). In line with Topalova and Khandelwal (2011), we use GMM regressions, which instrument the lagged dependent variable with lags (Arellano and Bond, 1991). Although we lose a large number of observations, these estimates are consistent with H3 (see Table A13 in the appendix). Note that the coefficient of the lagged dependent variable is significant, but close to zero, indicating that the problem of unit root is not serious in our case, probably due to the short time-span.[55]

Table 5 shows the results of equation 21. Throughout all the estimates the coefficient of the interaction between *POE* and $\Delta\tau$ is always negative and statistically significant, as expected. This is the case even when we include industry year fixed effects (column 5), trends (column 6), and firm fixed effects (column 7), which are very demanding tests. Remember that the number of observations is lower in these models because we dropped the firms with negative markups and firms with markups higher than one.

Figure 8 shows the graphical interpretation of the interaction term, which refers to column 3. When tariff cuts increase, POEs'S markups decline significantly. This is evidence of the pro-competitive effect described by our theoretical model. On the contrary, the slope for SOEs is negative, but it is not statistically significant. This can be seen from the fact that the confidence intervals overlap for different values of MFN tariff cuts, i.e., linear predictions are statistically non-distinguishable one

[53] We obtain similar results if we run simple OLS regressions. Moreover, our results are similar if we cluster standard errors at the level of the industry (4-digit) or if we double-cluster standard errors at the level of the firm and the industry.

[54] When we include industry specific trends, we are unable to run fractional outcome regressions, which do not converge. As such, we run OLS regressions for columns 6 and 7 in Table 5.

[55] We obtain similar results if we double-difference both the left- and right-and-side variables and run OLS regressions (Table A14 in the appendix).

Table 5: POE vs. SOE: Markups and MFN tariff cuts. Fractional outcome regressions (columns 1-10) and OLS regressions with robust standard errors clustered at the firm level (columns 11-12).

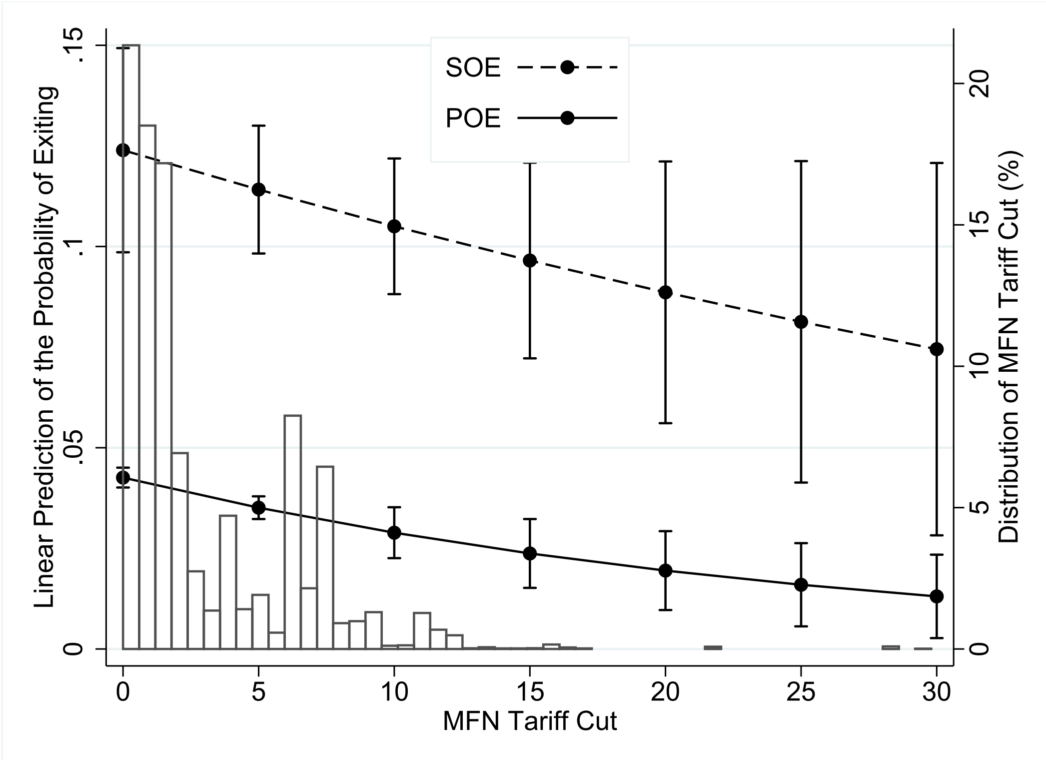
VARIABLES	(1) FracReg Markups	(2) FracReg Markups	(3) FracReg Markups	(4) FracReg Markups	(5) FracReg Markups	(6) OLS Markups	(7) OLS Markups
POE	-0.506***	-0.704***	-0.790***	-0.790***	-0.801***	-0.046***	
	(0.043)	(0.202)	(0.198)	(0.198)	(0.196)	(0.017)	
MFN Tariff Cut	0.001	-0.002	0.008	0.008	0.006	0.002	0.000
	(0.002)	(0.009)	(0.010)	(0.010)	(0.011)	(0.002)	(0.000)
POE*MFN Tariff Cut	**-0.006****	**-0.020****	**-0.021****	**-0.021****	**-0.024****	**-0.001***	**-0.001*****
	(0.003)	**(0.009)**	**(0.009)**	**(0.009)**	**(0.010)**	**(0.001)**	**(0.000)**
Constant	-1.080***	-1.242***	-0.583*	-0.281	1.247*	0.430***	
	(0.018)	(0.195)	(0.346)	(0.383)	(0.676)	(0.059)	
Observations	144,479	144,411	144,034	144,034	144,411	144,034	144,097
R-squared						0.150	0.331
Controls	NO	NO	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES	YES	NO
Business control	NO	NO	NO	YES	NO	NO	NO
Industry-year FE	NO	NO	NO	NO	YES	NO	NO
Trends	NO	NO	NO	NO	NO	YES	NO
Firm FE	NO	NO	NO	NO	NO	NO	YES

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

from the other for SOE. This finding implies that tariff cuts have no effect on SOEs' markups. In short, trade liberalization does not trigger higher product market competition for SOEs. This result validates our third hypothesis, showing that the pro-competitive effect of trade is hampered by the presence of SOEs.

Robustness Checks. We implement the same robustness checks as for H1 and H2. In particular, we distinguish between POEs and POEs that are partially owned by the state (Table A15 in the appendix). Moreover, we show that results are similar if we use PSM rather than entropy balancing (Table A16 in the appendix). Furthermore, we show that our results hold if we include interactions between each control and a dummy for the post-WTO accession (Table A11, columns 5 and 6). Finally, our placebo test confirms that the interaction between POE and MFN tariffs is not significant if we use 1999 MFN tariffs as baseline (Figure A9).

Figure 8: POE vs. SOEs: The effect of MFN tariff cuts on firm's markups.



Note: The predictions are plotted from column 3 in Table 5. Fractional outcome regression with industry (4-digit) fixed effects and robust standard errors clustered at the firm level. The histogram shows the distribution of $\Delta\tau$.

4.2 Industry-Level Analysis

Main Variables and Sample. The firm-level analysis provides robust evidence supporting H1, H2, and H3. We now move to the industry-level analysis to test H4. The dependent variable is the time-varying measure of *TFPR* in industry *i*. Specifically, we calculate this as the weighted average value of TFPR for all the firms *f* operating in industry *i* in time *t*.[56] *TFPR* reports data at the beginning of the year.

Our main independent variables are MFN tariff cuts, a dummy for the SOE-dominated sectors, and their interaction. While we have already described the first variable, i.e., $\Delta\tau_{i,t}$, remember that *SOE-dominated Sector* is a dummy scoring one if an industry has more than 40% of workers employed in SOEs. We use the percentage of workers in the pre-WTO accession period, i.e,. in 2006 and 2007.[57]

[56] The average value of each firm-level variable is weighted by share of firm size by industry, i.e., number of employees. We rely on size rather than revenue for the same reason that we explained above: POEs tend to under-report sales to evade taxes (whereas SOEs do not). Therefore weighting on revenue would lead us to under-estimate POEs in moving from firm-year to industry-year as unit of analysis.

[57] Tariff cuts kick in after 2007 in our sample. Results are similar if we use data of workers (employed in SOEs) reported

The larger *SOE Labor Share* is, the more an industry is "owned" by the state.[58] 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 only a few industries.[59]

We estimate a sample of 620 industries (ISIC 4-digit) between 2006 and 2012, for which data on tariffs are available.[60] We rely on OLS regressions with robust standard errors clustered by industry at the ISIC 4-digit level for our baseline models. As in the case of markups, not controlling for lagged productivity generates the potential problem of serial correlation. As such, we include a lagged dependent variable on the right-hand side of some models. In some estimates in which we include a lagged dependent variable, we run GMM regressions that instrument the lagged dependent variable with one lag (Arellano and Bond, 1991) to avoid Nickel bias (Nickel, 1981). Finally, we double-difference both dependent and independent variables as a further way to take care of dynamic panel estimation problems (Arellano and Honoré, 2001; Trefler, 2004).

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. 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 have larger firms. To tackle this issue, we again rely on entropy balancing. Specifically, we balance out a set of *exogenous* covariates with the respect to *SOE-dominated Sector*. We can thus compare SOE-dominated sectors with a comparable counterfactual of POE-dominated sectors, running our main models with the weights obtained from entropy balancing.[61]

at the beginning of the year or at the end of the year.

[58] Results are similar if we use different thresholds, e.g., 35% or 45% of workers employed in SOEs.

[59] Given the distribution of the continuous measure of SOE labor share, using a dummy variable to identify SOE-dominated sectors seems appropriate (Figure A10).

[60] We are able to estimate up to 117 industries in a given year. There are 120 industries at the 4-digit level, which would result in 840 observations in seven years, 2006-2012. However, we have missing values for some covariates, which reduces our total number of observations. Moreover, when we include the lagged dependent variable on the right-hand-side of the model, we lose observations in the first year in which industries appear in the dataset. Since our dataset is unbalanced, we lose not only observations in 2006, but also in subsequent years.

[61] We balance POE with respect to the following variables: logged number of employees, log of profit, log of exports, level of tariff prior WTO accession, number of POEs and SOEs operating in each industry, capital-labor ratio, and

Second, similar to the firm-level analysis, we include Trefler (2004) business condition controls. In this case, the business conditions controls are built by regressing $TFPR_{i,t}$ over Vietnam's GDP, and the real interest rate, including industry and year fixed effects. These regressions generate a time-varying industry-specific prediction ($\widehat{TFPR}$) 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. Third, we include an industry-specific (2-digit) time trend to check if the parallel trend assumption holds.

H4: Productivity, MFN Tariff Cuts, and SOE Labor Share. Formally, we estimate the following main model:

$$\begin{aligned} TFPR_{i,t} = \lambda_0 + \lambda_1 SOE - dominated\ Sector_{i,pre-WTO} + \lambda_2 \Delta\tau_{i,t-1} + \\ \lambda_3 SOE - dominated\ Sector_{i,pre-WTO} \times \Delta\tau_{i,t-1} + \lambda_4 X_{i,t} + \delta_i + \delta_t + \epsilon_{i,t}, \end{aligned} \tag{22}$$

where the key coefficient of interest is λ_3, which is expected to be negative. X includes a set of control variables at the industry level. More specifically, we control for (logged) values of imports at the industry level, for the number of POEs and SOEs operating in each industry. Furthermore, we include the proportion of POEs and SOEs exiting the market in each industry. In addition, we control for average firm age, the logged number of employees and profit, the percentage of capital owned by the state in POEs, and the capital-labor ratio, which are calculated as average values for all the firms operating in a given industry i.[62] Furthermore, we include 2-digit industry fixed effects δ_i.

As said earlier, we estimate also first-difference models to account for serial correlation (columns 5 and 6):[63]

$$\begin{aligned} \Delta TFPR_{i,t} = \lambda_0 + \lambda_1 SOE - dominated\ Sector_{i,pre-WTO} + \lambda_2 \Delta\tau_{i,t-1} + \\ \lambda_3 SOE - dominated\ Sector_{i,pre-WTO} \times \Delta\tau_{i,t-1} + \lambda_4 \Delta X_{i,t} + \delta_t + \Delta\epsilon_{i,t}. \end{aligned} \tag{23}$$

The interaction between *SOE-dominated Sector* and MFN tariff cuts is always negative and sta-

average firm age. Our results hold if we use propensity score matching instead of entropy balancing, though we lose a large number of observations.

[62]Table A2 in the appendix shows descriptive statistics of all the variables described above.

[63]We do not first-difference *SOE-dominated Sector*, because its values are at the baseline.

tistically significant in every model (see Table 6). Moreover, the coefficient of $\Delta\tau$ is always positive except in column 1 and is significant in columns 2, 3, and 4. These results are consistent with our fourth hypothesis: 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.[64]

We implement further tests to corroborate our findings. First, our results are similar if we include industry-specific trends (column 4), which is a very demanding test of H4. Second, our results hold when we double first-difference (columns 5 and 6), which is de facto equivalent to use 4-digit industry fixed effects. Third, our results are robust to the inclusion of the lagged dependent variable, which is often not significant, and run both OLS (Table A17) and GMM (Table A18). The fact that the lagged dependent variable is not significant may be explained by our relatively short time-span and by the fact that accession to the WTO has been a shock for the Vietnamese economy. Foourth, our results hold if we use a continuous measure of SOE labor share (pre-WTO values) as showed in Table A19. Finally, we interact each of the controls with the post-accession dummy, i.e., *Post-WTO*. Results are reported in Table A20 in the appendix and are very similar to the one showed above.

A counterfactual exercise. Our analysis has showed that the presence of SOEs tames the competition, selection, and productivity effects of trade. Although our reduced-form empirical approach does not allow us to account for general equilibrium interactions, we can use regression coefficients to perform partial equilibrium calculations and get a sense of the magnitude of the foregone productivity gains from trade due to the presence of SOEs.

We start showing the gains in trade from Vietnam's accession to the WTO (see Table 7). We rely on the coefficient estimates in column 2 of Table 6, and focus on POE-dominated industries (i.e., *SOE-dominated Sector* = 0). We then estimate (i) the linear predictions of POE-dominated industries with no tariff cuts and (ii) the linear predictions of POE-dominated industries with tariff reductions greater than zero in the post-WTO period. Then, we take the average value of these two linear predictions across industries and years and calculate their growth rate. By dividing this

[64] The results are substantially similar if we replace TFPR with l'abor productivity, with productivity estimated using Olley and Pakes' (1996) method, and with productivity estimated using Ackerberg, Caves, and Frazer' (2015) correction. The last two measures of productivity are estimated using the Stata command "prodest." Unfortunately, we are unable to build a measure of productivity a là Levinsohn and Petrin (2003), since we do not have data on raw materials to estimate the input demand function.

Table 6: TFPR, MFN tariff cuts, and SOE labor share: OLS regressions with standard errors clustered by HS 4-digit.

VARIABLES	(1) OLS TFPR	(2) OLS TFPR	(3) OLS TFPR	(4) OLS TFPR	(5) OLS d.TFPR	(6) OLS d.TFPR
SOE-dominated	0.013	0.155**	0.155**	0.183***	0.029	0.029
	(0.083)	(0.068)	(0.068)	(0.067)	(0.055)	(0.055)
MFN Tariff Cuts	-0.002	0.024***	0.024***	0.019***	0.015	0.015
	(0.005)	(0.005)	(0.005)	(0.007)	(0.014)	(0.014)
SOE-dominated*MFN Tariff Cut	**-0.011***	**-0.031*****	**-0.031*****	**-0.025*****	**-0.035****	**-0.035****
	(0.006)	**(0.005)**	**(0.005)**	**(0.004)**	**(0.015)**	**(0.015)**
Constant	-1.176**	-0.342	-19.703***	-1.100	-0.181	-0.439**
	(0.454)	(0.706)	(6.109)	(0.888)	(0.144)	(0.213)
Observations	620	620	620	620	478	478
R-squared	0.403	0.611	0.611	0.668	0.464	0.464
Controls	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	NO	NO
Year FE	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES	YES
Business control	NO	NO	YES	NO	NO	YES
Trends	NO	NO	NO	YES	NO	NO

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

growth rate by five, we obtain our annual productivity growth in the post-WTO period, 2008-2012. In these industries, the post-WTO tariff reductions produce an annual increase in TFPR of 9.6%. Since these industries account for about 40% of Vietnam's manufacturing output, the annual overall manufacturing productivity increases by 3.8%, a result in line with Trefler (2004) and Trefler and Lileeva (2010). This effect is substantive, but not particularly remarkable, given the importance of accessing the WTO for a small closed economy.[65]

To get a sense of the loss of efficiency produced by a strong SOE presence, we implement the following simulations. We estimate the linear predictions of SOE-dominated industries facing positive tariff cuts (i.e. $\Delta\tau > 0$). Next, we build our counterfactual by replacing the value of *SOE-dominated Sector* with zero and then estimating a second set of the linear predictions. In other words, we estimate what, according to our empirical model, would have been the effect of trade liberalization on TFPR if the industries with high presence of SOEs had been replaced by the same industries but with low or no presence of SOEs. As before, we take the average value of these two linear predictions across industries

[65]Trefler (2004) looks at the effect of a single preferential trade agreements between Canada and the US on those two large open economies.

Table 7: Gains from trade for the Vietnamese economy with and without SOE-dominated sectors.

	POE-dominated Sector		
	$\Delta\tau = 0 \to \Delta\tau > 0$	Output	Annual aggregate productivity gains
Annual productivity gains	9.6%	40%	3.8%
	Couterfactual analysis : $\boldsymbol{\Delta\tau > 0}$		
	SOE-dominated $\to$ *POE-dominated*	Output	Annual aggregate productivity gains
Annual productivity gains	13.2%	7%	0.9%

and years. Finally, we calculate the growth rate of the two average values (i.e., when *SOE-dominated Sector* = 1 and *SOE-dominated Sector* = 0) to capture the lower productivity gains from trade in industries with a large presence of SOEs.

Table 7 shows the result of this simulation. The average overall productivity gains would have been 13.2% larger in a counterfactual Vietnamese economy without SOE-dominated sectors. Since SOE-dominated industries account for 7% of Vietnam's manufacturing output, *the annual overall manufacturing productivity would have been increased by an extra 0.9% by replacing SOE-dominated industries with POE-dominated industries.* In sum, we find that the presence of SOEs has substantively hampered productivity growth in Vietnam after the accession to the WTO.

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 due to barriers to entry and easier access to credit, a de facto barrier to exit, the presence of SOEs can hamper the selection and competition effects of trade, thereby severely reducing the productivity gains of openness.

We have tested the model's predictions using a new data set of Vietnamese firms to assess the effects of the 2007 WTO entry on Vietnam's economy. Our firm-level analysis shows that the post-WTO probability of exiting the market is much larger for private firms than for state-owned firms. Moreover, our empirical analysis supports the theoretical prediction that two distinguishing features of SOEs, entry barriers and preferential access to credit, are key in shaping their response to the product market liberalization brought about by WTO access.

Moreover, in the industry-level analysis, we show that trade liberalization leads to sizable productivity gains in POE-dominated industries, while productivity does not increase in SOE-dominated industries. Finally, with a simple counter-factual exercise, we have shown that the aggregate productivity gains from trade would have increased by roughly 66% in the five years after Vietnam's accession to the WTO (i.e., 13.2 × 5), if SOE-doiminated industries had been replaced by POE-dominated industries.

References

[1] Abadie A. and Imbens, G. (2006) "Large sample properties of matching estimators for average treatment effects", *Econometrica* 74(1), 235-267.

[2] Angrist, D. J. and Pischke, J-S. (2009) *Mostly Harmless Econometrics* Princeton: Princeton University Press.

[3] Ackerberg D. A., Caves K., and Frazer G. (2015). "Identification Properties of Recent Production Function Estimators." *Econometrica*, 83(6): 2411-2451.

[4] Antras, P. and R. Staiger (2012). "Offshoring and the Role of Trade Agreements." *American Economic Review*, 102: 459-465.

[5] Arellano, Manuel and Bo Honoré. (2001) "Panel Data Models: Some Recent Developments," in James J. Heckman and Edward Leamer, eds., *Handbook of Econometrics*, Vol. 5, Amsterdam: North-Holland: 3229-3296.

[6] Arellano, Manuel, and Stephen Bond. (1991). "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations." *Review of Economic Studies* 58(2): 277-297.

[7] Atkeson, A. and A. Burstein (2008). "Pricing to Market, Trade Costs, and International Relative Prices," *American Economic Review*, Vol. 98(5): 1008-2031.

[8] Aw, B W., X. Chen, and M. J. Roberts. (2001) “Firm-level Evidence on Productivity Differentials and Turnover in Taiwanese Manufacturing,” *Journal of Development Economics*, 66(1): 61-86.

[9] Bekkers, E., and J. Francois. (2013) “Trade and industrial structure with large firms and heterogeneity”, in *European Economic Review,* Serie 60: 69-90.

[10] Bernard, A., B. Jensen, S. Redding, and Peter Schott. (2012) “The Empirics of Firm Heterogeneity and International Trade”, *Annual Review of Economics*, 4: 283-313.

[11] Bernard, A., B. Jensen, and P. Schott. (2006) “Trade Costs, Firms and Productivity.” *Journal of Monetary Economics* 53(5): 917–37.

[12] Bonfiglioli, A., R. Crino’, and G. Gancia (2016). “Trade, Finance and Endogenous Firm Heterogeneity”, mimeo.

[13] Brander, J. (1981) “Intra-industry Trade in Identical Commodities,” *Journal of International Economics* 11 (February): 1-14.

[14] Brander, J. and P. Krugman. (1983) “A Reciprocal Dumping Model of International Trade,” *Journal of International Economics*, 15: 313-321.

[15] Brou, D and M. Ruta (2013). “A Commitment Theory of Subsidy Agreements.” *B.E. Journal of Economic Analysis and Policy*, 13: 239-270.

[16] Costinot, A. (2008). “A Comparative Institutional Analysis of Agreements on Product Standards,” *Journal of International Economics*, 75: 197-213.

[17] The Economist. (2012) “The Rise of State Capitalism”, special issue January 21.

[18] Ederington, Josh, and Michele Ruta. (2016) “Nontariff measures and the world trading system.” *Handbook of Commercial Policy* 1: 211-277.

[19] Edmond, C., V. Midrigan, and D. Xu (2015). “Competition, Markups, and the Gains from International Trade,” *American Economic Review,* 105(10): 3183-3221.

[20] Fosse, H.B., and P. Raimondos-Møller. (2012) "Reducing Tariffs According to WTO Accession Rules : The Case of Vietnam" *Review of Development Economics*, Vol. 16(2): 331-341.

[21] Friedman, J. (1993, April)."Oligopoly theory", Volume 2, *Handbook of Mathematical Economics*, Elsevier.

[22] Gentzkow, Matthew. (2006) "Television and Voter Turnout." *Quarterly Journal of Economics*, 121(3): 931-972.

[23] Hainmueller, J. (2012). "Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies." *Political Analysis*, 20(1): 25-46.

[24] Head, K., T. Mayer and J. Ries (2002), 'On the Pervasiveness of Home Market Effects', *Economica*, 69: 371–90.

[25] Horn, H., Maggi, G., and R. Staiger (2010). "Trade Agreements as Endogenously Incomplete Contracts." *American Economic Review*, 100: 395-419.

[26] Hsieh, C.-T., and P. Klenow. (2009) "Misallocation and Manufacturing TFP in China and India." *Quarterly Journal of Economics*, 124(4): 1403–48.

[27] Hsie, C-T. and Z. Song. (2015) "Grasp the Large, Let Go of the Small: The Transformation of the State Sector in China," Forthocoming in *Brookings Papers on Economic Activity.*

[28] Impullitti, G. and O. Licandro. (2017) "Trade, Firm Selection, and Innovation: the Competition Channel," *Economic Journal*, forthcoming.

[29] Impullitti, G., O. Licandro., and P. Rendhal (2017) "Large Firms, Innovation and the Gains from Trade," mimeo University of Nottingham.

[30] Kowalski, P., M. Büge, M. Sztajerowska, M. Egeland. (2013) "State-Owned Enterprises: Trade Effects and Policy Implications", *OECD Trade Policy Papers*, No. 147, OECD Publishing.

[31] Leuven E. and B. Sianesi. (2003) "PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing". Available at `http://ideas.repec.org/c/boc/bocode/s432001.html`.

[32] Levinsohn J. and A. Petrin. (2003) "Estimating Production Functions Using Inputs to Control for Unobservables". *Review of Economic Studies* 70(2): 317–341.

[33] Lileeva, A., and D. Trefler. (2010) "Improved Access to Foreign Markets Raises Plantlevel Productivity . . . For Some Plants." *Quarterly Journal of Economics* 125(3): 1051–99.

[34] Manova, K. (2013). "Credit Constraints, Heterogeneous Firms, and International Trade", *Review of Economic Studies,* 80: 711-744.

[35] Malesky, E. J., and M. Taussig. (2009) "Where Is Credit Due? Legal Institutions, Connections, and the Efficiency of Bank Lending in Vietnam," *Journal of Law, Economics, and Organization*, 78(1): 252-535.

[36] Malesky, E. J., D. Georguiev and N. M. Jensen. (2014). "Monopoly Money: Foreign Investment and Bribery in Vietnam, a Survey Experiment. " *American Journal of Political Science*, forthcoming.

[37] Markusen, J. R. and A. J. Venables (1988), 'Trade Policy with Increasing Returns and Imperfect Competition: Contradictory Results from Competing Models', *Journal of International Economics*, 24: 299–316.

[38] McCaig, B. (2011). "Exporting out of Poverty: Provincial Poverty in Vietnam and U.S. Market Access." *Journal of International Economics*, 85(1): 102-113.

[39] Melitz, M. (2003) "The impact of trade on intraindustry reallocations and aggregate industry productivity," *Econometrica*, 71: 1695-1725.

[40] Melitz, M. and S. Redding. (2014) "Heterogeneous Firms and Trade", *Handbook of International Economics*, Volume 4, (eds Elhanan Helpman, Gita Gopinath and Kenneth Rogoff), Elsevier: North Holland, Chapter 1: 1-54.

[41] Melitz, M., and D. Trefler. (2012) "Gains from Trade when Firms Matter", *Journal of Economic Perspectives* 26, no. 2.

[42] Neary, P. (2010) "Two and a Half Theories of Trade," *The World Economy*, 33(1): 1-19.

[43] Neary, P. (2003). "Globalisation and Market Structure", *Journal of the European Economic Association,* 1(2-3): 245-271.

[44] Nickell, S. (1981). "Biases in Dynamic Models with Fixed Effects", *Econometrica,* 49(6): 1417-1426.

[45] Nguyen, T. V. and N. J. Freeman. (2009) "State-owned enterprises in Vietnam: are they 'crowding out'the private sector?" *Post-Communist Economies* ,21(2): 227-247.

[46] Olley, S. O. and Pakes, A. (1996). "The dynamics of productivity in the telecommunications equipment industry. *Econometrica*, 64: 1263-1297.

[47] Painter, M. (2002). Public Administration Reform in Vietnam. In *Governance and Public Sector Reform in Asia,* Cheung, Anthony B.L. and Scott, Ian (eds.); Routledge Curzon: London.

[48] Papke, Leslie and Jeffrey Wooldridge. (1996). "Econometric Methods for Fractional Response Variables with an Application to 401 (k) Plan Participation Rates." *Journal of Applied Econometrics*, 11(6): 619–32.

[49] Papke, Leslie E., and Jeffrey M. Wooldridge. (2008) "Panel data methods for fractional response variables with an application to test pass rates." *Journal of Econometrics* 145(1): 121-133.

[50] Parenti, M. (2016). "Large and Small Firms in a Global Market: David vs. Goliath", mimeo ECARES.

[51] Pavcnik, N. (2002). "Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants." *Review of Economic Studies* 69(1): 245–76.

[52] Phan, D., and I. Coxhead. (2013) "Long-run costs of piecemeal reform: wage inequality and returns to education in Vietnam." *J. Comp. Econ.*, 41: 1106-2.

[53] Pincus, J., V. T. Anh, P. D. Nghia, B. Wilkinson, and N. X. Thanh. (2012) "Structural Reform for Growth, Equity, and National Sovereignty," VELP, Harvard Kennedy School, February 13-17.

[54] Shimomura, K. and J. Thisse (2012). "Competition among the big and the small." *RAND Journal of Economics* 43(2): 329–347.

[55] Song, Z., K. Storesletten, and F. Zilibotti. (2011) "Growing like china." *The American Economic Review* 101.1: 196-233.

[56] Tenev, S., A. Carlier, O. Chaudry, and Q. T. Nguyen. (2003) "Informality and the Playing Field in Vietnam's Business Sector," Washington D.C.: International Finance Corporation.

[57] Topalova, Petra and Amit Khandelwal. (2011) "Trade Liberalization and Firm Productivity: The Case of India". *The Review of Economics and Statistics*, 93(3): 995-1009.

[58] Trefler, D. (2004) "The Long and Short of the Canada–U.S. Free Trade Agreement." *American Economic Review* 94(4): 870–95.

[59] Van Long, N., H. Raff and F. Stahler. (2011) "Innovation and Trade with Heterogeneous Firms," *Journal of International Economics*, 84(2): 149-159.

[60] Vasavakul, T. (1997) "Vietnam: The Third Wave of State Building." *Southeast Asian Affairs 1997*; Institute of Southeast Asian Studies: Singapore.

[61] Vo, T. (2007) "Institutional Changes for Private Sector Developments in Vietnam: Experience and Lessons." *East Asian Bureau of Economic Research Paper Series 22*, Tokyo, Japan, February.

Appendix: for Online Publication

A1. Baseline model

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. The standard utility maximization problem leads 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. The first order conditions of the firm problem (2) are

$$\left[(\alpha-1)\frac{q_D^D}{y_D}+1\right] p_D = \frac{1}{\tilde{z}} \tag{24}$$

$$\left[(\alpha-1)\frac{q_D^F}{y_D}+1\right] p_F = \frac{\tau}{\tilde{z}} \tag{25}$$

Since the two countries are symmetric, $q_D^D = q_F^F \equiv q$, $q_D^F = q_F^D \equiv \breve{q}$, $y_D = y_F \equiv y$, $E_D = E_F$, $Y_D = Y_F$, $p_D = p_F = p_y$. From (24) and (25) and using $q/y + \ \breve{q}/y = 1/n$ we get

$$\left[(\alpha-1)\frac{q}{y}+1\right] = \frac{2n_y - 1 + \alpha}{n_y\,(1+\tau)} \equiv \theta_{d,y} \tag{26}$$

$$\left[(\alpha-1)\frac{\breve{q}}{y}+1\right] = \tau\frac{2n_y - 1 + \alpha}{n_y\,(1+\tau)} \equiv \theta_f = \tau\theta_{d,y} \tag{27}$$

which allows us to express the price of exported goods as

$$p_y = \frac{\tilde{z}^{-1}}{\theta_{d,y}} = \frac{\tau\tilde{z}^{-1}}{\theta_{f,y}}$$

where θ_D, y and θ_f are the markups charged in the domestic market and in the export market, respectively. We can now rewrite (24) and (25) as follows

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

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

$$\frac{q+\tau\breve{q}}{\tilde{z}}=n_y\left[\theta_{d,y}\frac{q}{y}+\tau\theta_{d,y}\frac{\breve{q}}{y}\right]\frac{(1-\gamma)E}{n_y}\left(\frac{y}{Y}\right)^{\alpha}. \tag{28}$$

Let us define the inverse of the average markup,

$$\theta_{\tau,y}\equiv\theta_{d,y}\frac{q}{y}+\tau\theta_{d,y}\frac{\breve{q}}{y}=\frac{\theta_{d,y}q+\theta_{f,y}\breve{q}}{q+\breve{q}}.$$

Notice that using (24) and (25) it is easy to show that $\theta_{\tau,y}$ is

$$p=\frac{1}{\theta_{\tau,y}}\frac{1}{\tilde{z}}$$

indeed the inverse of the average markup. Using $y=\{[1/\tilde{z}]\left(Y^{\alpha}/\left(\theta_{d,y}(1-\gamma)E\right)\right)\}^{\frac{1}{\alpha-1}}$, it is easy to prove that $(y/Y)^{\alpha}=\tilde{z}/\left(M\bar{z}_y\right)$. From (26) and using $q/y+\ \breve{q}/y=1/n_y$ we obtain

$$\frac{q+\tau\breve{q}}{\tilde{z}}=\theta_{\tau,y}\frac{(1-\gamma)E}{n_yM_y}\frac{z}{\bar{z}_y} \tag{29}$$

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. Similarly, we can derive the expression

$$\frac{q+\breve{q}}{\tilde{z}}=\theta_{d,y}\frac{(1-\gamma)E}{n_yM_y}\frac{z}{\bar{z}_y}$$

which together with (29) allow us to obtain (EC).

A2. Mixed market model

Demands from the differentiated good becomes $p_g=\left(E/X^{\alpha}\right)g^{(\alpha-1)}$ and $p_y=\left(E/X^{\alpha}\right)y^{(\alpha-1)}$ where total expenditure in the differentiated goods industry is

$$E=\left(\int_0^{M_g}p_{gj}g_j\ \mathrm{d}j+\int_0^{M_y}p_{yj}y_j\ \mathrm{d}j\right).$$

The firm problem is similar to the previous one in (2), yielding exactly the same first order conditions (26) and (27). The only difference is that, due to the different demand structure, (28) becomes

$$\frac{q+\tau\breve{q}}{\tilde{z}} = n_y\left[\theta_{d,y}\frac{q}{y}+\tau\theta_{d,y}\frac{\breve{q}}{y}\right]\frac{E}{n_y}\left(\frac{y}{X}\right)^{\alpha},$$

where

$$\begin{aligned}\left(\frac{y}{X}\right)^{\alpha} &= \theta_{d,y}^{\frac{\alpha}{1-\alpha}}\frac{z}{\bar{z}},\\ \left(\frac{g}{X}\right)^{\alpha} &= \theta_{d,g}^{\frac{\alpha}{1-\alpha}}\frac{z}{\bar{z}}\end{aligned}$$

and

$$\bar{z} = M_g\theta_{d,g}^{\frac{\alpha}{1-\alpha}}\bar{z}_g + M_n\theta_{d,y}^{\frac{\alpha}{1-\alpha}}\bar{z}_y$$

with $\bar{z}_g = \frac{1}{M_g}\int_0^{M_g} z_j dj$ and $\bar{z}_y = \frac{1}{M_y}\int_0^{M_y} zjdj$ being the average productivity of SOEs and POEs respectively. Proceeding like in the benchmark model we obtain $n_y\left(\theta_{d,y}\frac{q}{y}+\tau\theta_{d,y}\frac{\breve{q}}{y}\right) = \theta_{\tau,y}$, which allows us to write variable labour demand (total production) as

$$\frac{q+\tau\breve{q}}{\tilde{z}} = \theta_{\tau,y}\theta_{d,y}^{\frac{\alpha}{1-\alpha}}\frac{E}{n_y}\frac{z}{\bar{z}}$$

and the total output sold as

$$\frac{q+\breve{q}}{\tilde{z}} = \theta_{d,y}^{\frac{\alpha}{1-\alpha}}\frac{E}{n_y}\frac{z}{\bar{z}}.$$

Using these conditions and the fact that firms bring investors to the participation constraint into the liquidity constraint we can derive the cutoff conditions,

$$E = \frac{\hat{\lambda}_y n_y}{(1-\theta_{\tau,y})\,\theta_{d,y}^{\frac{\alpha}{1-\alpha}}}\frac{\bar{z}}{z_y^*}. \tag{30}$$

$$E = \frac{\hat{\lambda}_g n_g}{(1-\theta_{\tau,g})\,\theta_{d,g}^{\frac{\alpha}{1-\alpha}}}\frac{\bar{z}}{z_g^*} \tag{31}$$

where $\bar{z}$ is weighted average productivity,

$$\bar{z} = M_g\theta_{d,g}^{\frac{\alpha}{1-\alpha}}\int_{z_g^*}^{\infty} z\mu_g(z)dz + M_n\theta_{d,y}^{\frac{\alpha}{1-\alpha}}\int_{z_y^*}^{\infty} z\mu_y(z)dz$$

where the equilibrium distributions are $\mu_j(z) = f(z)/(1-\Gamma(z_j^*))$ and mass of varieties $M_j = 1-F\left(z_j^*\right)$ for $j = g, y$. Using (30) and (31) we obtain

$$Z \equiv \frac{z_y^*}{z_g^*} = \left(\frac{\hat{\lambda}_y n_y}{\hat{\lambda}_g n_g}\right)\left[\frac{(1-\theta_{\tau,g})\,\theta_{d,g}^{\frac{\alpha}{1-\alpha}}}{(1-\theta_{\tau,y})\,\theta_{d,y}^{\frac{\alpha}{1-\alpha}}}\right]. \tag{32}$$

Our assumption 1 ($n_y > n_g$) implies that $\theta_{\tau,y} > \theta_{\tau,g}$ but also that $\theta_{d,y} > \theta_{d,g}$, hence it is not sufficient to establish that selection is tougher for POEs, as the non-linear term in θ_d generates an ambiguity. In order to focus on the empirically relevant case, we assume that the differential access to credit implies that $\hat{\lambda}_y/\hat{\lambda}_g$ is large enough to guarantee equilibria where $z_y^* > z_g^*$.

Labor market clearing closes the model,

$$n_g M_g \int_{z_g^*}^{z_y^*} \left(\frac{g + \tau \breve{g}}{\tilde{z}} + \hat{\lambda}_g \right) \mu(z) dz + n_y M_y \int_{z_y^*}^{\infty} \left(\frac{y + \tau \breve{y}}{\tilde{z}} + \hat{\lambda}_y \right) \mu(z) dz + \beta E = 1,$$

which leads to

$$E = \left[\frac{1 - \left(\hat{\lambda}_g n_g M_g + \hat{\lambda}_y n_y M_y \right)}{n_g M_g \theta_{\tau,g} \theta_{d,g}^{\frac{\alpha}{1-\alpha}} \frac{\bar{z}_g}{\bar{z}} + n_y M_y \theta_{\tau,y} \theta_{d,y}^{\frac{\alpha}{1-\alpha}} \frac{\bar{z}_g}{\bar{z}} + \beta} \right], \tag{33}$$

where $\bar{z}_j = \int\limits_{z_g^*}^{\infty} z \mu_j(z)\, dz$ for $j = g, y$.

The equilibrium system is defined by (30), (31), and (33), determining E, z_y^* and z_g^*. The model is less tractable than the benchmark model and we cannot obtain closed form solutions for the endogenous variables. We can however show that the key comparative statics hold. First we show that, as in the baseline model, the pro-competitive effect of trade is stronger for POEs than for SOEs. Differentiating the average markup with respect to the trade cost and the number of firms yields

$$-\frac{\partial \theta_{X,i}}{\partial \tau \partial n_i} = -\left(\frac{\partial \theta_{\tau,i}}{\partial \tau \partial n_i} \theta_{d,i}^{\frac{\alpha}{1-\alpha}} + \frac{\alpha}{1-\alpha} \theta_{d,i}^{\frac{2\alpha-1}{1-\alpha}} \frac{\partial \theta_{d,i}}{\partial \tau \partial n_i} \right) > 0.$$

As in the previous section, the first component $-\partial \theta_{\tau,i} / \left(\partial \tau \partial n_i\right) > 0$. The second term $-\partial \theta_{D,i}/\partial \tau \partial n_i = (1-\alpha) / \left(n^2 (1+\tau)\right) > 0$. Hence the pro-competitive effect is larger the stronger is the pre-liberalization level of competition.

We can also show that this implies that trade liberalization increases the distance between the two POEs and the SOEs cutoff Z. Using (32) we obtain

$$-\frac{\partial \ln Z}{\partial \tau} = \frac{\partial \theta_{\tau,g}/\partial \tau}{(1-\theta_{\tau,g})} - \frac{\partial \theta_{\tau,y}/\partial \tau}{(1-\theta_{\tau,y})} + \frac{\alpha}{1-\alpha} \left(\frac{\partial \theta_{d,y}/\partial \tau}{\theta_{d,y}} - \frac{\partial \theta_{d,g}/\partial \tau}{\theta_{d,g}} \right) > 0,$$

where the inequality derives from $\theta_{\tau,y} > \theta_{\tau,g}$, $|\partial \theta_{\tau,y}/\partial \tau| > |\partial \theta_{\tau,g}/\partial \tau|$, and $\left(\partial \theta_{d,y}/\partial \tau\right)/\theta_{d,y} = \left(\partial \theta_{d,g}/\partial \tau\right)/\theta_{d,g} = -\left(1+\tau\right)^{-1}$, which makes the term in brackets equal to zero. Since the model is less tractable we cannot in general show that the pro-competitive effect of trade induces more selection. We can only show it in the special case where the number of SOEs firms is at $\underline{n}_g = (1-\alpha)/2$, so trade has no pro-competitive effect on these firms, and parameter restrictions $\alpha \leq 1/2$ and $\mathcal{A}_y > (1/\theta_{d,y} - 1)$ hold. In this case,

$$-\frac{\partial \ln Z}{\partial \tau} = -\frac{\partial \ln z_y^*}{\partial \tau} = -\frac{\partial \theta_{\tau,y}/\partial \tau}{(1-\theta_{\tau,y})} + \frac{\alpha}{1-\alpha} \frac{\partial \theta_{d,y}/\partial \tau}{\theta_{d,y}} < 0,$$

where the inequality derives from the fact that $\alpha \leq 1/2$ implies $\alpha/(1-\alpha) < 1$, $\mathcal{A}_y > (1/\theta_{d,y} - 1)$ is sufficient for $(1-\theta_{\tau,y}) = (1-\mathcal{A}_y\theta_{d,y}) < \theta_{d,y}$ and $\partial \theta_{\tau,y}/\partial \tau > \partial \theta_{d,y}/\partial \tau$ since $\mathcal{A}_y > 1$. This suggests that a reduction in the variable trade costs increases the survival cutoff more for POEs than for

SOEs (which remains unchanged) and, as a consequence, selection and exit will be more pronounced for private firms. Moreover, since we have established that the the term in square brackets in (32) is increasing when the trade cost declines, the positive effect of trade liberalization on the relative cutoff Z is larger the larger is the difference in access to credit $\hat{\lambda}_y/\hat{\lambda}_g$. Hence, due to stronger credit constraint, trade-induced selection will be stronger for POEs than for SOEs.

A3. Meltiz and Ottaviano with credit frictions and fixed costs

Here we provide a short derivation of the results. We will skip some steps, when they can easily been recovered from the original Melitz and Ottaviano (2008) model. Recall that the utility function is

$$U = q_0^c + \alpha \int_0^x \frac{Nq}{x} di - \frac{\gamma}{2} \int_0^x \left(\frac{Nq}{x}\right)^2 di - \frac{\eta}{2} \left(\int_0^x \left(\frac{Nq}{x}\right) di \right)^2$$

where q_0^c is an outside good, N is the number of firms/varieties, γ pins down substitutability across varieties and $\eta > 0$ substitutability between the homogeneous good and the differentiated varieties. Solving the household problem the demand for each variety reads

$$q_i \equiv L q_i^c = \frac{\alpha L}{\eta N + \gamma} - \frac{L}{\gamma} p_i + \frac{\eta N}{\eta N + \gamma} \frac{L}{\gamma} \overline{p}. \tag{34}$$

We first solve the firm problem and determine the survival cutoff for the closed economy, then we derive the open economy equilibrium. Identifying each variety i with its cost draw c, the firm problem is

$$\max_{q(c)} \pi(c) = \left(\frac{\alpha L}{\eta N + \gamma} - \frac{L}{\gamma} p(c) + \frac{\eta N}{\eta N + \gamma} \frac{L}{\gamma} \overline{p} \right) (p(c) - c) - (1-d)\lambda - \delta_y F(\tilde{z}) - (1-\delta_y) t\lambda$$

$$\begin{aligned} & s.t. \\ LC: \quad & \left(\frac{\alpha L}{\eta N + \gamma} - \frac{L}{\gamma} p_i + \frac{\eta N}{\eta N + \gamma} \frac{L}{\gamma} \overline{p} \right) (p(c) - c) - (1-d)\lambda \geq F(\tilde{z}) \\ PC: \quad & -d_y \lambda + \delta_y F(\tilde{z}) + (1-\delta_y) t_y \lambda \geq 0, \end{aligned}$$

where the credit constraints operate exactly as in our benchmark model. The first order condition yields

$$p(c) = \frac{1}{2} \left(\frac{\alpha \gamma}{\eta N + \gamma} + c + \frac{\eta N}{\eta N + \gamma} \overline{p} \right), \tag{35}$$

substituting this and demand (34) into the profit function we get

$$\pi(c) = \frac{L}{4\gamma} \left(\frac{\alpha \gamma}{\eta N + \gamma} + \frac{\eta N}{\eta N + \gamma} \overline{p} - c \right)^2 - (1-d)\lambda - \delta_y F(\tilde{z}) - (1-\delta_y) t\lambda.$$

As in our model, the optimal decision of firms is to adjust their payment F to take the investors to their participation constraint, which in equilibrium holds with equality. Substituting this into the liquidity constraint (LC) and using the result that equilibrium profits gross of fixed costs are

$$\left(\frac{\alpha L}{\eta N+\gamma}-\frac{L}{\gamma}p\left(c\right)+\frac{\eta N}{\eta N+\gamma}\frac{L}{\gamma}\overline{p}\right)\left(p\left(c\right)-c\right)=\frac{L}{4\gamma}\left(\frac{\alpha\gamma}{\eta N+\gamma}+\frac{\eta N}{\eta N+\gamma}\overline{p}-c\right)^{2}$$

we obtain the survival cutoff the survival cutoff

$$c_D=\frac{\alpha\gamma}{\eta N+\gamma}+\frac{\eta N}{\eta N+\gamma}\overline{p}-2\sqrt{\frac{\gamma\hat{\lambda}}{L}}, \tag{36}$$

where $\hat{\lambda}=\left[1+\frac{1-\delta}{\delta}\left(d-t\right)\right]\lambda$ is the fixed cost augmented for the cost of financing it externally. Substituting it back into the equilibrium profit function we obtain

$$\pi\left(c\right)=\frac{L}{4\gamma}\left(2\sqrt{\frac{\gamma\hat{\lambda}}{L}}+c_D-c\right)^{2}-\hat{\lambda}.$$

The free entry condition reads

$$\int_0^{c_D}\left[\frac{L}{4\gamma}\left(2\sqrt{\frac{\gamma\hat{\lambda}}{L}}+c_D-c\right)^{2}-\hat{\lambda}\right]dG(c)=f_E,$$

which with Pareto distribution of the cost parameter c, $dG(c)=\frac{k}{c_M}\left(\frac{c}{c_M}\right)^{k-1}$, and setting $c_M=1$, yields,

$$b_1c_D^{k+2}+b_2\sqrt{\hat{\lambda}}c_D^{k+1}=f_E.$$

where $b_1=L/\left[2\gamma\left(k+2\right)\left(k+1\right)\right]$ and $b_2=\sqrt{L/\gamma}/\left(k+1\right)$. It is easy to see that $\partial c_D/\partial\hat{\lambda}<0$ and $\partial c_D/\partial f_E<0$, so higher fixed and sunk entry costs make the economy more selective.[66]

Consider now a two-country world, a home country and a foreign country, where in order to export firms pay an iceberg cost τ and a fixed operating cost λ_x, on which they are financially constrained as in the closed economy case. To preserve some tractability we focus on the case where countries are perfectly symmetric.[67] The profit function for producing domestically and the domestic cutoff will be

[66]Let

$$F=b_1c_D^{k+2}+b_2\sqrt{\hat{\lambda}}c_D^{k+1}-f_E,$$

using the implicit function theorem we get,

$$\begin{aligned}\partial c_D/\partial\hat{\lambda} &= -\frac{\partial F/\partial\hat{\lambda}}{\partial F/\partial c_D}<0,\\ \partial c_D/\partial f_E &= -\frac{\partial F/\partial f_E}{\partial F/\partial c_D}<0.\end{aligned}$$

[67]With asymmetric country it is possible to perform the comparative statics showing the selection effect of trade but analysing the effect of larger fixed costs on trade-induced selection is not possible.

similar as those in closed economy, while for exporters we obtain

$$\pi_X(c) = \frac{L}{4\gamma}\left(2\sqrt{\frac{\gamma\hat{\lambda}_X}{L}} + \tau c_X - \tau c\right)^2 - \hat{\lambda}_X.$$

Notice that, as in the closed economy case, financial frictions increase the fixed cost of exporting, $\hat{\lambda}_X = \left[1 + \frac{1-\delta}{\delta}(d-t)\right]\lambda_X$; The export cutoff is

$$c_X = \frac{1}{\tau}\left(\frac{\alpha\gamma}{\eta N + \gamma} + \frac{\eta N}{\eta N + \gamma}\overline{p} - 2\sqrt{\frac{\gamma\hat{\lambda}_X}{L}}\right). \tag{37}$$

The free entry condition in open economy is

$$\int_0^{c_D} \pi_D(c)dGc + \int_0^{c_X} \pi_X(c)dGc = f_E,$$

where $\pi_D(c)$ is the same as in autarky and f_E is the entry cost. Notice that (36) and (37) imply

$$c_X = \frac{1}{\tau}\left(c_D + 2\sqrt{\frac{\gamma}{L}}\left(\sqrt{\hat{\lambda}} - \sqrt{\hat{\lambda}_X}\right)\right). \tag{38}$$

Using the same Pareto distribution for the cost parameter and (38) the free entry yields,

$$b_1 c_D^{k+2} + b_2\sqrt{\hat{\lambda}}c_D^{k+1} + \rho b_1\left[c_D + 2\sqrt{\frac{\gamma}{L}}\left(\sqrt{\hat{\lambda}} - \sqrt{\hat{\lambda}_X}\right)\right]^{k+2} + \rho b_2\sqrt{\hat{\lambda}_X}\left[c_D + 2\sqrt{\frac{\gamma}{L}}\left(\sqrt{\hat{\lambda}} - \sqrt{\hat{\lambda}_X}\right)\right]^{k+1} = f_E, \tag{39}$$

where $\rho = \tau^{-k}$. Using the implicit function theorem we obtain

$$\frac{\partial c_D}{\partial \rho} = -\frac{\frac{\partial F}{\partial \rho}}{\frac{\partial F}{\partial c_D}} = -\frac{[\cdot]^{k+1}\left(b_1[\cdot] + b_2\sqrt{\hat{\lambda}_X}\right)}{(c_D)^k\left[b_1(k+2)c_D + b_2(k+1)\sqrt{\hat{\lambda}}\right] + \rho[\cdot]^k\left\{b_1(k+2)[\cdot] + b_2(k+1)\sqrt{\hat{\lambda}_X}\right\}} < 0, \tag{40}$$

where F is the free entry condition, and $[\cdot] = c_D + 2\sqrt{\frac{\gamma}{L}}\left(\sqrt{\hat{\lambda}} - \sqrt{\hat{\lambda}_X}\right)$. Hence we obtain the standard selection effect of trade liberalization.

Next we analyse how the fixed operating costs and thus the financial frictions affect the selection effect of trade. It is useful to rearrange (40) as follows

$$\frac{\partial^2 c_D}{\partial\rho\partial\sqrt{\hat{\lambda}}} = -\left(\frac{\frac{\partial^2 F}{\partial\rho\partial\sqrt{\hat{\lambda}}}\frac{\partial F}{\partial c_D} - \frac{\partial^2 F}{\partial c_D\partial\sqrt{\hat{\lambda}}}\frac{\partial F}{\partial \rho}}{\left(\frac{\partial F}{\partial c_D}\right)^2}\right) < 0,$$

$$\frac{\partial^2 F}{\partial\rho\partial\sqrt{\hat{\lambda}}}\frac{\partial F}{\partial c_D} =$$
$$2\sqrt{\frac{\gamma}{L}}\left[\cdot\right]^k\left[b_1\left(k+2\right)\left[\cdot\right]+b_2\left(k+1\right)\sqrt{\hat{\lambda}_X}\right]\cdot$$
$$\left\{\left(c_D\right)^k\left[b_1\left(k+2\right)c_D+b_2\left(k+1\right)\sqrt{\hat{\lambda}}\right]+\rho\left[\cdot\right]^k\left[b_1\left(k+2\right)\left[\cdot\right]+b_2\left(k+1\right)\sqrt{\hat{\lambda}_X}\right]\right\}$$

and

$$\frac{\partial^2 F}{\partial c_D\partial\sqrt{\hat{\lambda}}}\frac{\partial F}{\partial\rho} =$$
$$\left(k+1\right)\left\{b_2x^k+\rho\left[\cdot\right]^{k-1}\left[b_1\left(k+2\right)\left[\cdot\right]+b_2k\sqrt{\hat{\lambda}_X}\right]2\sqrt{\frac{\gamma}{L}}\right\}\left[\cdot\right]^{k+1}\left(b_1\left[\cdot\right]+b_2\sqrt{\hat{\lambda}_X}\right)$$

rearranging and simplifying we obtain

$$\frac{\partial^2 F}{\partial\rho\partial\sqrt{\hat{\lambda}}}\frac{\partial F}{\partial c_D}-\frac{\partial^2 F}{\partial c_D\partial\sqrt{\hat{\lambda}}}\frac{\partial F}{\partial\rho}=T_1+T_2>0,$$

where

$$T_1=2\rho\sqrt{\tfrac{\gamma}{L}}\left[\cdot\right]^k\left\{\begin{array}{c}\left[b_1\left(k+2\right)\left[\cdot\right]+b_2\left(k+1\right)\sqrt{\hat{\lambda}_X}\right]^2\\ -\left[b_1\left(k+2\right)\left[\cdot\right]+b_2k\sqrt{\hat{\lambda}_X}\right]\left[b_1\left(k+1\right)\left[\cdot\right]+b_2\left(k+1\right)\sqrt{\hat{\lambda}_X}\right]\end{array}\right\}>0$$

and

$$T_2=\left(x\left[\cdot\right]\right)^k\left\{\begin{array}{c}2\sqrt{\tfrac{\gamma}{L}}\underbrace{\left[b_1\left(k+2\right)\left[\cdot\right]+b_2\left(k+1\right)\sqrt{\hat{\lambda}_X}\right]}_{\equiv A}\left[b_1\left(k+2\right)x+b_2\left(k+1\right)\sqrt{\hat{\lambda}}\right]\\ -b_2\left[\cdot\right]\underbrace{\left[b_1\left(k+1\right)\left[\cdot\right]+b_2\left(k+1\right)\sqrt{\hat{\lambda}_X}\right]}_{\equiv B}\end{array}\right\}$$

since $A>B$, $T_2>0$ if

$$2\sqrt{\frac{\gamma}{L}}\left[b_1\left(k+2\right)x+b_2\left(k+1\right)\sqrt{\hat{\lambda}}\right]>b_2\left[c_D+2\sqrt{\frac{\gamma}{L}}\left(\sqrt{\hat{\lambda}}-\sqrt{\hat{\lambda}_X}\right)\right],$$

which using the definition of b_1 and b_2 can be shown to hold.

Using the free entry condition we can rewrite

$$\frac{\partial c_D}{\partial\rho}=-\frac{\frac{\partial F}{\partial\rho}}{\frac{\partial F}{\partial c_D}}=-\frac{f_E-\left(b_1c_D^{k+2}+b_2\sqrt{\hat{\lambda}}c_D^{k+1}\right)}{\left(c_D\right)^k\left[b_1\left(k+2\right)c_D+b_2\left(k+1\right)\sqrt{\hat{\lambda}}\right]+\rho\left[\cdot\right]^k\left\{b_1\left(k+2\right)\left[\cdot\right]+b_2\left(k+1\right)\sqrt{\hat{\lambda}_X}\right\}},$$

and

$$\frac{\partial^2 c_D}{\partial \rho \partial f_E} = -\left(\frac{\frac{\partial^2 F}{\partial \rho \partial f_E}\frac{\partial F}{\partial c_D} - \frac{\partial^2 F}{\partial c_D \partial f_E}\frac{\partial F}{\partial \rho}}{\left(\frac{\partial F}{\partial c_D}\right)^2} \right) < 0,$$

where $\frac{\partial^2 F}{\partial \rho \partial f_E} = 1$ and $\frac{\partial^2 F}{\partial c_D \partial f_E} = 0$.

A4. 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 Classification (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.

A5. Other Figures and Tables

Figure A1: MFN tariffs after WTO accession by 2-digit industries.

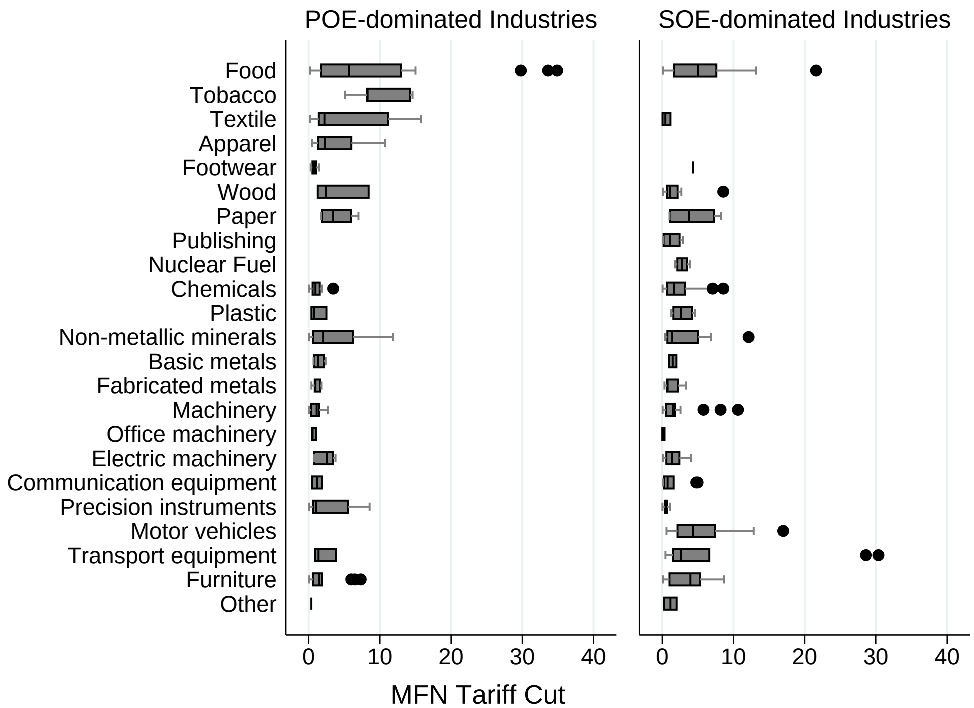


Figure A2: Bias toward SOEs.

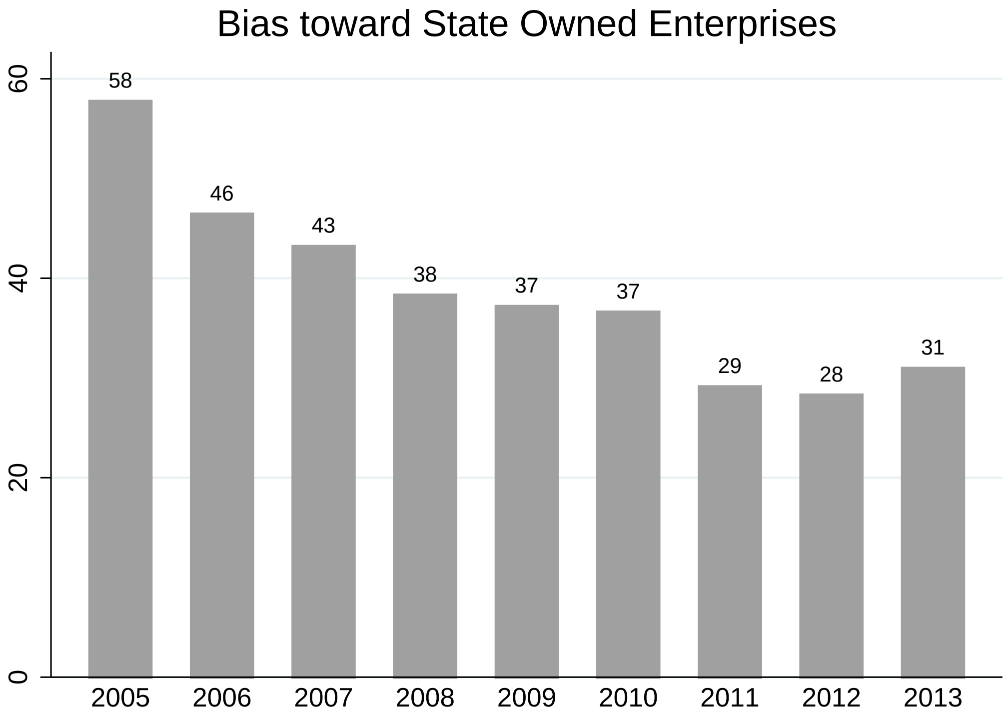


Figure A3: Types of bias toward SOEs.

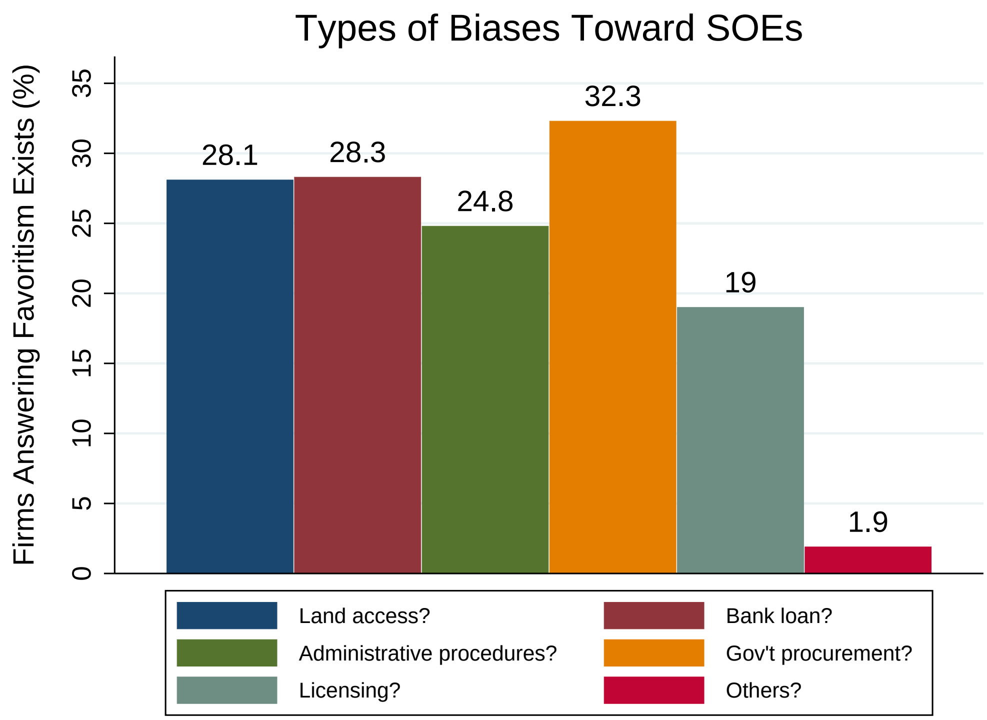
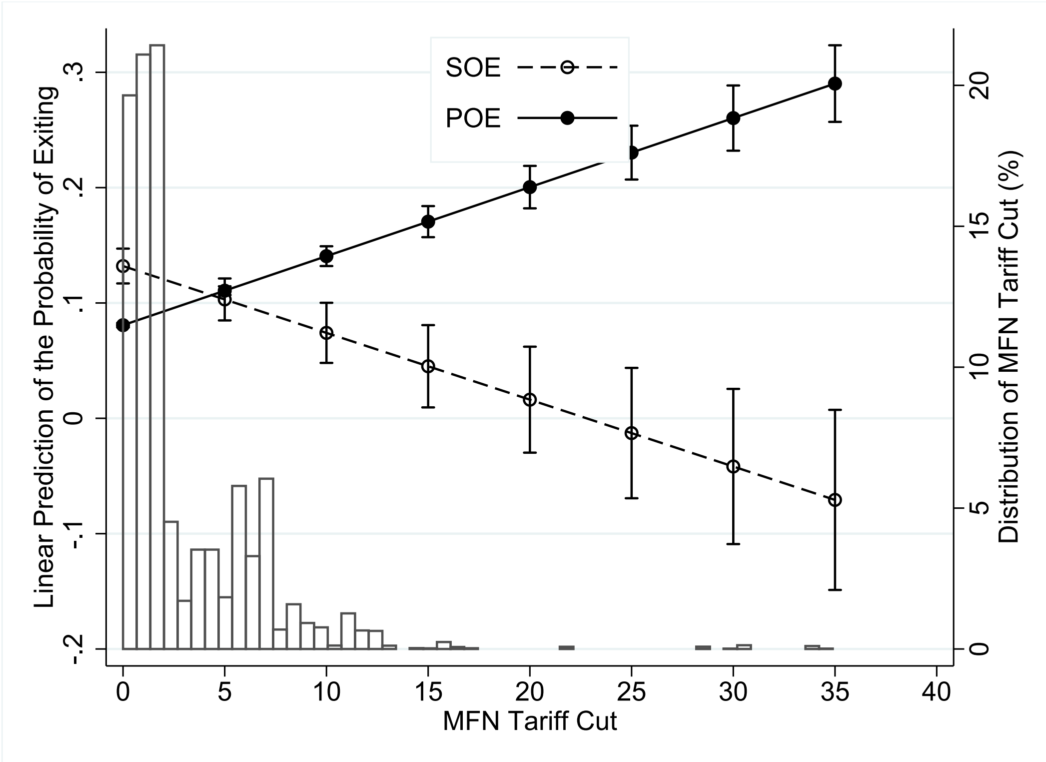
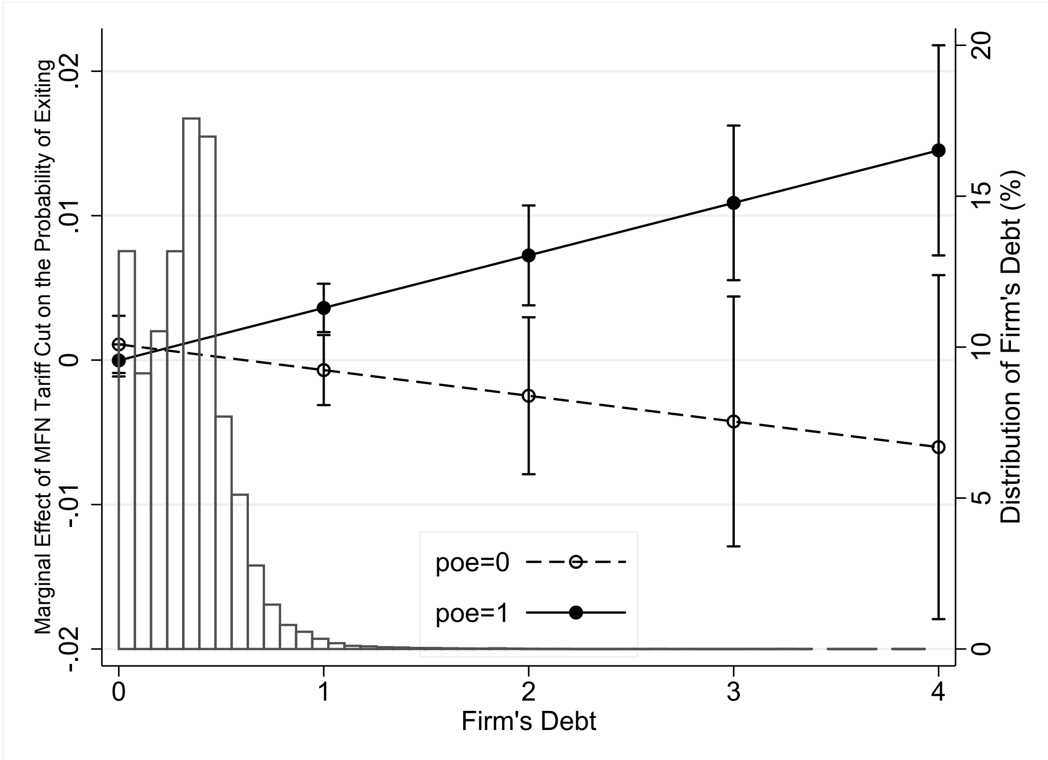


Figure A4: POE vs. SOE: the effect of MFN tariff cuts on firm's exit



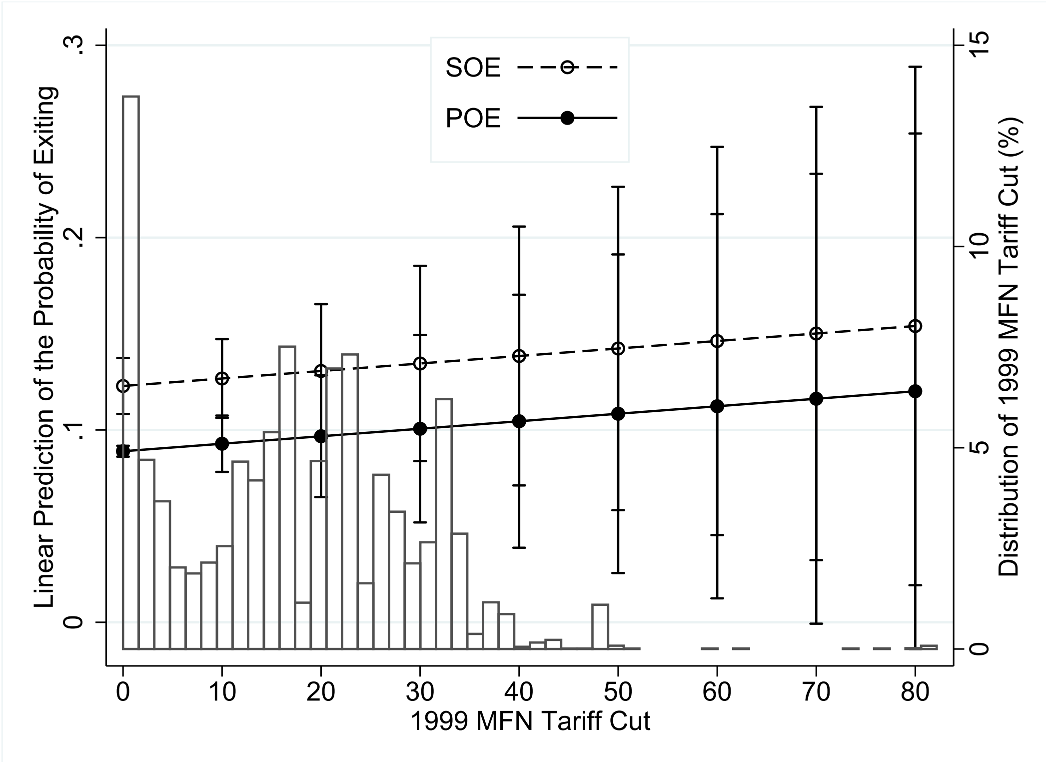
Note: The predictions are plotted from column 3 in Table 3 including the interaction term between a dummy of foreign firms and *MFN Tariff Cut*. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered at the level of the firm. The histogram shows the distribution of $\Delta\tau$.

Figure A5: POE vs. SOE: The effect of firm's debt on firm's exit



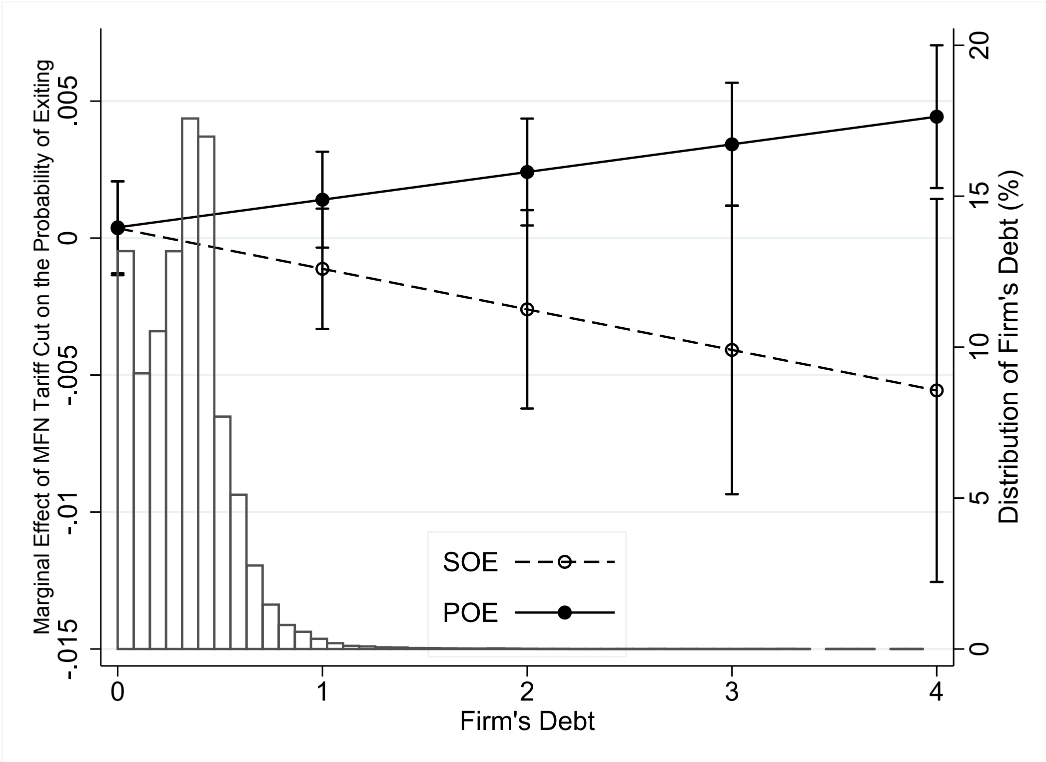
Note: The predictions are plotted from column 4 in Table 4 including triple and double interaction terms between a dummy of foreign firms, *MFN Tariff Cut*, and *Firm's Debt*. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered at the level of the firm. The histogram shows the distribution of $ln(Firm'sDebt)$.

Figure A6: POE vs. SOE: the effect of 1999 MFN tariff cuts on firm's exit



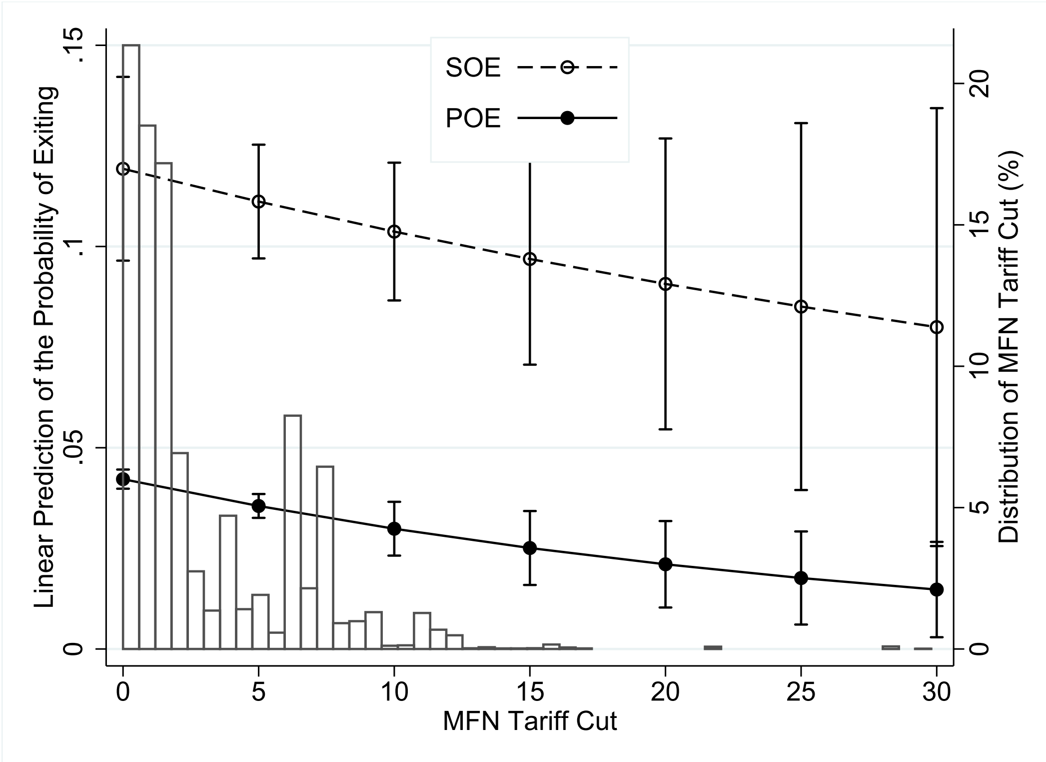
Note: The predictions are plotted from column 3 in Table 3 replacing $\Delta\tau$ with *1999 MFN Tariff Cut*. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered at the level of the firm. The histogram shows the distribution of *1999 MFN Tariff Cut*.

Figure A7: POE vs. SOE: The effect of firm's debt on firm's exit (1999 MFN Tariff cuts)



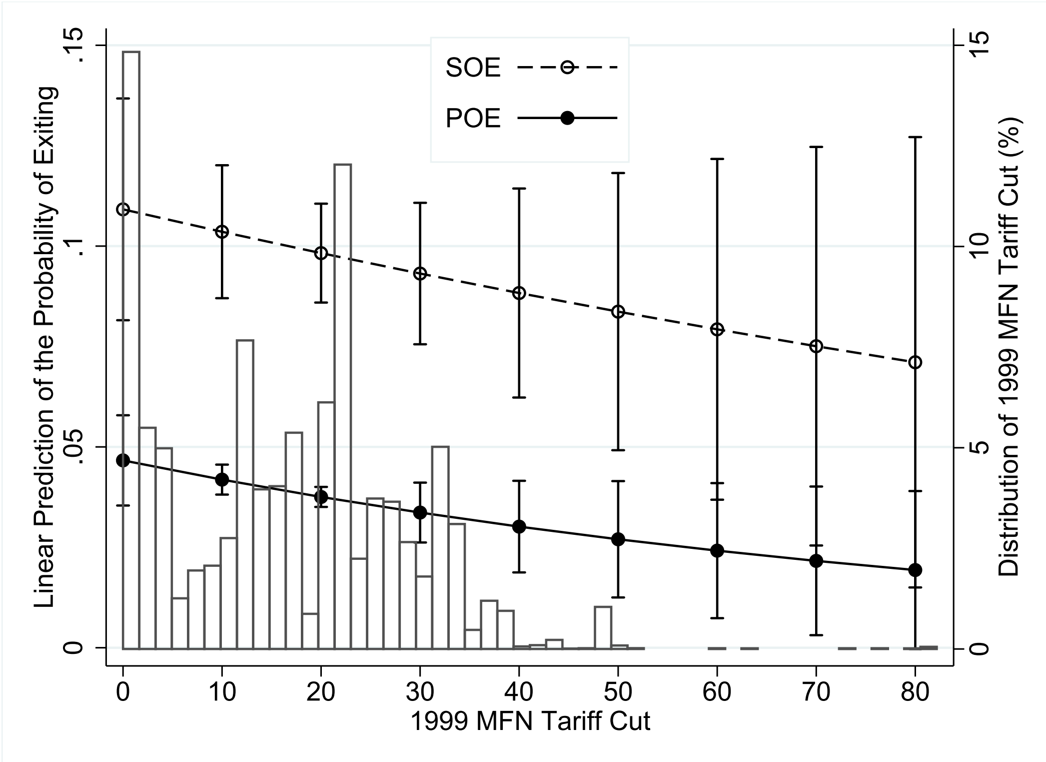
Note: The predictions are plotted from column 4 in Table 4 replacing $\Delta\tau$ with *1999 MFN Tariff Cut*. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered at the level of the firm. The histogram shows the distribution of $ln(Firm'sDebt)$.

Figure A8: POE vs. SOEs: The effect of MFN tariff cuts on firm's markups



Note: The predictions are plotted from column 6 in Table 5 including the triple interaction term among a dummy of foreign firms, *MFN Tariff Cut*, and*Firm's Debt* as well as the double interaction terms. Fractional outcome regression with industry (4-digit) fixed effects and robust standard errors clustered at the firm level. The histogram shows the distribution of $\Delta\tau$.

Figure A9: POE vs. SOEs: The effect of 1999 MFN tariff cuts on firm's markups



Note: The predictions are plotted from column 3 in Table 5 replacing $\Delta\tau$ with *1999 MFN Tariff Cut*. OLS regression with industry (4-digit) fixed effects and robust standard errors clustered at the level of the firm. The histogram shows the distribution of *1999 MFN Tariff Cut*.

Figure A10: Distribution of SOE Labor Share

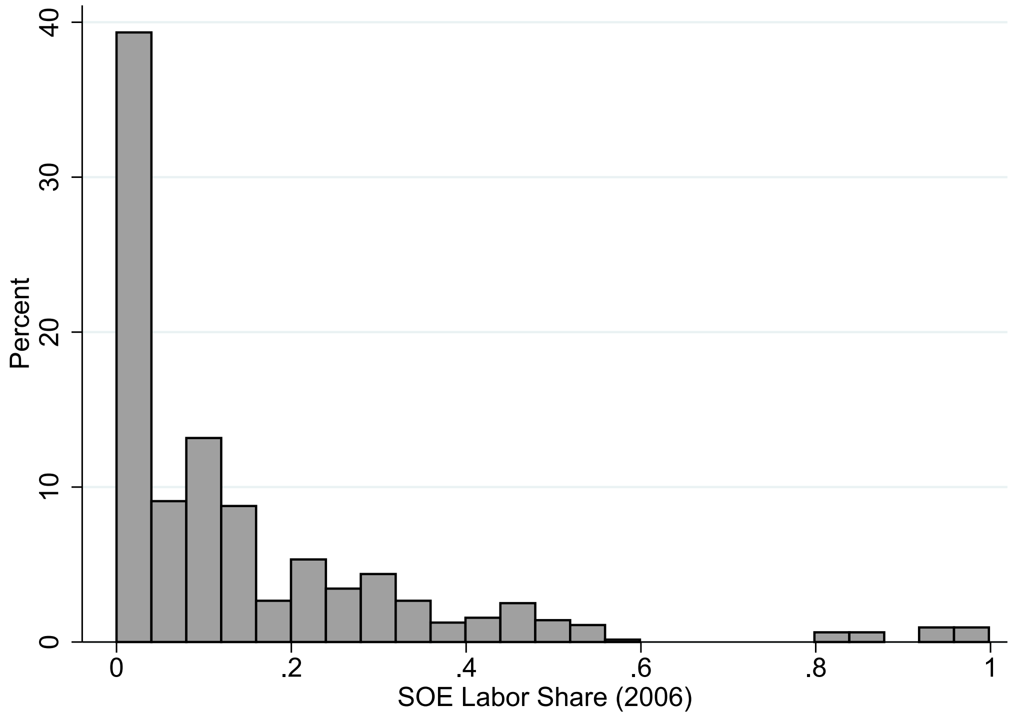


Table A1: Differences between POEs covariates and SOEs covariates.

	POE			SOE		
Variable	Mean	Variance	Skewness	Mean	Variance	Skewness
ln(Labour)	2.88	1.73	1.05	4.81	2.59	-0.03
ln(Assets)	8.34	2.91	0.43	10.62	3.68	-0.30
MFN Tariff	10.91	56.99	1.51	13.00	73.46	1.54
ln(Exports)	9.40	90.56	0.07	12.89	84.76	-0.65
ln(K/L)	5.40	1.70	-0.69	5.76	2.12	-0.20
PTA Tariff	0.01	0.14	27.78	0.02	0.21	21.81
Age	41	811	-0.60	55	190	-2.68
Age squared	2529	3563003	-0.46	3216	1071655	-1.80

	POE			SOE		
Variable	Mean	Variance	Skewness	Mean	Variance	Skewness
ln(Labour)	2.88	1.73	1.05	2.88	1.97	-0.03
ln(Assets)	8.34	2.91	0.43	8.34	4.91	-0.30
MFN Tariff	10.91	56.99	1.51	10.91	56.10	1.54
ln(Exports)	9.40	90.56	0.07	9.40	95.62	-0.65
ln(K/L)	5.40	1.70	-0.69	5.40	2.97	-0.20
PTA Tariff	0.01	0.14	27.78	0.01	0.14	21.81
Age	41	811	-0.60	41	811	-2.68
Age squared	2529	3563003	-0.46	2529	3549747	-0.51

Table A2: Explaining MFN tariff cuts: OLS with industry (4-digit) fixed effects and robust standard errors by HS 4-digit.

VARIABLES	(1) MFN Tariff Cut	(2) MFN Tariff Cut	(3) MFN Tariff Cut
MFN Tariff Cut (lagged)	-0.370***	-0.369***	-0.366***
	(0.075)	(0.076)	(0.076)
TFPR	0.596	0.779	0.735
	(0.532)	(0.688)	(0.520)
SOE Labor Share	2.640	3.022	-1.718
	(2.358)	(2.363)	(3.773)
TFPR*SOE Labor Share		-1.750	
		(1.959)	
Markups	-0.164	-0.184	-0.664
	(0.500)	(0.505)	(0.503)
Markups*SOE Labor Share			3.126
			(2.228)
Size	-0.262	-0.291	-0.127
	(0.593)	(0.604)	(0.620)
POE Exit	-0.001	-0.001	-0.000
	(0.003)	(0.003)	(0.003)
K/L	-0.560	-0.584	-0.710
	(0.667)	(0.681)	(0.670)
Age	-0.123**	-0.124**	-0.118*
	(0.061)	(0.062)	(0.062)
State capital	0.082	0.085	0.090
	(0.213)	(0.215)	(0.211)
HHI	2.576	2.649	1.601
	(2.255)	(2.276)	(2.445)
Number of foreign firms	0.002	0.002	0.002
	(0.004)	(0.004)	(0.004)
Number of SOEs	0.005	0.002	0.004
	(0.020)	(0.021)	(0.020)
Number of private firms	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
Exports	-0.072	-0.059	-0.087
	(0.123)	(0.117)	(0.123)
Constant	13.155*	13.477*	13.863*
	(7.774)	(7.996)	(7.790)
Observations	577	577	577
R-squared	0.331	0.332	0.334
Industry FE	YES	YES	YES
Year FE	YES	YES	YES

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

Table A3: Descriptive statistics.

Firm-level analysis				
Variable	Mean	Std. Dev.	Min	Max
Exit	0.07	0.25	0	1
MFN Tariff Cut	1.37	1.43	-28.82	34.89
POE*Post-WTO	0.78	0.42	0	1
POE	0.91	0.29	0	1
Foreign firm	0.07	0.25	0	1
TFP	0.04	1.69	-15.40	12.50
ln(Markup)	0.34	0.96	0.01	0.99
HHI	0.06	0.12	0	1
ln(Number of Employees)	3.05	1.46	0	11.46
ln(Assets)	8.54	1.84	0	19.35
ln(K\L)	5.43	1.32	0	13.74
ln(Exports)	9.72	9.54	0	21.74
Age	42.69	27.70	0	69
Age squared	2592	1837	1	4761
Preferential Tariff Cut	0.01	0.38	0	20
MFN Tariff	11.10	7.67	0	91.39

Industry-level analysis				
Variable	Mean	Std. Dev.	Min	Max
TFP	-0.16	0.50	-2.13	1.41
ln(Markup)	0.26	0.47	0.01	0.82
MFN Tariff Cut	1.27	4.77	-28.82	34.89
SOE Revenue Share	0.11	0.19	0	1
ln(Number of Employees)	5.55	1.17	1.60	10.30
ln(K\L)	5.80	0.83	0	9.11
Exit	30.00	94.00	0	924
Age	50.00	7.00	1	69
ln(Exports)	10.74	9.38	0	21.74
Capital owned by state	3.89	5.80	0	35.08
Number of SOEs	9	19	0	224
Number of Semi-POE	223	500	0	5046.00
Number of POEs	393	906	1	8048
Number of Foreign Firms	29	88	0	927
MFN Tariff	9.98	11.08	0	91.39

.

Table A4: Exit and Post-WTO: OLS regression with entropy balancing and standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)
	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)
POE	0.020***	-0.085***	-0.085***	-0.086***	-0.086***	
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	
Post-WTO	0.015***	0.001	0.002	-0.045	-0.021***	
	(0.001)	(0.002)	(0.002)	(0.028)	(0.003)	
POE*Post-WTO	**0.047*** **	**0.039*** **	**0.039*** **	**0.042*** **	**0.041*** **	**0.017*** **
	(0.002)	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**
Constant	-0.015***	0.018**	0.017**	0.057*	-20.964	
	(0.001)	(0.008)	(0.008)	(0.030)	(131.325)	
Observations	226,050	225,564	225,564	225,564	225,564	225,564
R-squared	0.037	0.095	0.095	0.099	0.097	0.671
Controls	NO	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Balancing	NO	NO	NO	NO	NO	NO
Business control	NO	NO	YES	NO	NO	NO
Industry-year FE	NO	NO	NO	YES	NO	NO
Trends	NO	NO	NO	NO	YES	NO
Firm FE	NO	NO	NO	NO	NO	YES

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

Table A5: Exit, Post-WTO, and Fim's Debt: OLS regression with entropy balancing and standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	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)
POE		0.060***	-0.069***	-0.069***	-0.071***	-0.072***	
		(0.003)	(0.005)	(0.005)	(0.005)	(0.005)	
Post-WTO	0.018***	0.003	-0.007**	-0.009***	-0.069***	-0.024***	
	(0.002)	(0.002)	(0.003)	(0.003)	(0.009)	(0.004)	
Firm's Debt	0.038***	0.009*	0.029***	0.029***	0.025***	0.027***	0.026***
	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)	(0.003)
Post-WTO*Firm's Debt	0.059***	0.002	0.001	0.001	0.007	0.004	-0.018***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)	(0.008)	(0.005)
POE*Post-WTO		0.025***	0.023***	0.023***	0.029***	0.029***	0.034***
		(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
POE*Firm's Debt		-0.037***	-0.001	-0.001	0.000	-0.001	-0.013***
		(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.004)
POE*Post-WTO*Firm' Debt		**0.139*** **	**0.090*** **	**0.089*** **	**0.084*** **	**0.089*** **	**0.017** **
		(0.009)	**(0.010)**	**(0.010)**	**(0.010)**	**(0.010)**	**(0.007)**
Constant	0.080***	-0.080***	0.118***	0.124***	0.029	17.867***	
	(0.015)	(0.005)	(0.016)	(0.016)	(0.047)	(6.287)	
Observations	129,459	129,466	129,459	129,459	129,459	129,459	129,459
R-squared	0.104	0.052	0.105	0.106	0.110	0.108	0.741
Controls	YES	NO	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	NO	NO	NO	NO	NO	NO
Business control	NO	NO	NO	YES	NO	NO	NO
Industry-year FE	NO	NO	NO	NO	YES	NO	NO
Trends	NO	NO	NO	NO	NO	YES	NO
Firm FE	NO	NO	NO	NO	NO	NO	YES

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

Table A6: Exit and MFN cut: OLS regression with Only POE, Semi-POE, entropy balancing, and standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	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)
Completely private	0.064***	0.025	0.020	0.020	0.015	0.021	
	(0.003)	(0.017)	(0.016)	(0.016)	(0.015)	(0.014)	
Partially State Owned	0.041***	0.015	-0.003	-0.003	-0.007	-0.002	
	(0.003)	(0.017)	(0.017)	(0.017)	(0.016)	(0.014)	
MFN Tariff Cut	-0.002***	-0.005***	-0.005***	-0.005***	-0.007***	-0.005***	-0.001***
	(0.000)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.000)
Completely private*MFN Tariff Cut	**0.002*** **	**0.016*** **	**0.013*** **	**0.013*** **	**0.013*** **	**0.013*** **	**0.003*** **
	(0.000)	**(0.002)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.000)**
Partially State Owned*MFN Tariff Cut	**0.002*** **	**0.013*** **	**0.010*** **	**0.010*** **	**0.010*** **	**0.010*** **	**-0.002*** **
	(0.000)	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.000)**
Constant	-0.064***	-0.076***	0.635***	1.930***	0.991***	322.928	
	(0.002)	(0.009)	(0.070)	(0.431)	(0.096)	(.)	
Observations	226,050	225,564	224,982	224,982	225,564	224,982	224,982
R-squared	0.040	0.157	0.347	0.347	0.361	0.358	0.672
Controls	NO	NO	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES	YES	NO
Business control	NO	NO	NO	YES	NO	NO	NO
Industry-year FE	NO	NO	NO	NO	YES	NO	NO
Trends	NO	NO	NO	NO	NO	YES	NO
Firm FE	NO	NO	NO	NO	NO	NO	YES

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

Table A7: Exit, MFN Tariff Cut, and Firm's Debt: OLS regression with Only POE, Semi-POE, entropy balancing, and standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	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)
Completely private	0.065***	0.054***	0.023**	0.023**	0.020**	0.023**	
	(0.003)	(0.006)	(0.010)	(0.010)	(0.010)	(0.010)	
Partially State Owned	0.083***	0.068***	0.018*	0.018*	0.014	0.017	
	(0.003)	(0.005)	(0.011)	(0.011)	(0.010)	(0.011)	
MFN Tariff Cut	-0.003***	0.000	0.001	0.001	0.001	0.000	-0.003***
	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)
Firm's Debt	0.013***	-0.002	0.004	0.004	0.004	0.007	0.007**
	(0.004)	(0.011)	(0.012)	(0.012)	(0.011)	(0.012)	(0.003)
MFN Tariff Cut*Firm's Debt	-0.001	-0.002	-0.003	-0.003	-0.003	-0.003	-0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Completely private*MFN Tariff Cut	-0.000	-0.001	-0.002*	-0.002*	-0.002	-0.002	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Completely private*Firm's Debt	-0.009	0.011	0.019	0.019	0.019	0.016	0.038***
	(0.007)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.005)
Partially State Owned*MFN Tariff Cut	0.001	-0.000	-0.000	-0.000	0.000	0.000	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Partially State Owned*Firm's Debt	0.102***	0.129***	0.126***	0.126***	0.124***	0.123***	-0.027***
	(0.007)	(0.013)	(0.013)	(0.013)	(0.012)	(0.013)	(0.004)
Completely private*MFN Tariff Cut*Firm's Debt	**0.012*** **	**0.013*** **	**0.012*** **	**0.012*** **	**0.011*** **	**0.012*** **	**0.001**
	(0.002)	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.002)**
Partially State Owned*MFN Tariff Cut*Firm's Debt	**0.002**	**0.003**	**0.002**	**0.002**	**0.002**	**0.002**	**0.005*** **
	(0.002)	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.003)**	**(0.001)**
Constant	-0.103***	-0.069***	0.008	0.003	0.051**	21.961*	
	(0.006)	(0.008)	(0.027)	(276.770)	(0.020)	(11.920)	
Observations	129,466	129,459	129,125	129,125	129,459	129,459	129,459
R-squared	0.056	0.073	0.103	0.103	0.110	0.113	0.741
Controls	NO	NO	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES	YES	NO
Business control	NO	NO	NO	YES	NO	NO	NO
Industry-year FE	NO	NO	NO	NO	YES	NO	NO
Trends	NO	NO	NO	NO	NO	YES	NO
Firm FE	NO	NO	NO	NO	NO	NO	YES

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

Table A8: Exit, MFN Tariff Cut, and Firm's Debt: Weibull models with standard errors clustered at the firm level.

	(1)	(2)
	Weibull	Weibull
VARIABLES	Pr(Exit=1)	Pr(Exit=1)
POE	-0.746***	0.230
	(0.177)	(0.264)
MFN Tariff Cut	-0.032***	0.054**
	(0.011)	(0.025)
POE*MFN Tariff Cut	**0.044***	-0.068**
	(0.010)	(0.030)
Firm's Debt		1.050***
		(0.185)
MFN Tariff Cut*Firm's Debt		-0.059**
		(0.025)
POE*Firm's Debt		-0.332*
		(0.175)
POE*MFN Tariff Cut*Firm's Debt		**0.100***
		(0.029)
Constant	-13.530***	-4.240***
	(1.214)	(0.285)
ln_p	0.601***	0.640***
	(0.016)	(0.018)
Observations	224,982	129,125
Controls	YES	YES
Year FE	YES	YES
Industry FE	YES	YES
Balancing	NO	NO

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

Table A9: Exit and MFN cut: OLS regression with PSM and standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
VARIABLES	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)	Pr(Exit=1)
POE	0.060***	0.042***	0.042***	0.043***	0.042***
	(0.012)	(0.009)	(0.009)	(0.009)	(0.010)
MFN Tariff Cut	-0.001	-0.002	-0.002	0.001	-0.005**
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
POE*MFN Tariff Cut	**0.002**	**0.003***	**0.003***	**0.002**	**0.002**
	(0.002)	**(0.002)**	**(0.002)**	**(0.001)**	**(0.002)**
Constant	-0.064***	-0.021	0.760***	0.063	0.056
	(0.013)	(0.060)	(0.282)	(0.077)	(0.058)
Observations	218,387	217,861	217,861	218,387	217,861
R-squared	0.046	0.088	0.088	0.100	0.096
Controls	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
PSM	YES	YES	YES	YES	YES
Business control	NO	NO	YES	NO	NO
Industry-year FE	NO	NO	NO	YES	NO
Trends	NO	NO	NO	NO	YES

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

Table A10: Exit, MFN tariff cut, and Firm's Debt: OLS regression with PSM and standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)
	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)
POE	0.024**	0.083***	0.014	0.014	0.009	0.002
	(0.011)	(0.013)	(0.012)	(0.012)	(0.011)	(0.011)
MFN Tariff Cut	-0.000	0.007	0.002	0.002	0.011*	-0.002
	(0.003)	(0.006)	(0.002)	(0.002)	(0.006)	(0.003)
Firm's Debt	0.028***	0.021	0.011	0.011	0.009	-0.001
	(0.008)	(0.020)	(0.012)	(0.012)	(0.010)	(0.010)
MFN Tariff Cut*Firm's Debt	-0.006***	-0.005	-0.005*	-0.005*	-0.005**	-0.003*
	(0.002)	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)
POE*MFN Tariff Cut		-0.009	-0.009*	-0.009*	-0.008*	-0.006**
		(0.006)	(0.005)	(0.005)	(0.004)	(0.002)
POE*Firm's Debt		0.041**	0.058***	0.058***	0.063***	0.080***
		(0.021)	(0.017)	(0.017)	(0.012)	(0.010)
POE*MFN Tariff Cut*Firm's Debt		**0.011****	**0.010*****	**0.010*****	**0.010*****	**0.009*****
		(0.005)	**(0.004)**	**(0.004)**	**(0.003)**	**(0.002)**
Constant	0.022	-0.111***	0.035	0.002	0.078***	
	(0.027)	(0.023)	(0.027)	(0.075)	(0.022)	
Observations	123,642	123,939	123,642	123,642	123,939	123,642
R-squared	0.104	0.066	0.107	0.107	0.116	0.126
Controls	YES	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
PSM	YES	YES	YES	YES	YES	YES
Business control	NO	NO	NO	YES	NO	NO
Industry-year FE	NO	NO	NO	NO	YES	NO
Trends	NO	NO	NO	NO	NO	YES

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

Table A11: Exit, MFN tariff cut, Markups, and Firm's Debt: OLS regression with controls interacted with the post-WTO dummy, entropy balancing and standard errors clustered at the firm level.

VARIABLES	(1) OLS Pr(Exit=1)	(2) OLS Pr(Exit=1)	(3) OLS Pr(Exit=1)	(4) OLS Pr(Exit=1)	(5) FracReg Markups	(6) FracReg Markups
POE	0.023	0.013*	0.029**	0.005	-0.785***	-0.289*
	(0.017)	(0.007)	(0.012)	(0.006)	(0.195)	(0.155)
MFN Tariff Cut	-0.005***		0.002*		-0.001	
	(0.001)		(0.001)		(0.009)	
Post-WTO		0.493***		0.039		1.360**
		(0.058)		(0.044)		(0.551)
Firm's Debt			0.008	-0.005		
			(0.012)	(0.006)		
POE*MFN Tariff Cut	**0.011*** **		**-0.004*** **		**-0.019** **	
	(0.001)		**(0.001)**		**(0.009)**	
POE*Post-WTO		**0.043** **		**0.020**		**-0.615** **
		(0.019)		**(0.016)**		**(0.244)**
MFN Tariff Cut*Firm's Debt			-0.003			
			(0.002)			
POE*Firm's Debt			0.054***	-0.007		
			(0.012)	(0.008)		
Post-WTO*Firm's Debt				0.002		
				(0.014)		
POE*MFN Tariff Cut*Firm's Debt			**0.008*** **			
			(0.002)			
POE*Post-WTO*Firm's Debt				**0.120*** **		
				(0.015)		
Constant	0.262***	0.292***	-0.017	0.001	-0.861***	-1.438***
	(0.065)	(0.069)	(0.025)	(0.021)	(0.295)	(0.393)
Observations	225,564	225,564	129,459	129,459	144,411	144,411
R-squared	0.362	0.357	0.111	0.112		
Controls	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Balancing	YES	YES	YES	YES	YES	YES
Controls*Post-WTO dummy	YES	YES	YES	YES	YES	YES

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

Table A12: Markups and MFN tariff cut: fractional outcome regressions and OLS regressions with lagged dependent variable, entropy balancing and standard errors clustered at the firm level.

VARIABLES	(1) FracReg Markups	(2) FracReg Markups	(3) FracReg Markups	(4) FracReg Markups	(5) FracReg Markups	(6) OLS Markups	(7) OLS Markups
POE	-0.302***	-0.150	-0.268**	-0.268**	-0.270**	-0.012	
	(0.040)	(0.146)	(0.131)	(0.131)	(0.110)	(0.008)	
MFN Tariff Cut	0.002	0.007	0.017**	0.017**	0.025***	0.001**	0.001***
	(0.002)	(0.006)	(0.007)	(0.007)	(0.007)	(0.001)	(0.000)
POE*MFN Tariff Cut	**-0.008*** **	**-0.015** **	**-0.018*** **	**-0.018*** **	**-0.024*** **	**-0.001** **	**-0.000* **
	(0.003)	**(0.007)**	**(0.006)**	**(0.006)**	**(0.007)**	**(0.001)**	**(0.000)**
Markups (lagged)	4.267***	4.215***	4.024***	4.024***	4.065***	0.433***	0.242***
	(0.108)	(0.183)	(0.173)	(0.173)	(0.161)	(0.022)	(0.016)
Constant	-3.518***	-3.777***	-3.660***	-3.708***	-3.789***	0.014	
	(0.132)	(0.182)	(0.249)	(0.283)	(0.355)	(0.015)	
Observations	64,018	63,984	63,816	63,816	63,984	63,816	63,849
R-squared						0.316	0.416
Controls	NO	NO	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES	YES	NO
Business control	NO	NO	NO	YES	NO	NO	NO
Industry-Year FE	NO	NO	NO	NO	YES	NO	NO
Trends	NO	NO	NO	NO	NO	YES	NO
Firm FE	NO	NO	NO	NO	NO	NO	YES

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

Table A13: Markups and MFN tariff cut: GMM regressions with lagged dependent variable, entropy balancing and standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)
	GMM	GMM	GMM	GMM	GMM	GMM
VARIABLES	Markups	Markups	Markups	Markups	Markups	Markups
POE	-0.017***	-0.010	-0.010	-0.010	-0.006	-0.011
	(0.003)	(0.010)	(0.013)	(0.013)	(0.009)	(0.009)
MFN Tariff Cut	0.000*	0.001*	-0.012	-0.012	0.001*	0.000
	(0.000)	(0.000)	(0.014)	(0.014)	(0.001)	(0.002)
POE*MFN Tariff Cut	**-0.000****	**-0.001****	**-0.001**	**-0.001**	**-0.002*****	**-0.001****
	(0.000)	**(0.000)**	**(0.001)**	**(0.001)**	**(0.001)**	**(0.001)**
Markups (lagged)	0.199***	0.270***	0.285***	0.285***	0.272***	0.269***
	(0.019)	(0.047)	(0.052)	(0.052)	(0.046)	(0.046)
Constant	0.064***	0.057***	0.000	-0.122	0.000	0.000
	(0.022)	(0.002)	(0.000)	(0.164)	(0.000)	(0.000)
Observations	64,018	63,984	63,816	63,816	63,984	63,816
AR(1)	-15.59***	9.10***	-5.81***	-5.81***	-9.37***	-8.89***
AR(2)	1.83*	1.1	0.74	0.74	1.23	1.02
# of groups	30,608	30,602	30,515	30,515	30,602	30,515
# of instruments	103	103	106	106	219	189
Controls	NO	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES	YES
Business control	NO	NO	NO	YES	YES	YES
Industry-Year FE	NO	NO	NO	NO	YES	NO
Trends	NO	NO	NO	NO	NO	YES

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

Table A14: Markups and MFN tariff cut: OLS regressions with double first differences, entropy balancing and standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	Markups	Markups	Markups	Markups	Markups	Markups	Markups	Markups	Markups	Markups
MFN Tariff Cut	0.000	0.000	0.000	0.000	0.000	0.000	0.001**	0.001**	0.001**	0.001*
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
POE*MFN Tariff Cut	**-0.000****	**-0.001**	**-0.001****	**-0.001***	**-0.001****	**-0.001***	**-0.001****	**-0.001****	**-0.000****	**-0.001****
	(0.000)	**(0.001)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.001)**	**(0.000)**	**(0.001)**	**(0.000)**	**(0.000)**
Constant	-0.005***	-0.002	-0.001	-0.008***	0.006***	0.007***	-0.042	0.033*	0.013	-1.514
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.041)	(0.017)	(108.695)	(1.956)
Observations	64,018	63,984	63,847	63,814	63,847	63,814	63,847	63,814	63,847	63,814
R-squared	0.002	0.003	0.013	0.016	0.013	0.016	0.020	0.037	0.015	0.022
Controls	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Business control	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO
Industry-year FE	NO	NO	NO	NO	NO	NO	YES	YES	NO	NO
Trends	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES

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

Table A15: Markups and MFN Tariff Cut: OLS regression with Only POE, Semi-POE, entropy balancing, and standard errors clustered at the firm level.

VARIABLES	(1) FracReg Markups	(2) FracReg Markups	(3) FracReg Markups	(4) FracReg Markups	(5) FracReg Markups	(6) FracReg Markups	(7) FracReg Markups
Completely private	-0.533***	-0.759***	-0.808***	-0.808***	-0.817***	-0.044***	
	(0.044)	(0.209)	(0.204)	(0.204)	(0.196)	(0.017)	
Partially State Owned	-0.489***	-0.675***	-0.781***	-0.781***	-0.791***	-0.046***	
	(0.043)	(0.200)	(0.196)	(0.196)	(0.197)	(0.017)	
MFN Tariff Cut	0.001	-0.002	0.008	0.008	0.006	0.002	0.000
	(0.002)	(0.009)	(0.010)	(0.010)	(0.011)	(0.002)	(0.000)
Completely private*MFN Tariff Cut	**-0.003**	**-0.016***	**-0.018****	**-0.018****	**-0.021****	**-0.001**	**-0.000****
	(0.003)	**(0.009)**	**(0.008)**	**(0.008)**	**(0.010)**	**(0.001)**	**(0.000)**
Partially State Owned*MFN Tariff Cut	**-0.009*****	**-0.022****	**-0.023****	**-0.023****	**-0.026****	**-0.001***	**-0.001****
	(0.003)	**(0.010)**	**(0.009)**	**(0.009)**	**(0.011)**	**(0.001)**	**(0.000)**
Constant	-1.077***	-1.239***	-0.586*	-0.285	1.246*	0.430***	
	(0.018)	(0.195)	(0.345)	(0.381)	(0.675)	(0.059)	
Observations	144,479	144,411	144,034	144,034	144,411	144,034	144,097
R-squared						0.150	0.331
Controls	NO	NO	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES	YES	NO
Business control	NO	NO	NO	YES	NO	NO	NO
Industry-Year FE	NO	NO	NO	NO	YES	NO	NO
Trends	NO	NO	NO	NO	NO	YES	NO
FIRM FE	NO	NO	NO	NO	NO	NO	YES

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

Table A16: Markups and MFN tariff cut: OLS regression with PSM and standard errors clustered at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	FracReg	FracReg	FracReg	FracReg	FracReg	FracReg	FracReg	FracReg	FracReg	FracReg
VARIABLES	Markups	Markups	Markups	Markups	Markups	Markups	Markups	Markups	Markups	Markups
POE	-0.418***	-0.475***	-0.475***	-0.503***	-0.025***	-0.418***	-0.475***	-0.475***	-0.503***	-0.025***
	(0.144)	(0.134)	(0.134)	(0.109)	(0.008)	(0.144)	(0.134)	(0.134)	(0.109)	(0.008)
MFN Tariff Cut	-0.009	-0.009	-0.009	0.002	0.001	-0.009	-0.009	-0.009	0.002	0.001
	(0.013)	(0.014)	(0.014)	(0.012)	(0.002)	(0.013)	(0.014)	(0.014)	(0.012)	(0.002)
POE*MFN Tariff Cut	**-0.020****	**-0.016***	**-0.016***	**-0.015***	**-0.001****	**-0.020****	**-0.016***	**-0.016***	**-0.015***	**-0.001****
	(0.010)	**(0.009)**	**(0.009)**	**(0.009)**	**(0.001)**	**(0.010)**	**(0.009)**	**(0.009)**	**(0.009)**	**(0.001)**
Constant	-1.255***	-0.539	-0.280	0.399	0.377***	-1.255***	-0.539	-0.280	0.399	0.377***
	(0.148)	(0.601)	(0.589)	(0.665)	(0.051)	(0.148)	(0.601)	(0.589)	(0.665)	(0.051)
Observations	139,859	139,511	139,511	139,859	139,511	139,859	139,511	139,511	139,859	139,511
R-squared					0.163					0.163
Controls	NO	YES	YES	YES	YES	NO	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Balancing	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Business control	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO
Industry-year FE	NO	NO	NO	YES	NO	NO	NO	NO	YES	NO
Trends	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES

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

Table A17: TFP, SOE-dominated sectors, and MFN tariff cut (industry-level): OLS regression with lagged dependent variable, entropy balancing and standard errors clustered by HS 4-digit.

	(1)	(3)	(5)
	OLS	OLS	OLS
VARIABLES	TFPR	TFPR	TFPR
SOE-dominated	0.012	0.087	0.087
	(0.062)	(0.087)	(0.087)
MFN Tariff Cuts	0.001	0.012	0.012
	(0.005)	(0.012)	(0.012)
SOE-dominated*MFN Tariff Cut	**-0.013****	**-0.023****	**-0.023****
	(0.005)	**(0.010)**	**(0.010)**
TFPR (lagged)	0.291***	0.014	0.014
	(0.088)	(0.122)	(0.122)
Constant	-0.177	-0.336	-0.207
	(0.300)	(0.578)	(0.575)
Observations	480	480	480
R-squared	0.518	0.605	0.605
Controls	YES	YES	YES
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Balancing	NO	YES	YES
Business control	NO	NO	YES

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

Table A18: TFP, SOE-dominated sectors, and MFN tariff cut (industry-level): GMM regression with lagged dependent variable, entropy balancing and standard errors clustered by HS 4-digit.

	(1)	(2)	(3)
	GMM	GMM	GMM
VARIABLES	TFPR	TFPR	TFPR
SOE-dominated	0.030	0.094	0.094
	(0.073)	(0.085)	(0.085)
MFN Tariff Cuts	0.000	-0.002	-0.002
	(0.004)	(0.008)	(0.008)
SOE-dominated*MFN Tariff Cut	**-0.011*** **	**-0.011** **	**-0.011** **
	(0.004)	**(0.006)**	**(0.006)**
TFPR (lagged)	0.071	-0.166	-0.166
	(0.099)	(0.140)	(0.140)
Constant	-0.016	-0.193	-0.451
	(0.435)	(0.142)	(0.698)
Observations	480	480	480
AR(1)	-3.94***	-1.70*	-1.70*
AR(2)	-1.62	-1.35	-1.35
# of groups	48	48	48
# of instruments	95	95	95
Controls	YES	YES	YES
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Balancing	NO	YES	YES
Business control	NO	NO	YES

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

Table A19: TFP, SOE Labor Share, and MFN tariff cut (industry-level): OLS regression with entropy balancing and standard errors clustered by HS 4-digit.

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
VARIABLES	TFPR	TFPR	TFPR	TFPR	d.TFPR
Share of SOE-dominated	0.103	0.399**	0.399**	0.413**	0.065
	(0.154)	(0.156)	(0.156)	(0.172)	(0.130)
MFN Tariff Cuts	-0.001	0.023**	0.023**	0.014	0.006
	(0.006)	(0.010)	(0.010)	(0.010)	(0.020)
Share of SOE-dominated*MFN Tariff Cut	**-0.016**	**-0.034*** **	**-0.034*** **	**-0.021** **	**-0.019**
	(0.013)	**(0.012)**	**(0.012)**	**(0.010)**	**(0.020)**
Constant	-1.128**	-0.424	-16.878***	-1.045	-0.157
	(0.465)	(0.743)	(6.152)	(0.941)	(0.147)
Observations	620	620	620	620	478
R-squared	0.403	0.598	0.598	0.659	0.441
Controls	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Balancing	NO	YES	YES	YES	YES
Business control	NO	NO	YES	NO	NO
Trends	NO	NO	NO	YES	NO

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

Table 20: TFP, SOE-dominated sectors, and MFN tariff cut (industry-level): OLS regression with controls interacted with the post-WTO dummy, entropy balancing and standard errors clustered by HS 4-digit.

VARIABLES	(1) OLS TFPR	(2) OLS TFPR	(3) OLS TFPR	(4) OLS TFPR
SOE-dominated	-0.000	0.025***	0.025***	0.020***
	(0.004)	(0.004)	(0.004)	(0.007)
MFN Tariff Cuts	0.015	0.189***	0.189***	0.209***
	(0.076)	(0.063)	(0.063)	(0.066)
SOE-dominated*MFN Tariff Cut	**-0.012****	**-0.034*****	**-0.034*****	**-0.028*****
	(0.006)	**(0.004)**	**(0.004)**	**(0.004)**
Constant	-1.413***	-0.762	-6.774	-1.239
	(0.364)	(0.746)	(14.626)	(0.983)
Observations	620	620	620	620
R-squared	0.423	0.648	0.648	0.694
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Controls*Post-WTO dummy	YES	YES	YES	YES
Balancing	NO	YES	YES	YES
Business control	NO	NO	YES	NO
Trends	NO	NO	NO	YES

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