Regulatory Protection and the Geography of Trade: Evidence from Chinese Customs Data

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September 29, 2017

Abstract

To comply with the demands of increasingly regulated markets, firms today must label, package or even rework products to meet the high standards of the destination market. These technical barriers to trade (TBT) can raise prices and perhaps quality, but firms may also respond by moving out of the market entirely or rerouting their trade through third countries. In the former case, top firms enjoy monopolistic rents. In the latter case, firms seeking to meet a standard in a country may shift transit trade toward countries with similar regulatory levels as the destination market. The consequences could be dire for smaller exporters and developing markets that have enjoyed at least some of the rents associated with transit trade. To study these effects, we examine the effects of regulatory protection on the flow of China's exports between 2000-2007, drawing on a unique dataset that covers the universe of over 130 million customs transactions reported by Chinese firms at the level of the shipment, including price, quantity, and the country of transit prior to arrival at the final market. During this period, China's exports quadrupled and its trading partners adopted hundreds of regulatory barriers to trade. Joining the customs data with the catalogue of regulatory barriers collected by the World Trade Organization, we examine the consequences of these regulatory barriers for the margins of trade, both across firms and across transit countries, and, for the first time, map the geography of trade for the largest exporter in a world of regulated markets.

The absence of tariff protection, even through the global financial crisis, has been called a victory for the global trade regime. However, policymakers and watchdogs have noted the rise of regulatory barriers to trade—licensing, testing, and labeling requirements—as both an unconstrained and rising form of trade protection.[1] In this paper, we argue that these differential effects arise from the way that differences among firms allow some companies to benefit from regulatory barriers to trade *in the destination market*. We examine these effects using transaction level data from Chinese exporters from 2000-2007, one market that accounts for between 4 and 9 percent of global export activity. Following prior work, we find that smaller firms are closed out of the market, allowing larger firms to expand. This effect is linear in the size of the firm, with medium sized firms expanding more than small firms, and large firms expanding the most. The result is that regulatory protection benefits the largest exporters and exacerbates inequality.

The formal economic analysis shows how the fixed cost component of regulatory protection that is absent in tariffs have direct and indirect effects on industry. The direct costs on a firm of complying with a regulation can be onerous; it is costly to raise the funds to rework a product, commission a laboratory to undergo testing, or retain lawyers to fill out paperwork. These costs can drive a firm to exit, but unlike a tariff, these costs are also invariant to trade volume. The indirect, or general equilibrium effect, of these measures is to alter the composition of trade. Political scientists have argued for decades that trade barriers harm the most productive and globally engaged firms, and so are likely to be opposed as globalization expands (Milner 1988). Regulatory barriers are particularly onerous for less productive, smaller firms. When these firms exit competition slackens, prices rise, and the largest volume producers benefit. Using a model of imperfect competition, we show that there is a point at which the productivity advantage of a firms means that a regulatory barrier increases profits.

We also find regulatory barriers alter the geography of global supply chains. Using Chinese customs statistics, we show strict regulations cause the largest Chinese firms to send their products to farther flung intermediaries that can enable firms to evade the regulation. Regulatory protection not only shifts market power toward the top firms, but also reorients the supply chain. Examining trade in honey, a highly regulated product, we examine the flows of trade before and after the European Union negotiated

[1] See, for example, Evenett (2014). Recent analysis of French firm-level data find that these barriers have different effects than tariffs, decreasing trade on the extensive margin but increasing trade on the intensive margin among a few large exporters (Fontagné et al. 2015; Fontagné and Orefice 2016).

new standards for Chinese manufacturers. We find evidence that Chinese firms systematically avoid barriers by shifting sales through India. Extending this analysis, we find that firms will increase the share of trade to third parties when a destination raises a technical barrier to trade (TBT), and that this diverting effect is largest for smaller firms. Regulatory protection appears to drive smaller firms away from the regulating state, but expand business with the largest exporters.

These indirect consequences of regulatory protection raises the political question, why would a government raise a barrier to trade that expands access for foreign firms? Using the Chinese case, we get a suggestion of a motive. Examining the ownership composition of exporters following a regulatory barrier to trade in a destination market, we see that the reallocation effect shifts market share toward firms that have foreign affiliates. Insofar as regulatory barriers are chosen by governments that host these affiliates, regulatory protection has a benefit of potentially profiting local firms.

This paper proceeds as follows. Section 1 offers a narrative account of the effects of regulatory barriers on firm profits. Section 2 develops these ideas in a formal economic model. Section 3 describes the data infrastructure necessary to analyze over 163 million observations. Section 4 econometrically identifies the effect of regulatory barriers to trade on trade volume at the level of the firm. Section 5 identifies the effect of regulatory barriers to trade on 3rd party entrepôt trade and the registration of firms, as regulatory barriers reorient the global supply chain. Section 6 concludes.

1 Firm interests in Anti-competitive Regulation

The costs imposed by regulatory barriers to trade advantage the largest firms by restricting competition. Tariffs are used by governments for revenue that is partially paid by foreign companies, reducing foreign market access to the benefit of local firms. These costs are variable, applying to trade in proportion to their value. Unlike tariffs, regulatory barriers have a fixed cost component, limiting the ability for less competitive firms to cover costs. This feature of regulatory barriers distinguishes them from taxes and quotas that disproportionately affect products produced in large volume, reshaping the political coalitions in favor of protection. Below, we develop an economic theory of firm dynamics facing a foreign regulation to explain the challenges posed by regulatory protection. The following sections develop hypotheses that relate firm interests over competition to government choices over trade policy.

1.1 Strategic Entry and Exit under Regulatory Barriers to Trade

The economic effect of a policy depends on how that policy interacts with the competitive environment. Policies that raise the costs from a whole industry can nonetheless have positive effects for a subset of the industry by reducing competition Stegemann (1989); Busch and Reinhardt (1999); Kennard (2017). In this section, we present an economic analysis that shows how regulatory barriers advantage the most productive firms in a market, generating a dimension of political competition that divides the traditional liberalization and protectionist coalitions.

Prior formal theoretical analysis of the effects of fixed costs by Rogerson (1984) demonstrates how regulations can affect entry by making it easier for price-setting incumbents to deter entrants. Higher regulatory barriers lower the volume that a monopolists must sell at to keep entrants out.[2] However, the result was limited to contexts in which some firms were able to take pre-emptive action. In the following, we show that this basic insight is not limited to situations where a leading firm can move first.

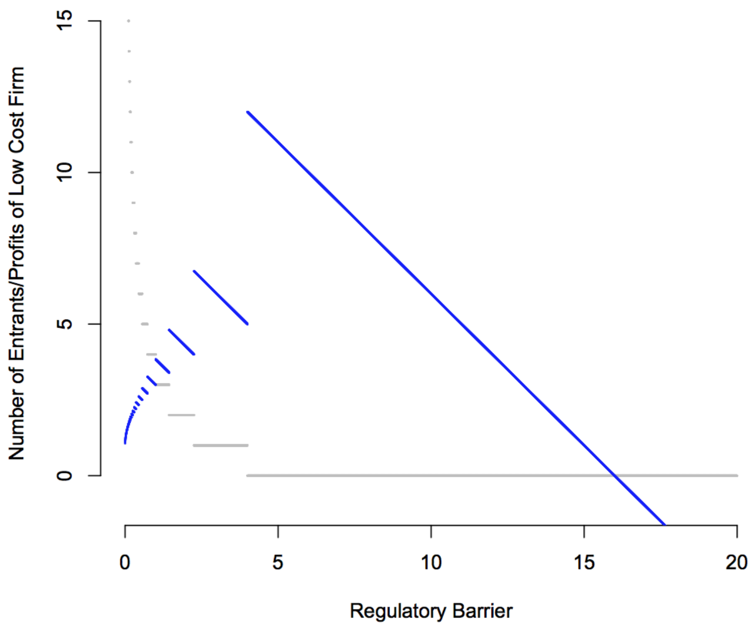
We suppose that there is one productive (low marginal cost) firm in Cournot style competition with an endogenous number of less productive firms. The novel result, given in Equation 1, is that the profits of the most productive firm rise with the size of the regulatory barrier, operationalized as F. These result follows directly from entry and exit dynamics. Firms enter until the point that it is no longer profitable to do so. This 'zero profit' condition is present in a number of complicated general equilibrium models, including those in the 'New New' trade models of monopolistic competition.[3] Raising fixed costs raises prices, drives out entrants, and increases the profits of the firms that remain.

The result can be visualized by plotting the number of firms that enter alongside the profits of the productive firm. The grey step function in Figure 1 plots the equilibrium number of firms that enter a market under different levels of a regulatory barrier. As the regulatory barrier rises, the number of less productive firms whose expected profits exceeds the fixed costs declines, until only the most productive firm remains. The blue lines describe the profitability of the low cost firm, showing that while higher fixed costs reduce profits, the effect of reducing competition improves profitability. Higher

[2] Specifically, William Rogerson 1984 shows that under linear demand $p = \alpha - \beta q$, marginal costs c and fixed costs F, increases in fixed costs increase the dominant firm's profits if and only if $F < \frac{(\alpha - c)}{25\beta}$.

[3] The Melitz model generates a similar result (Melitz 2003; Gulotty 2017).

Figure 1: Equilibrium entry levels (grey)/ Profits of low cost firm (blue)

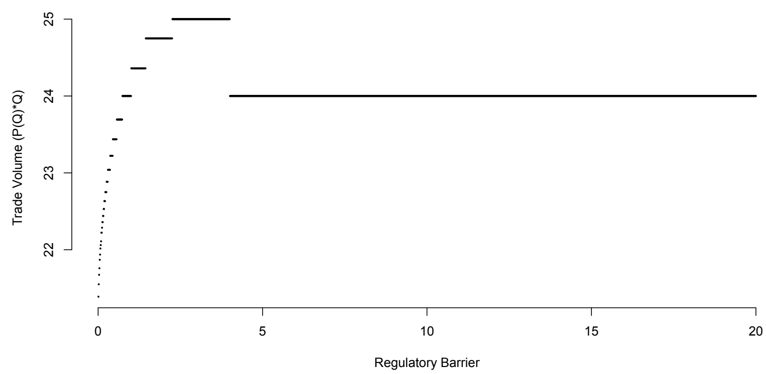


Simulation of formal model developed in Appendix.

regulatory barriers benefit the low cost firm until all competing firms are driven out of the market.

The key distinction between regulatory barriers and traditional forms of protection is the nature of the cost. If regulatory barrier has a marginal cost component it can as a substitute for tariffs and other traditional forms of protection. Equation 2 shows that so long as entry is profitable for the high cost firm, and demand is linear, the low cost producer is worse off than the high cost producer in the face of higher marginal costs. Marginal cost affecting policies, such as tariffs, would therefore by opposed by the largest and most productive firms, and the consequence of adopting such a measure would be to decrease overall trade volume. The effect of the policy does not only depend on the export orientation of the firm or industry, but rather the interaction between the margin of cost of the policy and the relative productivity of the firm.

Figure 2: Equilibrium quantity times price in Cournot Model.



Simulation of formal model.

A second implication of this framework is that the distortions associated with regulatory protection need not affect overall trade activity. The impact of a fixed cost the quantity of trade may be more than offset by the rise in prices. Figure 2 plots the overall trade volume associated with a rise in regulatory protection. These entry and exit dynamics show that the current emphasis on trade volume, both in scholarship and practice is insufficient for regulatory protection.

2 Model of regulations as fixed costs

This section develops a theoretical economic model which motivates the political preferences on the part of firms for regulatory barriers to trade and tariffs. In this Cournot competition model of oligopoly, firms compete via quantity and are differentiated by their marginal productivity. Regulatory barriers to trade act as a fixed cost to be paid upon entry.

Suppose that a Chinese sector (s) consists of one low cost producer and an integer of N high cost firms with endogenous entry, for a total of $N + 1$ firms. These firms face linear demand in some destination market k, where the price ($P_k > 0$) is a declining function of the overall quantity of goods on the market ($Q \geq 0$), with an exogenous demand parameter $\alpha > 0$. In the following we focus on one representative market and sector:

$$P = \alpha - Q$$

Within a particular product category, firms are differentiated by their productivity or per unit cost. Here we characterize that cost as $c_k \geq 0$, where k indexes whether the firm faces a high constant marginal cost (H) or low marginal cost (L). The regulation takes the form of an exogenous fixed cost $F \geq 0$.

In equilibrium, a *high* cost firm $i \in N$ conjectures that the other high cost firms will produce $(N-1) * q_{H-i}$ and and the low cost firm will produce q_L. Entry and exit dynamics will determine $N = N^*$, where N^* is the equilibrium number of high cost firms. In a Cournot Nash Equilibrium, each of the parameters are determined by zero profit conditions.[4]

2.1 Endogenous entry and zero profits

The endogenous number of high cost firms, N^*, is determined via entry and the zero profit condition. The zero profit condition sets the profits of the

[4]The profits of the high cost producer (i) will be:

$$\pi_{Hi} = (\alpha - q_L - \sum_{j \in N \setminus i} q_{Hj} - q_{Hi}) * q_{Hi} - q_{Hi} * c_{Hi} - F$$

which is maximized at

$$q^*_{Hi}(q_L) = \frac{\alpha - \sum_{j \in N \setminus i} q_{Hj} - q_L - c_{Hi}}{2}$$

Taking all high cost firms as identical, this can be reduced to a response to the quantity produced by the low cost firm:

$$q^*_{Hi}(q_L) = \frac{\alpha - q_L - c_H}{N+1}$$

The profits of the low cost producer will be

$$\pi_L = (\alpha - q_L - N * q_H) * q_L - q_L * c_L - F$$

which is maximized at

$$q^*_L(q_H) = \frac{\alpha - N * q_H - c_L}{2}$$

Combining the endogenous response functions generate quantities for high and low cost firms:

$$q^*_H = \frac{\alpha + c_L - 2c_H}{N+2}$$

$$q^*_L = \frac{\alpha - c_L}{2} - \left(\frac{\alpha + c_L - 2c_H}{2}\right) * \frac{N}{N+2}$$

high cost firm π_H equal to 0. Inserting the optimal quantities from the first order conditions of the firms solves for N^*.[5]

$$\begin{aligned}\pi_H(q_H^*, N) &= [\alpha - Q]q_H^* - c_H q_H^* - F = 0 \\ &= q_H^* * q_H^* - F = 0\end{aligned}$$

$$F = \left(\frac{\alpha + c_L - 2c_H}{N+2}\right)^2$$

$$N^* = \frac{\alpha + c_L - 2c_H}{\sqrt{F}} - 2$$

The equilibrium number of entrants in a sector is thereby an increasing function of the size of the sector, α, decreasing in the fixed cost of entry and decreasing in the marginal cost advantage of the top firm. Monopolies would arise either because of high barriers to entry or because the low cost producer is overwhelmingly efficient.

Comparative Statics

Given the endogenous N^*, the profits of the low cost firm can be rewritten as a function of F:

$$\pi_L = q_l^2 - F$$

$$\pi_L = \left[c_H - c_L + \sqrt{F}\right]^2 - F$$

Differentiation yields the marginal response of a change in the fixed cost to the profits of the productive firm.

$$\frac{\partial \pi_L}{\partial F} = \frac{(c_H - c_L)}{\sqrt{F}} > 0 \iff c_H > c_L \tag{1}$$

[5]Note that this equation creates an upper bound on F which allows positive entry, namely:

$$\left(\frac{\alpha + c_L - 2c_H}{2}\right)^2 \geq F$$

Equation 1 shows low cost producers always profit from stricter regulatory barrier, at least until the barrier is so high as to drive the high cost firms completely from the market.[6]

To highlight the unique features of the higher regulatory barrier to trade, we contrast these fixed costs with changes in tariffs, which alter variable costs. Even for the low cost firm the derivative of profits with respect to the marginal cost is always negative.[7] For high cost firms, the derivative is also negative so long as $\alpha + c_l - 2c_H > 0$. All firms lose from higher variable cost measures, so long as fixed costs are positive and there is at least on high cost firm that enters the market.

Comparing the change in profits in the low cost firm relative to the high cost firm, the high cost firm loses more than the low cost firm if:

$$\frac{\partial \pi_H}{\partial c_H} > \frac{\partial \pi_L}{\partial c_L} \iff$$

$$4c_H - 3c_L + 2\sqrt{F} > \alpha$$

Again using the condition on F for it to be profitable for any high cost firm to enter,

$$4c_H - 3c_L + \alpha + c_L - 2c_H > \alpha \iff$$

$$2c_H - 2c_L > 0$$

Which is true by the assumption that the costs differ across firms $\square$.

The above analysis establishes that:

$$\frac{\partial \pi_L}{\partial c_L} < \frac{\partial \pi_H}{\partial c_H} \tag{2}$$

Equation 2 shows that so long as entry is profitable for the high cost firm, and demand is linear, the low cost producer is worse off than the high cost producer in the face of a higher marginal cost (such as what happens when tariffs rise). Consistent with the consensus in the literature, the largest and most productive firms would be harmed by tariffs, even as they raise

[6]Note that if entry is 0, then in order for the low cost firm to make non-negative profits,

$$\left[\frac{\alpha - c_L}{2}\right]^2 \geq F$$

[7]

$$\frac{\partial \pi_L}{\partial c_L} = -2(c_H - c_L + \sqrt{F}) < 0 \iff c_H - c_L > -\sqrt{F}$$

prices. Fixed costs raise prices, but do so by limiting competition, altering the composition of the market. Using Chinese customs data, we examine these compositional changes as firms experience fixed cost barriers abroad. Examining data at this scale introduces novel difficulties, which we describe the the following section.

3 Data and data infrastructure

Our empirical analyses draw upon the Chinese Customs Trade Statistics (CCTS) collected by China's General Administration of Customs.[8] This dataset contains the universe of China's monthly firm-level export/import transactions with 243 destination/source countries and 7,526 products in the 8-digit Harmonized System. Each firm-product-country transaction records the name and registration type of the firm, product name and HS code, total value (in US dollars), quantity and unit of measurement (one of 12 such as kilograms, square meters, etc.) of the shipment, port of entry in China (40 of them), destination country (for exports) or country of origin (for imports), and intermediate country or region.

There are 132,560,023 transactions over the eight-year period (2000-2007). For the purpose of this study, we restrict our analysis to the exporting transactions only, totaling $4.483 trillion. This reduces the number of transactions to 31,156,907. Because only one product is recorded in each transaction, firms that export more than one product at once are recorded as multiple transactions. In total 290,972 firms have exported at least once in the dataset. The number of firms have increased steadily over time, from 67,213 in 2000 to 193,273 unique enterprises in 2007. The most dramatic increase occurred in 2004, when the revised Foreign Trade Law fully liberalized the trading rights, allowing virtually any firm or individual in China to directly engage in imports and exports.[9]

There are two types of firms that engage in exports: manufacturers that sell products (usually with the same HS4-digit code) directly to foreign markets, and trading firms that export a variety of goods made by

[8]Scholars, mostly economists, have utilized portions of this dataset to study the role of intermediaries in trade facilitation (Ahn, Khandelwal and Wei 2011), the effect of tariff reduction on firm productivity (Yu 2015), multinational activity under credit constraints (Manova, Wei and Zhang 2015), export prices across firms and destinations (Manova and Zhang 2012), and export response to antidumping investigations (Lu, Tao and Zhang 2013).

[9]This is part of the commitments made by China in connection with its accession to the WTO.

other domestic producers. The sort of competitive dynamics that occur among trading firms (that sell services) and non-trading firms (that manufacture themselves) could alter the effects of a regulatory barrier. While the customs data do not contain information on production that could help distinguish these two types of firms, trading companies in China usually follow the convention of registering with a name containing Chinese characters for 'trading', 'importing', 'importing', or their variants. Following earlier studies (e.g. Ahn, Khandelwal and Wei (2011); Manova and Zhang (2012); Yu (2015)), we use a list of such characters to parse through the names of the company to identify trading firms.[10] On this measure, 18% of the firms in the sample are trading firms.

The scale of the raw customs data introduces some logistical and computational challenges. These data are 2.7 gigabytes on disk as a raw binary file and well within the capacity of desktop computers. Limiting the analysis to just exports and aggregating to the HS6 digit level leaves a manageable 600 megabytes. However, as we outline below, the file size rapidly expands once we account for the 0 trade flows in years that firms are not reporting a transaction (see Section 4.4 for details). The regression algorithms are also memory intensive: one stage of the analysis required more than 100 gigabytes of RAM. In this the following, we outline the strategy that we deployed to allow analysis of these large and unwieldy datasets.

Sharing datasets of this size bring logistical and computational hurdles—coordinating version control across computers and obtaining sufficient RAM to perform the analysis. We chose to use Amazon Web Services (AWS) Elastic Compute Cloud instances. These are inexpensive web-based computer servers in Amazon's data centers that can be scaled to the computational task.[11] The advantage is that in the midwest United States a server with 244 gigabytes of RAM is priced at $2.128 per hour, and a 16 gigabyte server costs less than 20 cents per hour. With this scalable RAM, it is possible to cost effectively match computational capacity to tasks without having to invest in dedicated computer hardware.[12]

Because most of the operations in this paper are regressions, the primary limit on our technology is memory. However, there are some preprocessing steps, such as calculating the per-firm total sales of a given product in a particular destination that can be divided into a number of subtasks. The

[10] We use the following nine keywords to classify trading firms: 贸易, 外贸, 进口, 出口, 商贸, 物流, 经贸, 科贸, 外经

[11] The computers come with a standard installation of Linux and the statistical software R.

[12] For most tasks, we found that the memory optimized r4.2xlarge instance was sufficient.

AWS server comes equipped with 32 virtual processors, allowing some operations to be parallelized, where tasks are allocated across CPU clusters. We used the R package, multidplyr, which offers a convenient and simple parallelization that automatically sets up each cluster and partitions the dataset efficiently (Wickham 2017). These steps turn a process that would take days to hours.

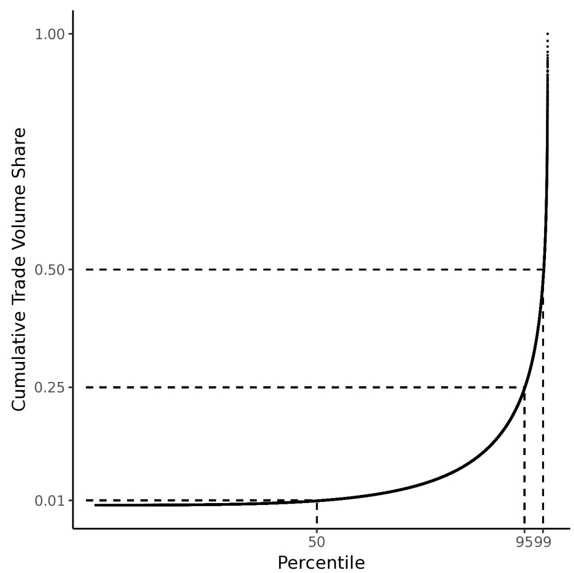
The overall workflow involves first summing the trade volume by year, country code, HS6 code, and enterprise code. For each of these observations, we record the several covariates, such as the registration code, which indicates whether the firm is an SOE, a collective enterprise, a cooperative, a private enterprise, a foreign enterprise, or a joint venture. The resulting dataset has 31,818,013 unique export transactions. We then expand the dataset, as described below, to include the 0 observations between transactions. This step expands the data to 163,632,952 observations. Finally, for the statistical analysis, we use the popular lfe package, which allows for efficient estimation of fixed effect models (Gaure 2013).

3.1 Descriptive Results

The most striking feature of international trade is its concentration at the level of the firm. Figure 3 displays a Lorenz curve plot of the total export sales across the dataset by firm. Lorenz curves visualize inequality among populations. In this case, although apparently a smooth line, the curve consists of individual points for each firm, ranked along the x-axis by the rank of that firm in total sales (Percentile). The fiftieth percentile, for example, represents the median firm in terms of trade volume. The y-axis represents the cumulative amount of trade held by firms at that rank. If trade were completely uniformly distributed, the curve would be the 45 degree line, deviations downward represent increasing inequality. The area between the curve and the 45 degree line is proportional to the Gini coefficient. Among Chinese exporters, we can see that the total share of trade held by the bottom fifty percent of companies is about 1 percent. The share of trade held by the top 95 percent of companies is 25 percent. The top one percent of companies are responsible for half of trade volume.

Inequality in trade is expressed in nearly every level of analysis among nearly every subset of firms. Figure 4 displays the most and least concentrated Chinese export sector. As those familiar with Chinese exports might expect, the two end of the spectrum are represented by textiles and mineral fuels. Textiles are infamous in China for small family run operations and the oil sector is almost entirely state run. What is striking is that both are

Figure 3: Firm concentration and TBT (pooled)



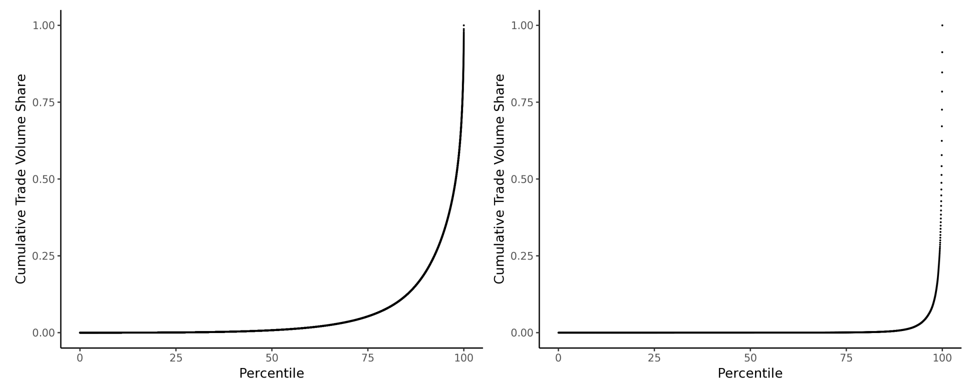
extraordinarily concentrated.

Scholars of trade would find the degree of concentration unsurprising. On average, the top individual exporter across a variety of markets is responsible for 15 percent of total exports (Freund and Pierola 2015). To give a sense for what this means in destination markets, Figure 5 displays the Lorenz curve by the final destination of each transaction. At both extremes of highly concentrated and dispersed are small nations but they are each instructive as to what is going on. Djibouti is an integral part of the "one belt, one road" strategy of China to expand exports, beginning with the Forum on China Africa Cooperation in 2000. Djibouti is now the location of the China's first overseas military installation, formally opened on August 1, 2017. Luxembourg, by contrast, is low on the list of China's export partners.

4 Regulatory Barriers and Trade Participation

Following a series of domestic and international reforms, China became the world's dominant manufacturer, dominating export markets. One of these products was honey, a product for which China enjoys a 25% market share.

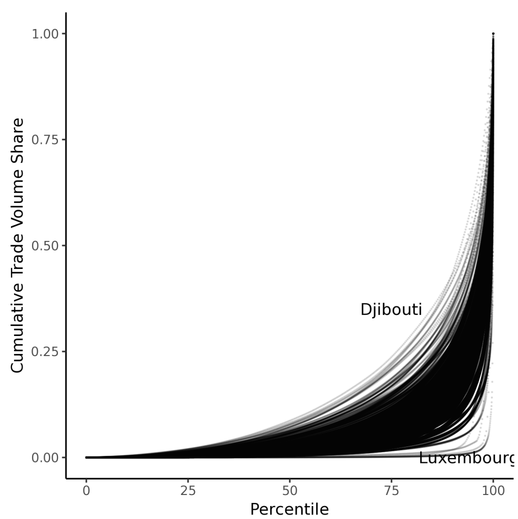
Figure 4: Most and least concentrated sectors



(a) Textiles (the least concentrated sector)

(b) Mineral Fuels/ Oil (the most concentrated sector)

Figure 5: Concentration across countries



Facing this influx of Chinese honey, some honey producers sought relief in the form of temporary tariffs, but European honey producers sought a ban, arguing that the Chinese honey had excessive amounts of chloramphenicol, an antibiotic used to treat bees.[13] No antibiotics had ever been approved for food animals raised in Europe and in 2001 and in response to these concerns the EU set up a strict residue standard on honey imports.[14] This was soon followed by a complete ban on all Chinese honey, along with several other animal products imported from China. It was only after China agreed to a new inspection regimes on Chinese animal facilities that the ban was lifted, and in July 2004 the honey trade became unstuck.

Figure 6 shows the trade flows into the EU during this regulatory action. The height of each bar indicates the yearly trade volume of Chinese honey exports to the European Community. Each bar is divided by whether the exporter ranks in the top 10 percent of honey exporters that year. In 2001, for instance, the top 10 percent of honey exporters held about 65 percent of China's total market share. After the ban was lifted, this share reached 86 percent. Each part of the ban corresponds to a region of Figure 1. The initial ban is equivalent to a prohibitive fixed cost, and the regulatory changes that allowed the honey to return to the market correspond to the higher concentrated honey market in the following years.

The model predicts that the concentration of the Chinese industry will rise in the presence of a regulatory barrier, but this result depends on all firms being forced to actually pay the costs of reworking the product. In practice, firms have mitigation strategies to avoid paying the costs. According to European honey firms, after the ban and heightened standards, Chinese firms would funnel honey to India to be relabeled and shipped on to Europe. This sort of illegal shipment is not fully captured in official trade statistics, but Figure 7 shows, at least in these data, a substantial increase of honey exports to India during the years of the ban. The bars of the figure represent the millions of dollars of exports from China to India in honey, substantially rising as honey is banned for sale in Europe. At the same time, European countries report a substantial increase in imports from India. The volumes, at least in official statistics, do not match, and both changes could be because of trade diversion and substitution, but the patterns are consistent with the alleged transshipment.

The European honey ban was short lived, but the following years of higher standards remained a substantial concern for smaller Chinese firms.

[13]Apparently the bees in China were suffering from American Foulbrood Disease.

[14]Decision 2001/159/EC.

Figure 6: Firm Concentration after Europe's two year honey ban

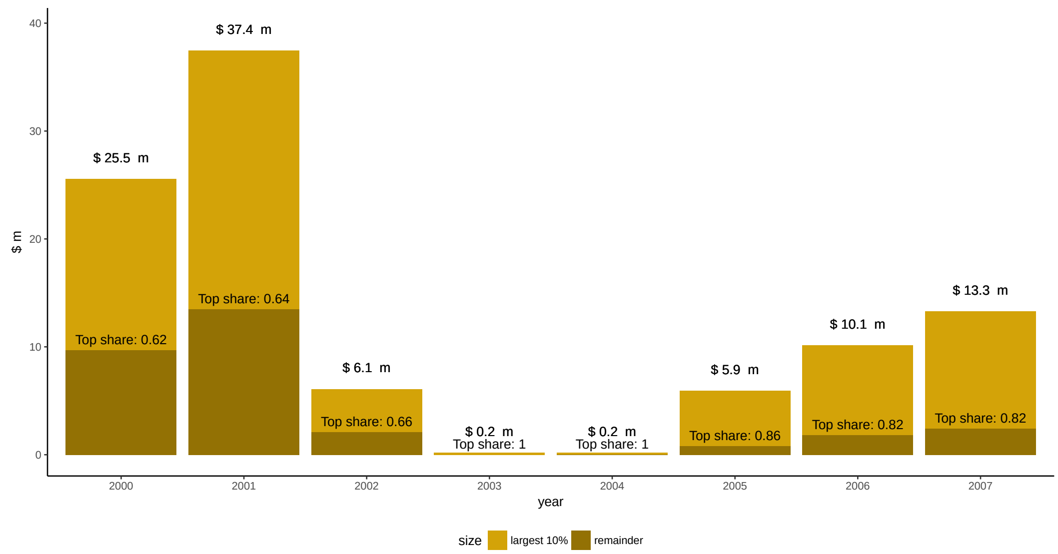
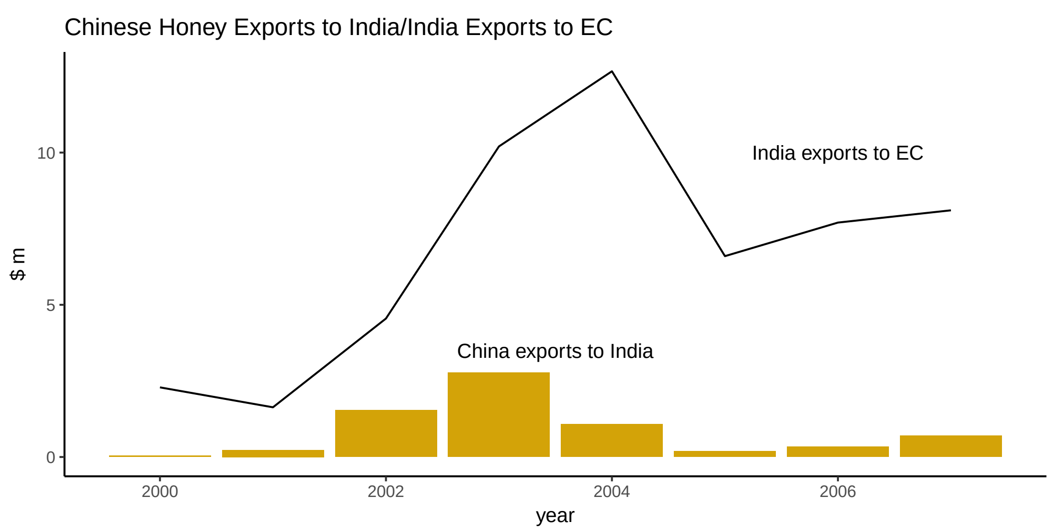


Figure 7: Chinese exports to India



In 2003, China raised a specific trade concern at the World Trade Organization against the European Community regarding their ban on honey. In the following, we use these specific trade concerns as a proxy for the presence of regulatory barriers in the destination markets for all Chinese goods.

4.1 WTO Database of Specific Trade Concerns

The Specific Trade Concerns (STCs) databases are the result of research by the WTO Secretariat that aimed to study the prevalence of regulatory protection. The TBT-STC Database provides information on 317 concerns raised in the TBT Committee between January 1995 and June 2011, providing a binary indicator of conflicts between governments on technical barriers to trade. While these concerns do not necessarily arise to the level of a dispute, the data has advantage over the small number of cases submitted to the WTO dispute settlement mechanism or the relatively frequent notification process, which relies on self-reporting by governments. Moreover, specific trade concerns raised by WTO members are highly disaggregated and, importantly, labeled by the Secretariat as affecting a number of HS6 digit categories of products.

STCs are not perfect measures of regulatory protection. While STCs reflect challenges faced by exporters, in order to reach the WTO committees, exporters must channel these concerns to governments. Even if a government wishes to raise the concern, there may be even more informal mechanisms to address these barriers. Members sometimes request the WTO Secretariat to put concerns on the agenda but withdraw them before they are presented to the Committee, arguing that a bilateral arrangement has been found. Because of these selection effects, the World Trade Report 2012 suggests that specific trade concerns may provide a distorted picture of the trade-restrictive or trade-distorting effects of TBT and SPS measures. Examination of the text of the committee minutes suggests that in many cases the STC is the first that governments have heard of the complaint. Nonetheless, to address the reporting bias, that is cases are only observed when the target state did not cut a deal, we focus analysis on variation in TBT Adoption within a market and an industry.

4.2 Trade volume

The theory above implies that the aggregate effects of TBT-STC on trade volume are ambiguous. On the one hand, the barrier can drive smaller firm to exit the market, lowering the amount of trade volume. On the other hand, larger firms will be able to expand to fill the space left by the reduced competition. Limiting the Chinese Customs data to firms that have positive trade in at least two years of 2000 to 2007, we sum the total reported trade volume to each every destination from China that ever experiences a TBT-STC. Table 1 displays the coefficient from regressing this value on the presence of a TBT. Accounting for product-year, product-destination and destination-year fixed effects, we find that TBT-STC are associated with larger trade volumes.

Table 1: Trade volume in a Product-Destination

	Dependent variable:	
	ln(volume)	
	(1)	(2)
TBT	0.109***	0.146***
	(0.034)	(0.038)
Observations	916,464	916,464
FE	PY+DY	PY+DY+PD
R^2	0.562	0.772
Note:	*p<0.1; **p<0.05; ***p<0.01	

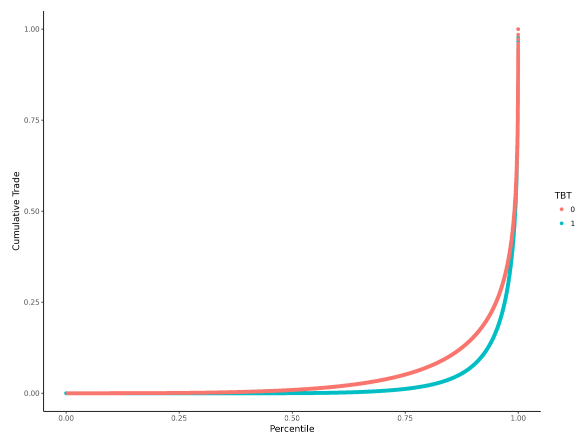
This result is consistent with research by Fontagné et al. (2015); Fontagné and Orefice (2016) finding that regulatory barriers in destination markets raise trade volumes.

4.3 Extensive Margin

Given this pattern, we might wonder why there are trade concerns if a TBT raises trade volume. The theory above offers an answer: while a regulatory barrier may offer advantages in the intensive margin, it may reduce the extensive margin. The intensive margin refers to the amount or volume of trade in a particular category or by a particular firm. If Adidas doubles its sales of sandals to Canada, it is doubling the intensive margin. If Adidas starts selling sandals to Iceland for the first time, or a new company enters and starts selling sandals to Canada, then there is an increase in the extensive margin. TBT are believed to expand the intensive margin, and harm the extensive margin. These studies of the extensive margin tend to examine aggregate trade volume, or trade volume disaggregated to the individual product, and test the number of varieties or the presence of positive trade.

Figure 8 provides a hint as to why regulatory protection is a problem from the perspective of the exporting country. As with the previous figure, these Lorenz curves consist of a single firm's cumulative trade, as well as the percentile of that firm among Chinese traders.

Figure 8: Firm concentration and TBT (pooled)



TBT have inconsistent effects on the extensive margin at the level of the product. Counting the number of unique varieties that are sold to a given destination, we find that in a model without product-destination fixed effects the number of varieties drops by 10 in sectors with TBT. Similarly, the number of firms drops by 3. However, these results are not robust to the inclusion of product-destination fixed effects. Under models (4) and (6), we do not find evidence of any reduction in either the number of unique varieties or the number of active firms.

Two problems conspire produce this inconsistency. The first is that the data does not cover non-Chinese firms that may be forced to exit by the TBT. For most countries and markets, China is only one origin of many. A destination country can experience an absolute decline in the variety or number of companies, but see a compositional switch toward Chinese firms, particularly if those Chinese firms are more productive and sell at lower cost than competing products. Furthermore, aggregate data combines heterogenous effects of the policy. Among Chinese firms, the few large firms could expand business in a variety of markets, while the more limited exporters

Table 2: Number of Varieties in a Product-Destination

	Dependent variable:			
	$\sum$ variety		$\sum$ firms	
	(3)	(4)	(5)	(6)
TBT	-9.878^{***}	-0.329	-2.904^{***}	2.117^{***}
	(2.217)	(1.403)	(0.474)	(0.281)
Observations	916,464	916,464	916,464	916,464
FE	PY+DY	PY+DY+PD	PY+DY	PY+DY+PD
R^2	0.230	0.867	0.335	0.899
Note:				*p<0.1; **p<0.05; ***p<0.01

are forced out of the market. For instance, if Iceland adopts a technical measure which raises testing costs, Adidas may be able to afford to expand its line of shoes at the expense of smaller exporters outside of China. It is difficult to say without knowing the number of firms that are not from China and selling shoes to Iceland whether the net effect is positive or negative.

In the following, we step away from these aggregate level analyses to study the compositional effect among Chinese firms. Using product-firm-destination level data, we are able to determine the effects of a TBT on the actors that engage in trade.

4.4 Handling 'Complete' Data

In order to study trade flows at the level of the firm, we develop a panel of all firms that have engaged in export from China. Creating a 'complete' dataset of products, companies, destinations and years requires making several choices. We know that any time a company records trade it is recorded by the customs office, but what about when that company is not engaged in trade? Among companies that export both in 2000 and in 2007, 23,637 are active continuously in some market—the remainder have at least an entire year without trade. As a complete dataset, the customs office is implicitly recording a 0 in every year that they do not observe an export. However, if we took every possible combination of company, product, year and destination, the dataset would comprise 65 billion observations. Even if such a dataset were technically manageable, many of the observations would be implausible—a Chinese shoe company busy selling sneakers to Finland will not export pig iron to Madagascar no matter what the trade costs. Instead, our strategy is to expand the dataset only as much as our identification strategy suggests, primarily temporally.

Within each company-destination observed in the dataset, we expand the dataset to include all combinations of years and products in that company-destination, filling in 0 for the values. For example, assume Jinjiang Huawei Shoes company exports boots to Morocco in 2004 and 2005 and exports sneakers to Brazil from 2000 to 2007. We extend the dataset to include the non-export of boots to Brazil, the non-export of sneakers to Morocco, and the non-export of boots to Morocco in 2000-2003 and 2006-2007. In this way, we do not assume that any firm produces a good that they do not export to some location. We do, however, assume that if a firm sends any product to any market, that the firm could send any of its other products to that market at any time. In some specifications, we further restrict the sample to those countries that ever raise a measure alleged to be a specific trade concern, leaving less than 100 million observations: 37 destinations, 6036 products, 36,879 companies and 8 years.

4.5 Firm-characteristics and regulatory politics

Our first and most important firm characteristic is firm size. Unfortunately, the data are not easily matched with traditional forms of firm size, namely employment, capitalization or sales. Instead, following prior practice, one could simply sum the total exports of any product to any destination by firm and take the natural log.[15] The average of this measure is 14 with a standard deviation of 2.35 ranging between 0 and 21.15 ($1.5 billion).

We prefer, however, a second strategy, which is to calculate firm size in a particular HS6 category and destination (lncompanysize). This allows a more economically relevant form of size, where size is compared to other firms that operate in a product category. This allows a firm to be small overall, but large in a destination and a product. Using this measure, we create indicators for each quintile of lncompanysize within each HS6 category and destination. While this measure has the possibility of being endogenous with our regulatory barrier, we tested the following models using only trade volume in 2000.

TBT might be a response to China's rise as an exporter, a particular feature of a destination market or other ideosyncratic features. To account

[15] To account for 0's we add 1 prior to taking the log.

for this, we again use HS6-year, HS6-destination and destination-year fixed effects. This allows us to control for China-specific production developments in a sector, idiosyncratic features of a destination and ideosyncratic features of a particular destination's products. This would account for the average effect of national policies or events and for characteristics of a particular market in a particular society.

This leads us to the following estimating equation:

$$ln(y_{iskt}) = \beta_0 + \beta_1 TBT_{skt} + \beta_2 z_{isk} + \beta_3 TBT_{skt} \times z_{isk} + \delta_{st} + \upsilon_{kt} + \gamma_{sk} + \epsilon_{sikt}$$

Here y_{sikt} are each firm i exports in US dollars of product s to destination k in year t. δ_{st} is the product-year fixed effect, υ_{kt} is the destination-year fixed effect, γ_{sk} is the product-destination fixed effect. TBT_{skt} is an indicator variable for if there is a TBT in a product-destination-year. z_{isk} is a measure of the firm size in a product and destination.

The cost to this identification strategy is that it has the potential to substantially limit the variation of the dependent variable. The average total sales of company of a particular product and destination is \$316,502. Within destinations and products, the standard deviation is \$646,102. Across destinations and products, the standard deviation is \$12,550,877. The average standard deviation within destinations and products is 2% but across products the standard deviation is 11%.

In order to explore the variation in the data, we begin by analyzing the estimating equation separately for each country, controlling for product and year fixed effects. Figure 9 displays the parameters for the interaction between the presence of a TBT and the largest quintile of firms in each country. Among the most precisely estimated parameters, they are systematically positive, indicating that for most countries, a regulatory barrier increases trade volume for the largest firms significantly more than the smallest. This is not the case for Venezuela, Croatia, New Zealand and Chile, where we estimate negative coefficients.

We also run a similar analysis by HS6 product category. Here we do so for those products in which at least one country has imposed a regulatory barrier to trade, now controlling for country and year fixed effects. Figure 10 displays the parameters for the interaction between the presence of a TBT and the largest quintile of firms in each six digit product category. Models with significant effects are displayed in red. While there is not sufficient variation within HS6 categories while controlling for country fixed effects, we find a statistically significant relationship in about a third of cases. Again regulatory barriers increase trade volume for the largest firms.

Figure 9: Effect of TBT among the largest quintile of firms (by Country)

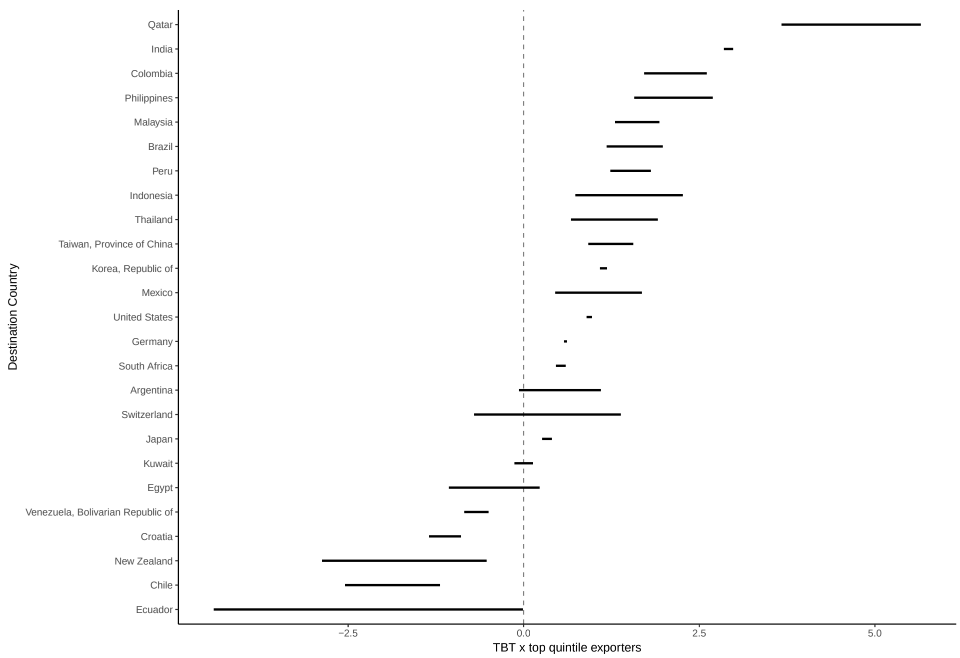
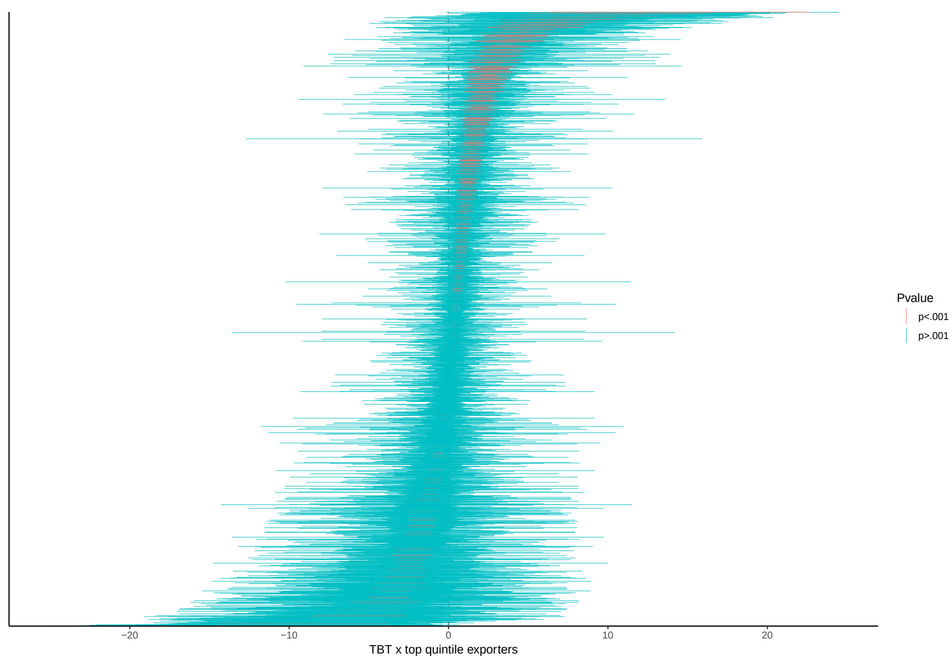


Figure 10: Effect of TBT among the largest quintile of firms (by HS6)



Neither of these models account for the fact that there are some products and countries in which there is very little trade. Nonetheless, they show that within products and within countries there is substantial variation to account for in the effects of TBT-STC. In the following, we estimate a model across the sample of companies and products in destinations that raise at maintain at least one TBT.

4.6 Firm-level trade effects

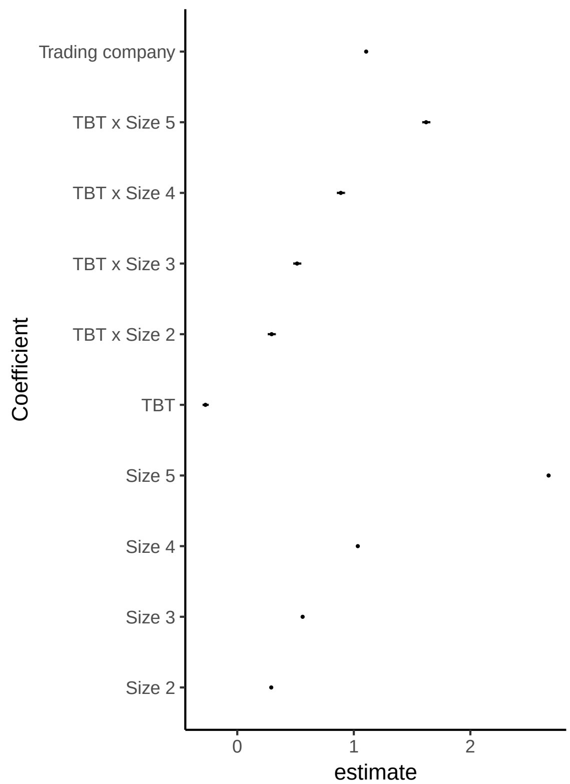
The results of the combined model show that the effect of a TBT is to substantially decrease trade volume for the smallest firms. Table 3 in the Appendix lists the coefficient estimates for various specifications. Model (7) shows that, controlling for product-year, destination-year, and product-destination fixed effects, the effect TBT on trade volume is positive. Model (8) shows this positive effect persists when conditioning on firm registration. Model (9) interacts TBT incidence with the quintiles of total trade volume for a firm. Firms in the bottom quintile experience less trade volume in years with a TBT. The effect of TBT is linearly dependent on the exports of the firm, each size category doubles the coefficient of the size below it. The final column shows that this interactive effect for a continuous estimator of size, controlling for firm registration.

We also estimate these same models with an indicator for trading firms. Table 4 shows that the overall fit of the model improves substantially. Figure 11 graphically displays the coefficients, along with the 99.9% confidence intervals. Each coefficient broadly matches with our expectations, among larger (and presumably more productive) firms, TBT are associated with higher trade values. These coefficients indicate that largest 20 percent of firms trade experience trade volumes that are 4 times higher when there is a TBT in the destination market.

5 The effect of TBT on the global supply chain

Regulatory barriers to trade have negative effects for smaller Chinese exporters that presumably lack the volume to cover the costs of reconfiguring their product, pay for tests, or adopt new labeling conventions. However, the same resources that enable a firm to cover these costs also allows a firm to organize a global supply chain. Both are functions of a firm's productivity Gulotty (2017). Global production may allow firms to respond to technical barriers by altering their strategy of shipment. In particular, as we saw in

Figure 11: Coefficients from regression of $\log(\text{value}_t)$ on TBT-STC and PY-DY-PD fixed effects



the case of the European honey ban, these firms might engage in entrepôt trade, either on the books or off.[16] In this section we study the effects of TBT on the stages of the global supply chain between the ports of China, the ports of intermediate locations and the final destination.

Entrepôt trade, particularly entrepôt trade originating in East Asia, has been a subject of scholarship for over a century. In his survey on the matter, Smith (1910) argued that goods from East Asia are particularly likely to be handled through entrepôt because of "their small bulk and high value—spices, drugs, silks, curios, and tea." More recently entrepôt trade has been connected to policy choices and the ability for firms to evade the negative effects of these policies. Fisman, Moustakerski and Wei (2008) present evidence that Hong Kong intermediaries are used to reexport Chinese products to evade tariffs on the mainland. In the following, we study how regulatory barriers to trade affect transshipment choices by Chinese firms and the choice to ship to third party destinations.

The length of time that a firm participates in the market declines when there is a TBT. We find that firms stay on the market for slightly shorter periods after a TBT is imposed in the destination market. This is consistent with these TBT barriers driving firms out of the market, but is also consistent with the sort of temporary entry under fake identities.

The second level of firm adjustment we examine in these data is in the path that trade takes to arrive at the final destination. Econometrically, we measure firm extent of entrepôt activity by the physical distances implied in the customs data. Each intermediate destination is passed through Google's geocoding api to obtain a longitude and latitude, which is then used to calculate the shortest path along the curved surface of the Earth. We then calculate the total excess distance as the extra kilometers that a product travels beyond the direct distance between China and the destination market. Regressing this distance on the presence of TBT, we find that TBT are weakly associated with companies send their products farther prior to final sale. This effect is increasing in company size, as we can see in Table 5, larger firms send their products longer distances before arriving at the final destination. This result is consistent with a finding in French customs data that large firms tend to be more able to open new locations in response to a regulatory barrier.

Finally, we can examine the cross-country reallocations of exports in the

[16]Prior work finds that multi-destination firms tend to reallocate sales if one destination adopts a technical barrier. The argument offered in these studies is that having multiple destination markets is a kind of insurance, a portfolio of destinations allows firms to easily avoid having to reconfigure or test.

presence of a TBT. After the European and American honey regulations closed off these markets, Chinese firms sent a larger share of their product to third parties. We tested whether this occurs for the universe of TBTs by calculating the share of trade that is diverted. We first summed overall trade for each firm in each product and year across all destination countries. Then, for each observed trade flow, we calculated the difference between the total trade in that product-year by that firm and that the trade in that destination. The result is a measure of the value of trade going toward 3rd parties. Intuitively, we would expect that if a country were to raise a regulatory barrier, the share of sales toward that destination would decline and the share of third parties would expand.

The results of regressing this 3rd party share on the presence of TBT are displayed in Table 7. The results of the statistical analysis have an intuitive interpretation. Among smaller firms, a TBT causes the firm to shift sales to third parties. These firms presumably cannot rework their product to satisfy the regulation, and are forced to ship to countries that have looser standards. Large firms, consistent with prior results, can thereby expand trade following a TBT.

5.1 Why adopt these measures?

Given that regulatory barriers to trade in fact expand trade among the largest and most powerful foreign firms, why then do governments raise these measures? If the goal were traditional protectionist ends, these measures appear particularly ineffective—the measures merely benefit some foreign firms. Examining the nature of the companies that are advantaged by regulatory protection suggests that domestic political economy of regulatory protection is one that serves local interests, namely the foreign affiliates of multinational enterprise. In Chinese customs data, these multinational firms are registered as foreign enterprises or joint ventures. In the following analysis, we examine whether these multinationals are associated with greater volumes of trade post-regulatory barrier.

Table 8 in the Appendix displays estimates from a regression of the triple interaction between MNC, an indicator for the registration of the firm as either joint ventures or foreign enterprise, the five category measure of firms size, and the indicator for the presence of the TBT. Combining the coefficients on the indicator, the double and triple interaction allows comparison of the differences in trade volumes for companies with and without a TBT in the destination market. The largest firm that is also a MNC experiences a total increase of $0.03 + 0.38 - 0.53 + 0.27 = 0.13$ more trade on the log scale relative to a similar large MNC without a TBT. However, the gains to the largest—non-multinational firms are also high, substantially more so than among MNCs $0.03 + 0.38 = 0.41$. If the benefits accrue to MNCs, they have the side effect of particularly benefiting top Chinese companies. Technical barriers to trade are disastrous for the smallest MNCs, which experience an average drop of -0.5 on the log scale. The difference being that there are many fewer large non-MNCs than there are large MNCs, and many fewer small MNCs than there are small non-MNCs.

We cannot know from these data whether the firm raising the regulatory barrier has Chinese affiliates that would benefit from the accrued rents, nor can this data speak to government incentives to respond to these foreign rents. The political economy framework developed by Gulotty (2017) suggests that governments are in fact motivated by foreign profits insofar as global firms share profits across the supply chain. This analysis offers micro-founded evidence that these rents are in fact available in China.

6 Conclusion

Our firm-centered account of trade policy finds that regulatory protection shapes the composition and geography of global trade in three ways. First, regulatory protection concentrates economic activity into the hands of a few firms. In the short run, this exacerbates economic inequality across businesses, benefits the top producers and is disastrous for smaller producers. In the long run this sort of concentration can undermine innovation and harm the dynamism of economies. Second, we find that regulatory protection decreases the length of time that a firm is continuously on the market. The way that regulations are administered may generate a pernicious form of churn, lowering accountability for product safety and quality while undercutting investment, exchange of knowledge and other long run benefits. Finally, regulatory protection also produces trade diversion, particularly among smaller firms, as they are forced to find markets that will accept their goods. The effect is that raising the standards for production without global coordination pushes the non-compliant products onto third parties.

These patterns are not evident in our data if we ignore the role of the firm. Our primary results arise from compositional changes in trade participation following a regulatory barrier. If we were to use aggregate product level data, we would smooth over these firm-level dynamics, missing the switch from smaller to larger firms. For political scientists who are interested in the political foundations of economic openness, it is essential to understand the effects of policy on the concentration and inequality of trade activity across firms. Aggregate trade flows matter, as they determine prices and welfare for consumers, but for producers, and particularly exporters, it matters more whether their product finds a market—it is no consolation to a small scale beekeeper that giant honey traders like Groeb Farms could escape millions of dollars of dumping duties.[17]

These results complement with prior research on the effect of regulatory protection in other firm-transaction data (Fontagné et al. 2015; Fontagné and Orefice 2016). Like Fontagné and Orefice (2016), which studies the number of TBT-free destinations at the HS4 digit level among French firms, we find that firms shift sales away from destinations that raise a regulatory barrier. The French data shows that multiproduct firms are highly sensitive to regulatory protection and that large firms are more likely to exit the market upon the imposition of a TBT. We find that the effect of regulatory barriers is less pronounced for trading firms and that large firms are less likely to shift to third markets.[18]

We find that regulatory protection benefits large firms. As with Gulotty (2017), we find that these benefits particularly accrue to multinationals, whose participation in the market comes at the expense of smaller exporters. The fact that these multinationals hire in the regulating market generates incentives on the part of governments to impose strict regulations. We find support for this claim, but that the hypothesized compositional effect is only part of the consequence of regulatory protection. Fixed cost barriers cause firms to enter the market for shorter periods and, among smaller firms, shift sales to third countries. Our results also suggest that, in the case of China, exporters may be seeking third markets not only as alternative final destinations, but as surreptitious entrepôts to outmaneuver regulators.

[17] Groeb Farms had 30 percent of the US domestic honey processing market and was caught purchasing 1,578 shipment containers of fraudulently entered Chinese honey, avoiding $79 million in tariffs. In the subsequent Honeygate investigations, the US settled for a $2 million dollar fine and the company emerged from bankruptcy with a new name, Sweet Harvest Foods.

[18] We suspect that the difference depends on the way that Fontagné and Orefice (2016) simultaneously controls for the volume of exports in 1995 and the share of trade in the HS2 sector, which are likely be collinear.

7 Appendix

Table 3: Model of trade value among TBT raising countries

	Dependent variable:			
	ln($value_t$)	ln($value_t$)	ln($value_t$)	ln($value_t$)
	(7)	(8)	(9)	(10)
TBT	0.319***	0.298***	−0.083***	−0.535***
	(0.004)	(0.004)	(0.006)	(0.009)
R: SOE		−0.102***		−0.016***
		(0.002)		(0.002)
R: Private		−0.626***		−0.239***
		(0.002)		(0.002)
R: Foreign		0.300***		0.211***
		(0.002)		(0.002)
R: Cooperative		0.546***		0.355***
		(0.004)		(0.004)
R: Households		−0.964***		−0.327***
		(0.003)		(0.003)
R: Joint enterprise		0.293***		0.178***
		(0.002)		(0.002)
R: Other		−0.932***		0.103***
		(0.017)		(0.016)
Size (2)			0.308***	
			(0.001)	
Size (3)			0.598***	
			(0.001)	
Size (4)			1.112***	
			(0.001)	
Size (5)			2.884***	
			(0.001)	
ln(Size)				0.490***
				(0.0002)
TBT× ln(Size)				0.087***
				(0.001)
TBT×Size (2)			0.156***	
			(0.007)	
TBT×Size (3)			0.283***	
			(0.007)	
TBT×Size (4)			0.524***	
			(0.007)	
TBT×Size (5)			1.041***	
			(0.007)	
Observations	92,165,816	86,033,592	92,165,816	86,033,592
FE	PY-DY-PD	PY-DY-PD	PY-DY-PD	PY-DY-PD
R^2	0.087	0.094	0.164	0.207
Note:			*p<0.1; **p<0.05; ***p<0.01	

Table 4: Model of trade value among all countries, controlling for trading firms

	Dependent variable:		
	ln($value_t$)		
	(11)	(12)	(13)
TBT	0.393***	0.439***	−0.273***
	(0.004)	(0.005)	(0.008)
Size 2			0.292***
			(0.001)
Size 3			0.561***
			(0.001)
Size 4			1.034***
			(0.001)
Size 5			2.671***
			(0.001)
trade_c	1.131***	1.132***	1.106***
	(0.001)	(0.001)	(0.001)
TBT:trade_c		−0.132***	
		(0.008)	
TBT:Size 2			0.295***
			(0.011)
TBT:Size 3			0.513***
			(0.011)
TBT:Size 4			0.888***
			(0.011)
TBT:Size 5			1.620***
			(0.011)
Observations	163,632,952	163,632,952	163,632,952
R^2	0.112	0.112	0.179
FE	PY-DY-PD	PY-DY-PD	PY-DY-PD
Note:		*p<0.1; **p<0.05; ***p<0.01	

Table 5: Model of Excess Distance

	Dependent variable:		
	lntotaldist		
	(14)	(15)	(16)
TBT	0.157***	−0.316***	0.017***
	(0.002)	(0.004)	(0.003)
lncompanysize		0.049***	
		(0.0001)	
TBT:lncompanysize		0.050***	
		(0.0004)	
Size2			0.023***
			(0.001)
Size3			0.049***
			(0.001)
Size4			0.099***
			(0.001)
Size5			0.290***
			(0.001)
TBT:Size2			0.045***
			(0.003)
TBT:Size3			0.078***
			(0.003)
TBT:Size4			0.176***
			(0.003)
TBT:Size5			0.402***
			(0.003)
Observations	92,165,803	92,165,803	92,165,803
FE	PY-DY-PD	PY-DY-PD	PY-DY-PD
R^2	0.260	0.264	0.264
Adjusted R^2	0.259	0.263	0.263
Note:		*p<0.1; **p<0.05; ***p<0.01	

Table 6: Model of Excess Distance (w/o 2007)

	Dependent variable:		
	lntotaldist		
	(17)	(18)	(19)
TBT	-0.013^{***}	-0.164^{***}	-0.055^{***}
	(0.001)	(0.003)	(0.002)
ln(companysize)		0.022^{***}	
		(0.00004)	
TBT:lncompanysize		0.016^{***}	
		(0.0002)	
Size2			0.003^{***}
			(0.0003)
Size3			0.013^{***}
			(0.0003)
Size4			0.035^{***}
			(0.0003)
Size5			0.123^{***}
			(0.0003)
TBT:Size2			0.007^{***}
			(0.002)
TBT:Size3			0.021^{***}
			(0.002)
TBT:Size4			0.048^{***}
			(0.002)
TBT:Size5			0.134^{***}
			(0.002)
Observations	80,645,085	80,645,085	80,645,085
R^2	0.027	0.031	0.030
FE	PY-DY-PD	PY-DY-PD	
Note:		*p<0.1; **p<0.05; ***p<0.01	

Table 7: Share of trade not to destination

	Dependent variable:	
	3rd party share	
	(20)	(21)
TBT	0.005***	0.015***
	(0.0005)	(0.001)
Size 2		0.011***
		(0.0001)
Size 3		0.031***
		(0.0001)
Size 4		0.065***
		(0.0001)
Size 5		0.133***
		(0.0001)
Trading Firm	0.211***	0.209***
	(0.0001)	(0.0001)
TBT:Size 2		−0.003**
		(0.001)
TBT:Size 3		−0.005***
		(0.001)
TBT:Size 4		−0.008***
		(0.001)
TBT:Size 5		−0.032***
		(0.001)
Observations	163,632,952	163,632,952
R^2	0.211	0.223
FE	PY-DY-PD	PY-DY-PD
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 8: MNC response to regulatory protection

	lnval
TBT	0.025***
	(0.004)
MNC	5.406***
	(0.005)
Size 2	0.293***
	(0.001)
Size 3	0.497***
	(0.001)
Size 4	0.776***
	(0.001)
Size 5	1.418***
	(0.001)
trade_c	1.500***
	(0.001)
TBT:Size 2	−0.011***
	(0.004)
TBT:Size 3	0.017***
	(0.004)
TBT:Size 4	0.117***
	(0.004)
TBT:Size 5	0.380***
	(0.004)
TBT:MNC	−0.547***
	(0.018)
MNC:Size 2	1.551***
	(0.006)
MNC:Size 3	2.095***
	(0.006)
MNC:Size 4	2.502***
	(0.005)
MNC:Size 5	2.954***
	(0.005)
TBT:MNC:Size 2	0.054**
	(0.025)
TBT:MNC:Size 3	0.109***
	(0.022)
TBT:MNC:Size 4	0.172***
	(0.021)
TBT:MNC:Size 5	0.274***
	(0.020)
Observations	163,632,952
R^2	0.296
Residual Std. Error	3.064 (df = 163118945)
Note:	*p<0.1; **p<0.05; ***p<0.01

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