The Mutable Geography of Firms' International Trade

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Abstract

Exporters frequently change their set of destination markets. This paper proposes a new approach to identify the underlying drivers of the changes in exporters' market decisions over time. The approach exploits the information on the price and quantity changes in the firm's continuing markets to uncover the micro shocks that drive firms' market changes. Applying the method to the customs data from China (2000-2006) and the UK (2010-2016), I find consistent results that most firm and firm-product level market changes are driven by demand-related shocks with a nontrivial proportion being correlated across markets.

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1 Introduction

Firms engaged in the global economy face a complex and ever-changing landscape. Contrary to the conventional wisdom that a firm tends to stay in a market once it enters a foreign market, recent studies have documented a high exit rate of firms following their entry into foreign markets.[1] These works highlight the importance of demand changes in driving the firms' export market decisions, as opposed to the classical models relying on productivity or cost changes (Melitz 2003; Bernard, Eaton, Jensen and Kortum 2003; Chaney 2008). While the demand explanations are appealing and can successfully explain the recently documented empirical facts, it is hard to rule out the fact that some firms may exit markets due to supply-side changes. How can we assess the relative contributions of supply versus demand factors in driving the firms' market changes in international trade?

A key challenge in quantifying the underlying drivers of the firms' market changes is that we do not observe the firms' prices and quantities in markets that they have already exited or have not yet entered. Consequently, direct estimation on the price and quantity changes in those markets to infer the underlying shocks becomes impossible. This paper proposes a novel approach to overcome this challenge by looking at the firms' price and quantity adjustments in their continuing markets. It first provides new empirical measures to link firms' intensive margin adjustments in continuing markets to their extensive margin adjustments in market participation. It then builds a tractable analytical framework to map the new empirical measures into the relative contributions of firm and firm-market specific demand and supply shocks in driving the firms' market changes.

Empirically, using detailed information on country-specific product sales by firms from the universe of customs transactions from China (2000-2006) and the UK (2010-2016),[2] I document two new facts on within firm (and product) market changes.[3] First, the geography of firms' international trade is highly mutable – an exporter frequently adjusts the set of markets it serves. This pattern is observed not only among growing firms, but also among established ones. In fact, this mutability is especially pronounced among "the happy few," the large, multi-product, and multi-destination exporters.[4] At the firm-product level, a typi-

[1] See Besedeš and Prusa (2011), Albornoz, Calvo Pardo, Corcos and Ornelas (2012, 2023), Ruhl and Willis (2017), Geishecker, Schröder and Sørensen (2019) and Fanelli, Hallak and Yin (2024). See Alessandria, Arkolakis and Ruhl (2021) for a recent literature review on exporter dynamics.

[2] The two time periods were selected based on data availability and for the purpose of studying entry dynamics both before and after the Great Trade Collapse.

[3] The empirical analysis is conducted separately at firm, firm-sector (2-digit HS) and firm-product (8 digit HS) level. While the exact quantitative estimates may differ, the main qualitative findings of this paper hold at different disaggregation levels.

[4] International trade is dominated by a relatively small number of large multi-product, multi-destination

cal established exporter changes *two-thirds* of its markets on a year-to-year basis, with about *one-third* of these market changes involving simultaneously adding and dropping markets.

Second, for the same product, firms that drop more markets also see a significant decline in the quantity sold in the markets they continue to export to, with prices remaining largely unchanged. For a one percentage point change in the drop-to-change ratio, defined as the proportion of markets being dropped relative to the total number of markets that have been changed in the same period, the average quantity in the continuing markets drops by 0.66% while the average price only increases by 0.01%. These estimates suggest that these market changes could be largely driven by demand-related shocks that not only contain destination-market-specific changes but also correlated changes across markets.

Theoretically, I build a tractable analytical framework to quantify the extent to which the firms' market changes are driven by various underlying shocks, including the firm-destination-specific demand shocks, and firm-specific demand and supply shocks.[5] I show the relationship between the drop-to-change ratio and the price and quantity adjustments in the continuing markets provides important insights on the underlying shocks that drive the within-firm market changes. For example, firms dropping markets due to supply shocks should also see price rises in their continuing markets, resulting in a positive relationship between price changes in the continuing markets and the drop-to-change ratio. Similarly, firms dropping markets due to global demand shocks should see large quantity drops in their continuing markets but limited price changes. In contrast, if the market changes are purely driven by firm-destination-specific shocks, then the drop-to-change ratio is uncorrelated with the price and quantity adjustments in the continuing markets. Applying the framework to the data suggests that the within-firm market changes are largely driven by demand rather than supply shocks, with a nontrivial fraction (13–45%) of these demand shocks being correlated across markets.

In addition to the within-firm market changes, I show that the uncovered micro shocks are also important for explaining the price and quantity dynamics as a firm grows and adds more markets. Specifically, I document that as firms grow and add more destination markets over time, they tend to sell more in their core destination markets, while their prices in these markets are barely changed. I show that this empirical pattern is driven by correlated demand shocks across destination markets within a firm. Supply shocks or firm-destination-specific shocks alone cannot explain the observed price and quantity dynamics of exporters

firms; see Mayer and Ottaviano (2008).

[5]I use the word "shock" to refer to demand or supply variation at a particular panel dimension. Some of these variations could arise from more fundamental shocks in alternative models or settings.

over time.

This paper contributes to the literature on understanding the exporter dynamics.[6] Existing works often focus on a particular mechanism to explain the extensive and intensive margins of international trade, which include the productivity and costs (e.g., Melitz, 2003; Chaney, 2008), informational frictions (Chaney, 2014), contract enforcement (Araujo, Mion and Ornelas, 2016), demand learning (e.g., Albornoz, Calvo Pardo, Corcos and Ornelas, 2012; Timoshenko, 2015; Fanelli, Hallak and Yin, 2024), and complementarities across markets (e.g., Morales, Sheu and Zahler, 2019; Alfaro-Urena, Castro-Vincenzi, Fanelli and Morales, 2023). This paper complements the existing literature by providing a systematic approach to uncover the underlying shocks that drive the market changes. I create new measures that link firms' extensive margin adjustments to their intensive margin adjustments and show that the prices and quantities in the continuing markets can provide useful information on the underlying shocks that drive the market changes.

This paper is also related to the broader literature on understanding the firm heterogeneity, encompassing both domestic firms and exporters, and spanning dimensions such as growth, size, and performance. Motivated by the important macroeconomic implications of firm heterogeneity,[7] this literature has explored various demand- and supply-side factors to explain the causes of firm heterogeneity.[8] While the heterogeneity in firm dynamics is traditionally attributed to supply-side factors such as firm productivity shocks and cost efficiency, recent literature has emphasized the importance of demand factors in explaining the firm heterogeneity.

The findings in this paper contribute to this literature in two ways. First, relative to the papers that show the importance of demand in explaining the firm heterogeneity (e.g., Foster, Haltiwanger and Syverson, 2008; Baldwin and Harrigan, 2011; Manova and Zhang, 2012; Hottman, Redding and Weinstein, 2016), my finding that the *within-firm* market changes are mostly driven by demand shocks brings additional evidence to this literature by showing the

[6] For the aggregate implications of the exporter dynamics, see Ghironi and Melitz (2005), Alessandria and Choi (2007), Das, Roberts and Tybout (2007), Ruhl (2008), Kehoe and Ruhl (2013), Alessandria and Choi (2014), Alessandria, Choi, Kaboski and Midrigan (2015), Fitzgerald and Haller (2018), and Alessandria, Choi and Ruhl (2021).

[7] There is a large literature on how micro-level firm heterogeneity influences aggregate outcomes, including aggregate productivity (Pavcnik, 2002), aggregate fluctuations (Gabaix, 2011; Di Giovanni, Levchenko and Mejean, 2014; Carvalho and Grassi, 2019), and international trade (Chaney, 2008; Melitz and Redding, 2015; Gaubert and Itskhoki, 2021).

[8] See e.g., Foster, Haltiwanger and Syverson (2008); Baldwin and Harrigan (2011); Eaton, Kortum and Kramarz (2011); Johnson (2012); Manova and Zhang (2012); Hottman, Redding and Weinstein (2016); Alfaro-Urena, Castro-Vincenzi, Fanelli and Morales (2023); Fitzgerald, Haller and Yedid-Levi (2023); Eslava, Haltiwanger and Urdaneta (2024).

importance of demand in explaining another dimension of firm heterogeneity, i.e., firms' market choices. Second, the findings that demand shocks play a significant role in explaining a firm's price and quantity dynamics in its core markets as it grows and expands underscore the importance of understanding demand-related channels (e.g., Fitzgerald, Haller and Yedid-Levi, 2023; Argente, Fitzgerald, Moreira and Priolo, 2024) in driving the firm growth dynamics.

The rest of the paper is organized as follows. Section 2 introduces the new empirical measures and discusses the key empirical findings. Section 3 introduces a tractable analytical framework to identify the underlying drivers of the observed market changes. Section 4 discusses the implications of identified shocks for exporter dynamics. Section 5 concludes.

2 Within-firm Market Changes: Measurement and Evidence

Firms engaged in international trade have a "frothy" extensive margin characterized by simultaneous entry and exit. I introduce a new set of empirical measures for this froth, which can be used to quantify the market changes by firms and the underlying drivers of their market change decisions.

In what follows, I first introduce the customs datasets that my empirical analysis is based on in Section 2.1, before introducing the new measures of within-firm market changes in Section 2.2 and showing the key stylized facts in Section 2.3. I then show the new empirical measures that link the intensive and extensive margin adjustments within a firm in Section 2.4. Finally, Section 2.5 exploits the heterogeneity in the empirical measures by product and firm types.

2.1 Data

I carry out my empirical analysis on two customs databases: (1) the Chinese Customs Database, i.e., the universe of import and export records for China from 2000 to 2006, and (2) administrative data from His Majesty's Customs and Revenue (HMRC) in the UK from 2010 to 2016.

The Chinese Customs Database reports detailed trade flows (quantities and values) at the firm-product-destination-month level. In addition to standard variables, such as the firm ID, an 8-digit HS code, the destination country and month, the database contains the Chinese measure word in which quantity is reported, an indicator of the form of commerce for tax and tariff purposes, and a categorization based on the registration type of the exporting firm. The database is available at the monthly frequency during the period 2000–2006. I aggregate trade flows into the annual level in this study. Like other firm-level studies using customs databases, I use unit values as a proxy for prices. A product is defined as a 8-digit Harmonized System (HS) code. A sector in defined as a 2-digit HS code.

The HMRC administrative datasets include transaction level trade flows for non-EU exports and monthly records for EU exports.[9] HMRC reports the value of transactions denominated in sterling and two quantity measures (net mass and quantity). I aggregate trade flows at the firm-product-destination-year level by summing over quantity and value of transactions. The unit value is calculated as the total sterling value divided by the quantity with reported quantities (net mass in kilos, units, pairs, etc) and as the total sterling value divided by the net mass (in kilos) for products for which there is no specific quantity units reported. Firms are identified by a firm-specific anonymised identifier. Products are defined by an 8-digit Combined Nomenclature (CN) code.[10] To create the same time span of Chinese firms, I focus on time period 2010-2016, where 2016 is the latest year of data available at the time when the analysis was performed.

Since the empirical patterns I document in the following sections are robust to the customs datasets used, I focus on discussing the results of Chinese exporters in the paper and report the statistics and estimates of UK exporters in Online Appendix: UK Results.

2.2 Measuring Changes in Trade Patterns

How can we measure changes in trade patterns? I develop two simple measures to capture the changes in the set of export markets served by a firm with a particular product over time. To illustrate the properties of the customs datasets and how the trade pattern measures are defined and calculated, it is useful to go through the following example. The example, constructed to reflect the actual structure of trading patterns of many firm and product level transactions, conveys the highly unbalanced nature of the data.

[9] EU records only contain UK firms whose exports to the EU exceed £250,000 in a given calendar year. The requirement to report exports at the detailed product level applies to firms whose total value of exports exceeds the reporting threshold. A comparison with official statistics indicates that these companies account for around 96–98% of the total value of UK exports to the EU.

[10] There has been a major revision in the product classification during the year 2012 and many small revisions in other years during my sampling period 2010–2016. I wrote an algorithm to convert all product classifications into the base year (2012) while keeping the maximum number of consistent product definitions based on the official concordance tables.

Consider a firm that sells a product to four countries, A, B, C, D over 4 time periods. The left panel of Figure 1 shows the trading records of this firm-product pair. An empty cell means no trade. The right panel shows the construction of relevant statistics.

					Trade Pattern	**Activity**	**M. Changes/ Markets**	**Drops/ Changes**
$t = 1$	A	B			A-B	–	–	–
$t = 2$	A		C		A-C	Churn	2/2	1/2
$t = 3$	A		C	D	A-C-D	Add	1/2.5	0/1
$t = 4$	A		C		A-C	Drop	1/2.5	1/1

Figure 1: An Example of Market Switching Measures

A trade pattern is defined as the set of destination markets that a firm-product pair exports to in a given period. The first column in the right-hand-side panel shows the identified trade patterns. In this example, three trade patterns are identified, i.e., A-B, A-C, and A-C-D. The second column in the right-hand-side panel classifies the activity of market changes into different categories. Market churn happens if the firm-product pair simultaneously adds and drops markets in a given period. In this example, market churn only occurs in period 2. The last two columns of Figure 1 show that changes to the extensive margin can be decomposed into two components: (a) the proportion of markets changed among all active markets and (b) the proportion of markets being dropped/added among the changed markets.

Specifically, I construct two measures to capture the magnitude and the direction of changes in the trade patterns of a firm (or firm-product):

Market Changes / Number of Markets (MCM) captures the magnitude of market changes, which is defined as:

$$\text{MCM}_{ft} \equiv \frac{N_{ft,t-s}^{changed}}{\frac{1}{2}(N_{ft} + N_{ft-s})}, \tag{1}$$

where f represents a firm or firm-product pair; $N_{ft,t-s}^{changed}$ is the number of markets that f has changed from period $t - s$ to period t; N_{ft} is the total number of markets exported by f at

t; and s is the lag between two observed periods.[11] The advantage of having both N_{ft} and N_{ft-s} in the denominator is that the measured MCM_{ft} will be bounded from 0 to 2.

Market Drop / Market Changes (DC Ratio) captures the proportion of markets being dropped among the total number of markets changed:

$$\text{Drop-to-change ratio}_{ft} \equiv \frac{N^{dropped}_{ft,t-s}}{N^{changed}_{ft,t-s}}, \tag{2}$$

where $N^{dropped}_{ft,t-s}$ is the number of markets that have been dropped from $t-s$ to t. Note that the drop-to-change ratio is a directional measure. If a firm only adds markets, the drop-to-change ratio will be zero; if a firm only drops markets, the drop-to-change ratio will be 1; if a firm simultaneously adds and drops markets, the drop-to-change ratio will be in between 0 and 1. The DC ratio also provides a simple way to calculate the *probability of churn:* the number of market churn activities over the total number of trading periods, i.e., the probability that the DC ratio is neither one nor zero. I also create the corresponding value measures of (1) and (2) by calculating the total trade value involved in the markets.

2.3 Stylized Facts on Within-firm Market Changes

Table 1 presents the distribution of market change measures for Chinese exporters during 2000–2006. The top panel shows the market changes based on trade patterns defined at the firm-product level. We see from the first row of panel (a) that a median Chinese exporter changes around *two-thirds* of markets at the annual frequency. The second row shows the corresponding value measure of these market changes. The trade value involved in these market changes is nontrivial – about a quarter of a firm's total trade value.

In view of the large scale of market changes found in the data, a natural question is whether these changes mainly consist of dropping existing markets or adding new markets. The next two rows of each panel show the count and value measures of the drop-to-change ratio. These statistics are calculated based on those time periods involving market changes. The median value of market drops over market changes (drop-to-change ratio afterwards) is around 0.5. This suggests that firms simultaneously add and drop markets—a pattern that is difficult to rationalize using trade models that focus exclusively on supply-side (productivity or cost efficiency) determinants of trade. Among these market changes, market churn accounts for around *one-third* of the trading periods.

[11] At the annual frequency, $s = 1$ in most cases.

Table 1: Measures of Within-firm Market Changes

	Median	Mean	Distribution (Percentile) 5th	25th	75th	95th	Observations
(a) Firm-product level							
MCM (count measure)	0.67	0.86	0.00	0.00	1.50	2.00	3,894,362
MCM (value measure)	0.24	0.72	0.00	0.00	1.73	2.00	3,894,362
DC (count measure)	0.50	0.47	0.00	0.22	0.67	1.00	2,652,112
DC (value measure)	0.42	0.46	0.00	0.03	0.90	1.00	2,652,112
Prob. of Churn	0.27	0.27	0.00	0.05	0.43	0.60	6,444,617
Number of Markets	1.00	2.90	1.00	1.00	3.00	10.00	6,444,617
(b) Firm-sector level							
MCM (count measure)	0.67	0.77	0.00	0.00	1.20	2.00	1,317,304
MCM (value measure)	0.14	0.52	0.00	0.00	0.85	2.00	1,317,304
DC (count measure)	0.50	0.45	0.00	0.17	0.68	1.00	958,212
DC (value measure)	0.37	0.44	0.00	0.02	0.88	1.00	958,211
Prob. of Churn	0.25	0.30	0.00	0.00	0.50	0.83	2,033,556
Number of Markets	2.00	4.95	1.00	1.00	5.00	19.00	2,033,556
(c) Firm level							
MCM (count measure)	0.67	0.69	0.00	0.29	1.00	2.00	454,901
MCM (value measure)	0.10	0.38	0.00	0.00	0.48	2.00	454,901
DC (count measure)	0.40	0.43	0.00	0.11	0.67	1.00	360,007
DC (value measure)	0.30	0.41	0.00	0.01	0.82	1.00	360,007
Prob. of Churn	0.33	0.35	0.00	0.00	0.67	0.86	649,633
Number of Markets	3.00	8.25	1.00	1.00	10.00	32.00	649,633

Source: Chinese Customs Database, 2000–2006.
Note: This table shows the summary statistics of different measures of within-firm market changes at the firm-product level in panel (a), the firm-sector level in panel (b), and the firm level in panel (c). The count measures for the market change to market (MCM) ratio and the drop-to-change (DC) ratio are defined as in (1) and (2). The value measures for the two ratios are calculated using the total trade value of the markets instead of the number of markets. Probability of churn is the number of market churn activities over the total number of trading periods.

Panel (b) and (c) of Table 1 show the results based on trade patterns calculated at a more aggregated firm-sector (2-digit HS) level and at the firm level, respectively. In general, we observe very similar patterns compared to the firm-product level results. At the more aggregated firm-sector or firm level, firms export to more markets and trade patterns are slightly more stable.[12]

2.4 Price and Quantity Adjustments in Continuing Markets

What drives these market changes? Do these market changes reflect large and frequent demand shocks facing the firms? Or are these changes driven by supply-side factors? For example, a firm receiving a common adverse cost shock will need to increase its prices and thus may no longer get enough demand in some destinations to cover its fixed costs of exporting to those destinations.

A known problem in addressing these questions is measurement. We do not observe the price that would have been set or the quantity that would have been sold before the firm enters (or after the firm exited) the market. A key innovation of this paper is to exploit the price and quantity adjustments in the firm's continuing markets (i.e., those markets that the firm continues to sell to from $t-1$ to t) to gauge the potential shocks facing the firms when they add or drop markets.

					Δ Outcome in Continuing Markets	**Drops/Changes**
$t=1$	A	B			–	–
$t=2$	A		C		$y_{A,2} - y_{A,1}$	1/2
$t=3$	A		C	D	$y_{AC,3} - y_{AC,2}$	0/1
$t=4$	A		C		$y_{AC,4} - y_{AC,3}$	1/1

Figure 2: Illustration of the Estimation Strategy

Note: The first subscript in y denotes the set of markets in which the variable is calculated. The outcome variable is unit value or mean quantity calculated based on the set of markets indicated by the first subscript of y.

Figure 2 illustrates the estimation strategy, where I regress the changes in mean unit value or quantity sold in the continuing markets on the drop-to-change ratio, which measures the

[12] All statistics are calculated based on year-to-year changes. In Appendix A.1, I report statistics with trade patterns calculated at different time frequencies. The magnitude of market changes increases slightly with the time span in which the trade pattern is calculated.

Table 2: Quantity and Price Elasticities to Drop-to-change Ratio

	Quantity Elasticity to DC	Price Elasticity to DC	Observations
Count Measure			
Firm-product level	-0.66***	0.01***	1,326,377
Firm-sector level	-0.70***	0.04***	667,478
Firm-level	-0.74***	0.05***	294,438
Value Measure			
Firm-product level	-0.61***	-0.00	1,326,377
Firm-sector level	-0.62***	0.01***	667,477
Firm-level	-0.62***	0.03***	294,438

Note: This table presents a summary of estimates from regressing changes in logged unit value or logged mean quantity in continuing markets on the drop-to-change (DC) ratio. The top and bottom panels present results using the count and value measures of the DC ratio, respectively. Rows within each panel indicate the level of disaggregation at which the market change measures are constructed. Each cell reports an estimate from a separate regression. Firm(-product/sector) and year fixed effects are added in each specification. The statistical significance is calculated based on robust standard errors with ***, **, * representing statistical significance at 1%, 5%, 10% level respectively. Source: Chinese Customs Database, 2000-2006.

direction of the market changes, i.e., proportion of markets being dropped.[13] The estimates from this specification captures whether firms dropping more markets also charge a higher price and a lower quantity in those continuing markets.

Table 2 presents a summary of the estimation results for the continuing markets. The estimates suggest the quantity in the continuing markets is significantly lower if more markets are dropped conditional on a market change. However, the changes in price of these markets are small and are only weakly related to the proportion of the markets being dropped.[14] For example, at a firm-product level, for a one percentage point increase in the drop-to-change ratio, the quantity in the continuing markets drops by 0.66%, while the price only increases by 0.01% in the continuing markets.

While the market-specific demand changes can be important in driving the market changes, the estimates highlight that global or common demand changes are also important in driving the market changes. More specifically, the large quantity changes in the continuing markets suggest that a nontrivial proportion of the market changes are driven by

[13]Note that the drop-to-change ratio is already a change measure and therefore no further time differences need to be taken.

[14]The magnitude of the unit value changes is small and the statistical significance of the unit value coefficients is sensitive to the estimation sample.

correlated changes across markets. If the market changes were purely driven by idiosyncratic market-specific changes, then we would not have observed any big change in the continuing markets.

2.5 Heterogeneity by Product and Firm Types

Relying on the rich information contained in the Chinese Customs Database, I uncover substantial heterogeneity in the magnitude of within-firm market changes based on the degree of product differentiation, the end-use of the product, the capital structure of the firm, and the nature of the business. However, the estimated quantity and price elasticities with respect to the drop-to-change ratio are highly similar and consistent across product and firm types.[15]

Heterogeneity by product types. Panel (a) of Table 3 breaks down trade transactions by product differentiation according to Rauch (1999) classification. Firms selling less differentiated products (such as commodities traded at the organized exchange) tend to have stable trade patterns and are less likely to change their destination markets. In contrast, firms selling more differentiated products, such as machinery and mechanical appliances and optical and photographic products, demonstrate a significantly larger degree of market changes. Panel (b) shows a breakdown by the end use categories of the goods. The magnitude of market changes are similar across consumption and intermediate goods, while it is higher for capital goods.[16]

Heterogeneity by firm types. Panel (c) of Table 3 shows the breakdown by firm registration types.[17] I find that market changes are considerable for both private and state-owned enterprises. In contrast, trade patterns appear more stable for foreign-invested enterprises. Panel (d) utilizes information about the form of commerce to group transactions into two

[15]Note that the regressions are conducted conditional on a market change. As a result, the substantial heterogeneity in the magnitude of market changes does not contradict the observed similarity in price and quantity elasticities once the analysis is restricted to the sample of market changes within each firm and product category. Table 3 presents regression estimates based on the count measure of the drop-to-change (DC) ratio. Similar regression results using trade value are provided in Appendix A.3.

[16]A breakdown by detailed two-digit industries is presented in Table A6 in the appendix.

[17]The registration type variable contains information on the capital formation of the firm across eight categories: state-owned enterprises, Sino-foreign contractual joint ventures, Sino-foreign equity joint ventures, wholly foreign-owned enterprises, collective enterprises, private enterprises, individual businesses, and other enterprises. I group three types of foreign-invested firms—namely, wholly foreign-owned enterprises, Sino-foreign contractual joint ventures, and Sino-foreign equity joint ventures—into one category, referred to as "foreign-invested enterprises."

Table 3: Within-firm Market Changes and Elasticities of Prices and Quantities to Drop-to-Change Ratio: Breakdown by Firm and Product Types

	MCM (count)	MCM (value)	Quantity	Price	Observations
All	0.67	0.24	-0.66***	0.01***	3,894,362
(a) Rauch Classification					
Differentiated Products	0.67	0.28	-0.67***	0.01***	2,941,998
Reference Priced	0.67	0.10	-0.54***	0.00	380,726
Organized Exchange	0.40	0.03	-0.59***	-0.01	43,147
(b) BEC Classification					
Capital	0.77	0.34	-0.66***	0.02***	219,311
Consumption	0.67	0.24	-0.64***	0.01***	1,524,589
Intermediate	0.67	0.23	-0.64***	0.01***	1,189,037
(c) Company Type					
State-owned Enterprises	0.86	0.44	-0.59***	0.01***	1,810,690
Private Enterprises	0.86	0.40	-0.73***	0.02***	859,079
Foreign-Invested Enterprises	0.40	0.01	-0.70***	-0.01**	959,474
(d) Form of Commerce					
General Trade	0.81	0.38	-0.65***	0.01***	3,171,831
Processing Trade	0.40	0.01	-0.74***	-0.02***	573,360

Note: The first two columns of the table presents the *median* values for the market change to markets ratio (MCM) calculated using the count measure or the trade value measure. The next two columns show estimates from regressing quantity or price changes (indicated by the column header) in the continuing markets on the count measure of the drop-to-change ratio. Each cell in these two columns presents an estimate from a separate regression. Firm-product and year fixed effects are added to all specifications. The statistical significance is calculated based on robust standard errors with ***, **, * representing statistical significance at 1%, 5%, 10% level respectively. Statistics and elasticities are based on trade patterns calculated at the firm-product (8-digit HS) level. Source: Chinese Customs Database, 2000-2006.

categories based on the purpose of trade: (i) firm-product pairs conducting general trade (i.e., manufacturers selling their own products in the foreign market) and (ii) firm-product pairs engaged in contracts to process other foreign firms' products or materials. A notable difference emerges between these two types of firms: large market changes are observed only in relation to general trade, while firms with contracts to process other firms' products show more stable trade patterns.[18]

Heterogeneity by exporter size. Lastly, I explore whether the market changes, and the elasticities of prices and quantities to drop-to-change ratio vary with exporter size. I divide the firm-product pairs into five equal sized bins based on their export value across all destinations and years. Table 4 reports median values of the key empirical statistics as well as the estimated quantity and price elasticities to the drop-to-change ratio.[19] There are three key observations. First, the median value of the count measure of MCM does not vary over the size of the firm-product – even large and established exporters frequently change the set of their destination markets. Second, the value measure of MCM decreases with firm size, suggesting that the markets being added or dropped account for an increasingly smaller share of the firm's total trade value as the firm grows large. Nonetheless, even for the largest exporters (bin 5), the trade value of those changed markets accounts for more than 10% of their annual total exports. Third, the price elasticity is consistently small and close to zero for all firm size bins, while the quantity elasticity increases in firm size.

[18] See Yu (2014) for further discussion on the key data features of processing trade in Chinese firms.

[19] The empirical patterns are robust to alternative measures and different aggregation levels. In Appendix A.2, I report additional statistics and estimates calculated at the firm-product level as well as those based on size bins calculated at the firm-sector level.

Table 4: Within-firm Market Changes and Elasticities of Prices and Quantities to Drop-to-Change Ratio: Breakdown by Exporter Size

Size Bin	No. of Dest.	MCM (count)	MCM (value)	Quantity	Price	Observations
1 (smallest)	1.00	0.67	0.66	-0.23***	0.00	1,290,050
2	1.00	0.67	0.51	-0.38***	0.01	1,289,982
3	1.00	0.67	0.39	-0.49***	0.02***	1,289,983
4	2.00	0.67	0.29	-0.64***	0.01***	1,289,999
5 (largest)	3.00	0.67	0.12	-0.84***	0.00	1,289,999

Note: This table presents the statistics by the exporter size bins, where the bins are defined based on the total export value of a firm-product across all destinations and years. The first three columns of the table reports the median number of destination markets and the market change to markets (MCM) ratios calculated using both the count measure and the trade value measure. The next two columns display the regression estimates for quantity and price elasticities with respect to the count measure of the drop-to-change ratio. Firm-product and year fixed effects are added to all specifications. Statistical significance is calculated using robust standard errors, with ***, **, and * denoting significance at the 1%, 5%, and 10% levels, respectively. The statistics and elasticities are based on trade patterns at the firm-product level. Source: Chinese Customs Database, 2000–2006.

3 Conceptual Framework

In this section, I develop a tractable analytical framework to highlight the key implications of the empirical facts documented in the previous section. Section 3.1 introduces the model setup. Section 3.2 derives a closed-form mapping between the model parameters and the proposed empirical measures, using a simplified version of the model with two types of firms and two markets. Section 3.3 then generalizes the results from Section 3.2 to include multiple firm types and markets, discussing how the contributions of various shocks can be identified from the new empirical measures. Section 3.4 applies the analytical framework to the Chinese customs data to uncover the key drivers of the market changes documented empirically.

3.1 Model Setup

In each period t, a firm f decides whether to export to market d based on its operating profit π_{fdt} relative to the fixed cost of exporting ζ_{fd}. The firm f's market participation indicator ϕ_{fdt} is:

$$\phi_{fdt} = \begin{cases} 1 & \text{if} \quad \pi_{fdt} > \zeta_{fd} \\ 0 & \text{if} \quad \pi_{fdt} \leq \zeta_{fd} \end{cases}$$

If π_{fdt} is greater than ζ_{fd}, the firm f will export to market d in period t and the market participation indicator ϕ_{fdt} equals one, while ϕ_{fdt} equals zero if otherwise.

The probability of a market d being added from $t-1$ to t is the joint probability that the firm did not export to market d in $t-1$ and decides to export to market d in t:

$$Pr(\pi_{fdt} > \zeta_{fd} \bigcap \pi_{fdt-1} \leq \zeta_{fd}),$$

which equals the probability of not exporting to market d in period $t-1$, $Pr(\pi_{fdt-1} \leq \zeta_{fd})$, multiplied by the conditional probability of exporting to market d in period t, $Pr(\pi_{fdt} > \zeta_{fd} | \pi_{fdt-1} \leq \zeta_{fd})$. Similarly, the probability of exiting a market d in period t is the joint probability that the firm exported to market d in $t-1$ and decides not export to market d in t, $Pr(\pi_{fdt} \leq \zeta_{fd} \bigcap \pi_{fdt-1} > \zeta_{fd})$.

Assuming there is a unit mass of firms, the fraction of firms exported to market d in $t-1$ is $Pr(\pi_{fdt-1} > \zeta_{fd})$ and the fraction of firms that did not export to market d in $t-1$ is $Pr(\pi_{fdt-1} \leq \zeta_{fd})$. Then the probability of a market change is the sum of the probability of those that exported in $t-1$ dropping the market in t and the probability of those that did not export in $t-1$ adding the market in t:

$$\underbrace{Pr(\pi_{fdt} > \zeta_{fd} \bigcap \pi_{fdt-1} \leq \zeta_{fd})}_{\text{Entrants}} + \underbrace{Pr(\pi_{fdt} \leq \zeta_{fd} \bigcap \pi_{fdt-1} > \zeta_{fd})}_{\text{Exiters}}, \tag{3}$$

where $Pr(\pi_{fdt} > \zeta_{fd} \bigcap \pi_{fdt-1} \leq \zeta_{fd}) = Pr(\pi_{fdt} > \zeta_{fd} | \pi_{fdt-1} \leq \zeta_{fd}) Pr(\pi_{fdt-1} \leq \zeta_{fd})$ is the probability of those that did not export to d starting to export to d in t.

As shown in (3), the key to understand how and why the market participation of firms has changed over time is to understand how the firm's destination-specific profits π_{fdt} are changing from one period to the next. Denote the percentage change in profits from $t-1$ to t as $\widehat{\pi}_{fdt} \equiv \pi_{fdt}/\pi_{fdt-1} - 1$ and the percentage difference between the fixed cost of entry and the period-($t-1$) profit as $\xi_{fdt-1} \equiv \zeta_{fd}/\pi_{fdt-1} - 1$. Substitute $\widehat{\pi}_{fdt}$ and ξ_{fdt-1} into (3) to rewrite (3) as:

$$\underbrace{Pr(\widehat{\pi}_{fdt} > \xi_{fdt-1} \bigcap \xi_{fdt-1} \geq 0)}_{\text{Entrants}} + \underbrace{Pr(\widehat{\pi}_{fdt} \leq \xi_{fdt-1} \bigcap \xi_{fdt-1} < 0)}_{\text{Exiters}}. \tag{4}$$

An observation from (4) is that firms' market changes depend on the distributions of two key statistics: (i) $\widehat{\pi}_{fdt}$, capturing how operating profits have changed from $t-1$ to t, and (ii) ξ_{fdt-1}, capturing the percentage difference between the fixed entry cost and the initial profit in period $t-1$.

To show the mechanisms behind the market changes, we need to specify the firm's profit maximization problem and study $\widehat{\pi}_{fdt}$. Specifically, I assume firms compete via monopolistic competition and each firm f faces the following residual demand function:

$$q_{fdt} = a_{fdt} b_{ft} (p_{ft})^{-\eta}, \tag{5}$$

where η is the elasticity of substitution and a_{fdt} and b_{ft} denote the firm-destination-specific and firm-specific demand shifters, respectively. Facing the residual demand function, the firm f chooses its price p_{ft} to maximize the profit:

$$\pi_{fdt} = q_{fdt}(p_{ft} - mc_{ft}),$$

where mc_{ft} denotes the firm's marginal cost. Taking the first order condition with respect to p_{ft} gives the optimal price as a constant markup over the marginal cost:

$$p_{ft} = \frac{\eta}{\eta - 1} mc_{ft}. \tag{6}$$

Substituting (6) and (5) into the profit function, it can be shown that the firm's profit at the optimal price is:

$$\pi_{fdt} = \frac{1}{\eta} a_{fdt} b_{ft} \left(\frac{\eta}{\eta - 1} mc_{ft} \right)^{1-\eta}. \tag{7}$$

Let $\widehat{X}_t \equiv \frac{X_t - X_{t-1}}{X_{t-1}}$ denote the percentage change of X from $t-1$ to t. Taking the first-order linear approximation of (7) gives the following percentage change in profit:

$$\widehat{\pi}_{fdt} = \widehat{a}_{fdt} + \widehat{b}_{ft} + (1-\eta)\widehat{mc}_{ft}. \tag{8}$$

As can be seen, the change in profits is driven by the changes in the firm's residual demand and its marginal cost on the supply side. In addition, the change in profits can be due to the changes in firm-destination-specific conditions or firm-specific conditions.

To quantify the relative importance between (1) residual demand changes vs. marginal cost (supply-side) changes, and between (2) firm-destination-specific changes vs. firm-specific changes, I introduce two weight parameters, $\rho \in [0, 1]$ and $\gamma \in [0, 1]$, to capture the relative importance between different types of changes,[20] and rewrite (8) as:

$$\widehat{\pi}_{fdt} = (1-\rho)A_{fdt} + \rho[\gamma B_{ft} + (1-\gamma)C_{ft}], \tag{9}$$

where $(1-\rho)A_{fdt} \equiv \widehat{a}_{fdt}$, $\gamma\rho B_{ft} \equiv \widehat{b}_{ft}$, and $(1-\gamma)\rho C_{ft} \equiv (1-\eta)\widehat{mc}_{ft}$. I assume A_{fdt}, B_{ft} and C_{ft} are drawn from mean zero normal distributions with variances $\sigma_A^2 = \frac{\sigma^2}{(1-\rho)^2+\rho^2}$ and $\sigma_B^2 = \sigma_C^2 = \frac{\sigma_A^2}{(1-\gamma)^2+\gamma^2}$, so that $\widehat{\pi}_{fdt}$ is normally distributed with $\mathcal{N}(0,\sigma^2)$. Under this assumption, the changes in optimal price and quantity are given by

$$\widehat{p}_{ft} = \rho\frac{1-\gamma}{1-\eta}C_{ft} \quad \text{and} \quad \widehat{q}_{fdt} = (1-\rho)A_{fdt} + \gamma\rho B_{ft} - \eta\widehat{p}_{ft}. \tag{10}$$

Most importantly, parameter ρ reflects the relative contribution of the firm-specific shocks compared to firm-destination-specific shocks in driving the profit changes, while parameter γ captures the extent to which the firm-specific shocks are driven by demand versus supply factors. The observed changes in prices and quantities in those continuing markets can inform the underlying shocks that drive those market change decisions. For example, if $\widehat{\pi}_{fdt}$ is mainly driven by firm-specific rather than destination-specific changes (i.e., ρ is close to one), then the changes in profits would be correlated across destination markets within a firm. Therefore, for firms dropping more markets, we should also see a drop in quantity sold or an increase in price charged in those markets it continues to sell to. In the next two sections, I show how the two contribution parameters, ρ and γ, as well as the volatility of the profit change σ, can be uniquely pinned down by the observed MCM ratio and the estimated quantity and price elasticities to the DC ratio.

3.2 Mapping Empirical Measures to Model Parameters: A First Look with Two Firm Types and Two Markets

In this section, I demonstrate how the constructed empirical measures map to the model parameters, using a simplified version with two firm types and two markets. To derive closed-form solutions, I make two simplifying assumptions. First, the entry cost for firms to enter market 1 is sufficiently low, ensuring that firms always export to market 1 in both

[20] An alternative way is to specify the shock processes for $\widehat{a}_{fdt}$, $\widehat{b}_{ft}$, and $\widehat{mc}_{ft}$ directly, e.g., $\widehat{a}_{fdt} \sim \mathcal{N}(0,\sigma_a^2)$, $\widehat{b}_{ft} \sim \mathcal{N}(0,\sigma_b^2)$, $\widehat{mc}_{ft} \sim \mathcal{N}(0,\sigma_{mc}^2)$. The volatility σ of the profit change and the relative contribution parameters, ρ and γ, can be backed out from σ_a, σ_b, and σ_{mc}. This approach is identical to my specification (9). The main advantage of specification (9) is that it allows for direct control of the contribution parameters, ρ and γ, which facilitates interpretation in later analysis.

periods $t-1$ and t. Consequently, market 1 represents the continuing markets. Second, only two types of firms sell to market 2, where ξ_{fdt-1} is randomly drawn from $\{-\overline{\xi}, \overline{\xi}\}$ with equal probability, where $0 < \overline{\xi} < 1$. Both assumptions will be relaxed in the quantitative exercises in Section 3.3, where all results remain consistent.

Under these assumptions, half of the firms that draw $\xi_{f2t-1} = -\overline{\xi} < 0$ would export to market 2 in $t-1$. Following (4), the probability of a change in participation in market 2 is:

$$\underbrace{Pr(\widehat{\pi}_{f2t} > \overline{\xi} \bigcap \xi_{f2t-1} = \overline{\xi})}_{\text{Entrants in market 2}} + \underbrace{Pr(\widehat{\pi}_{f2t} \leq -\overline{\xi} \bigcap \xi_{f2t-1} = -\overline{\xi})}_{\text{Exiters in market 2}}, \tag{11}$$

where the first term captures the probability of those firms that did not export to market 2 in $t-1$ and decide to enter market 2 in t due to the higher operating profit relative to the entry cost. Similarly, the second term captures the probability of those that exported to market 2 in $t-1$ but not in t due to a drop in profit.

Under the assumption that firms always export to market 1, mean MCM across all firms can be derived using (11) as

$$\begin{aligned} \text{MCM} &= \frac{2}{3} Pr(\widehat{\pi}_{f2t} > \overline{\xi} \bigcap \xi_{f2t-1} = \overline{\xi}) + \frac{2}{3} Pr(\widehat{\pi}_{f2t} \leq -\overline{\xi} \bigcap \xi_{f2t-1} = -\overline{\xi}) \\ &= \frac{4}{3} \Phi(-\overline{\xi}/\sigma), \end{aligned} \tag{12}$$

where the fraction 2/3 in front of the terms comes from the denominator of the MCM definition (1).[21] Given that $\widehat{\pi}_{f2t} \sim \mathcal{N}(0, \sigma^2)$ and ξ_{fdt-1} is drawn from $\{-\overline{\xi}, \overline{\xi}\}$ with an equal probability, it can be shown that the MCM ratio in this case equals $\frac{4}{3}\Phi(-\overline{\xi}/\sigma)$, where $\Phi(.)$ is the cumulative density function of a standard normal distribution. For a given $\overline{\xi}$, the measured MCM is increasing in the volatility of firms' profits, σ.

In this simple setup with two markets, the drop-to-change ratio can only take a value of zero (when the firm adds market 2 in t) or one (when the firm drops market 2 in t). Therefore, regressing the change in quantity in the continuing market (i.e. market 1) on the

[21] Based on (1), the denominator of the MCM ratio is the average number of markets over the two periods, $\frac{1}{2}(N_{ft} + N_{ft-1})$. For those firms that only exported to market 1 in $t-1$ but adds market 2 in t, the average number of markets is $\frac{1}{2}(2+1) = 3/2$. Similarly, it can be shown that the average number of markets for those that exported to two markets in $t-1$ but only exports to one market (i.e., drops market 2) in t is also 3/2.

drop-to-change ratio gives the following estimator:

$$\text{QDC} = \underbrace{\mathbb{E}(\widehat{q}_{f1t}|\widehat{\pi}_{f2t} \leq -\bar{\xi} \bigcap \xi_{f2t-1} = -\bar{\xi})}_{\text{Those dropping market 2 in } t} - \underbrace{\mathbb{E}(\widehat{q}_{f1t}|\widehat{\pi}_{f2t} > \bar{\xi} \bigcap \xi_{f2t-1} = \bar{\xi})}_{\text{Those adding market 2 in } t}. \qquad (13)$$

When the changes in profits are purely driven by firm-destination-specific changes (i.e., $\rho = 0$), the profit and thus market changes in market 2 do not provide any information in market 1, in which case the estimated elasticity in (13) will be exactly zero. To see this, I use the residual demand function (5) and the decomposition (9) to rewrite (13) as:[22]

$$\begin{aligned}\text{QDC} =& \underbrace{\mathbb{E}[(1-\rho)A_{f1t} + \rho\gamma B_{ft} + \frac{\eta}{\eta-1}\rho(1-\gamma)C_{ft} \mid (1-\rho)A_{f2t} + \rho\gamma B_{ft} + \rho(1-\gamma)C_{ft} \leq -\bar{\xi}]}_{\text{Those dropping market 2 in } t} \\ &- \underbrace{\mathbb{E}[(1-\rho)A_{f1t} + \rho\gamma B_{ft} + \frac{\eta}{\eta-1}\rho(1-\gamma)C_{ft} \mid (1-\rho)A_{f2t} + \rho\gamma B_{ft} + \rho(1-\gamma)C_{ft} > \bar{\xi}]}_{\text{Those adding market 2 in } t} \\ =& -2\rho^2\sigma\frac{\phi(\bar{\xi}/\sigma)}{\Phi(-\bar{\xi}/\sigma)}\frac{\gamma^2 + (1-\gamma)^2\frac{\eta}{\eta-1}}{\gamma^2 + (1-\gamma)^2} \leq 0, \qquad (14)\end{aligned}$$

where $\phi(.)$ and $\Phi(.)$ denote the probability density function and cumulative distribution function of a standard normal distribution, respectively. Three main insights arise from (14). First, for a given profit volatility σ and demand contribution γ, the magnitude of the elasticity of the quantity change in the continuing market with respect to the drop-to-change ratio increases with the contribution of firm-specific changes relative to firm-destination-specific changes, captured by ρ. Second, for a given ρ and γ, the magnitude of the elasticity rises with the profit volatility σ. Intuitively, larger profit volatility implies larger underlying demand or supply shocks, which result in bigger changes in quantity. Finally, for a given σ and ρ, the magnitude of the elasticity weakly decreases with the demand contribution γ, as indicated by the term $\frac{\gamma^2+(1-\gamma)^2\frac{\eta}{\eta-1}}{\gamma^2+(1-\gamma)^2}$, which reflects the unequal contribution of cost changes on quantity and profit.

[22] A similar expression can be obtained for the elasticity of the price change in the continuing markets to the drop-to-change ratio:

$$\text{PDC} = 2\sigma\frac{\phi(\bar{\xi}/\sigma)}{\Phi(-\bar{\xi}/\sigma)}\frac{\rho^2(1-\gamma)^2}{[(1-\rho)^2+\rho^2][(1-\gamma)^2+\gamma^2]}\frac{1}{\eta-1} \geq 0.$$

3.3 Mapping Empirical Measures to Model Parameters: Many Firm Types and Many Markets

In this section, I extend the simple model to allow for an arbitrary number of exporting markets and relax the two restrictive assumptions in Section 3.2. First, I remove the assumption of a stable market with sufficiently low entry costs that firms always export to. Second, instead of limiting the model to two types of firms with two distinct initial profit values, I adopt a more realistic distribution of initial profits. Following Head, Mayer and Thoenig (2014), I assume the initial profit distribution is log-normal.[23] In this more general case, there are no closed-form solutions.[24] Therefore, numerical simulations are used in this section instead. Nevertheless, all the key insights of the previous discussions will carry through.

Specifically, I simulate data for 10,000 firms potentially exporting to 20 markets according to the model setup in Section 3.1. I begin by calibrating $\sigma = 1.74$, $\rho = 0.23$, and $\gamma = 0.86$, which roughly aligns with my empirical estimates of the market changes-to-markets ratio (MCM) and the elasticities of quantity and price changes in continuing markets with respect to the drop-to-change ratio (DC) calculated at the firm-product level. This calibration indicates that approximately 23% of the with-firm market changes are driven by correlated shocks across markets within a firm-product, with most of these correlated shocks ($\approx$86%) being demand rather than supply driven. To further explore these mechanisms, I adjust these parameter values to illustrate how the three empirical measures vary in response to changes in each parameter.

Figure 3 shows the simulation results. The blue line in Figure 3(a) shows that the MCM ratio in the model is monotonically increasing in the volatility of the operating profit measured by σ, while keeping ρ and γ at the calibrated values. Varying ρ while keeping γ and σ unchanged, or varying γ while keeping the other two parameters unchanged has no impact on the MCM, as seen from the pink and the green line, respectively. This can also been seen from (12), where the MCM ratio does not depend on ρ or γ. Intuitively, firms' market decisions depend solely on the magnitude of their profit changes. The composition of a given profit change—whether driven by demand or supply factors—is irrelevant.

Figure 3(b) shows the model predicted elasticity of the quantity changes in continuing

[23] Due to the CES preference assumption, a firm's operating profit is a fraction of its sales: $\pi_{fdt} = \frac{1}{\eta} p_{ft} q_{fdt}$. Therefore, the profit distribution is a scaled version of the sales distribution. The assumption of log-normal profit distribution is for analytical convenience. All the results carry through if the initial profit distribution is Pareto.

[24] This is because there is no closed-form solution for the conditional expectation of a *multivariate truncated* normal distribution.

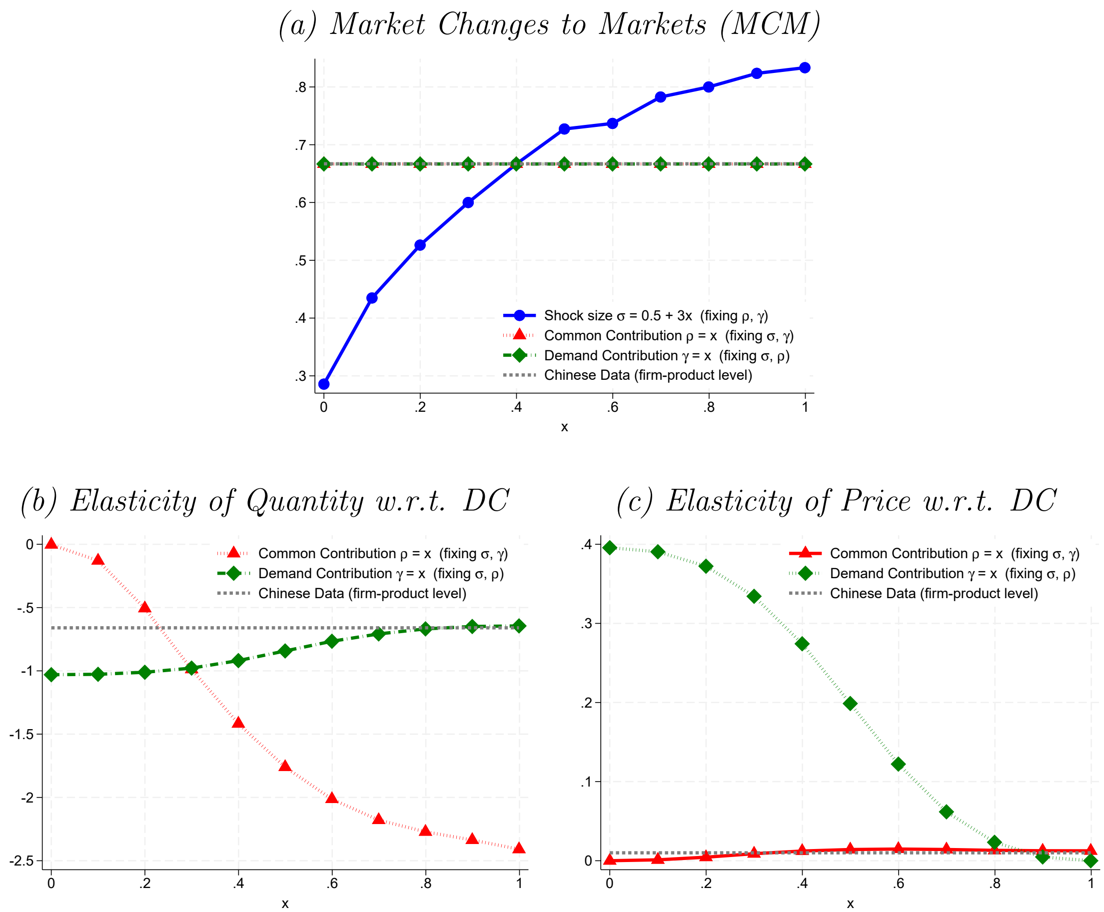

Figure 3: Relationship Between Empirical Measures and Model Parameters

Note: This figure plots how the three statistics (i.e., market changes to markets ratio, elasticity of quantity changes in continuing markets with respect to the drop-to-change DC ratio, and the elasticity of the price changes in continuing markets with respect to the DC ratio) calculated using the model simulated data vary with each of the key model parameters $\{\sigma, \rho, \gamma\}$. Each line shows the change in a given parameter, while keeping the other two parameters unchanged at their initial calibrated values and x-axis shows the value of the parameter being changed.

markets with respect to the DC ratio is monotonically decreasing in ρ, which is consistent with equation (14). It is worth noting that, when $\rho = 0$ and thus there are no correlated changes across markets, the estimated elasticity with respect to the DC ratio is always zero regardless of the volatility of profit σ, as shown by the red line. This is because when the changes to profits are not correlated across destination markets, the market changes are purely driven by firm-destination-specific changes and thus do not provide information about the quantity changes in the firms' continuing markets.[25]

Finally, the green line in Figure 3(c) shows that as γ increases, indicating that the changes in firms' residual demand changes contribute more to the profit changes, compared to the contribution of the marginal cost changes, the elasticity of the price changes in continuing markets with respect to the DC ratio is falling. Therefore, to match the very low price elasticity to DC ratio observed in the data (0.01, as shown in row 1, column (1) of Table 2), a value of γ close to one is required.

To sum up, these three statistics shown in Figure 3 provide a joint system to pin down the three key model parameters, $\{\sigma, \rho, \gamma\}$. MCM ratio pins down the volatility of the firm profits σ. The elasticity of the price changes in continuing markets with respect to the DC ratio pins down the contribution of the marginal cost changes to profit changes $(1 - \gamma)$. Given σ and γ, the elasticity of the quantity changes in continuing markets with respect to the DC ratio pins down the contribution of the firm-specific changes that are correlated across destination markets within a firm.

3.4 Applying to Chinese Customs Data

The identification strategy discussed above can be readily applied to most transaction-level databases with information on prices and quantities.[26] Applying this method to the Chinese Customs Database Table 5 shows the estimated parameters (σ, ρ, γ) for each of the different product and firm types. There are three main takeaways. First, the estimated σ suggests there is significant heterogeneity in the volatility of profits across product and firm types. The profits of goods traded on organized exchanges, the products sold by foreign-invested enterprises, and firms processing goods for other firms tend to be more stable. This explains why these firms experience fewer market changes.

[25] For clarity, I omitted the impacts of varying profit volatility σ on the quantity and price elasticities in Figure 3(b) and (c). Figure B3 in the Appendix shows the results including σ. Consistent with the analytical expression (14), the magnitude of the quantity elasticity with respect to the DC ratio increases with σ.

[26] While this paper focuses on firms' export market decisions, it should be clear that the method developed here can also be applied to study the drivers of extensive margin adjustments in firm-to-firm trade in the domestic context.

Table 5: Estimated Parameters

	σ (Shock size)	ρ (Common contrib.)	γ (Demand contrib.)
Full Sample	1.00	0.23	0.89
(a) Rauch Classification			
Differentiated Products	1.00	0.23	0.86
Reference Priced	1.00	0.21	0.95
Organized Exchange	0.42	0.37	0.96
(b) BEC Classification			
Capital	1.53	0.18	0.81
Consumption	1.00	0.23	0.86
Intermediate	1.00	0.23	0.86
(c) Company Type			
State-owned Enterprises	2.29	0.13	0.86
Private Enterprises	2.28	0.15	0.83
Foreign Invested Enterprises	0.42	0.43	0.87
(d) Form of Commerce			
General Trade	1.87	0.16	0.87
Processing Trade	0.43	0.45	0.99

Note: This table represents the estimated model parameters by separately matching the empirical statistics in Table 3 for each firm and product type. To facilitate comparison, the estimated σ for the full sample is normalized to one as the benchmark.

Second, the estimated ρ suggests that a nontrivial proportion (13–45%) of the shocks are correlated across destinations within a firm-product pair. As expected, commodities traded on organized exchanges are more prone to correlated shocks across destinations. These products are highly standardized and are often priced in US dollars, making them more sensitive to global demand shocks and dollar exchange rate movements. Foreign invested enterprises in panel (c) are also more prone to the correlated shocks, with an estimated ρ similar to that of firms in processing trade in panel (d). For both types of firms, the demand for their products is likely to originate from the contracted foreign multinationals, making them more exposed to global shocks.[27]

Third, the estimated demand contribution parameter γ is consistently high (81–99%) across all product and firm types, suggesting that most firm-level shocks are demand-driven rather than supply-driven. This is consistent with the existing papers that emphasize the importance of demand variations in driving the firm performance (e.g., Foster, Haltiwanger and Syverson, 2008; Baldwin and Harrigan, 2011; Hottman, Redding and Weinstein, 2016). For instance, Hottman, Redding and Weinstein (2016) find that demand differences (which could arise from quality or taste variation) can account for 80–97% of variation in firm sales. Foster, Haltiwanger and Syverson (2008) find that demand variations across producers are the dominant factor in determining survival.

4 Implications for Exporter Dynamics

In this section, I show that the uncovered micro shocks are also important for explaining the observed exporter dynamics. Section 4.1 calibrates the model to match the key firm and market distributions and the elasticities. Section 4.2 shows that the model performs extremely well in matching the non-targeted evolution of price and quantity dynamics in the data. Finally, Section 4.3 conducts two counterfactual exercises to highlight the importance of correlated demand shocks in shaping the observed exporter dynamics.

[27] The purpose of this paper is to decompose and identify the key variations that drives firms' market decisions. The common component ρ (the correlated "shocks") referred to in the text may well be endogenously generated in a richer model that accounts for the special features of the goods and firm types. However, due to the substantial heterogeneity in firm and product types, pinpointing a single source for the common component is challenging, if not impossible. Therefore, this paper does not take a definitive stance on the specific mechanism driving the common shock component. Instead, it provides valuable moments to guide and inform future research.

4.1 Extended Model and Calibration

I generalize the quantitative model discussed in subsection 3.2 to capture the dynamic features of the data. First, instead of simulating the model for two periods, I simulate the model for 7 periods, corresponding to the 7 years in the Chinese customs data. With multiple periods, the distribution ξ_{fdt-1} evolves over time and can no longer be drawn from an ex ante fixed distribution. Specifically, I assume firms' operating profit, optimal quantity and price evolve according to equations (9) and (10), with the same initial demand preference $a_{fd0} = b_{fd0} = 0$ and with the initial marginal cost mc_{f0} being drawn from a log-normal distribution $\Omega_f \sim \mathcal{LN}(0, \sigma_\Omega^2)$. The three shock parameters (σ, ρ, γ) and the dispersion of initial marginal cost σ_Ω jointly determine how the distribution of ξ_{fdt-1} evolves over time.

Second, to match the fact that most firms only export to a couple of markets, I assume the fixed cost of exporting to a market takes the following quadratic form:

$$\zeta_d = \exp[\chi_0 + \chi_1 d/D + \chi_2 (d/D)^2],$$

where $d \in \{1, ..., D\}$ is the market index and $D = 20$ is the total number of markets and $\chi_1 > 0$ and $\chi_2 > 0$ indicate that markets with a higher index d are more costly to reach.

The parameters $(\sigma, \rho, \gamma, \sigma_\Omega, \chi_0, \chi_1, \chi_2)$ jointly determine the distributions of the market and firm sizes. I use simulated methods of moments to calibrate these parameters to match the following statistics at the firm-product level: (i) the market change to markets ratio, the price and quantity elasticities to drop-to-change ratio in the full sample, (ii) the price and quantity elasticity estimates by firm size bins (see Figure 4), and (iii) the relationship between the firm size and the number of destination markets (see Appendix figure B2). Figure 4 shows that the model can successfully match the relationship between the firm size and the quantity and price elasticities estimated in the data even without calibrating separate parameters for each firm size groups (e.g., different σ, ρ, γ for each firm size bin).[28]

[28] The magnitude of the quantity elasticity to drop-to-change ratio increases in the exporter size due to the correlation of shocks across markets (i.e., $\rho > 0$) and the selection effects. Specifically, when there are no correlated shocks across markets (i.e., $\rho = 0$), the estimated quantity elasticity would be zero, as the continuing markets are not affected by the destination-specific shocks. Conditioning on $\rho > 0$, the pattern in Figure 4(a) arises from two endogenous selection effects. First, firms experiencing more positive shocks would select into the larger size bin and also increase their quantities in continuing markets by more. This explains why their quantities in continuing markets increase by more when there are positive shocks. Second, when there are negative shocks, firms in the larger size bin are better able to survive than smaller firms. Conditional on survival, larger firms' quantities in continuing markets drop by more, as smaller firms are more likely to have already exited those markets facing potentially large drops in quantity. Therefore, for a given level of drop-to-change ratio, larger exporters' quantities in continuing markets tend to vary by more.

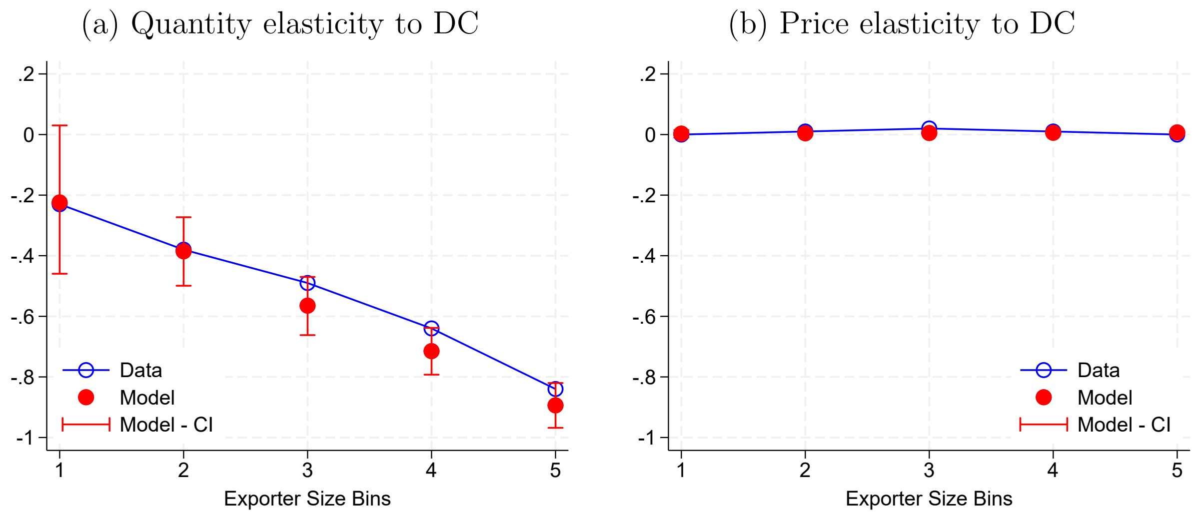

Figure 4: Matching moments by exporter size

Note: This figure compares the quantity and price elasticities to the drop-to-change ratio in the data and in the calibrated model. The data estimates are taken from Table 4. The firm size bins are categorized according to the total export value of a firm-product across all destinations and years. The model is simulated for 100 replications, with the red dot representing the median value of the 100 estimates, and the top and bottom red bars around the red dot representing the 5th and 95th percentiles, respectively.

4.2 Price and Quantity Dynamics

In this section, I study a firm's price and quantity dynamics as it grows and adds more markets over time. Specifically, I estimate an empirical specification in the spirit of Fitzgerald, Haller and Yedid-Levi (2023) and Argente, Fitzgerald, Moreira and Priolo (2024):

$$\ln \text{Outcome}_{ft} = \sum_{n} \beta_n * \mathbb{1}(\text{Number of market}_{ft} = n) + \delta_f + \delta_t + v_{ft}, \tag{15}$$

where Outcome_{ft} refers to the mean price, mean quantity in the firm's core market, or the total quantity in all markets of the firm. A market is defined as "core" if it is observed in all periods where the firm is observed in the dataset.[29] A set of ten dummies indicating the number of markets that firm f exports at t are included. If the number of markets exceeds 10, then it is grouped into one dummy indicating the number of markets is higher than or equal to 10.[30] β_n captures the impact of the given indicator variable on the outcome variable. δ_f and δ_t are firm and time fixed effect respectively, which ensures the comparison is made

[29] By definition, the core market is the first market (or among the set of first markets) the firm exports to. However, not all first markets are core markets (as some first markets may not survive for some firms).

[30] Note that f in the model corresponds to a firm-product or firm-sector pair in the data.

within a firm across time. v_{ft} is the residual term. Relative to the original specifications of Fitzgerald, Haller and Yedid-Levi (2023) and Argente, Fitzgerald, Moreira and Priolo (2024) that study a firm's price and quantity dynamics as it grows within a market, my specification focuses on the firm's dynamics as it grows and adds more markets.[31]

Figure 5 plots the empirical estimates β_n (from a firm-product level estimation) together with their model predicted counterparts. As can be seen, the calibrated model performs well in matching the firm's quantity and price dynamics as it grows and adds more markets, despite the fact that the model is not specifically calibrated to target the empirical moments β_n. This suggests the new measures and elasticities proposed and their relationship with firm size provide a powerful way to discipline firms' export dynamics.

Figure 5(a) and 5(b) show that as a firm grows and adds more markets, it also sells more quantity in its core markets, while it barely changes its price in its core markets. Figure 5(c) shows the results for total quantity in all markets of the firm. The difference between panels (a) and (c) reflects the role of extensive margin adjustments. Since price does not change with the number of markets the firm sells to, we get very similar patterns if total global sales of the firm is used as the dependent variable.

These results closely align with the findings of Fitzgerald, Haller and Yedid-Levi (2023) and Argente, Fitzgerald, Moreira and Priolo (2024) on firms' life-cycle of quantities and prices within a market. However, it is worth mentioning that the results of these two papers do not automatically imply the findings here. This is because a crucial condition to replicate the data pattern in (a) is to have shocks correlated across destination markets (i.e., $\rho > 0$). If all shocks are destination-specific demand shocks, the pattern in (a) would be a flat line because the firm's core markets would be unaffected by the destination-specific shocks. However, within each market, the quantity sold would increase in the number of years selling in the market, as the positive shocks accumulate over time conditional on survival, while firms receiving negative shocks exit. Therefore, in the absence of the correlated shocks across markets, the model can still replicate the within-market patterns observed in the two papers above, while failing to replicate the pattern in (a). In the next section, I provide more discussions on the key factors that explain the empirical patterns in Figure 5.

[31] In Appendix B.1, I implement the the original empirical specification of Fitzgerald, Haller and Yedid-Levi (2023) and Argente, Fitzgerald, Moreira and Priolo (2024) and document that the Chinese exporters follow the same empirical pattern as found in these two papers. In addition, the calibrated model is able to match these empirical patterns. See Appendix B.1 for more discussions on the difference between these two specifications.

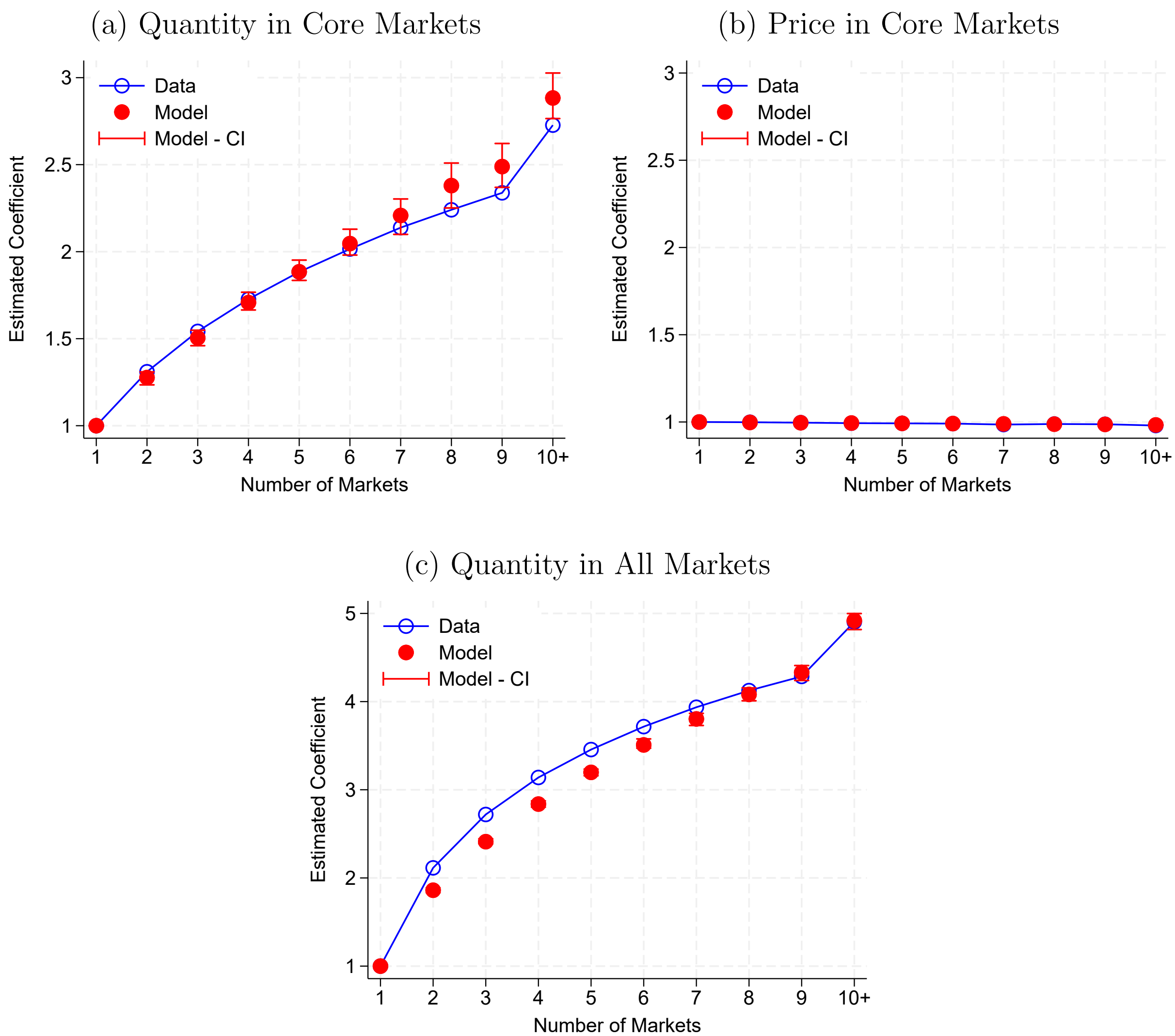

Figure 5: Quantity and price dynamics as a firm adds more markets

Note: This figure compares the quantity and price dynamics estimated from specification (15) in the data versus the calibrated model. The estimated fixed effect when the number of markets is equal to one is normalized to one. The data moments are estimated using firm-product-level data of Chinese exporters. The standard errors of the data estimates are small and omitted for clarity. The calibrated model is simulated for 100 replications, with the red dot representing the median value of the 100 estimates, and the top and bottom red bars around the red dot representing the 5th and 95th percentiles, respectively.

4.3 Importance of Demand Shocks and Common Component

In this section, I use two counterfactual cases to highlight the importance of demand shocks and common shocks across destination markets in shaping the empirical patterns on the exporter growth dynamics. Figure 6 illustrates this by showing the exporter's price and quantity dynamics in its core markets as the exporter expands into more destination markets over time and comparing two counterfactual cases relative to the baseline analysis: (1) setting the common component ρ to zero while keeping the other parameters unchanged from the baseline calibration, and (2) setting the demand contribution to the firm-specific shocks γ to zero and recalibrating the size of shock σ to match the dynamics of quantity elasticities in the baseline case.

In the first counterfactual case, by setting $\rho = 0$, all shocks are destination-specific. As a result, a firm's potential profit and the optimal price and quantity in each market are independently determined across markets. When a firm receives positive shocks in certain destination markets, its core markets (i.e., the markets that the firm always sells) would be unaffected by these destination-specific shocks. As can be seen in Figure 6(a) and 6(b), the firm's price and quantity dynamics in its core markets are unchanged if the firm's growth in destination markets is purely driven by destination-specific shocks. In this case, the firm grows by adding more markets over time when it receives positive shocks in these markets (see red line in Figure 6(c)). However, due to the lack of within-firm spillovers of shocks across destinations when $\rho = 0$, the increase in quantity sold will be much more muted than that under the baseline case, as shown in Figure 6(c).

In the second counterfactual case, I set the demand contribution γ to zero and recalibrate the size of shock σ to match the dynamics of quantity elasticities in the baseline case. In this case, the within-firm spillovers of shocks across destination markets are purely driven by the supply-side cost changes. As a consequence, a firm grows and adds more markets over time when it receives negative cost shocks (or positive productivity shocks) in these markets. As shown by the orange lines in Figure 6(a) and 6(c), the firm sells more in its core markets as it adds more markets over time and the quantity sold in all markets also increases due to both the new markets being added and the spillover effects of the favorable shocks on the core markets. The shock size σ is recalibrated such that the orange lines in Figure 6(a) and 6(c) can match the quantity dynamics under the baseline calibration (red lines). A crucial implication of this firm-specific supply shock can be seen in Figure 6(b). At the calibrated size of the shock that matches the quantity dynamics, the firm's prices in its core markets should drop significantly if the growth in the number of destination markets is driven by

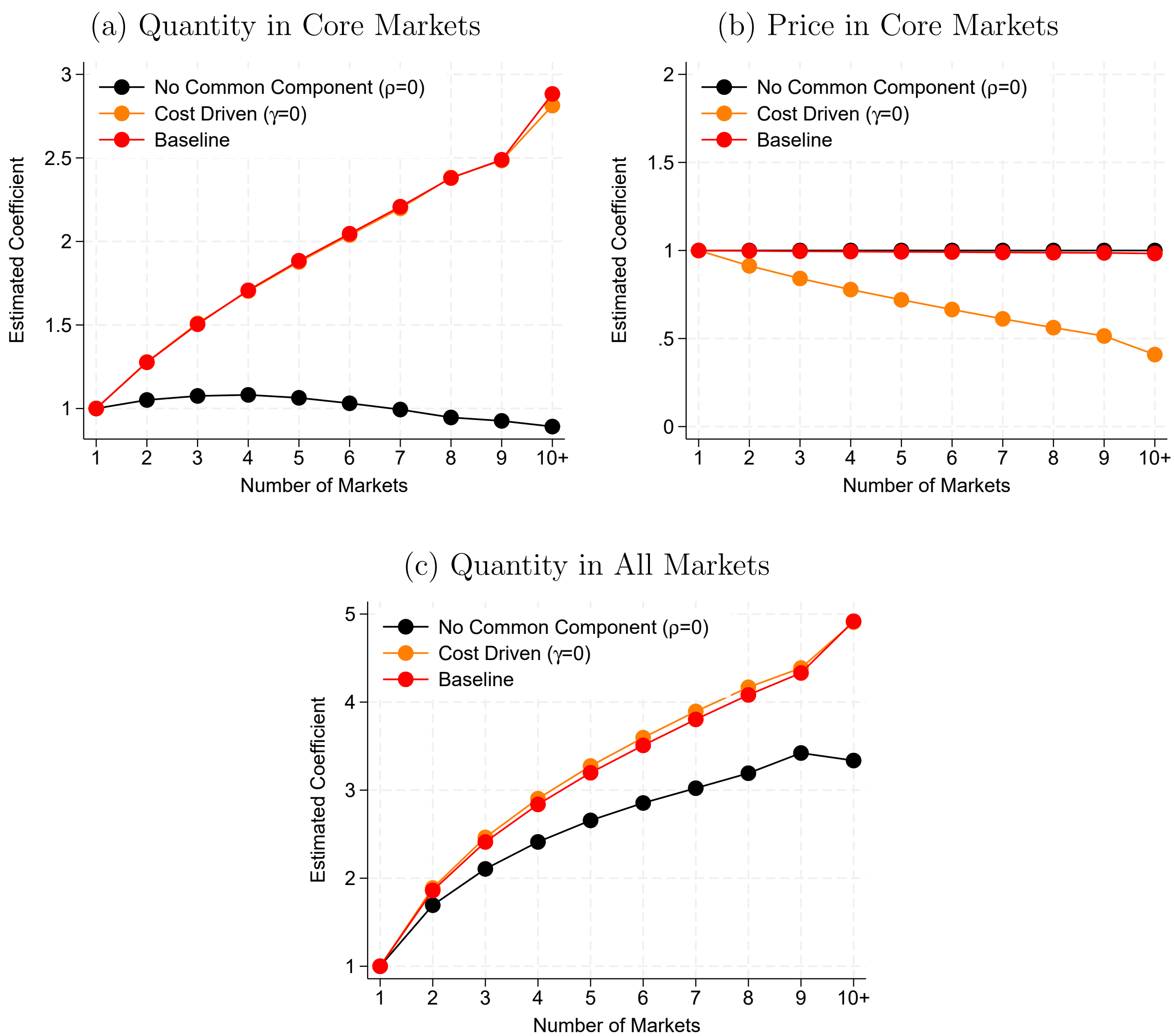

Figure 6: Counterfactual price and quantity dynamics

Note: This figure compares the quantity and price dynamics in the baseline model (in red) with two counterfactual calibrations. The black line represents the case when the contribution of the common shock component is set to zero $\rho = 0$. The orange line shows results where all the firm-level shocks are cost driven $\gamma = 0$. The calibrated model is simulated for 100 replications, with the dot in each line represents the median value of the 100 estimates.

firm-specific supply shocks. This is at odds with the empirical observation that the price dynamics are muted.

The importance of common, correlated demand components in explaining the empirical patterns of exporter dynamics aligns with recent works that highlight the complementarities across markets in firms' export decisions (e.g., Berman, Berthou and Héricourt, 2015; Alfaro-Urena, Castro-Vincenzi, Fanelli and Morales, 2023). While this paper does not take a stance on the specific mechanism generating the common demand change, the findings in this paper provide useful statistics for future models on the firm export dynamics and joint market decisions to target.

5 Conclusions

Firms frequently change the set of destinations to which they export their products—their international trade is characterized by what I call a "mutable geography." This dynamism in market changes observed is not merely an artifact of the early stages of a firm's growth in global markets. It is actually detectable among established exporters.

This paper proposes a new approach to understand the micro drivers of these market changes and decompose these factors into demand versus supply related components. The idea is to exploit the information on the price and quantity changes in the firm's continuing markets to infer the micro shocks that the firm receives. Applying this approach to the customs data from Chinese and UK exporters, I find consistent results in both countries that firms dropping more markets see big quantity drops in their continuing markets, with little change in price in these markets. Through the lens of the model, I conclude that most of within-firm market changes are demand rather than supply driven, with a non-trivial proportion (13–45%) of these demand changes being correlated across markets within a firm.

Finally, I show the uncovered shock contributions play an important role for explaining the price and quantity dynamics as a firm grows and adds more markets. The successful firms that expand globally also see big quantity increases in their core destination markets, while their prices in these markets are barely changed. These results highlight the need to understand the demand related channels in shaping firm growth dynamics (e.g., Argente, Fitzgerald, Moreira and Priolo, 2024).

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A Data Appendix

A.1 Market Changes Measured at Different Frequencies

Table A1 replicates Table 7 of Alessandria, Arkolakis and Ruhl (2021) using Chinese customs data. I divide the 7 years (=84 months) of data into intervals of 6, 12, 21, and 42 months. There are two key takeaways. First, within each time interval, the continuation rate decreases with the level of disaggregation. At the annual frequency, only 44.7% of firm-product-destinations that exported in a 12-month window continue to export in the next 12-month window. In contrast, 88.0% of firms that exported in a 12-month window continued to export in the next 12-month window. This is a natural result since demand tends to be less stable at more disaggregated levels. For example, suppose the probability of receiving an order at the firm-product-destination level is x, and the firm has n feasible product-destination pairs. The probability of firm continuation is $1 - (1 - x)^n$, which increases with the number of product-destinations the firm serves.

Second, within each aggregation level, the continuation rate decreases with the time span over which the statistics are calculated, consistent with the findings of Alessandria, Arkolakis and Ruhl (2021). This finding is more nuanced, as in principle, the continuation rate could go either way depending on the underlying driving forces of firms' export participation decisions. On the one hand, if the low continuation rate is primarily driven by infrequent shipping or lumpiness in demand, one might expect the continuation rate to increase with the time span over which the statistics are calculated. To clarify, consider a product that is shipped or demanded every 18 months. In this case, the continuation rate calculated at the 6- and 12-month frequencies will be zero, while it jumps to 100% when calculated at the 21- or 42-month frequencies. On the other hand, if the low continuation rate is predominantly driven by firm or product exits, one would expect it to decrease with the time span over which the statistics are calculated. For example, if the 6-month survival rate is constant at y, then the continuation rates at the 12-, 24-, and 48-month frequencies will be y^2, y^4, and y^8, respectively. Consistent with the findings of Alessandria, Arkolakis and Ruhl (2021), I find that the second force dominates, and the continuation rate decreases with the time span.[32]

Table A2 shows the corresponding within-firm market changes calculated at different aggregation levels and time spans. The market change to market (MCM) ratio increases with the time span over which the measure is calculated, consistent with the facts documented in

[32] The entrant share is a flip side of the coin. It increases with the level of disaggregation and the time span over which the statistics are calculated, reflecting the forces discussed above.

Table A1: Entry, Exit and Growth at Different Aggregation Levels and Time Spans

	Continuation Rate		Entrant Share	
	Count	Value	Count	Value
6 month				
Firm level	90.5	98.8	17.9	3.1
Firm-sector level	78.2	97.6	29.0	4.5
Firm-product level	64.7	93.4	40.5	9.6
Firm-destination level	67.5	94.2	39.0	8.9
Firm-sector-destination level	57.7	91.7	47.9	11.6
Firm-product-destination level	48.1	85.2	56.9	18.1
12 month				
Firm level	88.0	97.9	27.6	5.9
Firm-sector level	74.9	96.7	37.6	7.9
Firm-product level	63.3	90.8	47.0	14.7
Firm-destination level	65.5	93.8	46.3	11.9
Firm-sector-destination level	54.8	90.9	55.3	15.7
Firm-product-destination level	44.7	83.5	63.4	24.1
21 month				
Firm level	83.8	96.4	39.3	10.5
Firm-sector level	71.1	94.4	48.1	12.5
Firm-product level	61.2	87.3	55.5	19.9
Firm-destination level	62.3	92.1	57.4	17.4
Firm-sector-destination level	50.5	88.4	64.7	21.2
Firm-product-destination level	40.6	78.2	71.4	30.3
42 month				
Firm level	75.7	92.1	61.0	22.5
Firm-sector level	64.3	89.2	67.3	25.3
Firm-product level	56.9	77.5	68.1	35.9
Firm-destination level	56.0	87.0	73.8	30.9
Firm-sector-destination level	44.6	82.4	78.5	35.5
Firm-product-destination level	34.1	69.2	83.0	47.5

Source: Chinese Customs Database 2000-2006.

Note: The table shows the continuation and entrant shares by different aggregation levels and time spans over which the statistics are calculated. The continuation rate is the share of exporters that remain exporters across two windows; e.g., 88.0% of firms who exported in a 12-month window export in the next 12-month window. The entrants share indicates the share of total exporters accounted by entrants; e.g., 27.6% of exporters are firms that did not export 12 months prior. The value measures are defined analogously but for export values rather than firm counts.

Table A1.

Table A2: Market Changes at Different Aggregation Levels and Time Spans

Freq.	N. of Dest.	MCM (count)	MCM (value)	DC (count)	DC (value)	Churning Prob.
Firm-product level (mean)						
6 Month	2.49	0.79	0.67	0.48	0.48	0.29
12 Month	2.90	0.86	0.72	0.47	0.46	0.27
21 Month	3.34	0.93	0.78	0.45	0.44	0.23
42 Month	4.17	1.03	0.86	0.42	0.41	0.13
Firm-sector level (mean)						
6 Month	4.10	0.72	0.51	0.47	0.47	0.34
12 Month	4.89	0.78	0.52	0.45	0.44	0.30
21 Month	5.69	0.86	0.56	0.43	0.42	0.24
42 Month	6.89	0.96	0.61	0.40	0.38	0.13
Firm-product level (median)						
6 Month	1.00	0.67	0.16	0.50	0.45	0.30
12 Month	1.00	0.67	0.24	0.50	0.42	0.27
21 Month	2.00	0.86	0.36	0.50	0.36	0.23
42 Month	2.00	1.00	0.54	0.45	0.27	0.06
Firm-sector level (median)						
6 Month	2.00	0.67	0.13	0.50	0.42	0.33
12 Month	2.00	0.67	0.15	0.50	0.37	0.25
21 Month	2.00	0.80	0.21	0.40	0.29	0.00
42 Month	3.00	1.00	0.29	0.33	0.18	0.00

Source: Chinese Customs Database, 2000-2006.
Note: This table shows the mean and median values of different measures of market changes by different time spans. The statistics are calculated at the firm-product level in panel (a) and (c), and at the firm-sector level in panel (b) and (d). The first column shows the time spans over which the statistics are calculated.

A.2 Supplementary Estimates and Statistics by Exporter Size Bins

Table A3: Regression Estimates by Exporter Size Bins

	Quantity Elasticity to DC		Price Elasticity to DC	
Size Bin	Count	Value	Count	Value
(a) Firm-product level				
1 (smallest)	-0.24***	-0.24***	0.01	0.00
2	-0.39***	-0.38***	0.01	0.00
3	-0.51***	-0.48***	0.02***	0.01*
4	-0.68***	-0.62***	0.01***	0.00*
5 (largest)	-0.92***	-0.78***	0.00	-0.01***
(b) Firm-sector level				
1 (smallest)	-0.29***	-0.31***	-0.01	-0.03
2	-0.41***	-0.43***	0.03**	0.02
3	-0.59***	-0.55***	0.03***	0.01
4	-0.73***	-0.65***	0.02**	0.00
5 (largest)	-0.77***	-0.63***	0.03***	0.01*

Note: This table presents the elasticities of quantities and prices to the drop-to-change (DC) ratio by firm size at the firm-product level in panel (a) and at the firm-sector level in panel (b). The first column shows the firm size category, where the firm-products are ordered into 5 equal-sized bins based on their size measured by their total sales value across all destinations and years. Each column shows the key estimates from regressing quantity or price measures (indicated by the column header) on the count or value measure of the DC ratio. Each cell presents an estimate from a separate regression. Firm-product and year fixed effects are added for panel (a) specifications and firm-sector and year fixed effects are added for panel (b) specifications. The statistical significance is calculated based on robust standard errors with ***, **, * representing statistical significance at 1%, 5%, 10% level respectively. Source: Chinese Customs Database, 2000-2006.

Table A4: Statistics by Exporter Size

Size Bins	N. of Dest.	MCM (Count)	MCM (Value)	DC (Count)	DC (Value)	Churning Rate
(a) Firm-product level (mean)						
1	1.52	0.98	0.96	0.49	0.49	0.23
2	1.79	0.93	0.89	0.49	0.48	0.25
3	2.13	0.88	0.80	0.48	0.48	0.26
4	2.89	0.83	0.68	0.47	0.46	0.28
5	6.15	0.73	0.42	0.45	0.44	0.32
(b) Firm-sector level (mean)						
1	1.82	0.81	0.76	0.48	0.48	0.17
2	2.63	0.82	0.69	0.48	0.47	0.22
3	3.55	0.80	0.58	0.46	0.46	0.27
4	5.34	0.77	0.45	0.45	0.44	0.35
5	11.40	0.68	0.25	0.43	0.41	0.49
(c) Firm-product level (median)						
1	1.00	0.67	0.66	0.50	0.48	0.23
2	1.00	0.67	0.51	0.50	0.47	0.25
3	1.00	0.67	0.39	0.50	0.44	0.26
4	2.00	0.67	0.29	0.50	0.40	0.29
5	3.00	0.67	0.12	0.44	0.35	0.33
(d) Firm-sector level (median)						
1	1.00	0.67	0.12	0.50	0.46	0.00
2	1.00	0.67	0.29	0.50	0.43	0.00
3	2.00	0.67	0.26	0.50	0.38	0.25
4	3.00	0.70	0.18	0.44	0.35	0.33
5	7.00	0.67	0.08	0.41	0.33	0.57

Source: Chinese Customs Database, 2000-2006.

Note: This table shows the mean and median values of different measures of market changes by firm size. The statistics are calculated at the firm-product level in panel (a) and (c), and at the firm-sector level in panel (b) and (d). The first column shows the firm size category, where the firm-products are ordered into 5 equal-sized bins based on their size measured by their total sales value across all destinations and years. 5 refers to the largest firm size category.

A.3 Supplementary Estimates by Product and Firm Types

Table A5: Breakdown by Product and Firm Types: Number of Markets, DC Ratio and Quantity and Price Elasticities using the Value Measure of the DC Ratio

	N. of Dest.		DC (count)		DC (value)		Elasticity (value)	
	Mean	Median	Mean	Median	Mean	Median	Quantity	Price
Full Sample	2.90	1.00	0.47	0.50	0.46	0.42	-0.61***	-0.00
Rauch Classification								
Differentiated Products	2.96	1.00	0.47	0.50	0.46	0.42	-0.62***	0.00
Reference Priced	2.40	1.00	0.47	0.50	0.47	0.42	-0.51***	-0.00
Organized Exchange	2.24	1.00	0.49	0.50	0.49	0.48	-0.54***	-0.02**
BEC Classification								
Capital	3.14	1.00	0.46	0.50	0.46	0.41	-0.60***	0.01
Consumption	2.86	1.00	0.47	0.50	0.47	0.43	-0.60***	-0.00
Intermediate	2.69	1.00	0.46	0.50	0.46	0.40	-0.60***	-0.00
Company Type								
State-owned Enterprises	2.83	1.00	0.49	0.50	0.49	0.47	-0.56***	0.00
Private Enterprises	2.88	2.00	0.45	0.50	0.43	0.36	-0.68***	0.01*
Foreign Invested Enterprises	2.97	1.00	0.45	0.50	0.44	0.34	-0.65***	-0.02***
Form of Commerce								
General Trade	2.83	1.00	0.47	0.50	0.47	0.42	-0.60***	0.00
Processing Trade	3.25	1.00	0.46	0.50	0.45	0.38	-0.67***	-0.03***

Note: This table supplements Table 3 by reporting additional statistics on the market changes and the quantity and price elasticities estimated using the value measure of the drop-to-change (DC) ratio. Trade patterns are calculated at the firm-product level. Source: Chinese Customs Database, 2000-2006.

A.4 Statistics by Industries

Table A6: By Industries:
Trade Patterns Calculated at the Firm-sector(2-digit HS)-year Level

	MCM		DC		Prob. of Churn	Obs
	Count	Value	Count	Value		
1-5 Live animals; animal products	0.40	0.02	0.50	0.49	0.00	20,807
6-14 Vegetable products	0.40	0.01	0.50	0.44	0.00	67,079
15 Animal/vegetable fats	0.36	0.02	0.50	0.44	0.00	2,302
16-24 Prepared foodstuffs	0.29	0.00	0.50	0.37	0.00	51,767
25-27 Mineral products	0.40	0.03	0.50	0.44	0.00	21,617
28-38 Products of chemical and allied industries	0.67	0.16	0.50	0.39	0.25	146,275
39-40 Plastics/rubber articles	0.67	0.19	0.50	0.35	0.33	153,920
41-43 Rawhides/leather articles, furs	0.75	0.19	0.50	0.42	0.33	75,491
44-46 Wood and articles of wood	0.67	0.12	0.50	0.41	0.25	62,147
47-49 Pulp of wood/other fibrous cellulosic material	0.77	0.25	0.50	0.34	0.25	75,932
50-63 Textile and textile articles	0.67	0.15	0.50	0.37	0.25	353,130
64-67 Footwear, headgear, etc.	0.86	0.26	0.50	0.43	0.33	97,680
68-70 Misc. manufactured articles	0.74	0.21	0.50	0.38	0.33	110,541
71 Precious or semiprec. stones	0.86	0.25	0.50	0.37	0.17	16,984
72-83 Base metals and articles of base metals	0.67	0.17	0.50	0.35	0.25	248,422
84-85 Machinery and mechanical appliances, etc.	0.67	0.11	0.40	0.29	0.29	231,758
86-89 Vehicles, aircraft, etc.	0.67	0.13	0.43	0.32	0.33	46,603
90-92 Optical, photographic, etc.	0.67	0.16	0.50	0.37	0.33	66,768
93 Arms and ammunition	0.80	0.31	0.50	0.43	0.33	474
94-96 Articles of stone, plaster, etc.	0.76	0.19	0.50	0.41	0.33	178,790
97+ Others	0.67	0.06	0.50	0.44	0.00	5,069

Source: Chinese Customs Database, 2000-2006.
Note: This table reports the median values of market change to market ratio (MCM) and drop-to-change ratio (DC), as well as the probability of churn. Both the count measure and the value measure of the MCM and DC ratios are reported. The last column shows the number of observations.

B Model Appendix

B.1 Price and Quantity Dynamics within a Market

Figure B1 replicates the empirical specification of Fitzgerald, Haller and Yedid-Levi (2023) (FHY) using Chinese customs data and using simulated data from the calibrated model. The empirical results show strong support for the findings of FHY. In addition, my calibrated model is able to match the key quantity dynamics within a market. Under the benchmark calibration of my model, price is not destination-specific, and its variation is fully differenced out by the firm-time fixed effect, leaving no price dynamics in (b2). It is straightforward to incorporate a small destination-specific cost component into the model to generate the exact data pattern observed in (b1).

For the purpose of illustrating the relative importance of firm-level cost and demand shocks, it is preferable not to include firm-time fixed effects used in FHY, which absorbs all the firm-time variation. Therefore, I have chosen to use the alternative specification presented in Section 4.2, which emphasizes the price and quantity dynamics as a firm grows and enters new markets. The empirical specification in Section 4.2 also allows me to conduct counterfactual exercises to highlight the importance of the common shock component (i.e., ρ) in driving the export growth of a firm.

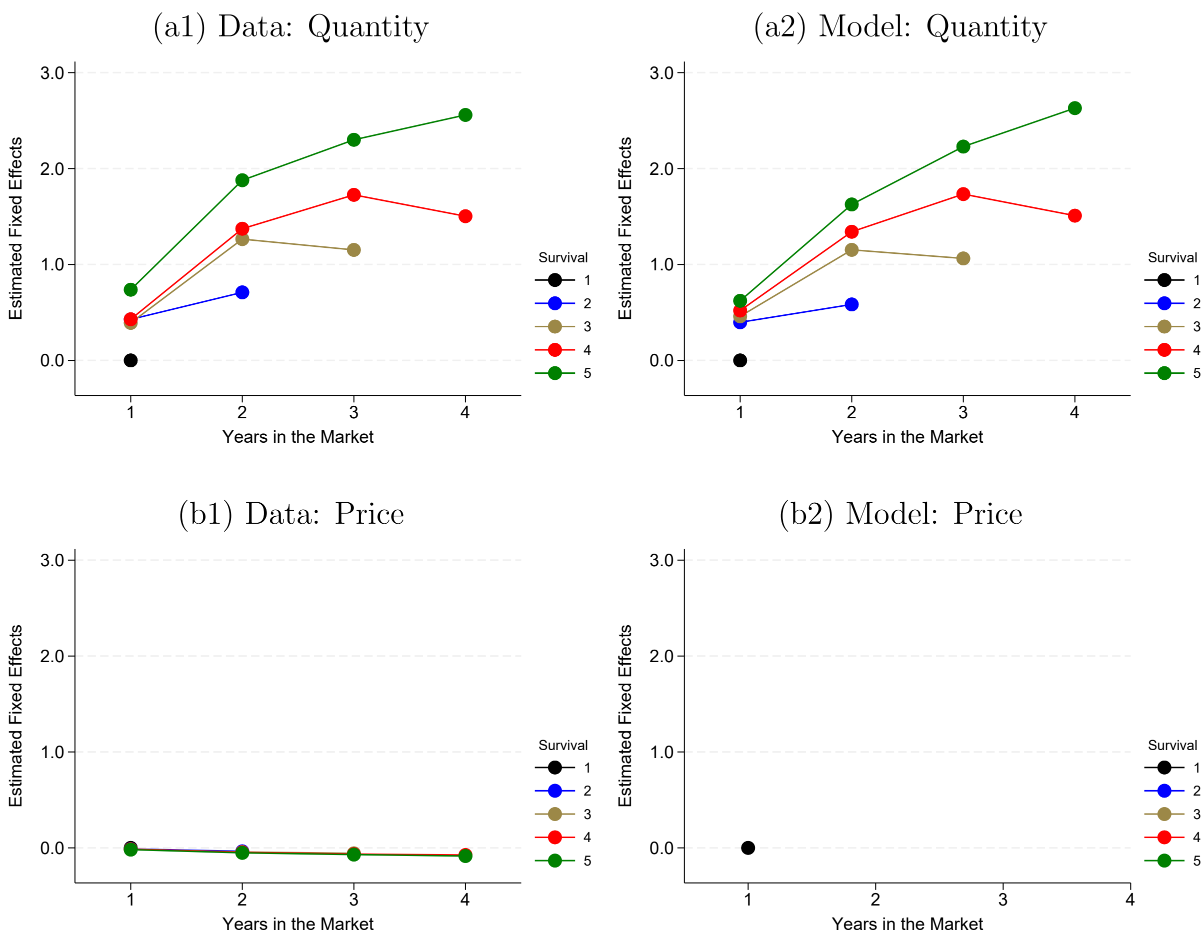

Figure B1: Quantity and Price Dynamics within a Market

Note: The data estimates are calculated based on firm-product-destination level data of Chinese exporters from 2000-2006. Firm-product-time and destination-product-time fixed effects are added to the estimation equations. The survival years are top-coded at 5.

B.2 Additional Model Simulation Results

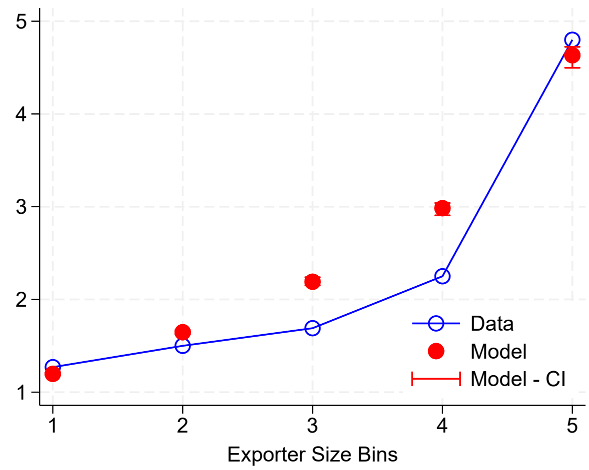

Figure B2: Number of Markets by Firm Size Bin

Note: This figure contrasts the mean number of markets by firm size bins in the data versus in the calibrated model in Section 4.1. The data statistics are calculated using firm-product level data of Chinese exporters (2000-2006).

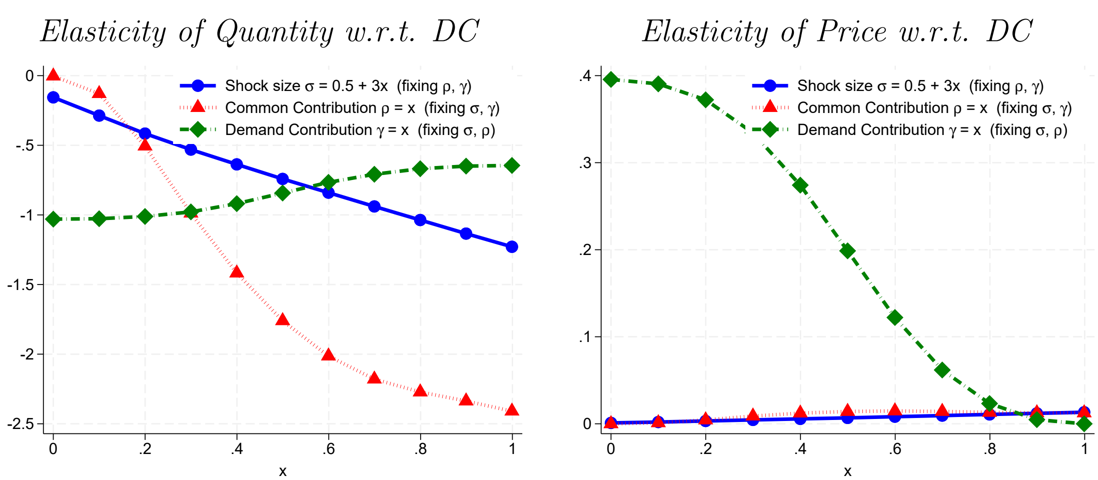

Figure B3: Relationship Between Empirical Measures and Model Parameters

Note: This figure plots the counterpart of Figure 3 (b) and (c) by adding the information on how the two elasticities change with the shock size σ (blue line). Each line shows the change in a given parameter, while keeping the other two parameters unchanged at their initial calibrated values and x-axis shows the value of the parameter being changed.