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Firm Performance and Trade with Low-Income Countries: Evidence from China

Hans-Jörg Schmerer
Luhang Wang

CESIFO WORKING PAPER NO. 4934
CATEGORY 8: TRADE POLICY
AUGUST 2014

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CESifo *Working Paper No. 4934*

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Abstract

Do firms in developing countries shift trade towards developed economies as a result of high economic growth? The matched customs-manufacturing firm data used in this study confront this hypothesized link with empirical evidence. Our analysis reveals a rising low-income country trade share around and after China's accession to the World Trade Organization. Based on this stylized fact, we analyze the link between firm characteristics and trade with low-income countries. We find evidence for sequential sorting into different export-modes according to firm productivity: i) only the most productive firms export to low-income countries, ii) exporting to low-income countries is mostly coupled to exporting to high-income countries, and iii) firms that switch to export to markets with higher potential are younger than firms that switch to export to both high- and low-income markets. Moreover, we find that firms tend to start exporting through specialization on high-income markets before diversifying to both type of markets.

JEL-Code: F100, F600, O100.

Keywords: trade with low-income countries, productivity, Chinese firms, firm level data, finance constraints, sequential exporting.

Hans-Jörg Schmerer
Institute for Employment Research
Regensburgerstr. 104
Germany – 90478 Nuremberg
Hans-Joerg.Schmerer@iab.de

Luhang Wang
WISE & SOE
Xiamen University
China
luhangwang@xmu.edu.cn

August 4, 2014
We are grateful to Stella Capuano, Juan Carluccio, Denis Fougere, Erwan Gautier, Andreas Hauptmann, Johann Graf Lambsdorff, Agnese Romiti and Erwin Winkler, as well as seminar participants at the Bank of France, the Chinese University of Hong Kong, and the University of Duisburg-Essen for helpful comments and suggestions.

1 Introduction

China's economic reforms and export promoting policies stimulated an impressive growth of exports at the extensive and intensive margin. However, only little is known about the role of low-income countries for China's recent development to one of the largest exporters in the world. Our paper uses Chinese firm level data that covers the period shortly before and right after its accession to WTO. Massive entry into export and rising firm productivity during that time provides an ideal platform for studying firms' sorting into foreign markets.[1]

We contribute to the existing literature by providing evidence on the link between a destination's market potential, firm productivity and sorting into export from a pure development economics perspective: How important are developing countries for firms based in emerging markets? Closely related to our paper, Crino and Epifani (2012) estimate the correlation between Italian firms' total factor productivity and their low-income country trade share. At odds with our findings, the authors find negative coefficients indicating that more productive firms trade less with developing countries. The explanation provided by the authors is that more productive firms produce high-quality goods demanded by consumers with higher income.[2] To explain the empirical pattern observed among Chinese exporters, we follow Chan and Manova (2013) by arguing that firms in China are financially constrained. There exists a vast and growing literature showing that firms in developing countries face difficulties financing certain projects. For China in particular, Feenstra, Li, and Yu (forthcoming) find that credit constraints are more stringent for firms with strong international linkage. Firms may want to serve high-income markets first if access to financial markets is restricted but additionally export to less attractive markets at later stages of their development.

This explanation is in line with our key result: Albeit a relatively low export intensity with low-income countries, markets in less developed countries are especially relevant for high-productivity firms that serve both low- and high-income destinations. The majority of firms specialize on export to developed countries. Those firms are not only less productive, but also younger at time of entry. Our results also suggest a transition from non-export to specialization, and from specialization to diversification. Firms that specialize focus mainly on markets with high potential. In line with Chan and Manova (2013), firms may bundle resources on entry into the most relevant economies with lower barriers to trade when entering export. Learning by exporting

[1] See Brandt, Biesebroeck, Wang, and Zhang (2012) for a study on firm performance after China's accession to WTO.

[2] See Crino and Epifani (2012) for an exhaustive literature review and Verhoogen (2007) for an application to developing economics.

and easier access to finance after a successful entry in advanced countries may pave the way for entry into other economies with lower market potential. Those countries may serve as platform for selling over-capacities at lower prices in less attractive markets.

Moreover, the Chinese data also reveals an increasing importance of low-income countries over our sample period.[3] At first glance, one may find this result puzzling. Taking the gravity model of trade seriously, one would expect that China's development to one of the largest economies in the world should be associated with intensified trade with developed economies.[4] However, tariffs and barriers to trade may have induced distortions that affect the "law of gravity". The presence of firm heterogeneity can explain the existence of sorting patterns according to export-destination characteristics and differences in barriers to trade such that only the most productive firms find it profitable to enter those markets.

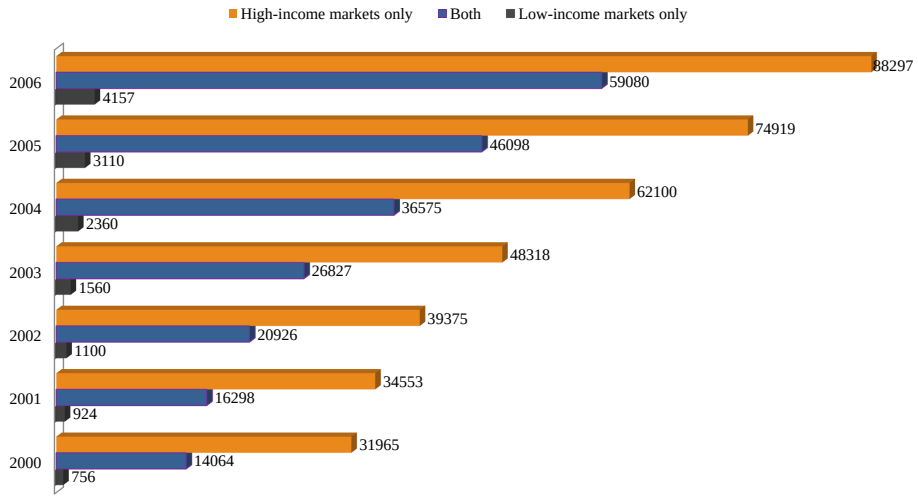

Figure 1: Different export strategies

A first glimpse at the data. Figure 1 presents numbers on different export-strategies over time. We construct dummies indicating whether firms solely export to low-, solely export to high-, or export to both low- and high-income countries. We denote those export-modes by L, H, and LH. Overall, our data reveals a huge increase of

[3] The total share of exports to countries with a per-capita income below the 50th percentile increased from 3 to 7 percent between 2000 and 2006. Countries are classified according to per-capita GDP observed in 2000. The classification is held constant afterwards. The change appears to be rather modest. However, decomposing the effects into the effects at the intensive and extensive margin reveals more pronounced changes. At the extensive margin, we observe that the share of firms exporting to low-income countries increased from 33 to 43 percent. Moreover, we find an increase in the export intensity from 10 to 15 percent at the intensive margin.

[4] This finding seems to contradict the law of gravity, which predicts that bilateral trade volumes are determined by the mass of two countries. Krugman (1979, 1980) model is usually cited as theoretical foundation of this result.

entry into export from 2000 to 2006. The number of firms that solely serve low-income countries increased by 3401 firms, whereas the number of firms that serve both high- and low-income countries increased by 45016. Moreover, the comparison of L and HL reveals an increase in the relative importance of the latter from 44 percent up to 67 percent.

One potential explanation is sorting of firms into different export regimes. Tariffs, which are usually higher in low-income countries, induce additional burdens to less productive firms competing with firms in low-income countries. High tariffs in developing countries prevent entry at least for the least productive firms. By the same token, firms in less developed countries are likely less competitive, which eases Chinese firms' entry at early stages of development.

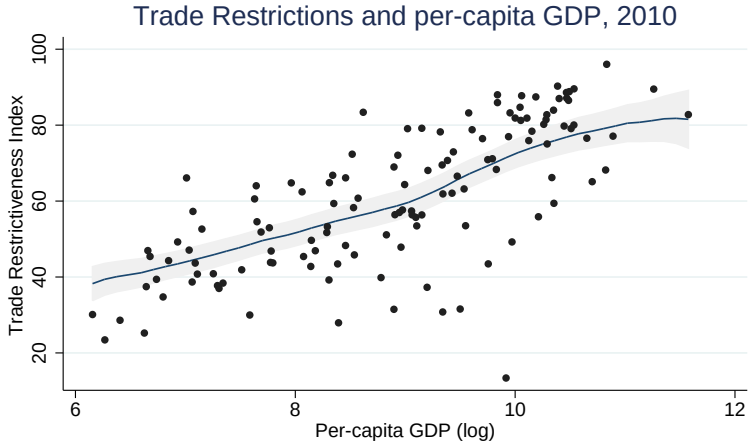

Figure 2: The link between per-capita income and tariffs

Figure 2 analyses the link between per-capita income taken from the Penn World Table and a tariff measure provided by the KOF globalization index. All observations are taken for the year 2010, which are the most recent observations available. The latter is a subindex that excludes non-tariff barriers to trade. Higher values of the index are associated with lower trade restrictiveness. The data reveals a positive correlation between per-capita GDP and the inverse-trade restrictiveness index: Countries with low per-capita GDP tend to use tariffs in order to protect infant industries.

Building on those facts and considerations, we will study the link between firm performance and the choice of the export-mode. Figure 1 identifies the H and HL export-modes as the most relevant ones in terms of absolute numbers. Figure 3 compares the productivity distributions of firms specializing on high-income markets (H) with the distribution of firms that serve both markets (HL). The comparison shows that firms serving both markets are on average more productive.

To address potential endogeneity between export-modes and firm productivity,

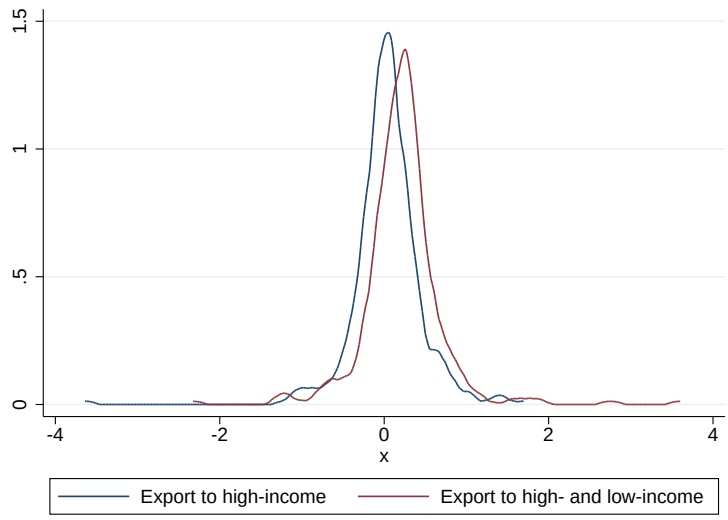

Figure 3: Productivity distributions by firms' export mode

we also look at firm's decision to enter different modes. In line with the sorting-hypothesis, we find that firms that enter the *HL* regime are already more productive compared to firms that enter export to high-potential markets only. Moreover, older firms are also more likely to enter both type of markets instead of specializing on high-income markets.

One question remains: What are the potential reasons for the massive entry into export, especially to high-income destinations, where firms are likely more competitive? Higher firm competitiveness and tough regulations by the WTO may be one reason why those countries do not protect certain industries from foreign competition. VAT tax rebates granted for exporting firms in China may have helped less productive firms to export to markets with high-potential and high competition up to today. For instance Yang (2012) reports:

> *The total value of the rebate payment increased substantially after China joined the WTO, quintubling in value from 2002 to 2008. These tax rebates are substantial: In 2006, the total tax rebates for exports received by exporting firms were equivalent to 10 percent of aggregate cooperate savings and approximately 14 percent of government tax revenue in the same year.*

These export promoting policies can rationalize the fact that relatively less productive firms are able to compete in high-income markets with higher potential demand but more competition with high productive domestic firms. Less productive firms may find it easier to overcome barriers to trade and competition in their earlier stages of development if their effective exporting costs are lower due to VAT tax rebates. Firms that become more productive over time are able to overcome the higher barriers

to trade in low-income countries at a later stage of their development. Additional incentives may stem from over-capacities that can be sold for lower prices at low-income countries. Manova and Zhang (2012) provide evidence for the link between quality and trade based on the Chinese customs data.[5]

Related literature. Our paper is closely related to the literature on firms' sorting into export. Sparked by Melitz (2003), recent firm-level studies consider productivity as the main determinant of export. Another strand of literature focuses on short-run dynamics as investments or productivity-upgrading. Impullitti, Irarrazabal, and Opromolla (2012) for instance introduce positive idiosyncratic firm efficiency shocks in a model with heterogeneous firms. The aim of their study is to explain hysteresis in export market participation. However, the assumption of perfect capital markets is less appealing for a study of firms located in developing countries.

Manova (2008) implements finance constraints into a Melitz (2003) type of trade model. Chan and Manova (2013) extend this framework in order to show that imperfections in the financial market determine the choice of the number and type of firms' export destinations. Bigger economies with lower trade costs are relatively more profitable due to potentially higher demand but lower tariffs. Their model and empirics show that firms pick trade partners according to market potential if there are finance constraints. Thus, under binding constraints the number of destinations is lower than the first-best outcome, where firms serve all markets that yield positive profits. Chinese firms are heavily constrained as access to credit is difficult for start-ups, especially in the private sector.[6] In line with their model and empirics we would expect firms picking countries with higher potential (size) and/or lower entry barriers first. Our findings support their results but our empirical analysis is elaborated at the firm-level, where we have information on firms' productivity, age, and capital. Moreover, we can identify entry and exit of firms.

Another strand of the literature focuses on the role of low-income countries for firms located in developed countries. Eaton, Kortum, and Kramarz (2011) show for France that firms that serve markets with low-potential have higher sales and export to a larger number of destinations. In line with their study, Crino and Epifani (2012) show that more productive Italian firms tend to export more to high-income markets. Our paper complements both papers by focusing on the low-income country trade share of firms in emerging markets.

[5] Bai, Krishna, and Ma (2013) provide evidence on the effects of direct or indirect export-modes on learning on exporting.

[6] There is a large and emerging literature on credit constraints in developing countries. For China Feenstra, Li, and Yu (forthcoming) and Hericourt and Poncet (2009) provide some evidence. The latter studies the link between foreign direct investment and finance constraints.

Recent work by Fabling and Sanderson (2012) shows that most of the productivity gap between exporting and non-exporting firms can be explained by sorting. After entry, firms invest more, which has an enhancing effect on labor productivity. Our study is related to their paper as we focus mainly on sorting of firms according to productivity. We go beyond their analysis as we take additional information about destination characteristics into consideration.

Defever, Heid, and Larch (2011) present evidence on spatial export-patterns. They argue that firms spread to markets with high proximity after entry into one particular destination. The multi-fiber agreement serves as a natural trade liberalization experiment due to massive entry into different locations. Their results suggest sequential entry into different destinations with a high proximity. Similar to us, the authors use the customs data for their empirical application. Our work is related as we also consider sequential sorting into export but it differs as we focus on sequential sorting according to market-potential and not space.

Chandra and Long (2013) use the Chinese manufacturing survey to analyze the impact of the 2004 VAT tax rebate reform on Chinese manufacturing firms' exposure to trade. Their findings indicate an increase in exports of 13% associated with a one percent tax rebate. Their identification strategy relies on a quasi natural experiment. In 2004 the central government shifted authority over those tax rebates to the local level. This shift created some regional heterogeneity in tax rebates. Local governments set tax rebates dependent on the region's financial situation.

The paper is structured as follows: Section 2 describes the estimation strategy and data used. We analyze the productivity to export-mode nexus by correlating the respective variables. In a last step we also look at the differences in productivity associated with entry into the different export-modes and other firm-characteristics. Section 3 presents the empirical results. Section 4 concludes.

2 Estimation strategy and data

Data and summary statistics. We use China's customs data and the Annual Manufacturing Survey from the National Bureau of Statistics for our analysis. The customs data covers the universe of exporters in China and include detailed information about destination and origin of exports. Manova and Zhang (2009) provide a more detailed discussion and stylized facts about the data.

The manufacturing firm survey contains information on the type of ownership, the size and the age of the respective firm. It covers all state-owned manufacturing firms as well as non-state-owned firms with revenues above 5 million RMB. Our version of

the data stems from Brandt, Van Biesebröck, and Zhang (2012), who describe all necessary cleaning procedures to obtain their restructured version of the data. Moreover, the authors construct the capital stock using perpetual inventory methods and information about investment reported by each firm. The two data sets can be combined through record linkages based on firms' names and location. Except for the export-strategy dummies, all variables in the regression are taken from the survey data. The export-mode dummy was constructed using the customs data.

The dummies H, L, HL indicate the export-mode. The dummies are mutually exclusive and take the value one if the firm exports to low-income countries only ($L = 1$), high-income countries only ($H = 1$), or both kind of markets ($HL = 1$). We classify countries according to their per-capita income obtained from the World Development Indicators. All countries with per-capita income below the 50th percentile are classified as destination with low market potential. We add information on non-exporters obtained from the Chinese manufacturing survey, which allows to construct the variable $N = 1$ if firms do not export. TFP is constructed as the residual from a Cobb-Douglas production function:

$$\ln TFP_{i(j)t} = q_{i(j)t} - m_j M_{i(j)t} - k_j K_{i(j)t} - l_j L_{i(j)t} \quad , \tag{1}$$

where q denotes firm revenue, m denotes input of intermediates, K denotes input of capital, and L denotes input of labor in firm i operating in industry j at time t. The share parameters m, k, and l, are industry-specific and taken from production function estimates reported in Yu (forthcoming).[7] Besides of Olley and Pakes (1996), the author also proposes an Arellano and Bond (1991) type of estimation strategy, which exploits lags of the endogenous variables as instruments. We follow Yu (forthcoming) using the benchmark sys-GMM estimates when computing TFP. Production functions are estimated separately for ordinary and processing trade firms.

Table 1 presents the first and second moments for all variable used in the study.

Are firms that export to high-income countries more productive? Based on the stylized facts presented above, we analyze the performance of firms that serve low-income countries. The focus of the analysis lies on the comparison between H and HL, the latter being the reference group in our analysis. We estimate the following model

$$\ln TFP_{i(j)t} \quad = \quad C + \kappa_1 H_{it} + \kappa_2 L_{it} + \kappa_3 N_{it} + \sum_{k=1}^{K} \beta_k CON_{it}^k + \nu_j + \mu_t \ (+\varrho_i) + \epsilon_{it} \quad , \tag{2}$$

[7] As robustness check we also estimate TFP as proposed by Brandt, Biesebroeck, and Zhang (2006).

Table 1: Summary statistics

Variable	Description	Mean	Std. dev.
TFP (ln)	*Total Factor Productivity*	0.943	0.516
H (d)	*Export to high-income countries only*	0.102	0.303
L (d)	*Export to low-income countries only*	0.002	0.050
HL (d)	*Export to high- and low-income countries*	0.061	0.240
NE (d)	*Non-exporters*	0.833	0.372
SOE (d)	*State owned enterprises*	0.265	0.441
COL (d)	*Collective enterprises*	0.154	0.361
PRI (d)	*Private enterprises*	0.399	0.489
THK (d)	*Enterprises from Taiwan or Hong Kong*	0.087	0.282
FOR (d)	*Foreign enterprises*	0.092	0.290
Size (ln)	*Number of employees*	4.649	1.113
Age (level)	*Age of the firm*	9.923	11.388
Capital (ln)	*Capital stock of the firm*	3.797	1.619

where TFP denotes total factor productivity of firm i in industry j at time t. C denotes the constant, H, L, and N are dummies that identify the export-strategy, CON includes control variables for size, capital, region- and ownership-dummies. The variables ν_j, μ_t, and ϱ_i are the estimated coefficients for the industry-, time-, and firm-fixed-effects. The inclusion of firm fixed-effects allows us to interpret the coefficients as measure for the productivity effects associated with switching from and to the reference export-mode, HL, and ϵ denotes the error term.

Productivity and the choice of the export-mode. The correlation between productivity and export-modes is likely driven by firms' endogenous choice of the desired export-mode conditional on firm performance and other firm characteristics. The use of entry-variables helps to identify causal results. Firm's productivity at time of entry or switch to one particular export-mode must have been determined before the respective period. Either the firm developed its productivity in the years before entry into export or it was developed during the time of using another export-mode. The former would be sorting, the latter more in favor of learning by exporting. Notice that both arguments are not exclusive. Firms may start exporting to markets with high-potential. Learning by exporting may explain why firms develop a higher productivity before sorting into another export-mode in a later step. Figure 4 gives a graphical analysis of the entry data. The category entry into low-income countries is negligible but entry into H and HL is substantial compared to the incumbent group.

We estimate the choice of entry in a multinomial logit model, which has the advantage to allow us to estimate the effects of different firm characteristics on the

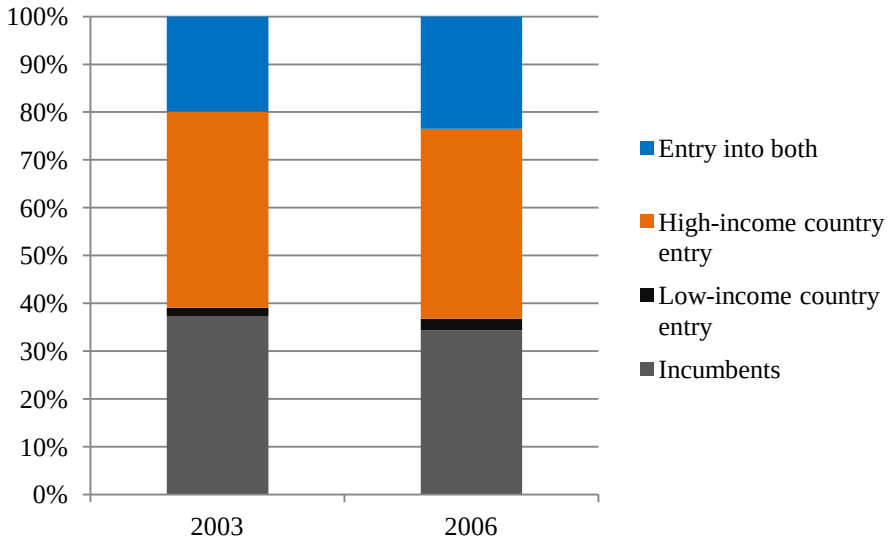

Figure 4: Entry into different export strategies

probability of choosing particular export-modes. The model reads

$$P(y = j|x) = \exp(x\beta_j) / \left[1 + \sum_{h=1}^{J} \exp(x\beta_h)\right] \quad , \tag{3}$$

where we follow the notation proposed in the textbook by Wooldrige (2002). The dependent variable summarizes the different binary export-mode dummies into one multinomial variable y. We are interested in how changes in the elements of the vector of regressors x change the probability of choosing particular export-modes $P(y = j|x)$ for all different outcomes j. The included regressors are identical to the regressors included in the analysis before.[8] We run two different setups: Firstly we construct the multinomial export-mode variable including the choices *non-export* ($y = 0$), *export to low-income countries only* ($y = 1$) , *export to high-income countries only* ($y = 2$), and *export to both* ($y = 3$) as robustness checks for the productivity-premium estimates. We also run regressions with a multinomial entry-into-export-mode variable that summarizes *entry into low-income countries only* ($y = 1$), *entry into high-income countries only* ($y = 2$), and *entry into both* ($y = 3$). The latter analysis is elaborated in the cross-section for the years 2003 and 2006. Estimated probabilities for $J - 1$ outcomes implicitly determine the outcome probability of the reference group. We choose the HL group as the reference category. The vectors β_j contains estimated coefficients for choice j of the included regressors.

[8] However, we include a broader industry-classification variable on the two-digit level. The multinomial logit does not converge for the full set of industry fixed effects at the four-four digit level.

3 Results

3.1 Main results

Total factor productivity and export-modes. Table 2 reports coefficients obtained from the linear model introduced in equation 2. Column 1 presents the benchmark specification including all firms. Industry-, region-and time-dummies, as well as size, capital, firm-age, and ownership controls are included but the coefficients are not reported. Detailed output tables are reported in the Appendix of this paper.

Table 2: Results of the benchmark regressions

Dependent variable: Total Factor Productivity (ln) *Reference group: Active on both high- and low-income markets*					
Model	ALL	ALL	SOE	PRI	FOR
High-income only	-0.054^{***}	-0.018^{***}	-0.050^{***}	-0.032^{***}	-0.051^{***}
	(0.002)	(0.003)	(0.005)	(0.004)	(0.003)
Low-income only	-0.045^{***}	-0.019^{*}	-0.061^{***}	-0.033^{***}	-0.066^{***}
	(0.007)	(0.010)	(0.014)	(0.010)	(0.013)
Non exporters	-0.079^{***}	-0.050^{***}	-0.121^{***}	-0.072^{***}	-0.055^{***}
	(0.002)	(0.004)	(0.004)	(0.003)	(0.003)
Industry-FE	x		x	x	x
Firm-FE		x			
R-squared	0.464	0.785	0.400	0.531	0.544
Observations	1151039	1151039	483052	460330	207657

Notes: Standard errors in parentheses, * significant at 10%, ** significant at 5%, *** significant at 1%. Standard errors clustered at the establishment-level. Constant, year-, industry-, and regional-dummies, firm-age, log size, and log capital controls included in all models but coefficients are not reported. *ALL* stands for *all firms*, *SOE* for *state owned enterprises including COL collective enterprises, PRI stands for private enterprises, FOR stands for foreign enterprises. FOR includes firms from Taiwan and Hong Kong THK and the rest of the world ROW.*

As already explained in the previous sections H, L, N and HL categories are mutually exclusive so that the coefficients have to be interpreted relative to the reference group HL. Our results are in line with the results discussed in the introduction: Firms that specialize on high-income markets are on average 5 percent less productive than firms that are active on both type of markets. Moreover, our results reveal that firms that specialize on H markets are only 2.5 percentage points more productive com-

pared to firms that do not export.[9]

Column 2 includes firm-fixed effects instead of industry-dummies. We obtain the same pattern as documented in column 1. Firms that shift from L or H to simultaneous export to both type of markets increase productivity by around 2 percentage points. However, the causality may go in both directions. The first results are correlations that do not allow for any conclusion about sorting or learning by exporting. It is still unclear whether firms are already more productive before the switch or whether firms become more productive afterwards. Interestingly, switching from non-export to export is always associated with a higher productivity. Column 3 to 5 report robustness checks separated by firms' ownership-types. The coefficients are significant in all columns but the magnitude of the effect is the strongest for foreign- and state-owned enterprises. Column 5 reveals a small productivity premium for exporters specializing on high- or low-income export destinations. Thus, the small productivity-premium associated with the results in column 1 may be driven by foreign owned firms. This result can be explained by the so-called proximity-concentration trade-off. Foreign firms may use Chinese affiliates to produce directly for the Chinese market in order to spare high transportation costs.[10] Dai, Maitra, and Yu (2012) argue that many Chinese firms engage in processing trade. A large fraction of Chinese exporters specialized assembling imported intermediates before exporting the final good. The value-added by the Chinese firm is rather limited but the firms are declared exporters. The difference in productivity with respect to non-exporters turns out to be relatively small.

Entry into export-modes, firm-age, and capital formation. The hypothesized link between tariffs and per-capita income motivates our second analysis. It may be that the described pattern can be explained by more productive firms' sorting into the HL regime. We use dummies that indicate entry into different export-modes to check whether firms that enter into one particular mode are already significantly different from firms that enter another one. The advantage of the customs data is that we observe the universe of Chinese exporters. Thus, export the first time to a particular destination can be declared as entry. A switch from one to the other export-mode is coded as entry into the export-mode reported in the year of analysis, which is elaborated separately for the years 2003 and 2006. We use two different definitions of entry. The first codes entry if a firm reports an export-mode in 2003 (2006), which is different from the export-mode reported in the previous years 2002 and 2001 (2005 to 2001). A second definition of entry is less rigorous as we also include firms that enter

[9] The result is roughly in line with the findings in Lu (2011) as specialized firms are almost as productive as non-exporters.

[10] See Helpman, Melitz, and Yeaple (2004) for a prominent discussion on firm productivity, exports and FDI.

a certain export-mode in between 2000 and 2003 or 2003 and 2006. Thus, we also include firms that switch between different modes within this time-frame. In those regressions, entry is coded as export using a certain mode in 2003 (2006) different from the mode used in 2000 (2003).

The model proposed by Chan and Manova (2013) suggests a sequential export-pattern. Instead of exporting to all markets that yield positive profits, firms may choose the second-best: Exporting to high-potential markets first. We test their hypothesis using a multinomial logit model. Younger firms with a lower capital stock should show a clear tendency to export to high-income markets only. Older firms may find it profitable to switch to the "first-best" outcome, after a period of learning by exporting and establishing a higher capital stock.

Specifications reported in Tables 3 and 4 exclude incumbent firms that do not switch or enter export-modes. The number of observations is low as we keep firms that use one of the export-modes the first time. The TFP coefficient indicates that firms that use the high-income-countries-only mode are less productive than firms entering or switching to both type of markets, HL. This results holds for both the year 2003 and the year 2006.

The firm-age coefficients are also significant and negative in both years: Younger firms are more likely to enter into high-income markets only. However, the effect is rather modest. The low magnitude of the effect may stem from the fact that all entry-firms are relatively young. Thus, the difference between entry into H and entry into HL may be low but the negative sign in addition to the clear pattern we found for the total factor productivity supports the sequential-sorting hypotheses. Export to low-income countries is less frequent. Thus, coefficients may be estimated less precisely and we report them only for sake of completeness without commenting much on them.

Table 3: Entry into export-modes I

Dep. var.: Multinomial Export-Mode Entry, year 2003
Respective mode in 2003 but a different one in 2002 and 2001

	Entry into H		Entry into L		Entry into HL	
	dy/dx		dy/dx		dy/dx	
TFP (log)	-0.097^{***}	(0.031)	0.042^{***}	(0.015)	0.055^{**}	(0.026)
Size (log)	-0.047^{***}	(0.008)	0.009	(0.006)	0.038^{***}	(0.008)
Age	-0.004^{***}	(0.001)	0.000	(0.001)	0.003^{***}	(0.001)
Capital (log)	0.007	(0.006)	-0.007	(0.004)	-0.001	(0.006)
N	5471					

Notes: See Table below. Entry into export-mode is coded as 1 if the firm exports in year 2003 but not in 2002 and not in 2001.

Table 4: Entry into export-modes II

Dep. var.: Multinomial Export-Mode Entry, year 2006 *Respective mode in 2006 but a different one in 2005 to 2001*						
	Entry into H		Entry into L		Entry into HL	
	dy/dx		dy/dx		dy/dx	
TFP (ln)	-0.100^{***}	(0.020)	0.030^{**}	(0.013)	0.070^{***}	(0.017)
Size (ln)	-0.034^{***}	(0.007)	-0.005	(0.005)	0.038^{***}	(0.007)
Age	-0.006^{***}	(0.001)	0.001	(0.001)	0.005^{***}	(0.001)
Capital (ln)	-0.001	(0.005)	0.008^{**}	(0.004)	-0.007	(0.004)
N	8453					

Notes: Standard errors in parentheses, * significant at 10%, ** significant at 5%, *** significant at 1%. Standard errors clustered at the establishment-level. Constant, industry-, and regional-dummies included but not reported. The model estimated is a multinomial logit. All coefficients are marginal effects. Reference group in the multinomial logit is export to high- and low-income countries, HL. Marginal effects are computed for the average firm. H denotes high-income countries only, and L denotes low-income countries only. Entry into export-mode is coded as 1 if the firm exports in year 2006 but not in 2005 to 2001.

The capital stock in our data is constructed based on investments. Firms that are more constrained should invest less and have lower capital stocks. The respective coefficients do not support this hypothesis. For both years, we find that firms with higher capital stocks tend to choose markets with high-potential only. Moreover, the coefficients are insignificant. We argue that the capital stock cannot be seen as a direct test of finance-constraints. Thus, the fact that we don't find significant effects do not reject the hypothesized existence of finance constraints in earlier stages of Chinese firm development. We present additional evidence on a larger set of firms including those that enter certain export-modes in a longer time-frame, where coefficients for capital are significant and have the expected signs: Firms that enter the H-mode report lower capital stocks compared to firms that enter the HL-mode.

We can interpret the marginal effects as follows. A 100 percent increase in total factor productivity is associated with a 9.7 percentage points lower probability of entry into H but a 5.5 percentage points higher probability of choosing entry into HL. Ten years older firms are 4 percentage points less likely to enter H but 3 percentage points more likely to enter HL. The counter-factual changes in the variables of interest are high in magnitude. Nevertheless, the scenarios are realistic as they cover the whole range of observed values of the respective variables.

Table 5 and 6 report robustness checks obtained from regressions that include the less rigorously defined entry as dependent variable. Except of the capital coefficient, results are roughly in line with the ones discussed in Tables 3 and 4.

Table 5: Entry into export-modes III

Dep. var.: Multinomial Export-Mode Entry, year 2003 *Respective mode in 2003 but a different one in 2000*						
	Entry into H		Entry into L		Entry into HL	
	dy/dx		dy/dx		dy/dx	
TFP (log)	-0.114^{***}	(0.020)	-0.002	(0.007)	0.115^{***}	(0.021)
Size (log)	-0.044^{***}	(0.005)	-0.003^{**}	(0.002)	0.047^{***}	(0.005)
Age	-0.002^{***}	(0.001)	0.000^{**}	(0.000)	0.002^{***}	(0.000)
Capital (log)	-0.009^{**}	(0.004)	-0.002	(0.001)	0.011^{***}	(0.004)
N	13585					

Notes: See Table below. Entry into export-mode is coded as 1 if the firm exports in year 2003 but not in 2000.

Table 6: Entry into export-modes IV

Dep. var.: Multinomial Export-Mode Entry, year 2006 *Respective mode in 2006 but a different one in 2003*						
	Entry into H		Entry into L		Entry into HL	
	dy/dx		dy/dx		dy/dx	
TFP (ln)	-0.111^{***}	(0.012)	-0.002	(0.003)	0.114^{***}	(0.011)
Size (ln)	-0.033^{***}	(0.004)	-0.006^{***}	(0.001)	0.039^{***}	(0.004)
Age	-0.005^{***}	(0.001)	0.000^{**}	(0.000)	0.004^{***}	(0.001)
Capital (ln)	-0.011^{***}	(0.003)	0.002^{**}	(0.001)	0.010^{***}	(0.003)
N	25208					

Notes: Standard errors in parentheses, * significant at 10%, ** significant at 5%, *** significant at 1%. Standard errors clustered at the establishment-level. Constant, industry-, and regional-dummies included but not reported. The model estimated is a multinomial logit. All coefficients are marginal effects. Reference group in the multinomial logit is export to high- and low-income countries, HL. Marginal effects are computed for the average firm. H denotes high-income countries only, and L denotes low-income countries only. Entry into export-mode is coded as 1 if the firm exports in year 2006 but not in 2003.

Dynamic approach: lagged export-mode status. The status prior to entry should be another good predictor of the export-mode at time of entry or switch. We expect that entry or switch into the HL-mode is more likely if a firm was specialized on high-income markets three years before. By the same token, we expect firms that start exporting to focus their attention on markets with high potential.

Table 7 allows for a first glance at a transition between the status in 2003 and the status in 2006. We keep all information from the manufacturing survey data including those observations that are not matched to the customs data, which form the category

Table 7: Transition matrix: 2003 to 2006

Transition matrix from 2003 to 2006						
Status 2003⇓	*HL*	*H*	*L*	*N*	*U*	Exit
Both	46%	12%	1%	2%	0%	40%
H	11%	36%	0%	2%	1%	50%
L	19%	5%	13%	2%	0%	61%
N	1%	1%	0%	47%	3%	48%
Unknown	1%	2%	0%	12%	36%	49%
Entrant	14%	23%	1%	52%	10%	–

Transitions from status in 2003 (columns) to status in 2006 (rows).
Transitions reported from the forward perspective 2003.

Table 8: Transition from 2003 to 2006, status

Outcome⇒ Status 2003⇓	HL	H	L	N	U	Z
HL 2003	0.154***	0.069***	0.004***	−0.407***	0.108***	0.072***
H 2003	0.081***	0.125***	0.000	−0.333***	0.083***	0.042***
L 2003	0.108***	0.028*	0.009***	−0.170***	0.086***	−0.062*
U 2003	0.045***	0.038***	0.001***	−0.285***	0.184***	0.015
N	181065	181065	181065	181065	181065	181065

Notes: Standard errors are not reported but t statistics can be found in the output tables reported in the Appendix, * significant at 10%, ** significant at 5%, *** significant at 1%. Standard errors clustered at the establishment-level.

unknown (export destination), U. Exiting firms are firms, which we observe in 2003 but not in 2006; entry are firms that we observe in 2006 but not in 2003. The transitions reveal that among firms using the HL mode in 2003, 46 percent of them do not switch the export-mode. Another 12 percent of the firms that use the HL mode in 2003 switch to the H mode in the year 2006 and only 1 percent switch to the L mode. However, around 40 percent of the firms exit exporting, which is not explained by the theories discussed in the literature overview.

Firms that specialized on high-income markets in the year 2003 also tend to remain within this particular mode. Around 36 percent of firms that export only to high-income markets in 2003 do not switch the export-mode. Another 11 percent switch to the HL regime. The first result is not surprising. Especially firms that diversified to both high- and low-income markets are expected to remain in this particular export-mode. The second result is exactly as one would expect.

We provide regression results on firm status in 2003 (2006) and the status in 2000 (2003) in Tables 8 and 14. The purpose of those regressions is to test whether the numbers reported in the transition matrix are significant, which is mostly the case.

The reference groups are non-exporters in 2000 and 2003 respectively. The coefficient estimate in the first row and first column of Table 8, 0.15, means that a firm that exports to both high- and low- income destinations in year 2000 is 15% more likely to be exporting to both high- and low- destinations in year 2006 than a non-exporter in year 2003.[11] We would like to focus on the choice of the two major modes of exporting "HL" and "H". What is interesting here is the observation that existing exporters, with status HL or L, have a higher probability premium in being HL than being H three years later than a non-exporter, suggesting that new exporters are more likely to start with mode H.

Nevertheless, the interpretation is different as the persistence in each regime is high. To circumvent this problem, we exclude them by focusing on entry or switchers only. The analysis complements the results obtained from the transition matrix.

We run multinomial regressions using more rigorously defined entry into export-modes as dependent variable. Table 9 and 10 report the results. For this last analysis we need to identify the previous status with certainty, which implies that the number of observations drops significantly. Reference group in all regressions is the non-exporter group. Firms that are not included in the customs data three years before the respective reporting period are not necessarily non-exporters as those firms may be born as exporting firms instead of switching from non-export to export. We discuss the coefficients more generally for all tables as the results are qualitatively the same. The first columns of Tables 9 and 10 show that firms that were already specialized on high- or low-income markets three years before the switch are less likely to switch to specialization on high-income markets, compared to firms that were non-exporters three years before. The same holds for firms that were already diversified at that time.

The coefficients have to be interpreted relative to the reference group non-exporters, which are those more likely to enter the H-mode. This is in line with the results reported above: Younger firms switch from non-exporting to export by specializing on markets with high-potential.

Column 2 confirms this result. However, the identification for entry into L is problematic due to the low number of entries into this particular export-mode. The probabilities of entering or switching the modes H or L are higher if firms were non-exporters in the years before. The probability of the choice of the HL-mode is higher for firms that have been using any type of export-mode compared to non-exporters. These findings complement the results discussed in the transition matrix: Firms usually keep on using the same export-mode over time but firms that switch to the HL-mode are not only older, those firms were likely already specialized.

[11] Instead of standard errors we report t statistics in the respective companion tables reported in the Appendix.

Table 9: Entry into export-modes and status before entry I

Dep. var.: Export-Mode Entry dummies, year 2003
Respective mode in 2003 but a different one in 2002 and 2001

	Entry into H		Entry into L		Entry into HL	
	dy/dx		dy/dx		dy/dx	
TFP (log)	-0.188^{***}	(0.049)	0.079^{**}	(0.038)	0.109^{**}	(0.050)
L(3-years before)	0.105	(0.091)	-0.136	(0.085)	0.031	(0.121)
H (3-years before)	-0.261^{***}	(0.030)	-0.120^{***}	(0.026)	0.381^{***}	(0.027)
HL (3-years before)	-0.397^{***}	(0.062)	0.043	(0.038)	0.354^{***}	(0.052)
N	1274					

Notes: See Table below. Entry into export-mode is coded as 1 if the firm exports in year 2003 but not in 2002 and not in 2001.

Table 10: Entry into export-modes and status before entry II

Dep. var.: Export-Mode Entry dummies, year 2006
Respective mode in 2006 but a different one in 2005 to 2001

	Entry into H		Entry into L		Entry into HL	
	dy/dx		dy/dx		dy/dx	
TFP (log)	0.010	(0.037)	-0.008	(0.031)	-0.001	(0.036)
L (3-years before)	-0.019	(0.106)	-0.035	(0.113)	0.054	(0.111)
H (3-years before)	-0.443^{***}	(0.034)	-0.042^{***}	(0.025)	0.486^{***}	(0.022)
HL (3-years before)	-0.184^{***}	(0.062)	0.027	(0.052)	0.156^{***}	(0.052)
N	1860					

Notes: Standard errors in parentheses, * significant at 10%, ** significant at 5%, *** significant at 1%. Standard errors clustered at the establishment-level. Constant, industry-, and regional-dummies included but not reported. The model estimated is a multinomial logit model. All coefficients are marginal effects. Marginal effects are computed for the average firm. H denotes high-income countries only, and L denotes low-income countries only, HL denotes export to both kind of markets. Entry into export-mode is coded as 1 if the firm exports in year 2006 but not in 2005 to 2001.

We can interpret the marginal effects as follows: Belonging to the H (HL) category three years before entry is associated with a 0.26-0.44 (0.18 - 0.40) lower probability of entry into H compared to being a non-exporter. The L category is less relevant. Belonging to the H (HL) category three years before entry is also associated with a 0.38-0.49 (0.16 - 0.35) higher probability of entry into HL compared to the non-exporter group. Notice that we are able to estimate coefficients for status and entry within the same group. Firms that report being H in 2000 may stop exporting to H in 2001 and 2002 before entering H again in 2003.

3.2 Robustness checks

As robustness check we also estimate TFP as proposed by Brandt, Biesebroeck, and Zhang (2006). Results are reported in Table 11.

Table 11: Results for the robustness check with different TFP

Dependent variable: Total Factor Productivity (ln) *Reference group: Active on both high- and low-income markets*					
Model	ALL	ALL	SOE	PRI	FOR
High-income only	-0.249^{***}	-0.073^{***}	-0.201^{***}	-0.188^{***}	-0.231^{***}
	(0.007)	(0.009)	(0.015)	(0.013)	(0.009)
Low-income only	-0.156^{***}	-0.094^{***}	-0.185^{***}	-0.139^{***}	-0.226^{***}
	(0.024)	(0.026)	(0.043)	(0.036)	(0.044)
Non exporters	-0.301^{***}	-0.198^{***}	-0.447^{***}	-0.290^{***}	-0.211^{***}
	(0.007)	(0.011)	(0.013)	(0.010)	(0.011)
Industry-FE	x		x	x	x
Firm-FE		x			
R-squared	0.282	0.789	0.279	0.315	0.216
Observations	1090823	1090823	460764	433428	196631

Notes: Standard errors in parentheses, * significant at 10%, ** significant at 5%, *** significant at 1%. Standard errors clustered at the establishment-level. Constant, year-, industry-, and regional-dummies, firm-age, log size, and log capital included in all models but not reported. All coefficients are marginal effects. *ALL* stands for *all firms*, *SOE* for *state owned enterprises including COL collective enterprises, PRI stands for private enterprises, FOR stands for foreign enterprises. FOR includes firms from Taiwan and Hong Kong THK and the rest of the world ROW.*

TFP is obtained from a Cobb Douglas production function. Log value added, q, is produced by input of log capital k and log labor, l. $\ln TFP$ can be obtained from $\ln TFP_{it}^{IND} = (q_{it} - \bar{q}_t) - \tilde{S}_{it}(l_{it} - \tilde{l}_t) - (1 - \tilde{S}_{it})(k_{it} - \bar{k}_t)$, where $\tilde{S}_{it}$ is a proxy for the elasticity of the Cobb-Douglas production function measured as wage sum over value-added. All variables used in the estimation are taken from their original data set. The results are qualitatively similar to the ones reported in the last section. Overall, the productivity-premium becomes much more pronounced compared to the benchmark regression results. The coefficients in all specifications are more than two times the coefficients reported in the benchmark regressions. The difference between non-exporters and firms that specialize on high-income markets is also smaller and likely insignificant.

Robustness check using multinomial logit. We compare the results obtained from the linear regression model with results that stem from a multinomial logit choice model. Results are presented in Tables 12.

Table 12: Benchmark results for the multinomial logit model

Multinomial Export-Mode				
	Non-exporters	H-mode	L-mode	HL-mode
	dy/dx	dy/dx	dy/dx	dy/dx
TFP	-0.0179^{***}	-0.0026^{***}	0.0004^{**}	0.0202^{***}
	(0.0009)	(0.0008)	(0.0001)	(0.0005)
Size (ln)	-0.0600^{***}	0.0280^{***}	0.0008^{***}	0.0311^{***}
	(0.0005)	(0.0004)	(0.0000)	(0.0004)
Age	-0.0003^{***}	0.0002^{***}	0.0000^{***}	0.0001^{***}
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Capital (log)	-0.0067^{***}	0.0006^{*}	0.0002^{***}	0.0059^{***}
	(0.0003)	(0.0003)	(0.0002)	(0.0002)
N	1151039			

Notes: Standard errors in parentheses, * significant at 10%, ** significant at 5%, *** significant at 1%. Standard errors clustered at the establishment-level. Constant, year-, industry-, and regional-dummies included but not reported. All coefficients are marginal effects. Reference group is export to high-income countries only H. L denotes export to low-income countries only, and LH denotes export to low- and high-income countries.

The reported coefficients associated with TFP are in line with the results discussed in the first part of the analysis. Relative to the reference group H, we find that more productive firms are more likely to choose to export to both H and L. A one-hundred percent increase in TFP is associated with a 2.1 percent higher probability of choosing the HL mode.

The coefficient is significant at the 1 percent level. Less productive firms are relatively more likely to serve only the domestic market. The multinomial logit has the advantage that we can also analyze the role of firm-size, firm-age, and capital for the choice of the export-mode. Firms that choose to export to both L and H are larger, older, and report higher capital-stocks. Firms that specialize on high- or low-income countries are hardly different with respect to size and age. Only the coefficient for TFP and capital stock is significant but the magnitude of the effect is rather small.

4 Conclusion

Our analysis showed that China's rise in exports is associated with a higher share of trade going to low-income countries. We identified two potential reasons for the increased relevance of developing countries over time: Firms may want to sell over-capacities at lower prices in markets with lower potential but tariffs prevent access of less productive firms. A rising firm productivity over time may explain why more and more firms are able to overcome additional market entry costs in later periods. Firms start producing for markets with high-potential and low barriers to entry and switch to serving low-income markets additionally in a later stage.

In line with that hypothesis we find evidence for sorting of firms into different export-modes according to productivity. Firms that enter exporting to both low- and high-income markets are more productive than firms that enter or switch to the export mode H (specialization on high-income countries). Relatively few firms specialize on low-income markets. We also find evidence for sequential sorting into markets according export-market potential. Firms that export to both high- and low-income destinations are slightly older compared to firms that enter or switch to the export-mode where firms specialize on export to high-income countries. This result hints towards the existence of constraints that prevent firms from serving all kind of markets immediately, likely finance-constraints.

Our results on the dynamics support this hypothesis. Firms that enter the export-mode HL were more likely specialized on either exporting to high- or exporting to low-income countries. Moreover, firms that enter specialization on export to high- or specialization on export to low-income countries were more likely non-exporters three years before entry or switch.

Future research should try to disentangle the different channels on the aggregated level. The exogenous shock to trade costs associated with the VAT tax rebate reform from 2004 may help to identify causal relationship on the industry-level. One may expect a massive entry into low-income countries as a result of reduced exporting costs if tariffs in low-income countries prevented exporters from entering those destinations. Gravity equations could be estimated in order to take distance and other drivers behind trade into consideration. However, these remaining points go beyond our firm-level study.

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A Detailed regression output

Table 13: Results for the benchmark regressions

Dependent variable: Total Factor Productivity *Reference group: Active on both high- and low-income markets*					
Model	ALL	ALL	SOE/COL	PRI	THK/FOR
High-income only	-0.054^{***}	-0.018^{***}	-0.050^{***}	-0.032^{***}	-0.051^{***}
	(0.002)	(0.003)	(0.005)	(0.004)	(0.003)
Low-income only	-0.045^{***}	-0.019^{*}	-0.061^{***}	-0.033^{***}	-0.066^{***}
	(0.007)	(0.010)	(0.014)	(0.010)	(0.013)
Non exporters	-0.079^{***}	-0.050^{***}	-0.121^{***}	-0.072^{***}	-0.055^{***}
	(0.002)	(0.004)	(0.004)	(0.003)	(0.003)
COL (dummy)	0.095^{***}	0.006	0.098^{***}		
	(0.002)	(0.004)	(0.002)		
PRI (dummy)	0.056^{***}	0.007^{**}			
	(0.001)	(0.003)			
THK (dummy)	0.060^{***}	0.004			-0.032^{***}
	(0.002)	(0.008)			(0.002)
FOR (dummy)	0.089^{***}	0.007			
	(0.002)	(0.008)			
Size (ln)	0.036^{***}	-0.004^{**}	0.049^{***}	0.017^{***}	0.026^{***}
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Age	-0.005^{***}	0.000	-0.005^{***}	-0.000^{***}	-0.001^{***}
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Capital (ln)	0.034^{***}	0.016^{***}	0.031^{***}	0.025^{***}	0.044^{***}
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Industry-FE	x		x	x	x
Firm-FE		x			
R-squared	0.464	0.785	0.400	0.531	0.544
Observations	1151039	1151039	483052	460330	207657

Notes: Standard errors in parentheses, * significant at 10%, ** significant at 5%, *** significant at 1%. Standard errors clustered at the establishment-level. Constant, year-, industry-, and regional-dummies, firm-age, log size, and log capital included in all specifications but coefficients are not reported. All coefficients are marginal effects. *ALL* stands for *all firms*, *SOE* for *state owned enterprises, COL stands for collective enterprises, PRIV stands for private enterprises, THK stands for Taiwan and Hong Kong enterprises, FOR stands for foreign enterprises.*

B Additional descriptives

The numbers about the evolution of the low income trade share over time are taken from the following graph. The blue dashed line with the highest locus in graph 5 represents the extensive margin computed as the share of exporters to low-income countries. The solid line in the middle of the graph represents the intensive margin, and the black solid line at the bottom of the graph represents the unconditional low-income country trade share. The axis associated with the extensive margin is the right axis.

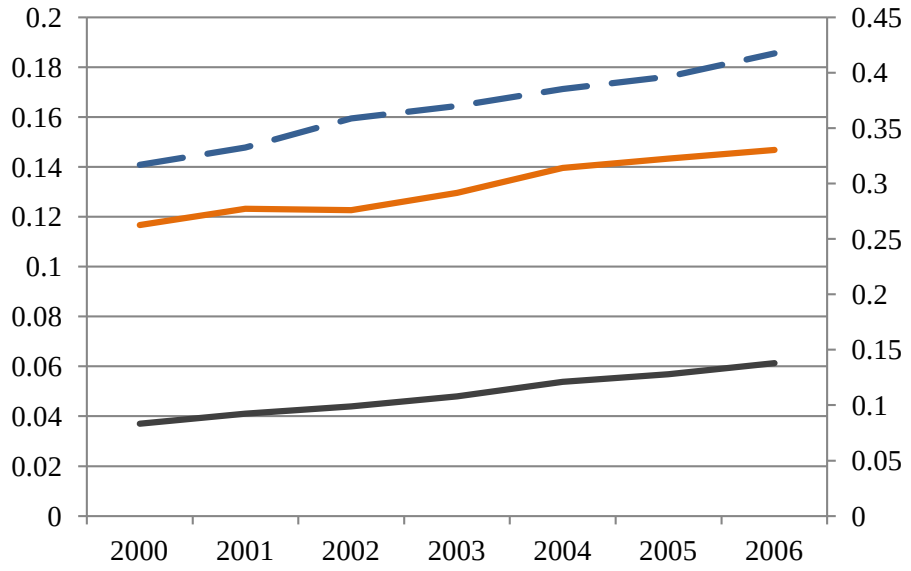

Figure 5: Relative importance of different export strategies

C Additional regressions for the transition dynamics

Table 14: Transition from 2000 to 2003, status

Outcome ⇒ Status in 2003 ⇓	B	H	L	N	U	Z
B 2000	0.0995***	0.0598***	0.0027***	-0.374***	0.112***	0.0999***
	(71.92)	(18.15)	(9.90)	(-20.47)	(20.69)	(6.39)
H 2000	0.0599***	0.0949***	0.0002	-0.297***	0.0928***	0.0488***
	(37.44)	(50.99)	(0.70)	(-19.96)	(26.28)	(3.59)
L 2000	0.0837***	0.0300***	0.0064***	-0.253***	0.0955***	0.0377
	(20.06)	(3.98)	(19.87)	(-6.30)	(6.79)	(0.92)
U 2000	0.0301***	0.0316***	0.0013***	-0.282***	0.180***	0.0383***
	(13.27)	(20.08)	(7.88)	(-28.10)	(60.90)	(3.35)
N	147242	147242	147242	147242	147242	147242

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 15: Transition from 2003 to 2006, status

Outcome⇒ Status in 2003⇓	B	H	L	N	U	Z
B 2003	0.154***	0.0691***	0.0046***	-0.407***	0.108***	0.0724***
	(129.44)	(14.88)	(14.70)	(-28.29)	(21.73)	(5.23)
H 2003	0.0818***	0.125***	0.0003	-0.333***	0.083***	0.0423***
	(44.88)	(45.31)	(0.78)	(-33.66)	(28.46)	(4.42)
L 2003	0.108***	0.0282*	0.00996***	-0.170***	0.0869***	-0.0627*
	(25.70)	(2.16)	(23.44)	(-5.72)	(6.26)	(-2.46)
U 2003	0.0454***	0.0388***	0.0016***	-0.285***	0.184***	0.0152
	(18.63)	(15.50)	(6.98)	(-40.80)	(69.47)	(1.59)
N	181065	181065	181065	181065	181065	181065

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$