# Time-Varying Impacts of Financial Credits on Firm Exports: Evidence from Trade Deregulation in China*

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**Abstract**

This paper investigates the heterogeneous and time-varying effects of financial credits on firm-level export performance. China's WTO accession leads to trade deregulation, which encourages a vast number of small domestic private firms to switch their exporting mode from indirect (through intermediaries) to direct exporting. Using a data set covering comprehensive Chinese manufacturing firms and employing a difference-in-differences approach (DID), we find that financial credits improve firm-level exports and productivity more for firms that switch from indirect to direct exporting than continuous indirect exporting firms. Further, we employ a difference-in-difference-indifferences (DDD) approach and find that improvements in firm-level internal and external finance have larger positive impacts on firm export values in the post-WTO accession period, conditioning on the firm switching from indirect to direct exporting. The time-varying impact may suggest an export distortion in China before its WTO accession, which prevents more productive but financially constrained small private domestic firms from direct exporting.

**JEL Codes**: F13, F14, F61, G20, G28.
**Keywords**: Financial Credits, Exporting Mode, Difference-in-Differences.

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# 1. Introduction

Financial credits, either internal or external to the firms, tend to be of major importance for their export decisions.[1] Entering export markets typically involves large start-up costs (Arkolakis, 2011; Aw et al., 2011; Dai and Yu, 2013; Chaney, 2016; Bai, et al., 2017), as firms need to collect and analyze information on foreign markets, adapt products and packaging to fit foreign preferences, learn local bureaucratic procedures for market access, set up distribution networks and advertize for marketing penetration. The start-up costs in international markets are usually huge, and hence financial credit is more important for exporters than non-exporters. Feenstra et al. (2014), for instance, address how the "time-to-ship" feature of exporting generates more uncertainty and reflects more incomplete information, and hence exporters rely more on financial credits.[2] In this paper, we attempt to investigate different roles played by financial credits on indirect exporters and exporters that switch their exporting mode from indirect to direct exporting.[3]

With the availability of micro firm-level data, a growing body of recent literature starts to examine the link between financial credits and firm-level export performance (e.g., Campa and Shaver, 2002; Greenaway et al., 2007; Berman and Héricourt, 2010; Minetti and Zhu, 2011; Manova, 2013; Manova et al., 2015; Channey, 2016). Greenaway et al. (2007), for example, find that financial health has a trivial effect on firm-level export participation decision in the UK, while a firm's export participation decision can significantly improve this firm's financial health. Berman and Héricourt (2010), to the contrary, document that the firm-level external and internal financial health effectively promote firms' export extensive margin, although their effect on the intensive margin is negligible. Minetti and Zhu (2011) find that financial rationing reduces firm-level exports on both extensive margin and intensive margin by employing data from the Italian manufacturing sector. The discrepant conclusions are partly caused by the heterogeneous influence of financial credits on different firms. Manova et al. (2015) show that financial constraints have a more pronounced impact on low-productivity firms, and firms belonging to financially vulnerable sectors. Jarreau and Poncet (2014) indicate that the export performance of foreign-owned firms and joint ventures relies more on their own financial credits than private domestic firms in China.

In this paper, we are primarily exploring the heterogeneous influence of financial credits on firms that are engaged in indirect (exporting through intermediaries) and direct exporting. Further, we attempt to study how China's WTO (World Trade Organization) accession varies

[1] Here, "financial credits" refers to the resources that a firm could rely on to finance for a broad range of economic activities, such as investment, working capital, and entry of international markets. The credits could be either internal, like firms' retained earnings, or external, like loans from outside creditors.

[2] More specifically, as suggested by Amiti and Weinstein (2011), there exits a longer time lag between exporting products and receiving sales revenue (i.e. longer "time to ship" for exports) and exporters also face intrinsically more uncertainty due to the difficulty with enforcing payment across borders.

[3] Following Bai, et al. (2017), we refer to exporting through intermediaries as indirect exporting mode.

the impact of financial credits on firms that switch from indirect to direct exporting (*the time-varying impact*). As discussed in Bai et al. (2017), indirect and direct exporters exhibit very different cost structures, and productivity and demand evolution is more favorable under the direct exporting mode. Specifically, direct exporters, who engage in frequent contact with foreign buyers, have more opportunity to improve their productivity and demand stock (e.g. Egan and Mody, 1992).[4] This may suggest a more efficient financial credit utilization among direct exporters. As such, relative to indirect exporters, we expect a larger impact financial credits have on exporters that switch their exporting mode from indirect to direct exporting. Besides, Khandelwal et al. (2013) indicate that for textile and cloth sector, the gains from quota removal mainly arise from the elimination of quota misallocation rather than trade itself. If the export license is also misallocated before China's WTO accession, we expect a more pronounced impact of financial credits on switchers in the post-WTO accession period.[5]

China offers an ideal setting to conduct this research in two aspects. First, it relaxed regulation on firms' manner of trade, especially exporting modes to fulfill its WTO membership commitment during 2001-2004. More specifically, before China joined the WTO, small firms with low registered capital (or sales, exporting values, etc.) had to rely on state-owned exporting intermediaries to export abroad (*indirect export*) due to the regulation on direct trading rights. When China became a member of the WTO, the accession clauses required that all firms should be permitted to export directly (*direct export*). We observe a substantial number of firms, especially private domestic firms, switching their exporting mode from indirect to direct export (see Figure 1 in the Appendix).

Second, in China, severe export distortion and resource misallocation exist (Khandelwal et al., 2013; Hsieh and Klenow, 2009). A considerable share of high-productivity firms were prevented from direct exporting before China's WTO accession because of their small scale. Export licenses were more favoring large and state-owned enterprises (SOEs) before China's WTO accession (see Khandelwal et al., 2013). As a result, China's WTO accession/deregulation offers a quasi-natural experiment to examine the degree of export distortion through uncovering the time-varying impact of financial credits.[6]

Using a comprehensive data set covering Chinese manufacturing firms, we find supporting evidence. First, by employing a difference-in-differences (DID) estimation approach, we find

[4] Egan and Mody (1992) demonstrate that a collaborative suppler-buyer relationship, on the one hand, improves exporters' learning-by-exporting efficiency; on the other hand, the buyers are less likely to change suppliers, which make investment in demand stock more effective.

[5] If the export licenses were misallocated before China's WTO accession, the switchers in the post-WTO accession period would exhibit higher export expanding potential as they are more productive, and hence, they can better utilize financial credits to support their in expanding product scope, production capacity or R&D investment.

[6] As our paper discusses the role of finance in the context of switching exporting modes (either indirect or direct exporters), we are excluded from talking about the extensive margin of exports (such as selection into exporting, product scope, number of destinations, and sales within each destination-product market). Thus, only the intensive margin of trade is investigated in this paper.

that a 10% increase in the firm-level internal (resp. external) finance will on average lead to a 4.33% (resp. 2.93%) more increase in switchers' (treatment group) export values relative to indirect exporters (control group). Meanwhile, a 10% increase in the firm-level internal (resp. external) finance will on average improve the productivity of the switchers by 0.78% (resp. 0.66%)) more relative to indirect exporters. Second, to examine the time-varying influence of financial credits on the export performance of switchers, we employ a difference-in-difference-in-differences (DDD) method.

The results demonstrate that conditioning a firm switching from indirect to direct exporting, a 10% increase in the firm-level internal (resp. external) finance will on average lead to a 6.18% to 38.97% (resp. 26.24% to 86.83%) more increase in export values after China's WTO accession.[7] The main findings remain when we use instrumental variable methods to account for the potential endogeneity issues associated with firms' switching in exporting modes.[8]

We further examine the channel through which financial credits manifest heterogeneous influence. The results show that switchers have a higher efficiency in finance usage than indirect exporters.[9] In addition, China's WTO accession further improves the efficiency of finance usage for switchers. The different efficiency in finance usage offers a possible interpretation for the heterogeneous influence of financial credits on firms' export performance.

Our work is closely related to Manova (2013) and Manova et al. (2015), in which the authors find a significant impact of financial credits on firm-level export performance. The impact is more pronounced for less productive firms and firms that belong to more financially vulnerable sectors. Differing from Manova (2013) and Manova et al. (2015), we emphasize the heterogeneous influence of financial credits on firms that are engaged in different exporting modes. This study implicitly uncovers another source which results in heterogeneous influence of financial credits on firm-level export performance: firms' exporting mode (cost structure) or efficiency in finance usage. Our story is also in line with Bai et al. (2017), in which they examine how the exporting mode (direct or indirect exporting) affects firm-level export performance, and provide a theoretical foundation on the firm-level heterogeneous performance under different exporting modes.

However, our work distinguishes itself from Bai et al. (2017) by paying particular attention to the time-varying impact of financial credits on switchers. The statistically significant time-varying impact, on the one hand, suggests export license misallocation among Chinese

[7]Notice that financial credits do not exhibit increasing importance on switchers' productivity. This is partly because, in the post-WTO accession period, switchers are more productive (see Figure 1 in the Appendix for more information). Lileeva and Trefler (2010) find that productivity growth is declining in the firm-level initial productivity. As such, these later more productive switchers exhibit a slower productivity growth, which makes financial credits less important in boosting firm-level productivity increase.

[8]In particular, we instrument the switching in exporting mode variable with the product of the firm-level initial productivity and province-level aggregate capital shock.

[9]Switchers have a higher efficiency in finance usage in terms of a lower current liquidity ratio, higher inventory turnover ratio, and short operation cycle.

exporters before China's WTO accession; on the other hand, it implies an increasing role that an effective financial market plays in boosting exports of China.[10] The conclusions further relate our study to Khandelwal et al. (2013) and Klenow and Hsieh (2009), who both emphasize the resource misallocation and distortion in China, which are of nontrivial influence on welfare. Khandelwal et al. (2013), for instance, show that most gains from trade in China are through the alleviation of distortion. If the diminishing distortion is the underlying source that increases the importance of financial credits on firm-level exports, gains from trade might have been underestimated.[11] All existing models do not account for the effect of trade liberalization on eliminating distortions, which further increases the effectiveness of the financial market.

The rest of the paper is organized as follows. Section 2 introduces information on policy and institutional background, especially how the regulation on exporting modes evolved over the period 2001-2004 in China. We also discuss how to construct the matched dataset and provide some summary statistics in Section 2. In Section 3, we talk about the construction of key variables and empirical methodology utilized to conduct statistical inference. Section 4 presents baseline empirical results and several robustness checks. Finally, we conclude in Section 5.

# 2. Policy Background and Data Description

We first present institutional background information on the policy change with regards to restrictions in firm direct exporting rights in China, since it is the source of the time-varying effects of financial credits on firm exporting that we are exploring in this paper. We then describe the two data sets we employ in this study and also explain the procedure by which we construct the matched sample that we use for the econometric analysis.

## 2.1. Policy Background

This paper explores the time-varying impact of financial credits on firm exporting behavior when the firm switches from indirect to direct exporting in the presence of a macroeconomic policy change primarily induced by China's WTO accession. The policy change that we emphasize here is China's deregulation on firms' direct exporting rights.

Ever since adopting the economic reform policy in 1978, China has been integrating into the global economy at an accelerated pace. However, as a typical planned (or centralized) economy, China still maintained substantive government intervention in various markets. The

[10] According to Bai et al. (2017), if there is no distortion, a time-invariant impact of financial credits on firm-level exports should be identified, since the cost structure difference between direct and indirect exporters is unchanged.

[11] Gains from trade are only 6% from Arkolakis et al. (2012) and slightly larger in Melitz and Redding (2015).

international exporting market was highly regulated before China's WTO accession. At the turning point of 1978, less than 20 specialized Foreign Trade Corporations and around 100 subsidiaries of these corporations dominated Chinese exports with government-issued monopoly trading rights. If a firm wanted to export abroad at that time, it could only go through these Foreign Trade Corporations that acted as exporting intermediaries. It means that only indirect exporting mode was allowed for a typical Chinese firm in that period.

As the reform and opening-up policy went into effect, China gradually granted more and more firms to export directly. In 1983, China allowed a few big state-owned enterprises to trade directly. All foreign-owned firms were granted direct exporting rights when the Foreign Trade Law was adopted in 1994. Reform on trading rights was further encouraged when the Chinese exchange rate reform was launched in 1994 (this reform allowed the previously government-controlled exchange rate to be partially determined by the market and thus provided incentives for firms to engage in international trade). In 1998, the Chinese State Council approved the issuing of direct exporting rights to state-owned and private domestic firms over a threshold size in terms of registered capital or other criteria like sales, net assets, and prospective exporting values (after January 2001, only the registered capital remained as the criterion). Yet, the registered capital requirement was quite demanding in the beginning, around 8.5 million yuan (approximately 1.03 million dollars in 2001) for private domestic firms. Over the 2001-2004 period, the reform pace accelerated for the second time when China tried to satisfy the requirements of the WTO accession.[12] For example, the registered capital requirements for private domestic firms to get direct exporting rights decreased from 8.5 million yuan to 5 million yuan in January 2001, and further reduced to 3 million yuan in July 2001.

After China entered the WTO in December 2001, the requirement dropped to 0.5 million yuan in September 2003, which in practice means there were almost no restrictions on firm exporting as those who want to export typically have a higher registered capital than 0.5 million yuan. Finally, starting from June 2004, the registered capital requirement fell to zero, and the restriction was fully removed. Though the registered capital requirement showed a dramatic drop over the 2001-2004 period for most of China, Special Economic Zones like *Shenzhen* and *Xiamen* were treated differently. To be specific, the registered capital requirement for Special Economic Zones stayed at a very low level of 2 million yuan ever since 1998, and dropped to 0.5 million yuan in September 2003. Given this difference, we rule out firms located in Special Economic Zones from our matched sample, as they were essentially unaffected by the trade deregulation, especially in the initial years.

It is worthy to mention that even though the restriction on direct exporting rights was eliminated then, there still exist numerous international trade intermediaries in China, since many small firms are relying on them to export under optimal decision processes. As discussed by Ahn et al. (2011), the set of intermediary firms could be identified from the ASIP

[12]To have a more detailed perception of how the reform or policy change was accelerated over the period 2001-2004, please see Table A.1 in the appendix of Bai et al. (2015).

(Annual Survey of Industrial Production) data set using Chinese characters that have English-equivalent meanings of "importer" "exporter", and/or "trading" in firms' name. When the set is identified, they conclude that intermediaries in China differ along several notable dimensions: intermediaries are more likely to engage in both importing and exporting relative to direct exporters; they could also handle products that span entirely unrelated sectors; intermediaries have a relative "country" focus, i.e. they export more products per country. In sum, Chinese intermediaries appear to have a lower product concentration and export more varieties per country than direct exporters. Moreover, in terms of underlying specific roles, as Ahn et al. (2011) suggest, Chinese intermediaries probably provide services ranging from promoting matches with foreign customers, exploring quality specifications required in foreign markets, and helping firms adapt their products to the needs of foreign consumers. More generally, they help firms establish channels to export their products in destinations where small firms themselves could not cover the massive additional fixed/variable costs to reach international markets. Comparing direct exporters and exporters through intermediaries, we expect firms choosing the direct exporting mode to experience a better growth path. Firms relying on the intermediary sector incur a one-time global fixed cost that provides indirect access to all markets and allows firms to save on market-specific bilateral fixed costs. The disadvantage is that intermediation results in higher marginal costs of foreign distribution and fewer opportunities to learning by exporting, which raises the price to foreign consumers. Therefore, the intermediation technology here benefits less productive firms. Productive direct exporters, though paying market-specific bilateral fixed costs, are still likely to grow faster and benefit more than indirect ones due to the future productivity advantage.

In the following sections, when exploring the time-varying impacts of finance on firm exporting mode changes, we will take into account this policy change by distinguishing the periods before and after 2002, or 2003, or 2004, because the main part of the policy change was phased in over the period 2001-2003. The direct exporting mode means both higher fixed/variable costs and more incentive to invest for future growth, thus providing a better opportunity for the financial credits to make more contributions. Therefore, we expect a more pronounced impact of financial credits on firm exporting when more private domestic firms switched from indirect to direct exporting mode, on the ground that direct exporting was more available for them after the threshold year we choose. [13]

## 2.2. Data Description

In this paper, we match two separate Chinese micro-level data sets to get the sample we are employing in the econometric analysis. The first data set is the Annual Survey of Industrial

[13]Though the deregulation on direct exporting rights also granted SOEs with smaller registered capital to serving international markets, in general they will be less likely to engage in direct exporting as a result of lower productivity when comparing with private domestic enterprises, see Khandelwal et al. (2013) as an example for the textile & cloth sector.

Production (ASIP) spanning the period 1998-2007. This survey, which collects annual firm-level data, is conducted by Chinese National Bureau of Statistics (NBSC). The data set is quite inclusive, in the sense that it incorporates all Chinese State-owned Enterprises (SOEs henceforth) and non-SOEs with annual sales over 5 million yuan (roughly speaking, 650,000 dollars at that time). In the survey, detailed firm-level information was collected, such as firms' geographic location, year of operation (i.e. the age of the firm), ownership type (state-owned, collective, private, foreign, etc.), employment, production and sales, balance sheet variables, and tax. As for this research, we focus on sales (especially exporting sales values) and balance sheet information, from which we construct exporting and finance variables in the econometric exercise. The second data set we use is product-level data from Chinese Customs (GACC), which were collected at a monthly frequency over the period 2000-2006. We add up values belonging to the same exporting entity over 12 months to obtain firm-level annual data, and thus, we can match it with the industrial survey data set. The Customs data cover the universe of transactions going through Chinese Customs, and contain firm-level information like geographic location, ownership type, exporting and importing variables (values, quantities, and unit prices), type of trade, mode of shipment, transit country, export destination country, and import source country.

First, we provide basic statistics for each data set. In the firm-level data set, ASIP, we list statistics of necessary variables to compute firm-level productivity as well as productivity itself in Table 1.[14] We inflate labor share (i.e. the ratio of total wage payment to value added) to match the number reported in Chinese input-output tables and national accounts (roughly 50%) as Hsieh and Klenow (2009) suggest. For the deflators of output, intermediate inputs and capital depreciation rate, we follow the tables constructed by Brandt et al. (2012). It is worth noting that when comparing domestically-selling firms to exporting firms, exporters have larger values of TFPR and value added in Table 1, which is consistent with the finding in the literature that firms with higher productivity export.[15]

Basic statistics for the Customs data set are presented in Table 2.[16] We notice that Chinese exporters do expand rapidly during our sample period as Manova and Zhang (2012) find. During these seven years, the number of exporting firms has increased from 62,746 to 171,144, which is nearly a 200% gross growth. The average number of products each exporter shipped aboard, measured by the distinct 10-digit HS codes, has also increased from 30 to 36.2. Firms,

[14] More specifically, we calculate the revenue productivity, denoted as TFPR, following the methodology introduced by Hsieh and Klenow (2009). Note also that TFPR is dimensionless in Table 1.

[15] In addition to our main focus on the impact of finance on firm exports, we also check the effect of finance on firm productivity (measured by TFPR) in the empirical analysis because several studies in the literature suggest that exporting has a positive impact on firm productivity through learning, see Kraay (1999) on China, Aw et al. (2000) on Taiwan and South Korea, Girma et al. (2004) on UK, Van Biesebroeck (2006) on sub-Saharan Africa, and De Loecker (2007, 2013) on Slovenia.

[16] For the product-level Customs data, we first add up the entries to firm-level by exporting values. That is, if a firm exports more than one good, we add up the export values of all goods and then obtain just one entry for that firm.

on average, exported to 6.9 countries in 2000 and this increased to more than 8 countries in 2006. To some extent, this evidence suggests that joining the WTO has improved Chinese firms' exporting performance in the global market.

Next, we explain the procedure we follow to match the two data sets. Our strategy is to make use of firms' Chinese name as the primary common variable for matching firms in the Customs data set to those in the ASIP dataset. We construct a concordance based on the identifiers that exist on both sides of the data: *ID* in the ASIP data set and *party_id* in the Customs data set by matching their corresponding Chinese names. As a supplement to the names, we also link firms' identifiers if they are sharing the same zip code and telephone number in both data sets. As such, the matching algorithm proceeds in 4 steps, see Appendices (Not for Publication) for more details. Using this matching procedure, we generate 93,222 pairs of identifiers during the length of our sample (2000-2006). In terms of the ASIP data that we are using as the master data set, we are able to match 20% of the total firms and 58% of the exporters. Our results are also highly comparable to those of Manova and Yu (2016), who focus on the year of 2005.

Third, using the matched sample, we document summary statistics to gain some intuition for our econometric analysis in the following sections. To conduct the econometric analysis, we need to distinguish different types of exporters. Firms, primarily private domestic enterprises (PDEs henceforth), which switched from indirect to direct exporting under the relaxed WTO regulations, are those that may have been most helped by an improvement in their financial conditions. Following Bai et al. (2017), we infer firms' exporting modes as follows. Firms from the ASIP data set are tagged as exporters if they report positive exports (otherwise they are non-exporters), and as direct exporters if they are also observed in the Customs data set. The fact that we observe the universe of transactions going through Chinese Customs allows us to tag the remaining exporting firms (those which are not observed in the Customs data set) as indirect exporters.[17] Firms that report exports larger than their exports in the Customs data set are exporting both directly and indirectly and are labeled direct exporters in this paper. Firms that do not sell domestically are removed from the sample.

In Table 3, we are comparing the three types of firms. Above all, we notice that the average export value of direct exporters is systematically higher than that of the indirect exporters over our sample period. Though both exporting values increased dramatically after 2004, the huge level value difference between them remained largely unchanged. The persistent difference suggests that switching from indirect to direct exporting may help firms to grow. This in turn probably provides firms an incentive to switch exporting modes. Next, aside from direct exporters entering more international markets, we find large productivity differences between

[17] A classification bias might show up when direct exporters are misclassified as indirect exporters. This occurs when identical firms that have different Chinese names recorded in the two data sets are unmatched. By definition, in our sample, those unmatched direct exporters will be treated in the same way as indirect exporters. This misclassification only renders our estimation results downward biased, provided that direct exporters are generally more productive and have a higher degree of exposure to trade than indirect exporters.

direct exporters and indirect exporters/non-exporters. The average productivity difference between direct exporters and indirect exporters is in the range of 5% to 20%. This is consistent with the literature that more productive firms are exporting directly as they can afford large additional exporting costs (Ahn et al., 2011). The average TFPR gap between direct exporters and non-exporters is also quite large. It lies between 10% and 30% across years. Also, more firms have been engaged in exporting and more exporters have switched from indirect exporting into direct exporting. From 2000 to 2006 the percentage of exporters has increased from 26.6% to 29.3%. In 2000, 10.9% of firms are inferred to be direct exporters, while 14.7% are indirect exporters. However, in 2006, 15.7% of firms are direct while only 13.5% are indirect. The finding of more direct exporting firms is consistent with Ahn et al. (2011) and Bai et al. (2017), and can probably be explained by the fact that more productive PDEs are engaged in exporting directly in the hope of taking advantage of favorable productivity and demand evolution.

Our identification hinges on the variation in the composition of direct exporters, which says that more PDEs shall enter the group of direct exporters in the post-WTO accession period. To see whether more PDEs were participating in direct exporting after the trade deregulation, we plot in Figure 1 the evolution paths for the share of private-domestic-enterprise (PDE) direct exporters in the pool of all direct exporters. It shows that the share of PDE direct exporters had increased significantly since China's WTO accession in December 2001. Specifically, the share of PDE direct exporters within all direct exporters increase from 22% to more than 45%. It is worthy to notice that the peak of PDE direct exporting appeared when the regulation was fully lifted. This could be ascribed to the reason that PDEs that were exempted from regulation in 2001, 2002, or 2003 have planed to switch but start switching in 2004 after a preparation period. This explanation holds in general, considering that direct exporting involves such massive costs and revenue uncertainty that only fairly sizable firms (which were enfranchised in earlier years) can manage it and it takes time to get prepared. Alvarez and López (2005) also find strong evidence, using Chilean data, supporting the conclusion that firms consciously prepare for becoming direct exporters. Moreover, Figure 1 displays that the average productivity of new switchers had risen remarkably in the trade deregulation period. This may suggest that the trade regulation resulted in substantial misallocation in exporting licenses. When the regulation was lifted, the degree of distortion had been alleviated, which led to more productive but financially constrained PDEs switch into direct exporters, and hence, improved the average productivity of switchers. Notice that after 2004, the final deregulation stage, the average productivity of new switchers further increases, which might suggest that the most productive but initially financial constrained PDEs start switching into direct exporters.[18]

As for the accuracy of the matched sample, we also pay attention to the issue of trade types. In recent work, Bernard et al. (2010, 2012) argue that carry-along trade is important

[18] Lileeva and Trefler (2010) find that initially more productive firms experience a slower productivity growth through the learning-by-exporting effect. We would expect a smaller productivity gain for firms that switch their exporting mode latter, since these firms have a higher initial productivity.

in the data. This refers to firms who export final goods for other firms when exporting their own products, thereby acting partially as intermediaries. However, in our benchmark regressions, we do not distinguish between such firms and those exporting only their own products, since the data *per se* provide no direct information for classification.[19] We dropped pure intermediaries between domestic producers and foreign buyers, i.e. those who show up in the Customs data set but do not report exporting in the survey data.[20] Another issue that we are concerned with is that processing and/or assembly trade is very different from ordinary trade. The former usually has lower productivities because it is more unskilled labor intensive, is less capital intensive, and has lower profitability (see Dai et al., 2016). Processing firms in China also pay lower fixed cost (due to government intervention), thus firms with low productivity would select into this type of trade. To guarantee that exporters in our sample are exceptional performers, which is a consensus in trade literature on heterogeneous firms, we are going to keep only ordinary trade firms in the empirical analysis.[21]

# 3. Variable Construction and Empirical Methodology

In this section, we first construct key variables related to firm-level exporting, finance, and productivity. Then we set up the baseline econometric model to identify the increased effect and time-varying increased effect of finance in promoting firm-level export value when the firm switches exporting mode.

## 3.1. Construction of Key Variables

Before implementing the econometric analysis, we construct the following relevant measures for our study from the two raw data sets and the matched sample. We first construct measures of financial credits. There are various ways to measure internal and external finance based on firms' balance sheet information. We follow Berman and Héricourt (2010) and Guariglia et al. (2011) by defining internal finance ($IF_{it}$) as the ratio of cash flows ($CF_{it}$) over total assets ($A_{it}$), i.e. $IF_{it} = \frac{CF_{it}}{A_{it}}$, since it is a direct measure of the ability of a firm using its own accumulated liquidity to finance new investment. Like Berman and Héricourt (2010), we

[19] We check the robustness of carry-along trade by dropping the firms that have export shares higher than 25%. The export share is defined as the ratio of export value from the Customs data to total sales in the ASIP data. When we exclude these carry-along traders, the summary statistics in Table 3 and our main empirical results are barely changed.

[20] The Customs data do not label the intermediaries. Ahn et al. (2011) and Manova et al. (2015) identify them using keywords in firms' Chinese names, like the Chinese counterparts of "trade company", "export-import company", and so on. We address the issue by following this identification method and find that our benchmark results stay unchanged to a large extent.

[21] More important, as Bai et al. (2017) point out, the processing and/or assembly trade bear quite different sunk cost and learning opportunities from ordinary trade and thus it is reasonable for us to drop them as our topic closely hinges on the cost structure and learning channel.

define external finance ($EF_{it}$) as the reciprocal of the ratio of total liabilities ($L_{it}$) over total assets, i.e. $EF_{it} = \frac{1}{L_{it}/A_{it}}$. It measures the firms' ability to borrow from the outside, with a lower liability ratio entailing firms more space to get external funds.

Then, we estimate firm-level productivity using the method introduced by Hsieh and Klenow (2009).[22] Since we do not have firm-level output price data, we focus on the "revenue productivity", i.e. TFPR.[23] The estimation of TFPR is conducted using the ASIP data set and the relevant variables for this estimation are firm-level value added, labor, and capital stock. Next, we define a key measure for this research, i.e. *exporting mode*, as a dummy variable that switches value from 0 to 1 when a firm moves from indirect exporting in the previous year to direct exporting in the current year (note that it takes value 0 when staying as indirect exporter in the current year). Finally, we obtain measures of export values directly from the Customs dataset, in which exporting values measure the intensive margin of firm export.

## 3.2. Empirical Methodology

The empirical strategy we employ in this paper are panel data difference-in-differences (DID henceforth) and difference-in-difference-in-differences (DDD henceforth) regressions. With divergent cost structures and growth paths between direct and indirect exporting, Chinese exporters bearing different exporting modes could serve as an interesting subject for applying the DID methods. To study the encouraging effect of firm-level financial credits on export values, we consider firms that switched from indirect to direct exporting as the treatment group and firms that continued to use indirect exporting as the control group. During the WTO accession period, the Chinese government has lowered the registered capital requirement, which then encouraged more PDEs to switch from indirect exporters to direct ones. The policy change thus provides a quasi-experiment that allows us to study the impact of trade deregulation on firm export performance. The impact of switching exporting mode promoted by financial credits on firm-level export performance might not be time invariant before and after the WTO accession since the trade deregulation provides better opportunities for financial credits to contribute in direct exporting. To capture the time-varying impact of the treatment effect promoted by fi-

[22] To account for the robustness of firm-level productivity measure, we compare it with the widely used proxy variable methods with semiparametric estimation, including Olley and Pakes (1996), Levinsohn and Petrin (2003), Wooldridge (2009) and Ackerberg et al. (2015). We find no significant changes relative to our baseline results. To save space, we present only the results using the method by Hsieh and Klenow (2009). It is nontrivial to mention that all these measures are revenue based, given the limitation that there is no firm-level output price data.

[23] There is a concern that the TFPR might not reflect the real movement in firm-level productivity, thus not acting as an appropriate efficiency measure (See Garcia-Marin and Voigtländer, 2017). The reason is that TFPR is a combination of output price and physical productivity, i.e. TFPQ. When output price decreases, an increase in TFPQ might not be accompanied by an increase in TFPR. That is to say, the efficiency gain will not be captured by TFPR when it is translated into lower output price for consumers. In our study, this potential measurement issue will only downward bias the estimated result when physical productivity is available, conditioning on the fact revealed in Brandt et al. (2017) that trade liberalization upon China's WTO accession induced a drop in output price and more so for direct exporters that are large and productive.

nancial credits, we divide the sample to pre- and post-WTO accession periods to generate cross period difference using the panel data difference-in-difference-in-differences method.[24]

First, we want to show that financial credits play a more pronounced role on firm-level exports for those switch their exporting mode from indirect to direct export. Furthermore, by directly participating in export markets, exporting firms are more likely to invest in productivity-enhancing activities, and innovate in a more efficient way. Thus, relative to indirect exporters, financial credits drive a faster productivity growth for switching firms (see Chen and Guariglia, 2013; Bai et al., 2017). Following the research designs of Meyer (1995) and Imbens and Wooldridge (2007), we conduct our first estimation using an individual-level panel data difference-in-differences model for multiple time periods:

$$\begin{aligned} y_{it} = \alpha + \eta_j \times d200j + \tau_1 \times dExportingmode_{it} + \tau_2 \times dExportingmode_{it} \times x_{it} \\ + \mathbf{z}_{it}\gamma + c_i + u_{it}; \quad j = 1,...,6. \end{aligned} \tag{1}$$

where $y_{it}$ is the firm-level export or productivity, $x_{it}$ is our measure of financial credits, and $\mathbf{z}_{it}$ are individual-specific controls which include $x_{it}$. The dummy variable $dExportingmode_{it}$ captures the change from indirect to direct exporting, it equals 1 if a firm switches from indirect to direct exporting and equals to 0 if it remains an indirect exporter.[25] The coefficient $\tau_1$ captures the average treatment effect (to be precise, on the treated) of switching the manner of exporting, and $\tau_2$ is the average treatment effect further promoted by financial credits. We expect a significant and positive $\tau_2$ for both export values and productivity (TFPR) regressions. We construct time dummies for the years 2001, 2002, 2003, 2004, 2005, and 2006. The expression $\eta_j \times d200j$ is a linear combination of the time dummies capturing the aggregate year-specific factors that would influence the change in $\tau_1$ or $\tau_2$. We estimate the empirical equation above using the fixed effect (FE) panel data method to control for firm-level unobserved heterogeneity $c_i$. However, it must be noted that in our context the empirical analysis based on the classic panel data difference-in-differences model might be unreliable since it is subject to an endogeneity (or self-selection) issue. If a firm's intensive exporting decision (i.e. to export more) encourages the firm to switch from indirect to direct exporting, then the $dExportingmode_{it}$ variable in the difference-in-differences equation is endogenous and the FE estimation is invalid.[26] We address the endogeneity issue using the instrumental variable approach. Specif-

[24] Figure 2 shows a more detailed description of the main idea and contributions of our work. The treatment is exactly what we define here.

[25] We define treatment as switching from indirect to direct exporting, and then evaluate relevant economic implication of this treatment. The choice of the treatment is not merely in line with the theory on the cost and benefit heterogeneity of alternative exporting modes, but also motivated by our data. It shown in our sample that on average the transition probability from indirect to direct exporting is double of that from direct to indirect exporting. To be specific, the average annual transition probability is 6.3% versus 3.5%. Thus, our data suggests that switching from indirect to direct exporting is a relatively more important than the reverse case, which also inspires us to focus on this phenomenon in the current study.

[26] Moreover, a selection problem might occur as a result of our first-differencing calculation in the FE method, when firms do not disappear from our sample but become unobserved for some periods (e.g. some firms stop

ically, we instrument the switch in the exporting mode variable $dExportingmode_{it}$ with the product of firms' initial productivity and province-level aggregate capital supply shock.[27] Exploring the idea proposed by Jarreau and Poncet (2014), we characterize aggregate capital supply using a financial market deepening variable, which is the market share of China's four biggest state-owned banks (namely, Industrial & Commercial Bank of China, Bank of China, China Construction Bank, and the Agricultural Bank of China) in total bank credits. A lower market share of these state banks in total bank credits implies a higher degree of financial market liberalization, and thus more financial access or capital supply for individual firms.[28] Since only province-level information on banking credits is available, we construct this variable for each province of China, thus all firms within a province share the same capital supply shock.

Second, we want to show the time-varying impact of the treatment augmented by financial credits on export values before and after the trade deregulation. As suggested by Meyer (1995) on treatment that is of higher-order interactions, we conduct our difference-in-difference-in-differences (DDD) estimation for multiple time periods:

$$\begin{aligned} y_{it} = \alpha + \eta_j \times d200j + \tau_1 \times dExportingmode_{it} + \tau_2 \times dExportingmode_i \times dWTO_t \\ + \tau_3 \times dExportingmode_{it} \times dWTO_t \times x_{it} + \mathbf{z}_{it}\gamma + c_i + u_{it}. \end{aligned} \tag{2}$$

In the DDD regression, we are interested in the triple interaction term of finance, treatment (switch in exporting mode), and policy intervention (before or after the WTO accession). All time and individual fixed effects are captured by $\{d200j, c_i\}$ in our fixed-effect panel regression. The remaining terms in the regression are the double interaction term of treatment and WTO accession (which characterizes the time variation in the treatment of interest) and the term for treatment *per se*. The dummy variable $WTO_t$ captures the impact of China's policy

exporting for a few years and re-enter later). Firms that stop exporting for a few years may not be as productive as constant exporters, thus the probability of their being observed is correlated with our independent variables, individual effect and the error term. Yet, the selection problem does not undermine our estimation because it leads to a downward bias and is less severe if the panel is short, which is just our case.

[27] A higher firm-level productivity implies a larger profit which covers the cost associated with entering international market and technology upgrading. We also think a higher regional capital supply shock might help to ease the financial needs of firm-level export mode switching. We carefully choose the IV components to reduce their correlations with our independent firm-level variables. We use firms' initial period productivity instead of current year productivity to avoid contemporaneous correlation, and interact it with province-level shocks to further mitigate the correlation at the firm level.

[28] In China, the market share of these big state banks in total bank credits was basically declining, which was a natural outcome following the gradual financial reforms since the 1990s. Primarily completed financial reforms include the promulgation of the Commercial Bank Law that provides a legal basis for changing the specialized state banks to state-owned commercial banks. It also meant the transformation of the share holding system in the four biggest state-owned banks, which helped establish a standardized corporate governance and an internal system of rights and responsibilities in accordance with the requirements for modern commercial banks. Other reforms like establishing privately owned small banks, accelerating interest rate liberalization, developing a deposit insurance scheme and improving financial institutions' market exit mechanism are already well underway.

change in exporting mode induced by the WTO accession; it equals 1 if the year is after 2001 (or 2002, or 2003, depending on how we divide the sample into pre- and post-WTO accession periods, since the trade deregulation was phased in rather than once for all). The variable $dExportingmode_i \times dWTO_t$ will be 1 if a firm switched from indirect to direct exporting and the year is later than 2001 (or 2002, or 2003). The coefficient $\tau_3$ measures the difference in average treatment effect promoted by financial credits before and after China's WTO accession across firms, i.e. the time-varying treatment effect promoted by finance. Again, we estimate the empirical equation above using the fixed-effect (FE) panel data methods to control for firm-level fixed effects and control for the endogeneity issue in switching exporting modes by using the instrumental variable method we introduced above.

# 4. Baseline Results and Robustness Checks

This section presents and discusses the empirical results of this paper. We begin with the panel data difference-in-differences estimation to show the increasing role of finance in promoting firm-level exports and productivity when a firm switches its exporting mode from indirect to direct export.[29] Next, we employ panel data difference-in-difference-in-differences estimation to examine how the role played by finance on switching firms varies over time, especially before and after China's WTO accession. For both types of estimation, we include the results with and without the instrumental variable to account for the endogeneity issue in switching exporting mode.

## 4.1. Panel Data Difference-in-Differences Estimates

Tables 4 and 5 show the difference-in-differences estimation results for firm-level export value with internal and external finance. We estimate four scenarios distinguished by two dimensions, that is, whether the switch in exporting mode is instrumented and whether firms' age and size (measured by firms' capital stock) are controlled for. As the young and small firms tend to rely more on financial credits to grow, we control for firm age and firm size to isolate the impact of export mode switching on firms' export performance.[30] Column 1 and 2 of Tables 4 and 5 present results for the scenarios without instrumenting the switch in exporting mode. It turns out that the estimates are barely changed when we control for firms' age and size. The estimates show that there is a significant increase in the role of financial credits in encourag-

[29] To account for the potential endogeneity issue of financial credits, we proxy the current value of finance by its first-order lagged value in all baseline estimations. We will further explore this issue using province-sector-level financial variables. Moreover, it is worthy to point out that we take log values for all continuous variables in our regressions.

[30] In all estimations, we also control for the yearly aggregate effect that would cause the changes in the difference-in-differences or difference-in-difference-in-differences estimates even in the absence of treatment, i.e. the switch in exporting mode.

ing firm's export value when the firm switches from indirect to direct exporting. Specifically, a 10% increase in internal (resp. external) finance in promoting firms' export value on average increases by 1.10% (resp. 1.72%) when the firm switches its exporting mode. Columns 3 and 4 indicate that after instrumenting the switching in exporting mode with the product of firm initial productivity and province-level capital supply shock, the average encouraging effect is even larger. Specifically, a 10% increase in internal (resp. external) finance boosts firm-level export value by 4.33% (resp. 2.93%) (controlling for firms' age and size makes no difference).[31]

The difference-in-differences estimation results for firm-level productivity with internal and external finance are presented in Tables 6 and 7. We consider the same four scenarios as in Tables 4 and 5. Also the estimates show that the increase in the encouraging effect of finance in promoting firms' productivity is both statistically and economically significant. In the scenarios without the instrumental variable for the switch in exporting mode (columns 1 and 2 of Tables 6 and 7), a 10% rise in internal (resp. external) finance on average increases firms' productivity by 0.14% (resp. 0.06%). If we use the instrumental variable, it indicates that the increase in firms' productivity will be 0.78% (resp. 0.66%), which is substantially larger than the OLS (ordinary least squares) estimates. Compared to the magnitudes for export values, it is suggestive that there is not a perfect transmission (i.e. incomplete pass-through) from the increase in firms' export value to that in productivity even though the transmission channel is positive.

Before moving on to the comparison between internal and external finance, we find it necessary to discuss the difference between OLS and IV estimates in Tables 4-7. A salient pattern in these tables is that the IV estimates are much larger than OLS estimates, with an inflation even more than fivefold in the case of productivity. We ascribe this difference to the fact that the instrumental variable method assigns more weights on firms that expect large gains from switching exporting modes and accumulating finance, thus inflating the average treatment effect from firm-specific or heterogeneous causal impact. To be specific, following the logic revealed in Imbens and Angrist (1994) and a recent application by Lileeva and Trefler (2010), we write the average treatment effect from OLS estimation as $\tau + \mathbf{E}(U)$, where $\tau$ is the same for all firms and $U$ is the firm-specific or heterogeneous causal impact. Differently, the (local) average treatment effect from IV estimation can be written as $\tau + \left(\mathbf{E}(U \times \Delta p)/\mathbf{E}(\Delta p)\right)$, where $\Delta p$ is the change in probability of switching exporting modes induced by the instrumental variable in the first stage estimation. $\Delta p$ acts as the weight used to average $U$ across firms. In the OLS case, the weight is the same across all firms since $\mathbf{E}(U)$ is estimated just using simple sample

[31] We implement the weak-identification test for all estimations with instrumental variables to address the potential weak-instrument problem following the routines proposed by Baum et al. (2007). As they suggest, it is better to use the robust analog of the Cragg-Donald (1993) F statistic, i.e. the *rk* Wald F statistic to replace the original Cragg-Donald F statistic. Though there does not exist a test for weak instruments in the presence of non-i.i.d. disturbances, the *rk* Wald F statistic is a sensible option as it is the state-of-the-art in the presence of heteroskedasticity, autocorrelation, or clustering. All of our IV estimations pass the weak-identification test, as the *rk* Wald F statistics are far larger than 10, which not only surpasses the critical values compiled by Stock and Yogo (2005) but also conforms to the "rule of thumb" of Staiger and Stock (1997).

average. Yet, the IV estimation puts more weight on firms that expect to gain substantially from switching exporting modes and accumulating finance, thus $\left(\mathbf{E}(U \times \Delta p)/\mathbf{E}(\Delta p)\right) > \mathbf{E}(U)$.

Noticeably, the difference-in-differences estimates in the internal and external finance cases are strikingly different. As for the export values, the IV estimation in Tables 4 and 5 shows that the case of internal finance produces much larger estimates. In specific, it turns out that the effect of a 10% increase in internal finance in promoting firm's export value on average increases by 1.81% (4.38% minus 2.57%) more than that of external finance when the firm switches exporting mode. This finding is consistent with the argument in Manova et al. (2015) that direct exporters are believed to be more dependent on outside funds than indirect exporters and domestic producers, in order to cover large entry and fixed costs when entering international markets. Take a representative firm as an example, it incurs large upfront entry and fixed costs (like studying the profitability of potential markets, product adjustment, and setting up distributional networks) when starting to export directly. Those once-for-all (to some extent at least) prepayments are substantial and could not be covered in general by firms' retained earnings or internal cash flows from routine operations. As a result, direct exporters typically rely more heavily on outside rather than internal financing to prepay entry and fixed costs. Alternatively, it means that external credit is more crucial in financing for entry and fixed costs of direct exporting. The variable costs of direct exporting (such as intermediate input, salaries, and equipment rental fees), however, are much less massive in a short time window, which leaves plentiful room for internal finance to take effect. Since export value is a flow variable and the associated costs are variable costs, we should expect internal finance will have a larger impact than external finance. Our difference-in-differences estimates provide solid support for this argument.

As for the productivity, Tables 6 and 7 show that the internal finance case produces much greater estimates again. To be specific, it turns out that a 10% increase in internal finance promotes firm's productivity on average by 0.12% (0.78% minus 0.66%) more than that of external finance when the firm switches its exporting mode. This is consistent with the case for export values above. We find two reasons are potentially responsible for the smaller promoting role of external finance in raising firms' productivity. First, as more external finance is allocated to cover entry and fixed costs, most of the increase in external finance cannot be counted as capital. It in turn means that the external finance is primarily not relevant for firms' production process, at least in a sense of direct relevance. Second, even though some part of the external finance that is used in exporting could be counted as capital (like the part for making market-specific investments in capacity and product adjustment), it basically helps firms upgrade product composition rather than directly helping firms produce more products. Since our revenue productivity measure cannot reflect the upgrade in product composition, external finance exhibits a smaller promoting role in our regressions.

## 4.2. Panel Data Difference-in-Difference-in-Differences Estimates

In Tables 8 and 9, we report the results for the difference-in-difference-in-differences estimation of export value with financial credits.[32] To save space, we report only the IV estimation results. Estimations capture the changes in the promoted impact of treatment (firm switches from indirect into direct exporter) by finance on firms' exporting value before and after China's WTO accession. Since the WTO accession and associated trade deregulation was phased in, we consider different threshold years to divide our whole sample (2000-2006) into pre- and post-WTO accession periods. Specifically, as discussed in the policy background, we consider three threshold years: 2002, 2003, and 2004. Above all, Tables 8 and 9 show that the estimates basically remain unchanged when we control for firms' age and size. Specifically, we find an increasing treatment effect of finance on switchers' exports, i.e. relative to exporters that switch their exporting mode in the pre-WTO accession period, financial credits increase firm-level exports more for firms that switch exporting mode in the post-WTO accession period, no matter how we distinguish pre- and post-WTO accession periods. This increase in the augmented treatment effect by finance substantiates the time-varying hypothesis of this paper. Export distortion is a possible interpretation for the time-varying impact of financial credits: i.e., in the pre-WTO accession period, export licenses in favor of larger and state-owned enterprises (SOEs). At the meanwhile, more productive but financially constrained PDEs have to export through intermediaries.[33] Switchers are less financial constraint firms, but not necessary firms that expect larger export or productivity growth after switching export mode. When the distortion has been alleviated in the post-WTO accession period, firms that expect larger export growth switch exporting mode, which leads to an increasing impact of financial credits.

Tables 8 and 9 also show that the increase in the promoting effect of finance on firms' exporting value is larger when we choose an earlier threshold year to divide our sample into pre- and post-WTO accession periods. If we treat 2002-2006 as the post-WTO accession period, the treatment effect on firm's export value augmented by doubling internal (resp. external) finance will be on average quadrupled (resp. ninefold) when the firm is observed switching in the post-WTO accession period rather than in the pre-WTO accession period. More specifically, conditioning on that a firm switches exporting mode, a 10% increase in firm-level internal (resp. external) finance on average leads to a 38.97% (resp. 86.63%) more export sales in the post-WTO accession period if we set the threshold year to 2001. When we postpone the threshold year to 2003, the average increase in export values promoted by a 10% increase in internal (resp. external) finance falls substantially to 9.84% (resp. 27.69%). And it is further decreases

[32] Since we concentrate on investigating the time-varying impact of finance on firm export performance in this study, to save space, we do not present DDD estimates for firm productivity as we do so for the DID case. However, it is necessary to mention that we get negative DDD estimates for productivity, which can be rationalized via a "negative selection" proposed by Lileeva and Trefler (2010). It basically says that when initially more productive PDEs switch to direct exporting in the post-WTO accession, productivity growth is expected to be slower.

[33] Khandelwal et al. (2013) find that before the quota removal of textile and cloth products in China, SOEs are more likely to obtain quotas than other firms, but they are featured with low production efficiency.

to 6.18% (resp. 26.24%) if the threshold year is 2004 for the internal (resp. external) finance case. The differences resulting from the choice of the critical years are related to the fact that China's deregulation in direct exporting rights is a gradual process.[34] It allowed different groups of firms to satisfy the direct exporting requirement in each year. As discussed in Section 2, the registered capital requirement in direct exporting for PDEs dropped dramatically from 8.5 million yuan (or 5 million yuan if the firm was publicly owned) to 3 million yuan in 2001, which grants a great number of PDEs to be eligible to export directly in our sample. When those credit-constrained PDEs started to export directly in 2002, they were enormously more in need of finance than previous direct exporters that were primarily non-constrained SOEs. As a consequence, a boost in the encouraging role of finance on firm exporting value occurs when many PDEs were enfranchised to export for the first time. The encouraging role then fell quickly in later years because the further deregulation just released more PDEs with lower registered capital to export directly. Those PDEs essentially were similar as the enfranchised PDEs in 2002, though a bit more credit constrained due to their smaller scale and thus still generating positive estimates when a later critical year is chosen.

One surprise is that we observe a higher increase in the promoting role of external finance than internal finance in our difference-in-difference-in-differences estimation for export values, no matter how we choose the threshold year for dividing pre- and post-WTO accession periods. Since the difference is along the time dimension, it might reflect that firms' access to internal finance was self-determined and largely unchanged in pre- and post-WTO accession periods, yet the access to external finance has been greatly improved with concurrent financial reforms. The relaxation in acquiring banking and trade credits thus provides a greater possibility for external finance to make a contribution.

## 4.3. Utilization of Finance Matters

In this section, we investigate the firm-level heterogeneous efficiency in utilizing finance to uncover the mechanism that results in our difference-in-differences and difference-in-difference-in-differences regression results. To this end, we construct four types of measure related to firms' usage of finance, and check how they change when firms engage in switching from indirect to direct exporting.

Working capital management has long been regarded as an effective way to increase firms' profitability (e.g., Shin and Soenen, 1998; Petersen and Rajan, 1997; Deloof, 2003; Eljelly, 2004). The four measures that characterize the efficiency of firms' usage of finance are current liquidity ratio, receivable turnover ratio, inventory turnover ratio, and operation cycle (Eljelly, 2004; Ding et al., 2013). First, current liquidity ratio ($CL_{it}$) is the ratio of liquid liability ($LL_{it}$) to liquid assets ($LA_{it}$), i.e. $CL_{it} = \frac{LL_{it}}{LA_{it}}$ expresses a company's ability to repay short-term creditors out of its total cash. A lower liquidity ratio indicates that a company is more

[34] It is equivalent to treating the elimination of export distortion as a gradual process.

liquid and has better coverage of outstanding debts, thus suggesting a higher efficiency in managing liquidity. Second, receivable turnover ratio ($RT_{it}$) is the ratio of net credit sales ($NCS_{it}$) to average accounts receivable ($AR_{it}$) in previous and current periods, i.e. $RT_{it} = 2 \times \frac{NCS_{it}}{AR_{i,t-1}+AR_{it}}$. It quantifies a firm's effectiveness in extending credit and in collecting debts on that credit. The receivable turnover ratio is an activity ratio measuring how efficiently a firm uses its assets. Third, inventory turnover ratio ($IT_{it}$) is defined as current sales ($S_{it}$) divided by average inventory ($IN_{it}$) in recent two periods, i.e. $IT_{it} = 2 \times \frac{S_{it}}{IN_{i,t-1}+IN_{it}}$. It is a ratio showing how many times a company's inventory is sold and replaced over a single period. A high turnover implies strong sales and, therefore, weak inventory, which then indicates that the firm is more efficient at generating returns from its assets and thus maintaining healthy financial conditions. Fourth, operation cycle ($OC_{it}$) is the sum of two parts, days receivables outstanding and days inventory outstanding within a year, that is, $OC_{it} = \frac{365}{RT_{it}} + \frac{365}{IT_{it}}$. It is also known as the cash conversion cycle, measuring how long a firm takes to convert it sales into cash holdings. A shorter operation cycle means better management performance and more efficiency in utilizing cash.

Figure 3 plots the dynamic paths of four financial variables defined above. It shows that, over the period 2001-2004 when the trade deregulation on direct exporting rights phased in, switchers exhibit higher efficiency and larger efficiency gains in finance usage than indirect exporters, where switchers are firms switching from indirect to direct exporters while non-switchers are constant indirect exporters. In specific, switchers not only have lower liquidity ratio but also exhibit a steeper decline than non-switchers, from 1.08 to 1.04 versus from 1.10 to 1.09. Similar patterns apply to inventory turnover ratio and operation cycle. Switchers have a higher inventory turnover ratio and shorter operation cycle. They also experience a steeper increase in their inventory turnover ratio and more significant drop in operation cycle. One exception is that the receivable turnover rate divergence between switchers and non-switchers occurs after 2005, rather than over the phase-in period of 2001-2004. This might be caused by the aggressive expansion of direct exporters when the direct exporting was fully liberalized. In that case, direct exporters tend to sell aggressively even when they cannot receive payments immediately, which then leads to massively accumulated accounts receivable and suppresses the receivable turnover ratio.

We further run panel data difference-in-differences regressions for all the four types of financial variables. As in the baseline case, the treatment is defined as the switch from indirect to direct exporting. Results are reported in Table 10. It reveals that exporters experience lower liquidity ratios, higher inventory turnover, and operation cycle when they switch from indirect to directing exporting, in comparison with the case where firms continue as constant indirect exporters. As for the receivable turnover rate, the treated group barely gains any efficiency. The coefficient is not significant, neither statistically nor economically.

The efficiency measures of finance utilization strongly suggest that switchers are better users of financial credits, which helps to explain the positive average treatment effect in our

DID regressions. This finding is highly consistent with the learning channel for direct exporters. First, switchers need to effectively utilize finance to support the learning process. After switching into direct exporting, firms have access to frequent contacts with foreign consumers and producers (see Egan and Mody, 1992, for more details), which encourages them to better design products and raise competitiveness via technology upgrading. All the learning activities require support from more finance, thus in turn urging firms to more efficiently exploit existing financial credits that typically are scare when firms are serving international markets. Second, direct exporting brings about better growth opportunities for productivity and demand, the higher expected returns also spur switchers to hike finance utilization rates. Bai et al. (2017) demonstrate that direct exporting generates much more favorable productivity and demand evolution for switchers. In that case, a profit-maximizing firm will naturally be incentivized to speed the velocity of financial credits so that it can reap more future benefits from exporting given a fixed amount of financial credits.

The channel of finance utilization also works well to explain our main findings in the panel data difference-in-difference-in-differences estimation. Relative to continuing indirect exporters, firms that switch their exporting mode from indirect to direct export, on average, have higher efficiency in utilizing finance. As such, we would expect a higher efficiency gain in the post-WTO accession period when more PDEs participated in this type of switch, since these PDEs are firms which are financial constrained but have large expected export or productivity growth after switching from indirect to direct exporting. This type of switchers has higher efficiency in finance usage. When finance is more difficult to acquire for PDE firms, we also naturally anticipate that they would even more efficiently utilize financial credits. The ulteriorly increased efficiency in utilizing finance thus lends support for our time-varying finding that the encouraging effect of finance on firm exporting is further heightened in the post-WTO accession period.

## 4.4. Robustness Checks

We further check the robustness of our baseline results above in this subsection. We shall show that a more rigorous proxy for endogenous firm-level financial credits that captures relatively exogenous variation in these variables does not change our main findings. We follow the idea of Manova et al. (2015) to proxy firm-level internal and external finance with sectoral counterparts. We expand it to province-sector-level proxies to generate more reasonable variation in finance, which can then be employed to identify the augmented treatment effect from firms' financial credits.

Tables 11-12 tabulate the panel data difference-in-differences estimates for export value, comparable to Tables 4-5. It is revealed that proxy firm-level finance using province-sector level counterparts marginally change our baseline results. The statistical significance keeps unchanged and economic magnitude is just slightly changed. We still have the conclusion

that on average the encouraging effect of finance on firms' export value increases when a firm switches its exporting mode, and the results are robust to including more controls like age and size, and instrument the potentially endogenous treatment with the product of firm's initial productivity and provincial capital supply shock. Tables 13-14 confirm the robustness of our baseline results in Tables 6-7 for firms' productivity, i.e. TFPR. They exhibit marginally changed estimates, and the main conclusion we drew previously still holds, that the encouraging effect of finance on productivity is higher when the firms engage into the switch from indirect to direct exporting. Moreover, it still shows an incomplete pass-through from gains in export value to gains in productivity.

In Tables 15-16, we present the panel data difference-in-difference-in-differences estimates using province-sector-level proxies for firm-level financial credits. The results are highly comparable to those in Tables 8-9, with only a sensible change in magnitudes. It reinforces our baseline finding that the increased encouraging effect of finance on firm's export value and productivity is higher when the firm switches from indirect into direct exporter and if the firm is observed in the post-WTO accession period. The results are robust to how we separate pre- and post- WTO accession periods. It also underscores a declining difference-in-difference-in-differences estimate when we choose a later cutoff year to separate pre- and post-WTO accession periods, which essentially reflects the phase-in feature of China's deregulation on directing exporting rights.

# 5. Conclusions

This paper examines the time-varying feature of the impacts of finance on firm exporting behaviors when a firm switches from indirect to direct exporting mode in the context of China's WTO accession. To fulfill WTO accession commitments, China gradually lifted the restriction in direct exporting rights over the period 2001-2004. It is noticeable that the regulation on exporting modes primarily inhibited PDEs from exporting directly while more SOEs were exempted, as their registered capital requirements were quite different. Direct exporters feature more favorable future outcomes, e.g. productivity and demand stock growth (Bai et al., 2017). Using panel survey data, we show that financial credits improve the firm-level exports and productivity more for firms that switch from indirect to direct exporting.

Knowing that PDE firms were typically credit constrained, we conjecture that the impact of financial credits on firm exports when the firm switches from indirect to direct exporting mode would be larger after China's WTO accession. This is because that many more PDEs were granted the opportunity to engage in direct exporting and the direct exporting typically incurs massive additional fixed/variable costs cost as well as subsequent investment in upgrading technology.

Using a panel data difference-in-difference-in-differences approach combined with instru-

mental variable methods to control for potential endogeneity issues associated with the switch in exporting modes, we find strong evidence to substantiate our time-varying hypothesis. The difference-in-difference-in-differences estimation produces a further increase in the role of finance in promoting firms' export value in the post-WTO accession period. The main results remain unchanged after controlling for possible endogeneity.

Though we are focusing on the time-varying impact of finance on firm performance, our work has strong implications in two dimensions. First, we show the heterogeneous impact of financial credits on different firms. We demonstrate that finance could make a pivotal contribution to firm-level exports and productivity growth when firms have a higher efficiency in finance usage. Second, our study implies additional welfare gains of trade liberalization. Our empirical findings suggest that when distortions exist, trade liberalization is an effective way to eliminate the distortion. Further, the elimination of distortions makes financial markets play a more pronounced role in improving firm-level exports, which results in additional welfare gains as export share further increases.

# References


[1] Ackerberg, D. A., K. Caves and G. Frazer 2015. "Identification Properties of Recent Production Function Estimators." *Econometrica*, ***83***, 2411-51.

[2] Ahn, J., A. K. Khandelwal, and S. J. Wei 2011. "The Role of Intermediaries in Facilitating Trade." *Journal of International Economics*, ***84***, 73-85.

[3] Amiti, M. and D. Weinstein 2011. "Exports and Financial Shocks." *Quarterly Journal of Economics*, ***126*** (4), 1841-77.

[4] Arkolakis, C. 2011. "Market Penetration Costs and the New Consumers Margin in International Trade." *Journal of Political Economy*, ***118*** (6), 1151-1199.

[5] Arkolakis, C., A. Costinot, and A. Rodriguez-Clare 2012. "New Trade Models, Same Old Gains?" *American Economic Review*, ***102*** (1), 94-130.

[6] Alvarez, R. and R. A. López 2005. "Exporting and Performance: Evidence from Chilean Plants." *Canadian Journal of Economics*, ***38*** (4), 1384-1400.

[7] Aw, B.Y., S. Chung, and M. Roberts 2000. "Productivity and Turnover in the Export Market: Micro Evidence from Taiwan and South Korea." *World Bank Economic Review*, ***14*** (1): 1-65.

[8] Aw, B.Y., Y. Xu, and M. Roberts. 2011. "R&D Investment, Exporting, and Productivity Dynamics." *American Economic Review*, ***101*** (4), 1312-1344.

[9] Bai, X., K. Krishna, and H. Ma 2015. "How You Export Matters: Export Mode, Learning and Productivity in China." *NBER Working Paper*, No. 21164.

[10] Bai, X., K. Krishna, and H. Ma 2017. "How You Export Matters: Export Mode, Learning and Productivity in China." *Journal of International Economics*, ***104***, 122-137.

[11] Baum, C.F., M. E. Schaffer, and S. Stillman 2007. "Enhanced Routines for Instrumental Variables / Generalized Method of Moments Estimation and Testing." *Stata Journal*, ***7***, 465-506.

[12] Berman, N. and J. Héricourt 2010. "Financial Factors and the Margins of Trade: Evidence from Cross-country Firm-level Data." *Journal of Development Economics*, ***93***, 206-17.

[13] Bernard, A. B., E. J. Blanchard, I. Van Beveren, and H. Y. Vandenbussche 2012. "Carry-along Trade." *NBER Working Paper*, No. 18246.

[14] Bernard, A. B., I. Van Beveren, and H. Y. Vandenbussche 2010. "Multi-product Exporters, Carry-along Trade and the Margins of Trade." *National Bank of Belgium Working Paper*, No. 203.

[15] Brandt, L., J. Van Biesebroeck, and Y. Zhang 2012. "Creative Accounting or Creative Destruction? Firm-level Productivity Growth in Chinese Manufacturing." *Journal of Development Economics*, ***97***, 339-51.

[16] Brandt, L., J. Van Biesebroeck, L. Wang, and Y. Zhang 2017. "WTO Accession and Performance of Chinese Manufacturing Firms." *American Economic Review*, ***107*** (9), 2784-2820.

[17] Campa, J. M., and J. M., Shaver 2002. "Exporting and Capital Investment: On the Strategic Behavior of Exporters." *Iese Research Papers*.

[18] Channey, T. 2016. "Liquidity Constraint Exporters." *Journal of Economic Dynamics and Control*, ***72***, 141-154.

[19] Chen, M. and A. Guariglia 2013. "Internal Financial Constraints and Firm Productivity in China: Do Liquidity and Export Behavior Make a Difference?" *Journal of Comparative Economics*, ***41*** (4), 1123-40.

[20] Cragg, J. G. and S. G. Donald 1993. "Testing Identifiability and Specification in Instrumental Variables Models." *Econometric Theory*, ***9*** (2), 222-40.

[21] Dai, M., M. Maitra, and M. Yu 2016. "Unexceptional Exporter Performance in China? The Role of Processing Trade." *Journal of Development Economics*, ***121***, 177-89.

[22] Dai, M., and M. Yu 2013. "Firm R&D, Absorptive Capacity and Learning by Exporting: Firm-Level Evidence from China." *World Economy*, ***36*** (9), 1131-1145.

[23] De Loecker, J. 2007. "Do Exporters Generate Higher Productivity? Evidence from Slovenia." *Journal of International Economics*, ***73***, 69-98.

[24] De Loecker, J. 2013. "Detecting Learning by Exporting." *American Economic Journal: Microeconomics*, ***5*** (5), 1-21.

[25] Deloof, M. 2003. "Does Working Capital Management Affect Profitability of Belgian Firms?" *Journal of Business Finance & Accounting*, ***30***, 573-588.

[26] Ding, S., A. Guariglia and J. Knight 2013. "Investment and Financing Constraints in China: Does Working Capital Management Make a Difference?" *Journal of Banking & Finance*, ***37*** (5), 1490-1507.

[27] Egan, M., and A. Mody 1992. "Buyer-Seller Links in Export Development." *World Development*, ***20*** (3), 321-334.

[28] Eljelly, A. 2004. "Liquidity-Profitability Tradeoff. An Empirical Investigation in an Emerging Market." *International Journal of Commerce and Management*, ***14*** (2), 48-61.

[29] Feenstra, R. C., Z. Li, and M. Yu 2014. "Exports and Credit Constraints Under Incomplete Information: Theory and Evidence from China." *Review of Economics and Statistics*, ***96*** (4), 729-44.

[30] Guariglia, A., X. Liu, and L. Song 2011. "Internal Finance and Growth: Microeconometric Evidence on Chinese Firms." *Journal of Development Economics*, ***96***, 79-94.

[31] Girma, S., D. Greenaway, and R. Kneller 2004. "Does Exporting Increase Productivity? A Microeconomic Analysis of Matched Firms." *Review of International Economics*, ***12*** (5), 855-66.

[32] Greenaway, D., A. Guariglia, and R. Kneller 2007. "Financial Factors and Exporting Decisions." *Journal of International Economics*, ***73***, 377-95.

[33] Garcia-Marin A. and N. Voigtländer 2017. "Exporting and Plant-Level Efficiency Gains: It's the Measure" *Working Paper*.

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

[35] Imbens, G. W. and J. D. Angrist 1994. "Identification and Estimation of Local Average Treatment Effects." *Econometrica*, ***62*** (2), 467-475.

[36] Imbens, G. W. and J. Wooldridge 2007. "What's New in Econometrics: Difference-in-Differences Estimation." *NBER Summer Institute Econometric Lectures*.

[37] Jarreau, J. and S. Poncet 2014. "Credit Constraints, Firm Ownership and the Structure of Exports in China." *International Economics*, ***139*** (4), 152-73.

[38] Khandelwal, A., P. Schott, and S. J. Wei 2013. "Trade Liberalization and Embeded Institutional Reform: Evidence from Chinese Exporters." *American Economic Review*, ***103*** (6), 2169-95.

[39] Kraay, A. 1999. "Exports and Economic Performance: Evidence from a Panel of Chinese Enterprises." *mimeo*, World Bank.

[40] Lileeva, A. and D. Trefler 2010. "Improved Access to Foreign Markets Raises Plant-level Productivity···For Some Plants." *Quarterly Journal of Economics*, ***125*** (3), 1051-1099.

[41] Levinsohn, J. and A. Petrin 2003. "Estimating Production Functions Using Inputs to Control for Unobservables." *Review of Economic Studies*, ***70***, 317-41.

[42] Manova, K. 2013. "Credit Constraints, Heterogeneous Firms, and International Trade." *Review of Economic Studies*, ***80***, 711-44.

[43] Manova, K., S. J. Wei, and Z. Zhang 2015. "Firm Exports and Multinational Activity under Credit Constraints." *Review of Economics and Statistics*, ***97*** (3), 574-88.

[44] Manova, K. and Z. Yu 2016. "How Firms Export: Processing vs. Ordinary Trade with Financial Frictions." *Journal of International Economics*, ***100***, 120-137.

[45] Manova, K. and Z. Zhang 2012. "Export Prices across Firms and Destinations." *Quarterly Journal of Economics*, ***127*** (1), 379-436.

[46] Melitz, M., and S. J. Redding 2015. "New Trade Models, New Welfare Implications. " *American Economic Review*, ***105*** (3), 1105-1146.

[47] Meyer, B. D. 1995. "Natural and Quasi-experiments in Economics." *Journal of Business and Economic Statistics*, ***13*** (2), 151-61.

[48] Minetti, R. and S. C. Zhu 2011. "Credit Constraints and Firm Export: Microeconomic Evidence from Italy." *Journal of International Economics*, ***83***, 109-25.

[49] Olley, S. and A. Pakes 1996. "The Dynamics of Productivity in the Telecommunications Equipment Industry." *Econometrica*, ***64***, 1263-97.

[50] Petersen, M. and R. G. Rajan 1997. "Trade Credit: Theories and Evidence" *Review of Financial Studies*, ***10(3)***, 661-691.

[51] Shin, H. and L. Soenen 1998. "Efficiency of Working Capital Management and Corporate Profitability" *Finacial Practice and Education*, ***8*** (2), 37-45.

[52] Staiger, D. and J. H. Stock 1997. "Instrumental Variables Regression with Weak Instruments." *Econometrica*, ***65*** (3), 557-86.

[53] Stock, J. and M. Yogo 2005. "Testing for Weak Instruments in Linear IV Regression." In: *Andrews DWK Identification and Inference for Econometric Models*, New York: Cambridge University Press.

[54] Van Biesebroeck, J. 2006. "Exporting Raises Productivity in Sub-Saharan African Manufacturing Firms." *Journal of International Economics*, ***67*** (2), 373-91.

[55] Wooldridge, J. W. 2009. "On Estimating Firm-level Production Functions Using Proxy Variables to Control for Unobservables." *Economics Letters*, ***104***, 112-4.

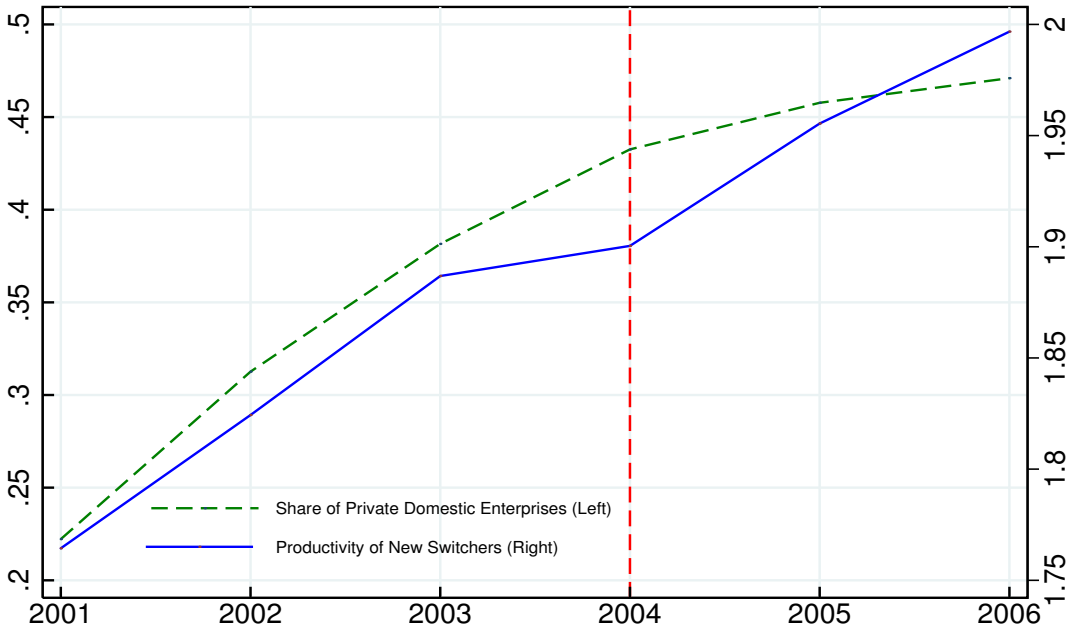


**Figure 1. Share of PDEs and their average productivity, 2001-2006.**

*Notes*. Share of private domestic enterprises is the share of private-domestic-enterprise (PDE) direct exporters in the pool of all direct exporters. Productivity of new switchers is the average productivity of firms that newly switch from indirect to direct exporting. The red dash line confines the period when China lifted its regulation on direct exporting rights, that is, 2004.

***Part I: Main Story of Our Work***

⇓

**Explained Variable:** Exporting Values

↓

**Treatment Effect**
**Treatment Group:** Indirect Exporters Who Switch to Direct Ones
**Control Group:** Indirect Exporters Who Remain as Indirect Ones

↓

**Goal 1:** Exploring How Finance Affects the Treatment Effect

↓

**Methodology:** Panel-data DID Method Is Applied

↓

**Goal 2:** Exploring How the Effect of Finance above Is Affected by the WTO Accession
**Pre-WTO Accession:** Many PDEs Are Not Allowed To Export Directly
**Post-WTO Accession:** More PDEs Are Allowed To Export Directly

↓

**Methodology:** Panel-data DDD Method Is Applied

⇓

***Part II: Main Results of Our Work***

⇓

**Contribution 1:** We Identify an Augmented Treatment Effect on the Treated Where Finance Promotes More Exports for Firms When They Switch from Indirect to Direct Exporting

↓

**Contribution 2:** We Reveal That the Encouraging Effect of Finance for the Treated Group is Greater after China's WTO Accession When More PDE Firms Are Engaged in Direct Exporting

**Figure 2: The Main Idea and Contributions of Our Work.**

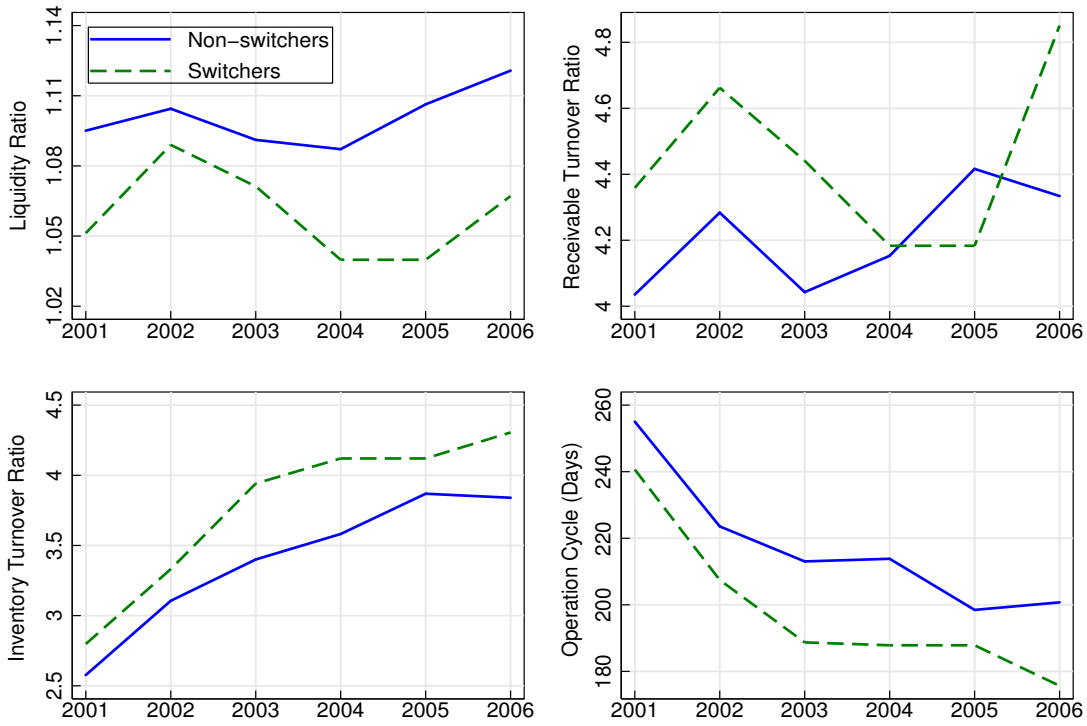


**Figure 2. Four measures of firms' efficiency in utilizing finance, 2001-2006.**

*Notes*. Non-switchers are indirect exporters in both previous and current periods. Switchers are firms switching from indirect exporters in the previous period to direct exporters in the current period. Since the construction of receivable turnover ratio and inventory turnover ratio requires lagged variables, the four financial variables start from 2001.

**Table 1. Basic Statistical Summary of the ASIP Data set**

| Year | Number of Firms | Number of Exporters | TFPR | TFPR of Exporters | Value Added | Value Added of Exporters | Employment Value | Capital Stock | Intermediate Input |
|---|---|---|---|---|---|---|---|---|---|
| 2000 | 146,898 | 36,759 | 1.46 | 1.62 | 14,105 | 28,573 | 354 | 25,247 | 39,597 |
| 2001 | 153,958 | 39,997 | 1.55 | 1.71 | 14,833 | 28,992 | 296 | 24,348 | 41,570 |
| 2002 | 165,491 | 44,886 | 1.64 | 1.77 | 16,600 | 31,738 | 287 | 24,274 | 45,893 |
| 2003 | 180,696 | 50,534 | 1.73 | 1.83 | 19,410 | 37,006 | 276 | 24,294 | 55,254 |
| 2004 | 258,390 | 76,482 | 1.79 | 1.88 | 17,235 | 31,645 | 224 | 20,400 | 49,465 |
| 2005 | 250,467 | 74,250 | 1.85 | 1.91 | 21,492 | 38,993 | 240 | 24,123 | 59,697 |
| 2006 | 278,014 | 78,052 | 1.9 | 1.95 | 24,101 | 45,515 | 229 | 25,227 | 65,822 |

*Notes*. As in Hsieh and Klenow (2009), TFPR is dimensionless; value added is measured in thousand yuan; labor is measured in persons; capital and intermediate inputs are measured in thousand yuan.

**Table 2. Basic Statistical Summary of the Customs Data set**

| Year | Number of Observations | Number of Firms | Export Value | Total Destinations | Average Destinations | Number of Products |
|---|---|---|---|---|---|---|
| 2000 | 1,882,359 | 62,746 | 29,6791.4 | 213 | 6.9 | 30 |
| 2001 | 2,121,515 | 68,487 | 286,292.2 | 222 | 7.3 | 30.9 |
| 2002 | 2,613,005 | 78,612 | 270,810.7 | 222 | 7.5 | 33.2 |
| 2003 | 3,243,538 | 95,686 | 276,459.1 | 220 | 7.8 | 33.9 |
| 2004 | 4,029,789 | 120,590 | 297,836.6 | 220 | 8.3 | 33.4 |
| 2005 | 5,103,048 | 144,030 | 298,019.1 | 221 | 8.3 | 35.4 |
| 2006 | 6,187,856 | 171,144 | 301,018.7 | 220 | 8.1 | 36.2 |

*Notes*. Export value is measured in thousand yuan.

**Table 3. Three Types of Firms in the Matched Dataset**

| Year | Exporting Mode | Number of Firms | Mean TFPR | Custom Export Value | Average Destinations |
|---|---|---|---|---|---|
| 2000 | Direct | 15,639 | 1.63 | 55,120.52 | 6.46 |
| | Indirect | 21,120 | 1.47 | 26,580.81 | |
| | Nonexporters | 106,994 | 1.37 | | |
| 2001 | Direct | 17,957 | 1.71 | 55,482.69 | 7.00 |
| | Indirect | 22,040 | 1.53 | 26,678.49 | |
| | Nonexporters | 110,188 | 1.48 | | |
| 2002 | Direct | 21,157 | 1.77 | 60,235.41 | 7.66 |
| | Indirect | 23,729 | 1.65 | 29,911.51 | |
| | Nonexporters | 115,891 | 1.57 | | |
| 2003 | Direct | 25,392 | 1.85 | 68,748.30 | 8.27 |
| | Indirect | 25,142 | 1.74 | 37,509.51 | |
| | Nonexporters | 124,233 | 1.66 | | |
| 2004 | Direct | 41,392 | 1.88 | 64,746.70 | 8.09 |
| | Indirect | 37,431 | 1.81 | 37,237.03 | |
| | Nonexporters | 174,321 | 1.73 | | |
| 2005 | Direct | 38,683 | 1.93 | 78,127.19 | 9.21 |
| | Indirect | 35,567 | 1.85 | 47,413.39 | |
| | Nonexporters | 166,285 | 1.78 | | |
| 2006 | Direct | 41,944 | 1.97 | 90,630.63 | 9.81 |
| | Indirect | 36,109 | 1.91 | 61,387.64 | |
| | Nonexporters | 188,714 | 1.84 | | |

*Notes*. As in Hsieh and Klenow (2009), TFPR is dimensionless; custom export value is measured in thousand yuan.

**Table 4. Difference-in-Differences Estimation for Export Value with Internal Finance**

| Dependent Variable (horizontal) | Export Value (1) | Export Value (2) | Export Value (3) | Export Value (4) |
|---|---|---|---|---|
| *dExportingmode* × *internalfinance* | 0.1096*** [0.0376] | 0.1097*** [0.0376] | | |
| *dExportingmode_IV* × *internalfinance* | | | 0.4261** [0.2109] | 0.4332** [0.2168] |
| Year Fixed Effect | YES | YES | YES | YES |
| Age | NO | YES | NO | YES |
| Size | NO | YES | NO | YES |
| R Squared | 0.14 | 0.14 | 0.14 | 0.14 |
| Number of Observations | 25,728 | 25,721 | 25,576 | 25,569 |

**Table 5. Difference-in-Differences Estimation for Export Value with External Finance**

| Dependent Variable (horizontal) | Export Value (1) | Export Value (2) | Export Value (3) | Export Value (4) |
|---|---|---|---|---|
| *dExportingmode* × *externalfinance* | 0.1728*** [0.0291] | 0.1723*** [0.0291] | | |
| *dExportingmode_IV* × *externalfinance* | | | 0.2892** [0.1358] | 0.2931** [0.1439] |
| Year Fixed Effect | YES | YES | YES | YES |
| Age | NO | YES | NO | YES |
| Size | NO | YES | NO | YES |
| R Squared | 0.15 | 0.15 | 0.15 | 0.15 |
| Number of Observations | 25,602 | 25,594 | 25,476 | 25,468 |

*Notes*. Robust standard errors in bracket; export value is measured in thousand yuan; year-fixed effect is a linear combination of year dummies for 2001-2006; size is measured by firms' capital stock; *dExportingmode_IV* is constructed as the product of firm-level initial productivity and province-level aggregate capital supply shock; *, *** indicate significance at the 10% and 1% confidence level, respectively.

**Table 6. Difference-in-Differences Estimation for TFPR with Internal Finance**

| Dependent Variable (→) | TFPR | TFPR | TFPR | TFPR |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *dExportingmode* × | 0.0144*** | 0.0142*** | | |
| *internalfinance* | [0.0047] | [0.0047] | | |
| *dExportingmode_IV* × | | | 0.0778*** | 0.0783*** |
| *internalfinance* | | | [0.0084] | [0.0084] |
| Year Fixed Effect | YES | YES | YES | YES |
| Age | NO | YES | NO | YES |
| Size | NO | YES | NO | YES |
| R Squared | 0.03 | 0.03 | 0.02 | 0.03 |
| Number of Observations | 37,630 | 37,618 | 37,438 | 37,426 |

**Table 7. Difference-in-Differences Estimation for TFPR with External Finance**

| Dependent Variable (→) | TFPR | TFPR | TFPR | TFPR |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *dExportingmode* × | 0.0064* | 0.0064* | | |
| *externalfinance* | [0.0037] | [0.0037] | | |
| *dExportingmode_IV* × | | | 0.0655*** | 0.0659*** |
| *externalfinance* | | | [0.0072] | [0.0072] |
| Year Fixed Effect | YES | YES | YES | YES |
| Age | NO | YES | NO | YES |
| Size | NO | YES | NO | YES |
| R Squared | 0.03 | 0.03 | 0.02 | 0.02 |
| Number of Observations | 37,460 | 37,447 | 37,274 | 37,261 |

*Notes*. Robust standard errors in bracket; TFPR is dimensionless; year-fixed effect is a linear combination of year dummies for 2001-2006; size is measured by firms' capital stock; *dExportingmode_IV* is constructed as the product of firm-level initial productivity and province-level aggregate capital supply shock; *, *** indicate significance at the 10% and 1% confidence level, respectively.

**Table 8. Difference-in-Difference-in-Differences Estimation for Export Value with Internal Finance**

| Dependent Variable (→) | Export Value (2002) | Export Value (2002) | Export Value (2003) | Export Value (2003) | Export Value (2004) | Export Value (2004) |
|---|---|---|---|---|---|---|
| *dExportingmode_IV* × | | | | | | |
| *internalfinance* × | 3.8972*** | 3.8880*** | 0.9837*** | 0.9725*** | 0.6182** | 0.6157** |
| *dWTO* | [0.7758] | [0.7761] | [0.3412] | [0.3414] | [0.2733] | [0.2731] |
| Year Fixed Effect | YES | YES | YES | YES | YES | YES |
| Age | NO | YES | NO | YES | NO | YES |
| Size | NO | YES | NO | YES | NO | YES |
| R Squared | 0.18 | 0.18 | 0.16 | 0.16 | 0.18 | 0.18 |
| Number of Observations | 25,593 | 25,586 | 25,593 | 25,586 | 25,593 | 25,586 |

*Notes*. Robust standard errors in bracket; export value is measured in thousand yuan; 2002, 2003, 2004 in parenthesis denote the critical years that we use to define *dWTO*; year-fixed effect is a linear combination of year dummies for 2001-2006; size is measured by firms' capital stock; *dExportingmode_IV* is constructed as the product of firm-level initial productivity and province-level aggregate capital supply shock; **, *** indicate significance at the 5%, 1% confidence level, respectively.

**Table 9. Difference-in-Difference-in-Differences Estimation for Export Value with External Finance**

| Dependent Variable (→) | Export Value (2002) | Export Value (2002) | Export Value (2003) | Export Value (2003) | Export Value (2004) | Export Value (2004) |
|---|---|---|---|---|---|---|
| *dExportingmode_IV*× | | | | | | |
| *externalfinance*× | 8.6627*** | 8.5982*** | 2.7693** | 2.7205** | 2.6241* | 2.6053* |
| *dWTO* | [3.2160] | [3.1850] | [1.1851] | [1.1721] | [1.4625] | [1.4552] |
| Year Fixed Effect | YES | YES | YES | YES | YES | YES |
| Age | NO | YES | NO | YES | NO | YES |
| Size | NO | YES | NO | YES | NO | YES |
| R Squared | 0.22 | 0.21 | 0.23 | 0.22 | 0.24 | 0.24 |
| Number of Observations | 25,576 | 25,568 | 25,576 | 25,568 | 25,576 | 25,568 |

*Notes*. Robust standard errors in bracket; export value is measured in thousand yuan; 2002, 2003, 2004 in parenthesis denote the critical years that we use to define *dWTO*; year fixed effect is a linear combination of year dummies for 2001-2006; size is measured by firms' capital stock; *dExportingmode_IV* is constructed as the product of firm-level initial productivity and province-level aggregate capital supply shock; *, **, *** indicate significance at the 10%, 5%, 1% confidence level, respectively.

**Table 10. Difference-in-Differences Estimation for Export Value with Internal Finance**

| Dependent Variable (horizontal) | Liquidity (1) | Receivable Turnover (2) | Inventory Turnover (3) | Operation Cycle (4) |
|---|---|---|---|---|
| *dExportingmode* | -0.0218** | 0.0026 | 0.0534*** | -0.0322*** |
| | [0.0107] | [0.0130] | [0.0127] | [0.0094] |
| *Export Share* | -0.0002 | -0.0006*** | -0.0008*** | 0.0007*** |
| | [0.0002] | [0.0002] | [0.0002] | [0.0001] |
| Constant | 0.1516*** | 1.6130*** | 1.2711*** | 5.3167*** |
| | [0.0149] | [0.0181] | [0.0177] | [0.0132] |
| R Squared | 0.16 | 0.09 | 1.14 | 0.08 |
| Number of Observations | 9,830 | 9,853 | 9,853 | 9,853 |

*Notes*. Robust standard errors in bracket; export share is the share of exports in firms' total sales, included to control for the level of involvement in international markets after the entry into direct exporting; age, size and year fixed effect have been controlled for all regressions; **, *** indicate significance at the 5% and 1% confidence level, respectively.

**Table 11. Difference-in-Differences Estimation for Export Value with Internal Finance Proxy**

| Dependent Variable (horizontal) | Export Value (1) | Export Value (2) | Export Value (3) | Export Value (4) |
|---|---|---|---|---|
| *dExportingmode* × *internalfinance* | 0.1005*** [0.0123] | 0.1006*** [0.0124] | | |
| *dExportingmode_IV* × *internalfinance* | | | 0.4019* [0.2163] | 0.4084* [0.2165] |
| Year Fixed Effect | YES | YES | YES | YES |
| Age | NO | YES | NO | YES |
| Size | NO | YES | NO | YES |
| R Squared | 0.15 | 0.15 | 0.15 | 0.15 |
| Number of Observations | 25,728 | 25,721 | 25,593 | 25,586 |

**Table 12. Difference-in-Differences Estimation for Export Value with External Finance Proxy**

| Dependent Variable (horizontal) | Export Value (1) | Export Value (2) | Export Value (3) | Export Value (4) |
|---|---|---|---|---|
| *dExportingmode* × *externalfinance* | 0.1213*** [0.0087] | 0.1212*** [0.0087] | | |
| *dExportingmode_IV* × *externalfinance* | | | 0.2934* [0.1766] | 0.2967* [0.1797] |
| Year Fixed Effect | YES | YES | YES | YES |
| Age | NO | YES | NO | YES |
| Size | NO | YES | NO | YES |
| R Squared | 0.15 | 0.16 | 0.15 | 0.15 |
| Number of Observations | 25,602 | 25,594 | 25,470 | 25,462 |

*Notes*. Robust standard errors in bracket; export value is measured in thousand yuan; internal and external finance are proxied by province-sector-level aggregate of firm-level counterparts; year fixed effect is a linear combination of year dummies for 2001-2006; size is measured by firms' capital stock; *dExportingmode_IV* is constructed as the product of firm-level initial productivity and province-level aggregate capital supply shock; *, *** indicates significance at the 10% and 1% confidence level, respectively.

**Table 13. Difference-in-Differences Estimation for TFPR with Internal Finance Proxy**

| Dependent Variable (→) | TFPR | TFPR | TFPR | TFPR |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *dExportingmode* × | 0.0232*** | 0.0237*** | | |
| *internalfinance* | [0.0073] | [0.0073] | | |
| *dExportingmode_IV* × | | | 0.0757*** | 0.0762*** |
| *internalfinance* | | | [0.0082] | [0.0082] |
| Year Fixed Effect | YES | YES | YES | YES |
| Age | NO | YES | NO | YES |
| Size | NO | YES | NO | YES |
| R Squared | 0.03 | 0.03 | 0.03 | 0.03 |
| Number of Observations | 37,630 | 37,618 | 37,438 | 37,426 |

**Table 14. Difference-in-Differences Estimation for TFPR with External Finance Proxy**

| Dependent Variable (→) | TFPR | TFPR | TFPR | TFPR |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *dExportingmode* × | 0.0137** | 0.0140** | | |
| *externalfinance* | [0.0060] | [0.0061] | | |
| *dExportingmode_IV* × | | | 0.0629*** | 0.0633*** |
| *externalfinance* | | | [0.0069] | [0.0068] |
| Year Fixed Effect | YES | YES | YES | YES |
| Age | NO | YES | NO | YES |
| Size | NO | YES | NO | YES |
| R Squared | 0.03 | 0.03 | 0.03 | 0.02 |
| Number of Observations | 37,460 | 37,447 | 37,274 | 37,261 |

*Notes*. Robust standard errors in bracket; TFPR is dimensionless; internal and external finance are proxied by province-sector-level aggregate of firm-level counterparts; year fixed effect is a linear combination of year dummies for 2001-2006; size is measured by firms' capital stock; *dExportingmode_IV* is constructed as the product of firm-level initial productivity and province-level aggregate capital supply shock; **, *** indicates significance at the 5% and 1% confidence level, respectively.

**Table 15. Difference-in-Difference-in-Differences Estimation for Export Value with Internal Finance Proxy**

| Dependent Variable (→) | Export Value (2002) | Export Value (2002) | Export Value (2003) | Export Value (2003) | Export Value (2004) | Export Value (2004) |
|---|---|---|---|---|---|---|
| *dExportingmode_IV* × | | | | | | |
| *internalfinance* × | 4.1921*** | 4.1836*** | 1.0862*** | 1.0742*** | 0.6873** | 0.6846** |
| *dWTO* | [0.8301] | [0.8310] | [0.3772] | [0.3769] | [0.3041] | [0.3043] |
| Year Fixed Effect | YES | YES | YES | YES | YES | YES |
| Age | NO | YES | NO | YES | NO | YES |
| Size | NO | YES | NO | YES | NO | YES |
| R Squared | 0.18 | 0.18 | 0.15 | 0.15 | 0.18 | 0.18 |
| Number of Observations | 25,593 | 25,586 | 25,593 | 25,586 | 25,593 | 25,586 |

*Notes*. Robust standard errors in bracket; export value is measured in thousand yuan; internal finance is proxied by province-sector-level aggregate of firm-level counterpart; 2002, 2003, 2004 in parenthesis denote the critical years that we use to define $dWTO$; year fixed effect is a linear combination of year dummies for 2001-2006; size is measured by firms' capital stock; *dExportingmode_IV* is constructed as the product of firm-level initial productivity and province-level aggregate capital supply shock; **, *** indicates significance at the 5%, 1% confidence level, respectively.

**Table 16. Difference-in-Difference-in-Differences Estimation for Export Value with External Finance Proxy**

| Dependent Variable (→) | Export Value (2002) | Export Value (2002) | Export Value (2003) | Export Value (2003) | Export Value (2004) | Export Value (2004) |
|---|---|---|---|---|---|---|
| *dExportingmode_IV*× | | | | | | |
| *externalfinance*× | 7.6095*** | 7.5537*** | 2.9090** | 2.8579** | 2.2544* | 2.2370* |
| *dWTO* | [2.393] | [2.3679] | [1.2326] | [1.2161] | [1.1665] | [1.1567] |
| Year Fixed Effect | YES | YES | YES | YES | YES | YES |
| Age | NO | YES | NO | YES | NO | YES |
| Size | NO | YES | NO | YES | NO | YES |
| R Squared | 0.22 | 0.22 | 0.23 | 0.22 | 0.23 | 0.23 |
| Number of Observations | 25,576 | 25,568 | 25,576 | 25,568 | 25,576 | 25,568 |

*Notes*. Robust standard errors in bracket; export value is measured in thousand yuan; internal finance is proxied by province-sector-level aggregate of firm-level counterpart; 2002, 2003, 2004 in parenthesis denote the critical years that we use to define $dWTO$; year fixed effect is a linear combination of year dummies for 2001-2006; size is measured by firms' capital stock; *dExportingmode_IV* is constructed as the product of firm-level initial productivity and province-level aggregate capital supply shock; *, **, *** indicates significance at the 10%, 5%, 1% confidence level, respectively.

# Appendices (Not for Publication)

## A.1. Matching Procedure for Manufacturing and Customs Data

We match Chinese manufacturing survey data (ASIP) and Customs data using the following procedure. This algorithm produces highly comparable results to the existing studies, like Manova and Yu (2016).

*Step 1.* Given the potential existence of typographical errors in both data sets, we clean the data sets using a conservative approach. In the Customs data set, we use the non-missing modes (i.e. the most frequent value) of party_id, zip code, and telephone number of the monthly data as the annual value for our matching purpose. In both annual data sets, if the identifier or "concatenation of zip code and telephone number" exists more than once, we discard all the observations to avoid the case that an identifier in one data set might link to multiple identifiers in the other data set. Less than 0.01% of the observations are dropped each year due to these typographical errors.

*Step 2.* To get the identifier concordance, we first match firms' Chinese name of the two data sets if the same names appear in both data sets in the same year. This provides the most reliable matching results. Then we add concordances if the same name shows up in different years of the two data sets, which might be due to delays in information updating. If the second match generates a different identifier concordance from the first match, we dropped the second matched result.

*Step 3.* We follow the same procedure in *Step 2* for the "concatenation of zip code and telephone" for the two data sets. Again we think that the matches from the same year are more reliable than matches from different years.

*Step 4.* The order of confidence in the concordance is: same names in the same year, same telephone number and zip code in the same year, same names in different years, and same telephone number and zip code in the different years. Every time the latter matches generate a different identifier concordance from the earlier matches, we use the earlier matched results.