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# Credit constraints, firm ownership and the structure of exports in China



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## ABSTRACT

We investigate how the export performance in China is influenced by credit constraints. Using panel data from Chinese customs, we show that credit constraints affect the sectoral composition of exports. We confirm that credit constraints provide an advantage to foreign-owned firms and joint ventures over private domestic firms in sectors with higher levels of financial vulnerability. We show that these distortions have been lessened over the period in conjunction with the reduction of State control over the financial intermediation system.

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## 1. Introduction

China's financial system has been widely viewed as lagging behind the country's rapid development and successful transition from a planned system to a market-driven economy over the past 30 years. Abundant research has shown it to be deficient and ineffective in its role of allocating capital across the economy (Boyreau-Debray, 2003; Dollar and Wei, 2007; Li et al., 2008) and of allowing firms to engage in international trade (Manova et al., 2014). China has however initiated several reforms since the mid 1990s so as to reduce State control over the banking sector,

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which leads to interferences and distortions in the allocation of bank credit. Existing research on the repercussions of China's financial reforms is very limited and mostly looks at the impact on economic growth and innovation (Guariglia and Poncet, 2008; Hanley et al., 2011; Demetriades et al., 2008). Despite growing evidence of the importance of financial development for participation in international trade, little is known on the effect of financial reforms and export performance in China. This issue is especially relevant as China's export sector has grown at the impressive rate of 25% yearly over the past 15 years (Brandt et al., 2012). In this paper, we investigate the impact of the progressive restructuring of the banking sector on China's export patterns.

Theoretical modeling predicts that the efficiency of the financial sector has a higher impact on growth and export performance in industries intrinsically more dependent on external finance.<sup>1</sup> This heterogeneity in sector-level dependence on finance provides a robust methodology to detect credit constraints and measure their evolution, as first proposed by Rajan and Zingales (1998). Recent models by Chaney (2005) and Manova (2013) predict that the efficiency of the financial system should affect the export structure, with the most dependent sectors being disadvantaged in environments with high distortions, but benefiting relatively more from improvements in financial system efficiency. Such patterns of exports have been found empirically in cross-country regressions by Manova (2013) and Berthou (2010) among others. We apply this methodology to study how the distortionary effect of financial markets imperfections on exports evolved as China's banking sector deregulated.

Our paper builds on Manova et al. (2014) who posit that the ownership status of Chinese firms provides a plausible proxy for firms' access to the financing needed for export activities in an environment that features relatively weak financial institutions. They compare domestic private firms and foreign-owned firms. Firms with partial and full foreign ownership can indeed be expected to rely on internal sources of funding from their parent companies, which help them to alleviate the credit constraints faced in exporting. Financial constraints are hence expected to be most pervasive for domestic private firms. This should give rise to a very specific pattern in terms of export whereby private domestic firms are not able to export as much as the other firm types, especially in financially dependent sectors. Relying on firm-level export data for the year 2005, Manova et al. (2014) show that foreign-owned affiliates are relatively less constrained than private domestic firms and are thus able to export more, especially in financially dependent sectors. They interpret their findings as being consistent with a causal impact of credit constraints on export behavior.

We use multiple years of data, as opposed to a single year, and consider differences across provinces to investigate how credit constraints are mitigated by financial development. The period covered by the data – 1997–2007 – is pertinent in this regard as it corresponds to a period of substantial reforms of the financial system in China, with a diminution of State control over the banking sector. Our study covers all firm types, including State owned firms. They are shown in the literature to be able to count on either the government authorities or the public banks to bail them out when their budget constraint are persistently breached (Cull and Xu, 2000; Brandt and Li, 2003). We show that private-owned firms had a substantial disadvantage compared to any other type of firms in finance dependent sectors in 1997, which has steadily decreased over the period. Contrary to Manova et al. (2014), we do not use firm-level data but exploit data aggregated by firm type. The focus of our study is hence different: while Manova et al. (2014) look at differences in firm-level export value across sectors,<sup>2</sup> we sum up province-level exports by sector and firm type groups, in order to look at the distribution of province-level exports across sectors. Our results thus provide information about the allocation of resources at the aggregate level: theory identifies two margins of the impact of finance on export activities of firms, as access to credit potentially constrains the selection of firms which successfully enter export markets, as well as the volume of exports by those firms. By using aggregate data by firm type and province, we identify the overall effect of credit constraints on those two margins. Our key contribution is then to exploit the cross-province variation in the efficiency of

<sup>1</sup> In the following we refer interchangeably to financially dependent or financially vulnerable sectors.

<sup>2</sup> Manova et al. (2014) only consider firms exporting in multiple sectors, which represent 49% of the total number of firms in 2005. In our study, we look at the distribution of province-level exports across sectors which includes both mono-industry and multi-industry firms.

the allocation of financial resources, using the share of banking sector activity that is not directly State-influenced, to assess the link between financial development and the patterns of export specialization across firm types.

Based on a panel dataset of bilateral exports at the province level for 191 countries and 27 3-digit ISIC sectors in 1997–2007 by ownership type (private, State-owned and foreign firms), we first confirm results by [Manova et al. \(2014\)](#) of foreign firms' advantage over private firms in sectors with higher levels of financial vulnerability. We find that in 1997, *ceteris paribus*, the ratio of exports by foreign firms to private firms is higher at the 75th percentile of the distribution of financial dependence than at the 25th percentile, by a factor 3.72. This suggests that imperfections in the financial system restrict private firms' ability to enter export markets, while foreign firms are able to circumvent these problems, possibly through the use of internal funding from parent companies.

We extend this analysis in several dimensions. First, looking at the evolution of credit constraints over time, we find evidence that the gap in export performance between foreign and private firms shrank significantly between 1997 and 2007, suggesting improved credit market conditions for private firms. We also shed light on the position of State-owned firms: these firms have enjoyed a significant advantage over private firms in finance-dependent sectors at the end of the 1990s, but this advantage has gradually vanished over the period.

We then turn to investigating whether the improvement in the efficiency of the banking sector has contributed to these evolutions. We thus estimate the impact of reforms to the financial system on export patterns separately by firm type. We build on the empirical literature relating finance development and trade in a cross-country setting ([Manova, 2013](#); [Berthou, 2010](#); [Beck, 2002, 2003](#); [Hur et al., 2006](#); [Svaleryd and Vlachos, 2005](#)) which shows that financially developed economies export relatively more in financially vulnerable sectors. We ask whether financial constraints faced by private firms have declined in provinces where State control over the banking sector has lessened. Using a measure of the degree of market driven finance in the economy based on the share of non-State-owned banks in lending,<sup>3</sup> we find results suggesting that the reduction of State interventionism in the banking system has contributed importantly to lifting constraints on private firms' export activity.

The rest of this article is structured as follows. In the following section we describe China's financial sector and its recent developments. In [Section 3](#), we present our data and our indicators of financial dependence and financial development. [Section 4](#) provides some descriptive statistics on the structure of Chinese exports across provinces and firm types. In [Section 5](#), we present our empirical approach and our results, showing that they are robust to various robustness checks. [Section 6](#) concludes.

## 2. China's financial and banking system

This section provides a short background on the evolution of China's financial system to help understand the meaning of the indicators used to proxy for improvement in the efficiency of the financial sector in China.

Before 1979, China's financial system consisted of a single bank: the People's Bank of China (PBOC), a central government owned and controlled bank under the Ministry of Finance, which served as both the central bank and as a commercial bank. Almost all financial transactions were handled by it according to the “cash plan” and “credit plan” ([Allen et al., 2009](#)). After 1979, the PBOC became a separate entity, while three newly created State-owned banks took over some of its commercial banking businesses: the Bank of China (BOC), the People's Construction Bank of China (PCBC), and the Agricultural Bank of China (ABC). A fourth State-owned bank, the Industrial and Commercial Bank of China (ICBC), was created in 1984 and took over the rest of the commercial transactions of the PBOC. These four banks have held the main share of banking activity, accounting for 55% of deposits and 51%

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<sup>3</sup> This measure is only available for the 1997–2004 period, so that this part of the empirical analysis is restricted to this period.

of credit nation-wide in 2004. They were wholly owned by the State, until 2005–2006, when three of them became listed on Shanghai and Hong-Kong stock exchanges, introducing minority private ownership in their capital structure.<sup>4</sup>

Direct State control over these four largest banks implies that lending decisions are largely based on policy rather than commercial motives, creating distortions in capital allocation in China (Boyreau-Debray and Wei, 2005; Dollar and Wei, 2007). These banks favored lending to State-owned enterprises even against profitability criteria (Allen et al., 2009; Park and Sehn, 2001). These four banks have been widely documented as conducting non-market credit allocation decisions. These may include discriminatory lending (e.g. among private firms), excessive lending to State-controlled firms leading to soft budget constraints, etc. Some of these banks serve to channel funds toward projects which may be more politically-oriented than profit-oriented; this has the consequence of diverting funds from other possible uses, thus creating credit constraints for firms with profitable projects but insufficient political support for them. The literature finds these big 4 State banks to be much less efficient (Yao et al., 2007; Shih et al., 2007; Chen et al., 2005). This inefficiency has become apparent in the large amounts of non performing loans (NPLs) accumulated by these four banks by the end of the 1990s, forcing the State to recapitalize them several times (notably in 1997 and 2002), and finally to partially privatize them (2006–2007). In parallel, a number of smaller credit institutions were allowed to develop starting in 1993. Their share of total bank assets rapidly grew to about 45%. These include 13 joint-stock banks whose shares are owned by jointly by the State and private sectors and are generally seen as the most market-oriented (Lin and Sun, 2009); city commercial banks, owned by local governments and firms, and private shareholders; and urban and rural credit cooperatives, which were transformed into commercial banks in 1996–1998. Finally, foreign banks were gradually allowed to open branches in China after 1996.

An important distinction between the big 4 State-owned Commercial Banks (SOCBs) and other banks in China is their full ownership by the State, which ceased in 2005–2006 for three of them that were listed publicly. By contrast, other banks have had a mixed ownership structure, with shareholders including urban enterprises, citizens and local governments (joint-stock banks), and foreign ownership. Using data on 35 City Commercial Banks and other joint-stock banks, Ferri (2009) finds that these “New Tigers” in the banking sector outperform the four SOCBs and attributes this to a fundamental difference in governance structure.

The direct State control over the SOCBs leads these four banks to respond to non-market incentives in their credit allocation decisions. Berger et al. (2009) report that they have “historically faced pressures and instructions from central and local governments to grant policy loans for political purposes, rather than for profit maximization.” One consequence is that private companies have been discriminated against in the allocation of credit by these four banks, which favored State-owned firms instead (Wei and Wang, 1997). Park and Sehn (2001) show that inefficient policy lending by State-owned banks has not diminished significantly even after the reforms of the 1990s. Brandt and Li (2003) observe that private firms have to use more expensive trade credit as a result of their limited access to bank credit. Firth et al. (2009) find that State minority ownership in firms' capital helps obtain credit from State-owned banks, which they interpret as evidence that political connections matter in lending decisions by these banks. As a second consequence of direct State control, the four SOCBs have been less efficient than other banks with mixed ownership structure, a fact that has been consistently found empirically in numerous studies. Berger et al. (2009), using the profit efficiency method for 1994–2003 data, calculate that the “big 4” are less than half as efficient as other domestic banks, and three times less efficient than foreign banks. Chang et al. (2010) find no correlation between credit growth of SOCBs and economic growth at the regional level, and attribute this to the low efficiency of SOCBs. Fu and Heffernan (2009) also find that joint-stock banks were more X-efficient during the 1993–2002 period, while the 4 SOCBs are found to have been less efficient (Lin and Sun, 2009) and less profitable (García-Herrero et al., 2009). This gap between the 4 SOCBs and

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<sup>4</sup> China Construction Bank's initial public offering (IPO) on Hong-Kong stock exchange took place on October 27th, 2005. This was followed by Bank of China's listing on the same market on June 1, 2006, then by ICBC's listing on October 27th, 2006 (simultaneously on Shanghai and Hong-Kong stock markets). The ABC went public in 2010.

other banks explains that the reduction of the relative importance of SOCBs is associated with improved overall efficiency and profitability of the banking sector (García-Herrero et al., 2009).

These specificities of China's financial system – the dominance of the sector by the four inefficient SOCBs – explain that traditional indicators of financial development, which measure banking sector size (such as the ratio of loans to GDP) are typically found to have no, or even a negative, impact on growth (Boyreau-Debray, 2003; Chen et al., 2005). For this reason, many authors have relied instead on measures of the 4-SOCBs' market shares, as an indicator of the level of distortions in the financial intermediation system, and found it negatively associated with growth (Boyreau-Debray, 2003; Chen et al., 2005; Guariglia and Poncet, 2008; Lin and Sun, 2009). In this study, we follow these authors and use the market shares of banks other than the four State-owned commercial banks (SOCBs) as China-specific indicators of reforms to the banking sector at the province level.

### 3. Data and indicators

The key data used in this paper are export flows data, disaggregated by province, sector and type of firms; a set of proxies of sector-level financial vulnerability; and a measure of the market share of the big four State-owned banks, used as a proxy for local financial development in Chinese provinces. Our sample consists of a panel of yearly observations for 30 provinces in mainland China.

#### 3.1. Measures of sector-level reliance on external finance

We use three different measures of a sector's financial vulnerability. These variables are meant to capture the technological characteristics of each sector which are exogenous to firms' financial environment and determine the degree of reliance of each sector's firms on external finance. They reflect the intrinsic reasons why industries differ in their need for credit beyond the economy-wide situation in terms of liquidity constraints. Our first indicator (*financial dependence*) focuses on differences of external finance dependence across sectors and is computed as the share of capital expenditures not financed out of cash flows from operations. Our second indicator (*liquidity needs*) was developed by Raddatz (2006) and is the ratio of inventories over annual sales. It thus captures another dimension of a firm's dependence on access to external financing: the time lag between investments and the realization of corresponding revenues. As a third indicator, we follow Manova et al. (2014) who use the share of R&D spending in total sales (R & D), based on the fact that as a long-term investment, research and development often implies greater reliance on external finance.

These three indicators have been computed by Kroszner et al. (2007), using data on all publicly traded U.S.-based companies from Compustat's annual industrial files; the value of the indicator in each sector is obtained as the median value among all firms in each 3-digit ISIC sector. We borrow these measures from this study. The use of US-based indices of financial vulnerability by sector relies on the hypothesis of a technological component to financial vulnerability which is common to firms in the US and in China. As argued by Rajan and Zingales (1998), the United States have a well-developed financial system, so that the variation in the use of financial services across US firms should reflect the technology-specific component of external finance needs. In addition, financial measures based on US firms' data can be seen as exogenous to financial development in China, whereas those indices would likely take different values if computed with Chinese firms' data, reflecting the fact that firms organize production differently in a credit-constrained environment.

In order to ensure that our measures of financial vulnerability do not simply reflect sectors' factor intensity, our regressions include sector-level indices for physical and human capital intensity from Braun (2003).<sup>5</sup> Summary statistics of the various sector level indicators are presented in Table 8 in the Appendix. Sectors are ranked in increasing order of their financial dependence. Tobacco stands out with the lowest reliance on external financing and plastic products for the highest. Interestingly, as

<sup>5</sup> Similarly to the measures of financial dependence used, indices of physical and human capital intensity are computed by Braun (2003) using data for US firms.

indicated in the last column, the share of foreign exports for the latter sector is 2.5 times higher than for the former, which conforms with the argument by [Manova et al. \(2014\)](#) that financial imperfections grant an export performance premium to foreign firms relative to domestic firms.

### 3.2. Financial development

As underlined in [Section 2](#), State control over financial intermediation is identified as one important source of distortions in capital allocation in China. In the empirical section, we measure the relative importance of finance devoid of State interventionism by the share of banks other than the four State-owned commercial banks (non-4-SOCBs) in total bank lending (non-4-SOCBs' share in credit).<sup>6</sup> These statistics were published in the [Almanac of China Finance and Banking](#), until 2004. As reported in [Table 6](#) in the Appendix, in 1990, the four State-owned commercial banks dominated the financial sector: they accounted for about 80 percent of the country's lending. Liberalization and reform efforts, notably in relation to the WTO accession, have greatly reduced this predominance and increased the share of banks other than the four SOCBs in credits, to nearly 37% in 1999 and 45% in 2004. [Table 7](#) in the Appendix indicates that the situation is however very diverse across China. While some provinces such as the North-Eastern provinces of Liaoning and Shandong have seen the share of the 4-SOCBs fall below 50% as early as the year 2000, other provinces (such as the far-Western provinces of Qinghai and Ningxia) still have State-dominated finance systems.

As argued above, the big-4 SOCBs stand out as less profitable, less efficient and have lower quality assets than the others. For these reasons, we believe that measures of the market share of these four fully State-controlled banks can be used as a measure of distortions in credit allocation.<sup>7</sup> They are likely to be associated with stronger credit constraints for some firms. More precisely, we expect high State-owned banks shares to be associated with higher constraints for private-owned firms, based on abundant evidence of discriminatory lending policies against private firms by State-owned banks. It should be noted, however, that the Chinese financial system possibly continues to favor State-owned enterprises (SOEs), despite liberalization. [Dollar and Wei \(2007\)](#) find that although low efficiency SOEs represent a declining share of national output (40% in 2005 down from 53% in 1995) their borrowing accounts for more than half of the total lending by the banking system. This may be due to the fact that private firms, although more productive, are still considered by Chinese banks as riskier than their public peers, possibly due to their short credit history, or to a lower chance of being bailed out by the government. Concerning State-owned firms, conventional wisdom in China's economics has it that these firms often benefit from “soft budget constraints” on the part of State-owned banks, due to the fact that lending by State banks is still partly determined by political reasons, rather than by commercial motives (see e.g. [Park and Sehart, 2001](#)). This would lead us to expect that credit constraints faced by State-owned firms tightened with improvements in the financial sector.

### 3.3. Trade data sources

The main data source is a database collected by the Chinese Customs. It contains Chinese export flows aggregated by province, year, product and destination country,<sup>8</sup> over the 1997–2007 period.<sup>9</sup>

<sup>6</sup> We checked that all the results in the paper are robust to using the share of non-4-SOCBs in total bank deposits.

<sup>7</sup> Note that we do not claim that non-4-SOCBs banks are free from State pressure and operate fully according to market forces. The fact that they should not harm our identification strategy but make the finding of a significant impact of our proxy less likely as our indicator would overestimate the extent of market orientation. Unfortunately, alternative measures of financial development, such as the share of foreign-owned banks or the share of non-performing loans, for example, are not available by year and province in the Chinese context.

<sup>8</sup> As the cross-destination dimension is not central to our analysis, we checked that all the results in the paper are robust to aggregating out the destination dimension.

<sup>9</sup> The original data is identified by an 8-digit code. As there were major reclassifications in the international HS 6-digit classifications in 1996 and 2002, we convert them to the same HS 6-digit classifications used in 1992, to avoid problems related to the reclassification of codes. In order to avoid classifying a product as a new variety, just because there has been a new product code or previous codes were split, we drop product lines that changed classification at the 6-digit level in the period, due to nomenclature changes.

In our empirical analysis, trade flows are aggregated up to the 27 3-digit ISIC sectors for which our indicators of sectors' financial vulnerability are available. We use a correspondence table between the international trade nomenclatures and the ISIC Rev. 2 categories, developed at the CEPII to match the Chinese HS 8-digit product codes with the ISIC 3-digit sector categories.<sup>10</sup>

The dataset also provides information on the ownership structure of firms, which makes it possible to distinguish between State-owned enterprises (SOEs),<sup>11</sup> private domestic firms, fully foreign-owned firms, and joint ventures (with foreign ownership less than 100%).

#### 4. A first glance at the structure of Chinese exports

There is tremendous systematic variation in export patterns across sectors at different levels of financial vulnerability and across provinces at different levels of State interference in finance. This section presents some simple correlations in the data which bode well for the empirical analysis to follow. All the subsequent figures plot the export value (in log) on the vertical axis for sectors ranked by their reliance on external finance (horizontal axis). The data points correspond to the sectors listed in Table 8. The focus is on how the relationship between exports and external dependence (as represented by the fitted line) is affected by the deregulation of the banking sector. We expect the sensitivity of exports to external dependence to rise (becoming more positive or less negative) as State-Owned banks relinquish market share.

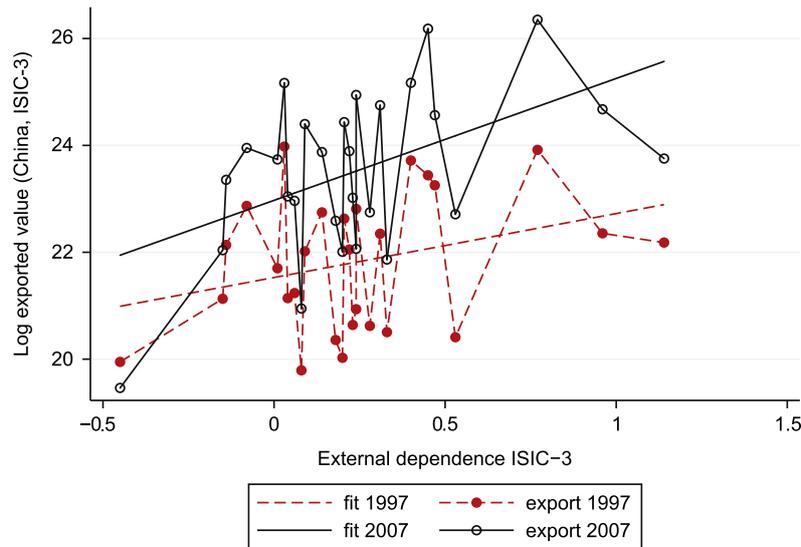
Fig. 1 compares the relationship between the export value of China and external dependence for the two extreme years of our trade data (1997 and 2007). Interestingly while exported values are larger for finance-dependent sectors for both years for reasons certainly related to China's comparative advantages,<sup>12</sup> the relationship between exports and external dependence (as represented by the fitted line) is steeper in 2007 compared to 1997, indicating that the period 1997–2007 has seen a faster growth of exports in the most financially vulnerable industries. In light of the theoretical prediction that in the presence of credit constraints, improvements in financial system's efficiency should benefit more the most finance-dependent sectors, this suggests that reforms to the financial sector in China over this period has reduced credit constraints. Similar results are obtained when looking at variations across provinces. Fig. 2 compares the export structure of the two provinces of Shaanxi and Ningxia in 2000. These two provinces, as indicated in Table 7 in the Appendix, have rather similar levels of GDP per capita and contributions in China's total exports; but they differ in the relative importance of SOCBs in their banking sectors, with the 4-SOCBs' share of credits at 65% in Shaanxi, versus 77% in Ningxia, in 2000. Shaanxi has higher export sales overall than Ningxia, and its advantage is much more pronounced in sectors more dependent on external finance. This suggests that provinces with a less State-controlled banking sector tend to show a greater export specialization in financially dependent sectors.

Our empirical approach will not only exploit variations across time and provinces but also variations across firm types as in Manova et al. (2014). In China, most of international trade is carried out by firms with partial or full foreign ownership. As shown in Table 6 in the Appendix, they accounted for 59% of the exports in 2004. For clarity in the following graphs, foreign affiliates and joint ventures are combined into a single category, referred to as foreign. Fig. 3 indicates that beyond this average performance, foreign-owned firms capture a systematically bigger share of Chinese exports in industries with higher levels of financial vulnerability than do domestic firms (State-owned and private together). Fig. 4 focuses on Shandong, the province with the highest share of non 4-SOCBs in banking, in 2000. It shows that a pattern of specialization by financial

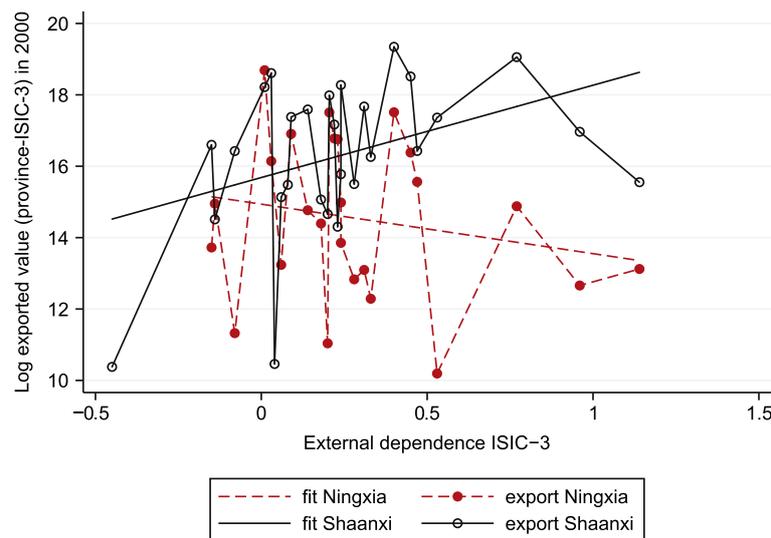
<sup>10</sup> This table is used in the construction of the TradeProd dataset. Details are available at <http://www.cepii.fr/anglaisgraph/bdd/TradeProd.htm>.

<sup>11</sup> We define SOEs as including collectively owned firms.

<sup>12</sup> These reasons will be accounted for in our regressions using industry fixed effects.



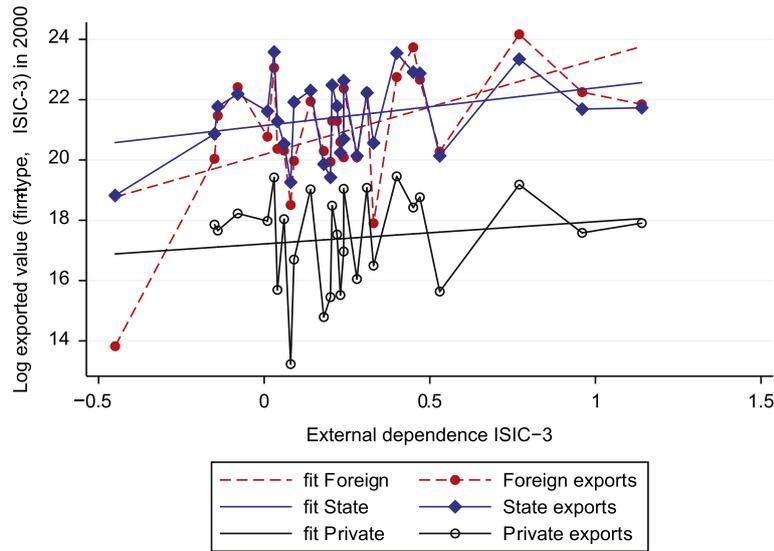
**Fig. 1.** Time evolution: export value and external finance dependence (1997 and 2007).  
Source: Chinese customs.



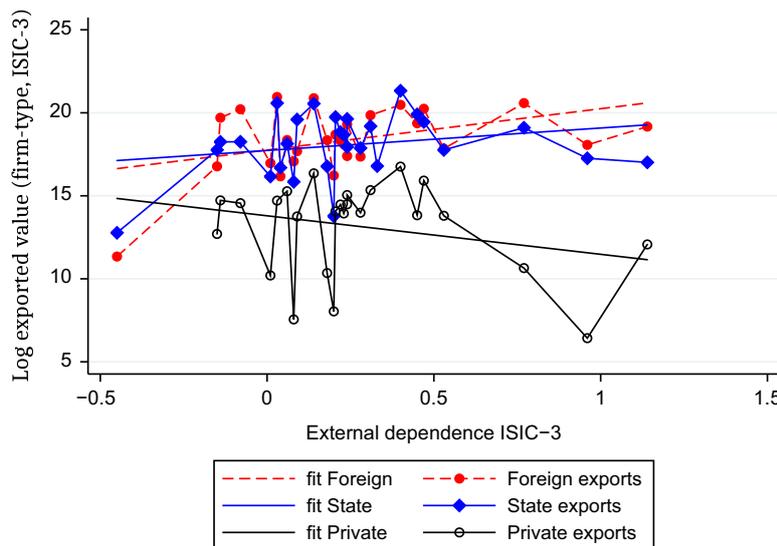
**Fig. 2.** Spatial heterogeneity: export value and external finance dependence in Shaanxi and Ningxia in 2000. Though having similar GDPs per capita and shares in China's exports, Shaanxi is much more financially developed than Ningxia.  
Source: Chinese customs.

dependence exists not only across provinces, but also among different firm types within a province: the distribution of foreign and State-owned firms' exports is more concentrated in high dependence industries than that of private firms. Interestingly, at least in the case of Shandong, the gap between the three firm types shrank significantly for the final year of our sample in 2004, as illustrated in Fig. 5, suggesting that inequalities in access to credit between firm types diminished.

Overall these summary statistics suggest that the structure of exports in China is distorted by financial system imperfections; that these distortions vary in severity across provinces and across firm types; and that they lessened over the period under study (1997–2007). These figures are consistent with China's financial distortions disproportionately hindering the export activity of private domestic firms that can only borrow in the local financial sector. Conversely, exports by foreign firms and State-owned firms appear as less constrained by credit availability, consistently with the hypothesis that foreign ownership allows firms to secure funds from parent companies, while State ownership facilitates financing from domestic banks (whether State-owned or not).



**Fig. 3.** Firm type heterogeneity: export value and external finance dependence (private, foreign+JV and state) in 2000. *Source:* Chinese customs.



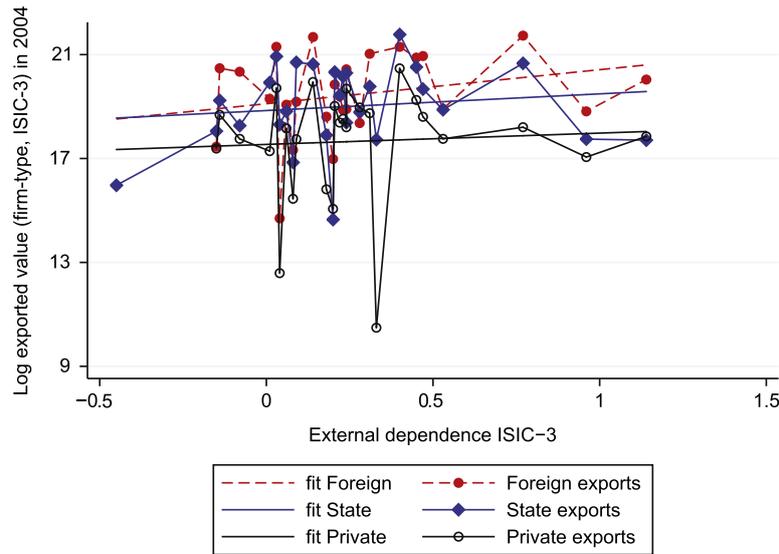
**Fig. 4.** Firm type heterogeneity in Shandong in 2000: export value and external finance dependence (private, foreign+JV and state). *Source:* Chinese customs.

## 5. Empirical analysis

Our empirical strategy follows two steps. First, we test if credit constraints vary across firm types, and how they evolved over the period. Second, we measure the impact of the reduction in State control over banking on constraints faced by exporting firms.

### 5.1. The impact of firm ownership on credit constraints

We identify the presence of credit constraints in China through the study of how the finance content of exports varies by firm ownership type. After controlling for determinants of specialization at the province level, we test if firms of different types specialize in sectors characterized by different levels of financial vulnerability. Such a structure of specialization would provide indirect evidence for the fact that credit constraints vary across firm types. As argued above and in [Manova et al. \(2014\)](#), we



**Fig. 5.** Firm type heterogeneity in Shandong in 2004: export value and external finance dependence (private, foreign+JV and state). Source: Chinese customs.

expect the impact of credit constraints to be mitigated by foreign and State ownership. Firm-level studies have generally found that private Chinese firms are credit constrained while State-owned firms and foreign-owned firms in China are not (Guariglia et al., 2011; Héricourt and Poncet, 2009). One possible factor behind this could be that foreign affiliates have access to internal capital from their parent companies. Concerning State ownership, State-owned enterprises are thought to be more immune to credit constraints than private firms since they enjoy preferential treatment and access to external finance from the domestic banking system (Dollar and Wei, 2007; Boyreau-Debray and Wei, 2005).

We estimate the following equation:

$$\ln X_{ijk}^F = \alpha^F D_F \times FinV_k + \beta_K^F D_F \times Kint_k + \beta_H^F D_F \times Hint_k + \eta^F + \theta_{ik} + \lambda_{ij} + \epsilon_{ijkF} \quad (1)$$

separately for every year  $t$  of our sample between 1997 and 2007. In this equation,  $X_{ijk}^F$  are the free-on-board export sales of all firms of type  $F$  in province  $i$  and industry  $k$ , for export destination  $j$  in a given year  $t$ . Firm types  $F$  include private, State-owned firms, foreign firms and joint-ventures. Binary indicator variables,  $D_F$ , take the value of 1 for firm type  $F$  and 0 otherwise. Province-industry fixed-effects  $\theta_{ik}$  control for provincial size and for patterns of specialization. The coefficients of interest are  $\alpha_F$ , which measure the relative advantage of firms of type  $F$  in sectors of higher financial vulnerability  $FinV_k$ , with respect to the reference group of private firms. Interaction terms  $D_F \times Kint_k$  and  $D_F \times Hint_k$  between firm type dummies and measures of capital and human capital intensity at sector level, as provided by Braun (2003), are included in order to control that the results are not being driven by a correlation between financial and factor intensity variables.

Firm-type-specific coefficients  $\alpha^F$ ,  $\beta^F$  and  $\eta^F$  are measured with respect to a reference group, which we choose to be private firms. The main effect of financial vulnerability (lower worldwide sales in more financially vulnerable sectors) cannot be observed, given industry fixed effects that control for systematic differences in firm exports across sectors and firm-type dummies that account for differences in average export performance between firms of different ownership type that are invariant across sectors. With this set of fixed effects, the coefficients on the interaction terms are identified from the variation across firm-types and sectors within province-country triad.

Hence, we focus on the comparison between firm type groups. Moulton (1990) shows that regressions with more aggregate indicators on the-right hand side could induce a downward bias in the estimation of standard-errors. All regressions are thus clustered at the province/country and sector level (two-way clustering).

Table 1 displays the regression results of running Eq. (1) on every year of our sample, using our benchmark indicator of sector finance intensity (*External dependence*). The potential limiting effect on

**Table 1**

Credit constraints and export values: by year.

Explained variable	Log exported value (province/country/ISIC/year)										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Foreign-owned × financial vulnerability	3.13 <sup>a</sup>	1.55 <sup>a</sup>	1.02 <sup>a</sup>	0.92 <sup>b</sup>	0.83 <sup>b</sup>	0.92 <sup>a</sup>	0.65 <sup>a</sup>	0.44 <sup>b</sup>	0.54 <sup>a</sup>	0.56 <sup>b</sup>	0.58 <sup>a</sup>
	(0.56)	(0.45)	(0.39)	(0.37)	(0.35)	(0.24)	(0.16)	(0.20)	(0.20)	(0.22)	(0.19)
JV-owned × financial vulnerability	2.73 <sup>a</sup>	1.10 <sup>a</sup>	0.66 <sup>b</sup>	0.54 <sup>b</sup>	0.46	0.64 <sup>a</sup>	0.48 <sup>b</sup>	0.22	0.24	0.16	0.06
	(0.44)	(0.33)	(0.31)	(0.27)	(0.28)	(0.25)	(0.23)	(0.32)	(0.34)	(0.36)	(0.32)
State-owned × financial vulnerability	2.10 <sup>a</sup>	0.58 <sup>c</sup>	0.31	0.22	0.26	0.43 <sup>b</sup>	0.17	−0.13	−0.12	−0.24	−0.35 <sup>c</sup>
	(0.42)	(0.33)	(0.32)	(0.26)	(0.25)	(0.17)	(0.13)	(0.19)	(0.18)	(0.20)	(0.19)
Foreign-owned	3.55 <sup>a</sup>	3.11 <sup>a</sup>	2.02 <sup>a</sup>	1.33 <sup>a</sup>	0.88 <sup>a</sup>	−0.14	−0.39 <sup>c</sup>	−0.86 <sup>a</sup>	−1.06 <sup>a</sup>	−1.23 <sup>a</sup>	−1.40 <sup>a</sup>
	(0.79)	(0.62)	(0.42)	(0.34)	(0.33)	(0.26)	(0.21)	(0.20)	(0.21)	(0.23)	(0.25)
JV-owned	3.80 <sup>a</sup>	3.17 <sup>a</sup>	1.93 <sup>a</sup>	1.29 <sup>a</sup>	0.84 <sup>a</sup>	−0.18	−0.43 <sup>b</sup>	−1.20 <sup>a</sup>	−1.40 <sup>a</sup>	−1.76 <sup>a</sup>	−2.02 <sup>a</sup>
	(0.70)	(0.50)	(0.33)	(0.25)	(0.30)	(0.24)	(0.20)	(0.20)	(0.22)	(0.23)	(0.22)
State-owned	4.77 <sup>a</sup>	4.30 <sup>a</sup>	3.22 <sup>a</sup>	2.54 <sup>a</sup>	2.05 <sup>a</sup>	1.03 <sup>a</sup>	0.66 <sup>a</sup>	−0.06	−0.47 <sup>c</sup>	−0.89 <sup>a</sup>	−1.34 <sup>a</sup>
	(0.68)	(0.55)	(0.46)	(0.31)	(0.28)	(0.19)	(0.18)	(0.25)	(0.25)	(0.24)	(0.20)
Observations	58,016	64,080	70,725	78,389	86,004	10,0200	11,6444	13,5705	14,7486	15,8743	16,5204
R <sup>2</sup>	0.096	0.109	0.132	0.116	0.113	0.102	0.073	0.047	0.035	0.035	0.036
Controls	Pairwise interactions between industries' factor intensity ( $Kint_k$ and $Hint_k$ ) and the firm ownership dummies										
Fixed effects	Province-country pair and province-industry pair										

Heteroskedasticity-robust standard errors are reported in parentheses. Standard errors are clustered at the province/country and industry levels.

<sup>a</sup> Indicate significance at the 1% confidence level.

<sup>b</sup> Indicate significance at the 5% confidence levels.

<sup>c</sup> Indicate significance at the 10% confidence levels.

exports of credit constraints is identified from the variation across firm types. The main coefficients of interest are hence those on the three interaction terms  $\alpha_F$ . If credit constraints are more severe for some firm types (e.g. private firms) than others, then the distortionary effect of financial markets imperfections on exports of these firms should be more apparent than for less constrained firms. Thus the sensitivity of their exports to financial vulnerability should be higher than for other firm types. Note that this effect is being measured with respect to the reference firm type, which is private firms here.

Since we rely on export data summed up by sector and firm type groups and look at the distribution of total exports of each firm type across sectors, we measure the result of two effects, the selection of firms into exporting, and the export value of selected firms. Theoretically, both margins should be affected by credit constraints. A positive coefficient  $\alpha_F$  would be consistent with both a reduced relative presence of private firms in finance-intensive sectors (selection effect) and a lower value of their exports when they are present.

A declining trend in the differences of finance specialization across firm types appears very clearly. The pattern of credit constraints across firm types has significantly evolved over the 10-year period. Access to credit appears to have significantly improved for the firms which were initially most constrained (private domestic firms, the reference group here), reducing specific advantages enjoyed by firms with partial or whole foreign ownership as well as State-owned firms: this is apparent in the declining advantage of all other firm types relative to private firms in finance-dependent sectors.

Findings of positive coefficients on financial vulnerability for foreign firms throughout the period are consistent with an advantage to foreign firms in high vulnerability sectors, relative to private domestic firms (the reference group). Foreign ownership is thus associated with a significant

specialization in “finance-intensive” industries. Firms with different ownership types possibly self-select into sectors characterized by different levels of financial constraints. In addition, foreign firms in finance-dependent sectors may be able to export more. Our coefficient captures the overall effect of these two channels, without distinguishing between the two margins. We see this result as evidence of credit constraints faced by exporting firms in China, with the severity of the constraints varying with the ownership structure of firms. Foreign firms have easier access to external finance, which provides them with an advantage in the most finance-dependent sectors. In contrast, domestic firms suffer from higher costs of credit so that a smaller fraction of them survives in those sectors, and those who do export less. These effects may be reinforced by competition effects, in the sense that domestic firms may be further crowded out from finance-intensive sectors, by the competitive advantage enjoyed by foreign firms in those sectors. At this point we are not able to discriminate between the two effects.

The advantage of State-owned firms in finance-intensive sectors, relative to private firms, exhibits a clear downward trend and has changed sign over the period. While this advantage was positive and significant in 1997, it became negative from 2004 onwards.

These latter results are consistent with [Manova et al. \(2014\)](#), who find using firm-level data for the year 2005 that State-owned firms do not seem to benefit from an advantage over private firms in finance-dependent sectors, despite their alleged easier access to finance through State-owned banks. However, our results shed light on this apparent paradox, by showing that this advantage existed at the end of the 1990s but that it diminished over the period, and then reversed around the year 2004. In the next section we will confirm the association between the diminution of State control over the banking sector and the diminution of the relative disadvantage of private-owned firms.

To illustrate the results from this table, we can compare the reduction in the specific advantage of foreign firms, relative to private firms for sectors at the 25th and 75th percentiles of the distribution of financial vulnerability. This corresponds to comparing ‘Apparel’ and ‘Machinery’ whose external finance dependence is 0.03 and 0.45 respectively ([Table 8](#) in the Appendix). Using coefficients from Columns 1 and 11 in [Table 1](#), this means that in 1997, all things being equal, the ratio of foreign firms to private firms exports is higher in a sector at the 75th percentile relative to a sector at the 25th percentile, by a factor 3.72 [ $\exp((0.45 - 0.03) \times 3.13)$ ]. In 2007, this value is down to 1.27 [ $\exp((0.45 - 0.03) \times 0.58)$ ].

[Table 2](#) confirms that the time evolution highlighted above is found consistently with the three indicators of financial vulnerability. In the regressions, the interactive terms between financial vulnerability and firm type are further interacted with a linear trend variable (equal to 1 for 1997, 2 for 1998, and so on). These specifications include double interaction terms involving the time trend variable and firm ownership status in order to control for changes in firm-type specific export performance.

In these regressions, the negative coefficients attracted by the triple interactive terms between financial vulnerability, firm type (foreign, JV and State-owned) and the trend variable corroborate the declining trend in the differences of finance specialization across firm types. The relative disadvantage of private firms in finance-intensive sectors has declined over the period, which is consistent with a gradual improvement in financial institutions in China over the period. The association between these two evolutions is established more directly in the next section.

## 5.2. Banking reforms and credit constraints

*Baseline:* We now ask if recent developments in the capital allocation system in China – namely, the diminishing market share of the big four State-owned banks – have been associated to the reduction in the export performance gap between foreign and private firms found in the previous section.

As firms of different ownership structures face different levels of access to credit, we expect improvement in the efficiency of the allocation of financial resources to affect these groups differently. We test if an increasing share of bank activity outside the four main State-owned banks in a province's total credits is associated with a rebalancing of exports toward finance-intensive sectors, in any of the four firm type groups (private, State-owned, foreign-owned, and joint ventures). As before, we look at

**Table 2**  
Credit constraints and export values over time.

Explained variable	Log exported value (province/country/ISIC/year)		
	Financial dependence (1)	Liquidity needs (2)	R&D (3)
Foreign-owned × fin. vulnerability	2.86 <sup>a</sup> (0.70)	24.63 <sup>a</sup> (5.30)	36.58 <sup>a</sup> (13.05)
JV-owned × fin. vulnerability	2.50 <sup>a</sup> (0.69)	26.19 <sup>a</sup> (6.10)	35.56 <sup>a</sup> (13.29)
State-owned × fin. vulnerability	2.18 <sup>a</sup> (0.73)	27.89 <sup>a</sup> (5.86)	27.97 <sup>b</sup> (12.96)
Fin. vulnerability × trend	0.31 <sup>a</sup> (0.08)	2.72 <sup>a</sup> (0.58)	3.71 <sup>b</sup> (1.50)
Foreign-owned × fin. vulnerability × trend	−0.25 <sup>a</sup> (0.07)	−2.86 <sup>a</sup> (0.54)	−2.95 <sup>b</sup> (1.28)
JV-owned × fin. vulnerability × trend	−0.25 <sup>a</sup> (0.07)	−2.93 <sup>a</sup> (0.54)	−2.89 <sup>b</sup> (1.26)
State-owned × fin. vulnerability × trend	−0.25 <sup>a</sup> (0.07)	−3.00 <sup>a</sup> (0.55)	−3.03 <sup>b</sup> (1.28)
Foreign-owned × trend	−0.17 <sup>a</sup> (0.04)	0.21 <sup>b</sup> (0.10)	−0.19 <sup>a</sup> (0.04)
JV-owned × trend	−0.20 <sup>a</sup> (0.04)	0.18 <sup>c</sup> (0.10)	−0.22 <sup>a</sup> (0.04)
State-owned × trend	−0.24 <sup>a</sup> (0.04)	0.15 (0.10)	−0.26 <sup>a</sup> (0.04)
Foreign-owned	0.92 <sup>b</sup> (0.39)	−2.34 <sup>b</sup> (1.06)	1.24 <sup>a</sup> (0.34)
JV-owned	0.98 <sup>a</sup> (0.38)	−2.57 <sup>b</sup> (1.25)	1.28 <sup>a</sup> (0.35)
State-owned	2.35 <sup>a</sup> (0.43)	−1.47 (1.05)	2.52 <sup>a</sup> (0.47)
Fixed effects	Province-country-year & province-industry		
Observations	1,180,996	1,180,996	1,180,996
R <sup>2</sup>	0.062	0.065	0.060

Heteroskedasticity-robust standard errors are reported in parentheses. Standard errors are clustered at the province/country and sector levels. Regressions also include pairwise interactions between industries' factor intensity ( $Kint_k$  and  $Hint_k$ ) and the firm ownership dummies.

- <sup>a</sup> Indicate significance at the 1% confidence level.
- <sup>b</sup> Indicate significance at the 5% confidence levels.
- <sup>c</sup> Indicate significance at the 10% confidence levels.

sector-level bilateral (province-country) export values by firm types, considering private firms as the reference group and using interactive terms for the other three groups to measure how they differ. We use the following specification:

$$\ln X_{ijkt}^F = \alpha^F D_F \times FinV_k + \beta FinDev_{it} \times FinV_k + \beta_F D_F \times FinDev_{it} \times FinV_k + \gamma^F D_F \times FinDev_{it} + \zeta^F k_{it} \times Kint_k + \eta^F h_{it} \times Hint_k + \theta_{ijt} + \lambda_{ik}^F + \epsilon_{ijkt}^F \quad (2)$$

where  $X_{ijkt}^F$  is the export value from province  $i$  to country  $j$  in sector  $k$  at year  $t$ , by firm type  $F$ .  $FinDev_{it}$  corresponds to province  $i$ 's financial development, which we proxy for using the share of non 4-SOCBs in total bank credits, introduced in log.  $FinV_k$  is one of our three indices of financial vulnerability at sector level  $k$ . We identify the effects of deregulation of the banking sector on export structure distortions from the variation within firm-type-province-industry, across years after controlling for yearly unobserved characteristics for the province/country pair with province/country/year fixed effects. Province-country-year fixed effects  $\theta_{ijt}$  control for time-varying provincial features such as size. Differentiating variables within province/industry/firm-type ( $\lambda_{ik}^F$ ) groups allows to control for patterns of specialization across provinces and firm types. With this set of fixed effects, the

coefficients on the interaction terms are identified from the variation across firm-types and sectors within a province-country-year triad, and from the variation in province-level deregulation of the banking sector across years within a firm-type-province-sector triad.

Our key parameters of interest are those capturing the impact of reforms to the financial sector on exports for the various firm types. It is measured by the double interaction term between financial development and financial vulnerability ( $\beta$ ) for private firms (the reference group) and by  $\beta+$  the triple interaction terms  $\beta^F$  between financial development and financial vulnerability for each other firm type  $F$ . If deregulation of the banking sector as State-owned banks relinquish market share mitigates the export structure distortions, then the sensitivity of exports to financial vulnerability should be higher in more financially deregulated provinces, especially for domestic private firms. We thus expect that  $\beta > 0$  and  $\beta^F < 0$ , reflecting the notion that domestic private firms may benefit more from deregulated banking markets compared to state-owned or foreign firms.

We further account for differences in endowments with variables  $k_{it} \times Kint_k$  and  $h_{it} \times Hint_k$ . They correspond to the interactions of measures of physical/human capital intensity at sector level with province-level endowments of each factor. Provincial endowment in human capital  $h_{it}$  is measured by the average number of years of schooling, while that in physical capital  $k_{it}$  is proxied by the per capita stock of capital.<sup>13</sup> All coefficients relating to differences in endowments will be allowed to vary by firm types. Hence our specification includes all pairwise interactions between sectors' factor intensity, regions' factor endowments, and the ownership dummies. We allow firm type exports to differ in sector finance vulnerability ( $\alpha_F$ ), as we observed to be the case in [Tables 1 and 2](#); and we also allow financial reforms to affect firm types' exports differently ( $\gamma_F$ ). In this way, any variable correlated with banking reforms, which could impact the balance of export activity across firm types, will be captured by these controls, but should not affect our coefficients of interest  $\beta$  and  $\beta_F$ , unless its effect runs through a financial channel. We thus adapt the methodology first used in [Rajan and Zingales \(1998\)](#), which consists in filtering the impact of financial reforms by the sector-level index  $FinV_k$ .<sup>14</sup> Standard errors are clustered at the province/country and sector levels.

[Table 3](#) display results from estimations of Eq. (2). Control variables for provincial factor endowments interacted with sector factor intensity and firm type dummy variables rule out the possibility that our estimates reflect a mere pattern of firm types specialization by factor (capital/human capital) intensity, which would be correlated with financial characteristics.<sup>15</sup>

Across our three indicators of financial vulnerability, we observe consistently that the impact of reforms to the financial sector on exports varies importantly across firm types. Findings of a positive and significant  $\beta$  suggest that the State's withdrawal from the banking system significantly reduces credit constraints for private firms, as evidenced by the fact that it causes these firms' exports to grow substantially more in sectors where finance is most needed. The negative coefficients ( $\beta^F$ ) attracted by the interactive terms between financial development and financial vulnerability for State-owned, foreign and joint-venture firms indicate that this mitigating effect of financial reforms on credit constraints is much less present for those firms. Changes in the domestic banking structure thus appear to have reduced the gap in credit access between private firms and other firms. We interpret this finding as evidence that well-developed financial markets create a level playing field allowing private firms to overcome their relative disadvantage due to limited internal funding.<sup>16</sup>

<sup>13</sup> It is computed as the accumulation of fixed investment using the permanent inventory method.

<sup>14</sup> Note that this methodology does not rule out the possibility of reverse causality in the relationship we observe. Banking reforms might have been driven partly by the growth of private firms activity in finance-intensive sectors. As we do not have an instrument for banking reforms, we remain careful about the direction of causality. However, the literature suggests that the political weight of private firms and entrepreneurs has been weak ([Huang, 2003](#)), leading private firms to use alternative sources of finance, in reaction to their limited access to the public banking sector ([Allen et al., 2005](#)). Financial reform in China is generally presented as a centrally planned process rather than as a response to political demand by private entrepreneurs ([Lin and Sun, 2009](#)).

<sup>15</sup> In unreported results, we test the robustness of our findings to the exclusion of Shanghai (the major banking center in China).

<sup>16</sup> In the unreported results, which are available upon request, we find similar patterns when we replace the firm type-province-industry fixed effects by fixed effects for the three following dimensions: firm-type, country-industry and industry-year.

**Table 3**  
Financial liberalization reforms and export structure distortions.

Explained variable	Log export value (province/country/ISIC/year)		
	Financial dependence (1)	Liquidity needs (2)	R&D (3)
Financial development × fin. vulnerability ( $\beta$ )	4.78 <sup>a</sup> (1.38)	32.33 <sup>a</sup> (3.19)	77.83 <sup>a</sup> (24.34)
Foreign-owned × fin. devt. × fin. vulnerability	-4.47 <sup>a</sup> (1.37)	-26.30 <sup>a</sup> (7.44)	-62.79 <sup>a</sup> (23.96)
JV-owned × fin. devt. × fin. vulnerability	-4.20 <sup>a</sup> (1.37)	-27.02 <sup>a</sup> (5.68)	-67.58 <sup>a</sup> (25.39)
State-owned × fin. devt. × fin. vulnerability	-4.57 <sup>a</sup> (1.38)	-31.61 <sup>a</sup> (3.97)	-74.43 <sup>a</sup> (23.62)
Foreign-owned × fin. devt.	-0.41 (0.51)	0.52 (1.39)	-0.63 (0.43)
JV-owned × fin. devt.	-0.26 (0.39)	0.86 (0.98)	-0.30 (0.35)
State-owned × fin. devt.	1.27 <sup>a</sup> (0.39)	3.04 <sup>a</sup> (0.61)	1.25 <sup>a</sup> (0.33)
$K/L$ × physical capital intensity	54.37 <sup>a</sup> (4.73)	49.44 <sup>a</sup> (4.32)	54.64 <sup>a</sup> (4.90)
$H/L$ × human capital intensity	0.50 (1.59)	1.40 (1.52)	0.45 (1.62)
Foreign-owned × $K/L$ × physical capital intensity	-37.39 <sup>a</sup> (5.60)	-31.93 <sup>a</sup> (5.42)	-37.62 <sup>a</sup> (5.84)
State-owned × $K/L$ × physical capital intensity	-42.85 <sup>a</sup> (5.11)	-37.94 <sup>a</sup> (4.96)	-43.05 <sup>a</sup> (5.33)
JV-owned × $K/L$ × physical capital intensity	-39.23 <sup>a</sup> (6.37)	-33.72 <sup>a</sup> (5.89)	-39.31 <sup>a</sup> (6.46)
Foreign-owned × $H/L$ × human capital intensity	-0.35 (1.98)	-1.18 (1.89)	-0.40 (1.98)
JV-owned × $H/L$ × human capital intensity	-0.03 (2.32)	-0.98 (2.18)	-0.06 (2.30)
State-owned × $H/L$ × human capital intensity	0.12 (2.24)	-0.76 (2.13)	0.15 (2.28)
Fixed effects	Province-country-year and firm type-province-industry		
Observations	709,563	709,563	709,563
$R^2$	0.058	0.061	0.059

Heteroskedasticity-robust standard errors are reported in parentheses. Standard errors are clustered at the province/country and industry levels.  $K/L$ ,  $H/L$  are proxies for physical and human capital endowments respectively at the province level. Physical and human capital intensity indices at sector level are taken from Braun (2003) and are computed on US firms data. Coefficients on interaction terms of firm type dummies with province factor endowments variables  $K/L$ ,  $H/L$  are not reported here.

<sup>a</sup> Indicate significance at the 1%, 5% and 10% confidence levels.

In order to assess the reduction in the distortions over the period in conjunction with the reduction of State control over the financial intermediation system, we consider a 20% increase in the non-big-four State banks share in credits (corresponding approximately to one standard deviation increase, as shown in Table 9 in the Appendix). As a consequence of reforms to the financial sector, exports by all firm types grow relatively more in financially dependent sectors, implying a rebalancing of exports across industries. Measuring, as before, external dependence at the 25th and 75th percentile of the distribution of Chinese exports in 1997, we find values of 0.03 and 0.45 (for ‘Apparel’ and ‘Machinery’, respectively). All things being equal, an improvement of the scale considered here (+20%) results in a growth differential of 40.1%<sup>17</sup> (for private firms at the 75th percentile of dependence, relative to the

<sup>17</sup> This figure is computed as  $0.2 \times \beta \times 0.42$  based on  $\beta=4.78$  in Column 1 of Table 3.

**Table 4**

Robustness checks (province): financial reforms and export structure distortions.

Explained variable Financial reforms measure	Log exported value (province/ISIC/country/year) Non 4-SOCBs' share in credits					
	(1)	(2)	(3)	(4)	(5)	(6)
Province control indicator	GDP per capita			FDI over GDP		
Financial vulnerability measure	Fin. dep	Liq	R&D	Fin. dep	Liq	R&D
Province fin. devt × sector fin. vulnerability	2.24 <sup>a</sup> (0.67)	5.87 <sup>b</sup> (2.51)	24.58 <sup>b</sup> (10.82)	9.79 <sup>a</sup> (1.78)	44.93 <sup>a</sup> (3.48)	139.80 <sup>a</sup> (40.56)
Foreign-owned × fin. devt × fin. vuln.	−1.54 (1.06)	−5.62 (6.16)	−6.04 (11.54)	−9.19 <sup>a</sup> (1.72)	−38.50 <sup>a</sup> (6.29)	−124.04 <sup>a</sup> (39.98)
JV-owned × fin. devt × fin. vuln.	−1.24 <sup>c</sup> (0.73)	−3.14 (4.19)	−10.90 (10.90)	−8.73 <sup>a</sup> (1.61)	−37.69 <sup>a</sup> (4.64)	−126.35 <sup>a</sup> (39.05)
State-owned × fin. devt × fin. vuln.	−2.40 <sup>a</sup> (0.68)	−6.41 <sup>b</sup> (2.71)	−24.98 <sup>b</sup> (10.59)	−9.55 <sup>a</sup> (1.75)	−42.47 <sup>a</sup> (3.62)	−136.44 <sup>a</sup> (40.24)
Prov. control × fin. vuln.	7.36 <sup>a</sup> (1.42)	35.69 <sup>a</sup> (2.83)	104.40 <sup>a</sup> (34.23)	−0.05 (0.14)	0.61 (0.95)	−2.38 (2.70)
Foreign-owned × prov. control × fin. vuln.	−7.40 <sup>a</sup> (1.30)	−30.67 <sup>a</sup> (3.74)	−106.29 <sup>a</sup> (32.69)	0.00 (0.19)	0.90 (1.39)	0.85 (4.17)
JV-owned × prov. control × fin. vuln.	−7.28 <sup>a</sup> (1.22)	−30.40 <sup>a</sup> (3.65)	−103.41 <sup>a</sup> (32.01)	0.02 (0.15)	−0.69 (1.53)	0.22 (2.29)
State-owned × prov. control × fin. vuln.	−6.70 <sup>a</sup> (1.27)	−30.76 <sup>a</sup> (3.40)	−97.99 <sup>a</sup> (32.44)	−0.10 (0.14)	−1.12 (1.12)	0.44 (2.32)
Foreign-owned × prov. control	−0.15 (0.43)	0.84 (0.72)	−0.34 (0.39)	−0.06 (0.09)	−0.21 (0.22)	−0.09 (0.09)
JV-owned × prov. control	−0.69 <sup>c</sup> (0.41)	0.27 (0.70)	−0.90 <sup>b</sup> (0.36)	0.04 (0.08)	0.19 (0.24)	0.04 (0.08)
State-owned × prov. control	−1.04 <sup>a</sup> (0.36)	0.12 (0.56)	−1.18 <sup>a</sup> (0.33)	0.05 (0.06)	0.24 <sup>c</sup> (0.14)	−0.00 (0.06)
Foreign-owned × fin. devt.	1.38 <sup>a</sup> (0.51)	1.19 (1.13)	1.11 <sup>b</sup> (0.48)	1.04 <sup>c</sup> (0.58)	2.11 <sup>c</sup> (1.23)	0.71 (0.47)
JV-owned × fin. devt.	1.35 <sup>a</sup> (0.37)	0.84 (0.73)	1.27 <sup>a</sup> (0.38)	0.53 (0.47)	1.60 <sup>c</sup> (0.82)	0.39 (0.41)
State-owned × fin. devt.	1.69 <sup>a</sup> (0.27)	1.36 <sup>a</sup> (0.36)	1.52 <sup>a</sup> (0.26)	0.66 (0.44)	2.26 <sup>a</sup> (0.56)	0.45 (0.37)
K/L × physical capital intensity	13.22 <sup>a</sup> (4.27)	14.39 <sup>a</sup> (3.63)	16.24 <sup>a</sup> (4.64)	13.71 <sup>a</sup> (3.82)	12.76 <sup>a</sup> (3.61)	14.60 <sup>a</sup> (3.98)
H/L × human capital intensity	2.15 <sup>b</sup> (0.96)	−1.14 (0.85)	1.81 <sup>c</sup> (0.97)	1.31 (0.89)	1.13 (0.87)	1.11 (0.92)
Fixed effects	Province-country-year and firm-type-province-industry fixed effects					
Observations	709,563	709,563	709,563	709,563	709,563	709,563
R <sup>2</sup>	0.016	0.026	0.014	0.008	0.011	0.007

Heteroskedasticity-robust standard errors are reported in parentheses. Standard errors are clustered at the province/country and industry levels.

<sup>a</sup> Indicate significance at the 1% confidence level.

<sup>b</sup> Indicate significance at the 5% confidence levels.

<sup>c</sup> Indicate significance at the 10% confidence levels.

25th percentile). Foreign firms also see their exports grow relatively more in dependent sectors, but the growth differential is of only 2.6%.<sup>18</sup> Over the period, this brings the distribution of private firms' exports closer to that of foreign firms, as observed in the previous section. We can compute that the ratio of private firms' to foreign firms' exports grows faster at the 75th percentile sector, than at the 25th, by 37.5%. This evolution is consistent with the capacity of well-developed financial markets to

<sup>18</sup> This figure is computed as  $0.2 \times (\beta + \beta_F) \times 0.42$  based on  $\beta = 4.78$  and  $\beta_F = -4.47$ , in Column 1 of Table 3.

**Table 5**

Robustness checks (industry): financial reforms and export structure distortions.

Explained variable Financial reforms measure	Log exported value (province/ISIC/country/year) Non 4-SOCBs' share in credits		
	(1)	(2)	(3)
Industry control indicator	Employment/output		
Financial vulnerability measure	Fin. dep	Liq	R&D
Province fin. devt × ind. fin. vuln.	4.10 <sup>a</sup> (1.12)	33.10 <sup>a</sup> (5.72)	59.60 <sup>a</sup> (14.03)
State-owned × fin. devt × fin. vuln.	−3.74 <sup>a</sup> (1.12)	−30.52 <sup>a</sup> (5.47)	−55.35 <sup>a</sup> (13.59)
JV-owned × fin. devt × fin. vuln.	−3.14 <sup>a</sup> (1.16)	−26.64 <sup>a</sup> (6.85)	−47.26 <sup>b</sup> (18.84)
Foreign-owned × fin. devt × fin. vuln.	−3.42 <sup>a</sup> (1.18)	−27.93 <sup>a</sup> (9.72)	−38.77 <sup>a</sup> (14.35)
Industry control × fin. devt.	−9.18 <sup>a</sup> (1.33)	−3.24 <sup>b</sup> (1.59)	−9.47 <sup>a</sup> (1.33)
State-owned × ind. control × fin. devt.	9.28 <sup>a</sup> (1.35)	3.45 <sup>b</sup> (1.64)	9.53 <sup>a</sup> (1.43)
JV-owned × ind. control × fin. devt.	10.15 <sup>a</sup> (1.60)	4.57 <sup>b</sup> (1.89)	10.19 <sup>a</sup> (1.54)
Foreign-owned × ind. control × fin. devt.	9.08 <sup>a</sup> (2.22)	3.40 (2.42)	8.49 <sup>a</sup> (2.25)
State-owned × fin. devt.	2.56 <sup>a</sup> (0.59)	2.39 <sup>a</sup> (0.74)	2.57 <sup>a</sup> (0.63)
JV-owned × fin. devt.	3.07 <sup>a</sup> (0.74)	2.62 <sup>b</sup> (1.14)	2.98 <sup>a</sup> (0.81)
Foreign-owned × fin. devt.	2.90 <sup>a</sup> (1.11)	2.51 (1.87)	2.11 <sup>c</sup> (1.24)
K/L × physical capital intensity	11.35 <sup>a</sup> (3.46)	12.73 <sup>a</sup> (3.55)	11.62 <sup>a</sup> (3.48)
H/L × human capital intensity	1.41 (0.93)	1.08 (0.90)	1.34 (0.94)
Fixed effects	province-country-year, firm type-province-industry		
Observations	709,563	709,563	709,563
R <sup>2</sup>	0.011	0.011	0.011

Heteroskedasticity-robust standard errors are reported in parentheses. Standard errors are clustered at the province/country and industry levels.

<sup>a</sup> Indicate significance at the 1% confidence level.

<sup>b</sup> Indicate significance at the 5% confidence levels.

<sup>c</sup> Indicate significance at the 10% confidence levels.

create a level playing field allowing private firms to overcome their relative disadvantage due to limited internal funding.

*Robustness checks:* One potential concern in the results from the previous section is that the effects identified might be attributable not to financial reforms, but rather to broader economic changes at the province level, likely to be correlated with it. Our identification strategy partly mitigates this endogeneity issue: by measuring the differential impact of financial development across sectors, depending on their degree of dependence on finance, we exclude the possibility that an omitted variable impacting exports positively across sectors be driving our results: this will not be the case unless the omitted variable has a differential impact across sectors ordered by financial dependence.

We now run additional regressions, where we test if two important province-level macro indicators (real GDP per capita and ratio of FDI over GDP)<sup>19</sup> are having such a differential impact

<sup>19</sup> Real GDP per capita (deflated by annual CPI) and FDI over GDP data come from the China Statistical Yearbooks.

across sectors, and if this impact may be driving our results. To do this, we use regressions based on Eq. (2), where we add province-level macro indicators, and their interactions with our financial dependence indicators. Table 4 reports the results of these robustness checks, for our three indicators of financial vulnerability.

The difference in the impacts of financial development on the exports of private firms versus other firm types remains large and significant.

In the first panel, one observes that the impact of financial development across firm types is reduced, when controlling for province-level GDP per capita (a proxy for economic development). This indicates a positive correlation between financial development and income per capita across provinces. However, the difference between firm types in the impact of financial development remains significant, in particular between private firms and State-owned and joint-venture firms. This indicates that this effect is not merely driven by such an omitted determinant. Similarly, the second panel that province-level ratios of FDI inflows over GDP, a proxy for openness policies, are also not driving our results for the impact of financial development.

A related concern is that our measure of financial vulnerability may be capturing other sector characteristics that would be associated with export performance. In particular, we may fear that financially vulnerable sectors happen to be the ones most favored by provincial governments and that our  $FinDev_{it}$  variable acts as a proxy for industrial policies through which a provincial government might seek to boost production and exports in favored sectors. To verify this issue, we check that our results in Table 3 are globally robust to the further inclusion of  $FinDev_{it} \times Ind.control_k$  by firm type (and their associated double interactions) where  $Ind.control_k$  captures the rationale for an interventionist strategy by the provincial authorities aiming to support employment, proxied by the average employment/output ratio by sector.

It is indeed likely that preferential treatment is granted to sectors with high employment potential as local officials are concerned by employment maximization.<sup>20</sup>

Table 5 report the results of Eq. (2) after adding these additional interactions.

Results suggest that State-owned and foreign firms have generally increased their export activity in high employment sectors, relatively to private firms. However, the differential impact of reforms to the banking sector on exports across sectors ordered by financial dependence is still significant, in particular between private firms and other firm types; consistently with this effect running through financial mechanisms, and not through other sector characteristics. Overall our results suggest that financial distortions have declined over time, hindering export growth to a lower extent.

## 6. Conclusion

In this paper, we investigate how the export performance of Chinese firms in China is influenced by credit constraints. Our results support a key role of financial constraints in restricting exports and in determining the patterns of export specialization across firm types in China. Credit constraints have provided an advantage to foreign-owned firms, and to a lesser extent State-owned firms, over private domestic firms in sectors with higher levels of financial vulnerability. We show that this advantage has diminished significantly since 1997. In particular, the advantage enjoyed by State-owned firms has entirely vanished in the mid-2000s. Our results suggest that the reduction in this gap between firm types relates to the improvements in the functioning of the financial sector. The ongoing development of well-developed financial markets appears to create a level playing field allowing private firms to overcome their relative disadvantage due to limited internal funding. Our findings indicate that further deregulation of the banking sector may be used to promote China's exports in financially vulnerable sectors.

<sup>20</sup> Data on sectoral employment come from the China Statistical Yearbooks.

## Appendix A. Graphs and descriptive statistics

See Tables 6–9.

**Table 6**  
Summary statistics: evolution over time.

Year	Non-Big-4 State-owned banks <sup>a</sup> in credits	Share of Foreign entities <sup>b</sup> in exports
1990	0.18	
1991	0.19	
1992	0.21	
1993	0.25	
1994	0.36	
1995	0.40	
1996	0.39	
1997	0.41	0.24
1998	0.38	0.25
1999	0.37	0.27
2000	0.41	0.29
2001	0.41	0.30
2002	0.42	0.31
2003	0.43	0.30
2004	0.45	0.31

Yearly average across Chinese provinces.

<sup>a</sup> Non-Big 4 State-Owned Banks correspond to banks other than the four main State-Owned Banks (the Bank of China, the People's Construction Bank of China, the Agricultural Bank of China and the Industrial and Commercial Bank of China).

<sup>b</sup> Foreign entities are defined here as firms with partial or full foreign ownership. *Source:* Almanacs of China's Finance and Banking and Chinese customs.

**Table 7**  
Summary statistics: cross-province heterogeneity.

*Source:* China's statistical yearbooks, Almanacs of China Finance and Banking and China customs.

Province	GDP per capita 2000	Share non-SOCBs in credits 2000	Foreign export share 1997–2007	Share in China's exports 1997–2007
Guangxi	4315	0.32	0.23	0.004
Hainan	6814	0.33	0.42	0.002
Liaoning	11,017	0.53	0.61	0.031
Ningxia	4791	0.23	0.15	0.001
Qinghai	5103	0.26	0.03	0.001
Guizhou	2645	0.29	0.16	0.001
Tianjin	16,375	0.30	0.84	0.032
Yunnan	4610	0.31	0.09	0.004
Jiangxi	4828	0.35	0.26	0.004
Shaanxi	4558	0.35	0.14	0.004
Gansu	3846	0.37	0.16	0.001
Inner Mongolia	5905	0.38	0.20	0.002
Shanghai	27,187	0.39	0.66	0.115
Xinjiang	7388	0.39	0.03	0.006
Fujian	11,496	0.40	0.61	0.048
Jiangsu	11,713	0.41	0.73	0.148
Hebei	7625	0.43	0.39	0.012
Sichuan	4770	0.44	0.18	0.007
Anhui	4840	0.45	0.26	0.007
Hubei	7175	0.45	0.31	0.006
Jilin	6791	0.47	0.38	0.003
Heilongjiang	8545	0.47	0.10	0.007

Table 7 (continued)

Province	GDP per capita 2000	Share non-SOCBs in credits 2000	Foreign export share 1997–2007	Share in China's exports 1997–2007
Guangdong	12,911	0.47	0.62	0.340
Chongqing	5142	0.47	0.13	0.003
Shanxi	5061	0.48	0.16	0.004
Zhejiang	13,410	0.48	0.35	0.097
Beijing	17,936	0.49	0.40	0.037
Hunan	5626	0.49	0.16	0.005
Henan	5415	0.52	0.19	0.006
Shandong	9518	0.54	0.55	0.060

Table 8

Summary statistics: sector-level characteristics.

Sources: Rajan and Zingales (1998), Braun (2003) and Kroszner et al. (2007).

Name of sector	ISIC	Hum. cap. intensity	Phys. cap. intensity	External dependence	Cumul. share		Liquidity needs	R&D intensity	Foreign share
					1997	2007			
25th percentile									
Tobacco	314	1.3539	0.0181	−0.45	0.003	0.000	0.25	0	0.20
Pottery	361	0.8041	0.0546	−0.15	0.012	0.003	0.17	0.02	0.24
Leather	323	0.6869	0.0324	−0.14	0.036	0.015	0.27	0.01	0.42
Footwear	324	0.5328	0.0181	−0.08	0.087	0.037	0.23	0.01	0.60
Non-ferrous metal	372	1.0982	0.1012	0.01	0.102	0.054	0.17	0.01	0.20
Apparel	322	0.5017	0.0189	0.03	0.256	0.126	0.21	0	0.33
75th percentile									
Refineries	353	1.6558	0.1955	0.04	0.265	0.135	0.07	0	0.07
Non-metal products	369	0.9522	0.0684	0.06	0.275	0.143	0.14	0.01	0.36
Beverages	313	1.1345	0.062	0.08	0.277	0.144	0.11	0	0.20
Iron and steel	371	1.251	0.1017	0.09	0.299	0.177	0.16	0.01	0.10
Food products	311	0.8117	0.0616	0.14	0.343	0.197	0.1	0.01	0.39
Paper products	341	1.1392	0.1315	0.18	0.347	0.202	0.12	0.01	0.45
Printing & publishing	342	0.9339	0.0515	0.2	0.350	0.205	0.08	0.01	0.64
Other chemicals	352	1.2089	0.0597	0.22	0.413	0.260	0.15	0.02	0.31
Rubber products	355	0.9854	0.0656	0.23	0.418	0.268	0.14	0.02	0.59
Furniture	332	0.6984	0.039	0.24	0.425	0.326	0.15	0.01	0.34
Metal products	381	0.9144	0.0531	0.24	0.473	0.329	0.18	0.01	0.35
Wood products	331	0.7409	0.0653	0.28	0.478	0.336	0.12	0.01	0.39
Transport equipment	384	1.3221	0.0714	0.31	0.509	0.383	0.19	0.02	0.41
Petroleum and coal	354	1.1531	0.0741	0.33	0.513	0.386	0.12	0.01	0.08
Textiles	321	0.6881	0.0726	0.4	0.632	0.458	0.17	0.01	0.30
75th percentile									
Machinery	382	1.1187	0.0582	0.45	0.721	0.657	0.22	0.02	0.66
Other manufacturing	390	0.7553	0.0393	0.47	0.796	0.697	0.22	0.02	0.44
Glass and products	362	1.0121	0.0899	0.53	0.800	0.703	0.15	0.02	0.49
Electrical machinery	383	1.0636	0.0765	0.77	0.944	0.938	0.2	0.07	0.65
Professional equipment	385	1.2341	0.0525	0.96	0.975	0.982	0.21	0.09	0.56
Plastic products	356	0.8274	0.0883	1.14	1.000	1.000	0.13	0.02	0.53

**Table 9**

Summary statistics: key variables.

Source: China's statistical yearbooks and Chinese customs. Foreign share computes the share of exports performed by fully foreign and JV firms.

Variables	Mean	Standard deviation	Min	Max
Share of non-4-SOCBs in credits	0.375	0.097	0.088	0.603
Export value (in US \$ billion)	9.66	22.7	0.0764	190
Foreign share in export value	0.293	0.215	0.0098	0.88

Summary statistics are computed based on 240 observations (30 provinces over the years 1997–2004).

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