# Internal Capital Markets and the Transmission of Exchange-Rate Shocks: Evidence from Chinese Business Groups*

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**Abstract**

Liquidity-constrained large shareholders often reallocate capital within business groups to finance their own projects, imposing credit constraints on other group members. Using microdata from Chinese customs, we study the impact of this negative externality on the transmission of exchange-rate shocks through exporters' pricing behavior. We exploit a mandatory ownership-structure reform in China that differentially increases group owners' borrowing capacity through a collateral channel and, as a result, reduces their incentive to use intragroup trade credit to tunnel resources out of publicly listed firms. Exporting subsidiaries of less tunneled public firms stabilize local-currency export prices more in response to exchange-rate fluctuations in the destination-market currency. Our estimate indicates an exporting subsidiary will price to market 45%-50% less if large shareholders tunnel 1% of the public firm's total assets. Subsidiaries also have access to less credit from tunneled firms.

**JEL classification: F12, F14, F31, G32, G34, G38**

**Keywords: Business Groups, Internal Capital Markets, Corporate Governance, Tunneling, Exchange Rates, Pricing-to-Market, Sticky Export Prices**

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*In February and July 2009, Wuliangye, Yibin Co. Ltd, a famous liquor producer and exporter in China, made two separate announcements to cut related party transactions with its group parent and export companies. As shown by its 2009 interim financial reports, the public firm's gross margin significantly increased. Analysts said such an observation is consistent with a long-standing, market-wide conjecture of "tunneling" by large shareholders before 2009* (translation our own). Securities Daily (September 10, 2009 )

# 1 Introduction

Following the demise of Lehman Brothers, the globe had witnessed a collapse of exports relative to output (Levchenko et al., 2010; Alessandria et al., 2010; Amiti and Weinstein, 2011; Chor and Manova, 2012a).[1] The Great Trade Collapse of 2008 has been widely viewed as the most compelling piece of evidence consistent with exporters facing more stringent capital constraints relative to domestic producers (Manova, 2013; Foley and Manova, 2015; Chaney, 2016).[2] The collapse called the public's attention to the role of banks in trade finance.

One important question is relatively unexplored: how financial frictions adversely impact trade outcomes when small exporters do not have a direct access to bank loans? It is well known that an overwhelming majority of firms in emerging countries are organized into business groups and, as a result, rely heavily on internal capital markets to finance their projects (Morck et al., 2005; Khanna and Yafeh, 2007). The weakness of legal institutions for corporate governance, accompanied by a separation of large shareholders' ownership and control, implies business groups in emerging countries can propagate economic shocks very differently than what has recently been found in U.S. conglomerates (Desai et al., 2008, 2004; Manova et al., 2015).

In this paper, we study the transmission of exchange-rate shocks by internal capital markets through a micro channel, namely, exporters' price adjustment to exchange-rate shocks. Studying the pricing mechanism is important to understand the international transmission of shocks and the design of monetary policy in an open economy (Chari et al., 2002; Devereux and Engel, 2003; Engel, 2012). Our empirical setting is China. As in the *Securities Daily* quote above, like firms

[1] The International Monetary Fund expected the total volume of global trade to shrink by 2.8% in 2009, the first contraction since 1982 ("Trade finance shrivels, pushing downturn deeper," Carter Dougherty, *New York Times*, March 3, 2009).

[2] Often-cited reasons include higher upfront costs, extra working capital, and increased risk associated with transnational operations.

in other East Asian countries, Chinese publicly listed firms heavily rely on business groups to operate, but liquidity-constrained group owners often expropriate minority shareholders through "tunneling" à la Johnson et al. (2000). A striking pattern is that Chinese subsidiaries are much more export-oriented than their publicly listed parents. Their exporting activities are therefore supposed to be financed by the domestic sales of public firms. By expropriating public firms' domestic sales, business-group owners can impose credit constraints on exporting subsidiaries.[3]

Our key empirical finding is that exporting subsidiaries of less tunneled firms price to market more — they reduce local-currency export prices more when domestic currency appreciates and increase prices more when it depreciates. Our point estimations indicate an exporting subsidiary of a publicly listed firm will price to market 45%-50% less if large shareholders tunnel 1% of the public firm's total assets. Because aggregate trade flows are determined by large firms, we weight regressions by public firms' size to identify the macro effects of this heterogeneity. The economic magnitude of tunneling on pricing-to-market is robust to treating large and small firms differently.

Our empirical findings most validate the extension of Melitz and Ottaviano (2008) to include exchange-rate movements (e.g., Berman et al., 2012). In contrast to the case of constant elasticity of substitution, a linear demand system with horizontal product differentiation implies the price elasticity of demand increases with the price consumers face. When exporters benefit from a reduction in tunneling, their marginal costs fall and the price elasticity of demand falls. A subsidiary's marginal cost could fall through two possible channels. First, an exporting subsidiary can borrow more from its less tunneled public parents, rather than from a bank, to finance its working capital. Second, the subsidiary sources products made by less tunneled public firms at cheaper prices and then engages in "Carry-Along Trade" à la Bernard et al. (2019). As a result, subsidiaries of less tunneled public firms price to market more.[4]

To conduct our empirical analysis, we match three datasets: transaction-level customs data, public firms and their related parties, and highly granular intragroup trade credit.

[3]We do not have financial data for most of the exporting subsidiaries. We match subsidiaries of public firms to the Orbis Asia-Pacific, which collects companies' filed accounts from the Chinese Administration of Industry and Commerce, the National Tax Bureau, and the National Bureau of Statistics of China (NBSC). On the sample period of 1999-2012, the average subsidiary has 6.9 million RMB total assets and 906 employees.

[4]We discuss the theoretical framework in section 6. Although we do not distinguish the above two channels in reducing subsidiaries' marginal cost, we emphasize the first channel in the model.

We empirically measure tunneling behaviors using data on intragroup trade credit.[5] Our identification strategy is to exploit the impact of a mandatory ownership-structure reform in China on group owners' reallocation of trade credit within business groups. In April 30, 2005, the state eagerly implemented the share-split structure reform, mandating all public firms convert their non-tradable shares into tradable ones as soon as possible. The major purpose of the reform was to improve internal governance by providing large shareholders with incentives to care about share prices. The reform was initiated under regulators' strong determination. After launching two batches of pilot companies within two months, Shang Fulin, chairman of China's Securities Regulatory Commission (CSRC), conveyed through a *People's Daily* news article that China would compete the reform within "a relatively short time."[6] Failing the reform would subject firms to delisting risks.[7] Because the supply of previously non-tradable shares would cause prices of tradable shares to plummet, the success of the reform crucially depended on how non-tradable shareholders compensated for tradable shareholders.

The reform, however, also increased the liquidity and thus the value of non-tradable ownership pledged by large shareholders to lenders during the pre-reform period.[8] Because providing banks with the option to liquidate pledged shares ex post eases financing ex ante, pledging shareholders' borrowing capacity was expected to increase afterwards. We document that large shareholders can borrow larger loans by pledging the *same* number of shares after the reform (see section 4.2). The mechanism has been well documented by other empirical studies (Gan, 2007; Chaney et al., 2012; Schmalz et al., 2017; Catherine et al., 2018).

An expanded borrowing capacity reduced large shareholders' incentive to tunnel, which is costly for the following three reasons. First, firms, including state-owned enterprises (SOEs), faced potential regulatory sanctions, especially after China's amendment of Securities Law in 2005. We identified 274 cases in which publicly listed firms were involved in tunneling scandals, and about 40% were SOEs. We show our measure of tunneling successfully predicts events

[5] As discussed by Chen et al. (2017), under China's accounting standards and tax rules, group owners prefer to use short-term intra-group loans to reallocate capital. A news article in the ninth issue of *People's Daily* revealed that, as of the end of 2002, among 703 firms listed on the Shanghai Stock Exchange, 36.5% of them provided their controlling shareholders with trade credit. Large shareholders appropriated public firms by about 33.9 billion RMB, which is about 3.31% of the total net assets of all the public firms.

[6] See "China determined to complete stock market reform in short time" (*People's Daily*, June 28, 2005).

[7] According to a *People's Daily* article dated on August 16, 2005, the CSRC warned that it "cannot exclude the possibility that firms that fail to reform would be subject to delisting."

[8] Section 2.3 discusses the background of the practice of share-pledge agreements in China.

in which regulatory authorities punish firms for tunneling-related reasons.[9] Second, ample anecdotes suggest returning the siphoned money to public firms largely increased the chance that shareholders would approve the reform proposal.[10] Third, large shareholders forgo dividends they are entitled to claim from the tunneled firm.

Prior to the reform, nearly 35% of publicly listed firms had large shareholders pledging their ownership to lenders. The average value of these collateralized shares, measured by the public firm's book value, was 188 million (RMB). We show the reform constituted a positive shock to pledging shareholders' borrowing capacities. We find group owners cut more tunnelings in the reform year, if they had pledged more non-tradable shares before. We document a positive association between collateralized shares and focal firms' abnormal stock returns around the event, suggesting investors expected minority shareholder expropriation to decline. As we demonstrate, however, the impact of collateral shares on tunneling was short lived and only concentrated in the reform year.

An important feature of our Chinese setting is that we can access customs data that provide information for each bilateral transaction at the monthly frequency, including values (in US dollars), quantities, product descriptions, and destination countries. As documented by Manova and Zhang (2012), one prominent feature of the data is that export prices vary considerably across Chinese producers selling in a given country and good, highlighting the extent of firm heterogeneity.[11] Combined with financial data from publicly listed firms, the customs dataset allows us to conduct a within-firm and -product-destination comparison of the effects of trade financing on export pricing across exporters. In the sample period from June 2005 through December 2006, we identify 150 publicly listed exporters and 412 exporting subsidiaries owned by 170 public firms. These exporters sold 2,456 products (defined by 6-digit Harmonization Code) to 53 destination countries by more than 70,000 bilateral transactions.

We discuss several potential concerns with our research design and our strategies to tackle such concerns. One concern is that the reform might have impacted Chinese public firms in several ways. Note that our strategy does not rely on a simple comparison of firm-level outcomes

[9] D'Acunto et al. (2019) document that Chinese SOEs react to location peers' punishment by reducing potential wrongdoings, improving corporate governance, and realizing higher productivities.

[10] See "Share-split structure reform forced large shareholders to reduce tunneling" (*International Finance News, People' Daily*, September 22, 2005).

[11] Export prices also vary considerably across trade partners within a given exporter.

before and after the reform announcement, which would raise the concern of unobservables affected by the reform, which in turn affects our outcomes of interest. Rather, our strategy integrates a difference-in-differences design with an instrument for the *cross-sectional* variation in the extent of tunneling by large shareholders during the reform year.

Our instrument is the amount of non-tradable shares pledged by large shareholders to lenders several years prior, measured immediately prior to the reform announcement by firms. Moreover, we focus on exporters at the level of subsidiaries of tunneled firms. These export units were not directly targeted by the reform and were located at least several levels away from the controlling chain of the pyramidal structure.

Our identifying assumption is that any divergence in the trends of exchange-rate pass-through after the reform is due to the reform itself, and not to other possible concurrent shocks such as foreign demand, monetary policy, or the changing distribution of active exporters. To assess the plausibility of the required identifying assumptions, we show that before the reform, the trends of exchange-rate pass-through of exporters with and without large shareholders pledging shares are parallel.

The second concern is whether the timing of the reform chosen by public firms had export considerations. Individual firms, especially state-owned enterprises (SOEs), however, had limited flexibility to time the reform, because of interventions from local government,[12] bureaucracies of the State-Owned Assets Supervision and Administration Commission (SASAC),[13] and the negotiation process between nontradable shareholders and institutional investors for compensation.

The last concern is the amount of collateralized shares might be correlated with errors in the price regression. Large shareholders, however, are less likely to strategically pledge in anticipation of a reform. Most firms compensate tradable shareholders in the form of new

[12]See "Shandong pronvince plans to complete the reform by three batches within six months" (*China Securities Journal*, November 25, 2005).

[13]See " The centralization of Shenzhen SASAC, 18 local public firms are finally approved to take the share-split structure return" (*National Business Daily*, July 20, 2005).

tradable shares.[14] Anecdotal evidence echoes our conjecture that reform often failed because pledging shareholders could not afford share compensation.[15]

We carry out instrumental variable (IV) estimation analysis on the sample period of 2005-2006. The sample unit is at the level of firm/subsidiary-product-destination-shipment-month, which is equivalent to one bilateral transaction. To match the timing of the drop in tunneling, we restrict our main regression sample on shipments after the announcement of the reform but within the reform year.[16]

We estimate regressions with a full set of firm and product-destination dummies. Firm-level unobservables such as productivity, firm location, size, capital intensity and ownership status all imply large differences in costs of capital. However, because our regression sample only spans the reform year, firm characteristics are mostly *time invariant* and can be fully absorbed by firm-fixed effects. Absorbing any systematic variation across product-destinations allows us to exclude the role of other time-invariant characteristics at the product-destination level, especially marginal cost and distribution cost, in explaining the differential reactions by exporters.

Our data and empirical approach allow us to obtain point estimates of the impact of tunneling on the price elasticity of goods, exported by subsidiaries of tunneled firms, to exchange-rate changes.[17] Our IV estimations show an increase in tunneling, measured by the supply of trade credit by public firms to large shareholders (and other entities owned by large shareholders), substantially increases export prices charged by subsidiaries of tunneled firms. The results are in line with the notion that financial constraints create an incentive for firms to raise prices (Chevalier, 1995; Dasgupta and Titman, 1998; Gilchrist et al., 2017). The results strongly support the premise of our theoretical framework as articulated in section 6.

Next, we document a negative elasticity of local-currency export price to the real exchange rate, suggesting exporters in our sample price to market. The estimated elasticity is about

[14]Recent research shows the compensation ratio is determined by institutional isomorphism (Haveman and Wang, 2013).

[15]As long as nontradable shareholders have enough non-collateralized shares to pay tradable shareholders, the reform can still be approved.

[16]As a robustness check, we also restrict the timing to be within the reform year, including months both before and after the reform. The rationale behind this specification is that the allocation of intragroup credit might already have been shifted before the reform announcement, as long as either banks or group owners anticipate the reform.

[17]The exchange rate in our paper is defined as the price of the home currency [renminbi (RMB) in China] in units of the foreign currency. A decrease in the exchange rate implies a depreciation of the domestic currency or an appreciation in the destination-market currency. An increase in the exchange rate implies the opposite.

-0.20 for all goods, including those exported by public firms, and -0.35 for goods exported only by subsidiaries of public firms. The number implies a one-unit increase (decrease) in the real exchange rate leads to a 0.2- to 0.35-unit decrease (increase) in export price (in RMB). Our finding is in contrast to Li et al. (2015) but is more in line with Berman et al. (2012). The former authors document a complete pass-through on the universe of customs data including all Chinese exporters from 2000 to 2007. One possible explanation is that our empirical design selects the most productive exporters into the sample.[18]

Our IV estimations yield the following main results: For our preferred sample, following a 10% exchange-rate appreciation, the average exporting subsidiary cuts its export price by 3.5%. A one-standard-deviation increase in tunneling (1.5% of the public firm's total assets) reduces this number to 1.7%. On the other hand, the average exporting subsidiary increases its export volumes by around 3.5%, but this elasticity increases to 7.4% when tunneling increases by one standard deviation. Therefore, tunneling affects the volume elasticity with a larger economic magnitude but in an opposite direction.

In particular, estimates from our weighted regressions suggest larger firms absorb more exchange-rate variations in their markups and that tunneling has a larger marginal impact on larger firms' pricing-to-market. We first weight regressions by the public firm's total assets. The estimated price elasticity ranges from -0.38 to -0.40, and a one-standard-deviation increase in tunneling reduces the elasticity to -0.22. We also report a much larger magnitude when the export-price regression is weighted by the volume of each bilateral transaction: The estimated price elasticity is increased to -0.60, and a one-standard-deviation increase in tunneling reduces the elasticity to almost zero.

We further confirm our empirical results are not driven by non-linearities in the way the instrument is constructed, are similar with different specifications of firm fixed effects, and are not materially altered by alternative specifications of collateral shares. Finally, we exclude exporters that simultaneously import intermediate goods from the same destination country. We conclude our findings are not driven by time-varying changes in exchange rates having offsetting effects on marginal costs (Amiti et al., 2014).

Worth special mention is that we find a much stronger effect of tunneling behavior on

[18]Li et al. (2015) also find productivities explain the heterogeneous pricing-to-market across firms.

price elasticities for exporters affiliated with the state-owned business groups, which counts for 79% of the sample. This finding is somehow surprising given that exporters with an SOE background receive government subsidizations.[19] Our findings, however, are consistent with SOE owners misallocating resources. For a variety of political reasons, including employment rate and social stability, state-owned business groups tend to transfer resources from units with better investment opportunities to those with worse opportunities; by contrast, private business groups do the opposite exactly because of high costs of external financing (Chen et al., 2017; Zhu, 2018). Thus, less tunneling better alleviates credit constraints faced by SOE export units.

The last question is whether subsidiaries of tunneled firms are indeed more financially constrained. We provide strong evidence that tunneling crowds out "propping credit," which is measured as intragroup credit supplied by publicly listed firms to their own subsidiaries.

## A. Related Literature

This paper is linked to several strands of literature. The first strand is the growing research on how financial friction interacts with export dynamics. Since 2008, researchers have been arguing the collapse in trade relative to industrial production largely stems from the funding shocks to banks during economic downturns (Amiti and Weinstein, 2011; Chor and Manova, 2012a).

Our paper differs from these studies. We emphasize the impact of internal finance as opposed to external finance on trade. Our results apply more to small exporters from developing countries. These firms are often rationed by external credit markets. Internal capital markets, however, as many studies from emerging countries show, can either enhance or weaken an exporter's advantage, depending on corporate governance (La Porta et al., 1999; Claessens et al., 2000; La Porta et al., 2002; Claessens et al., 2002). From the view of internal capital markets, our paper relates to, but also differs from, Desai et al. (2004), Desai et al. (2008), and Manova et al. (2015). The authors show foreign affiliates of US multinational firms are less constrained by local conditions than local firms.

Although our sample period does not include the Great Recession, our findings propose an alternative channel through which financial crisis, or financial frictions in general, contributes

[19]For example, see "China halts export-subsidy program after U.S. challenge" (*Wall Street Journal*, April 14, 2016).

to the trade collapse. In addition to drying up external financing, financial crisis itself can negatively impact group owners' investment opportunities, increasing their discount rates, and their incentives to expropriate minority investors. As a result, exporters organized within the same business group become more financially constrained and adjust export prices differently than financially healthy exporters, which in turn affect trade performance. Johnson et al. (2000), for instance, find the effectiveness of protection for minority shareholders explains the extent of exchange-rate depreciation and stock market decline better than do standard macroeconomic measures during the Asian financial crisis.

The second strand is the literature on the link between financial constraints and firms' pricing decisions. Chevalier (1995), Phillips (1995), Campello (2002), and Pichler et al. (2008) find output prices increase following an increase in firm leverage. Chevalier and Scharfstein (1996) and Dasgupta and Titman (1998) lay out theoretical frameworks for understanding the above stylized facts. Gilchrist et al. (2017) find liquidity constrained firms increased prices in 2008, while their unconstrained counterparts cut prices. To rationalize their findings, Gilchrist et al. (2017) develop a tractable general equilibrium model, in which monopolistically competitive firms face costly price adjustment, while setting prices to actively manage current versus future expected demand.

We study how financing affects trade flows through exporters adjusting prices to absorb destination-specific demand shocks. The pricing mechanism is important for the understanding of, first, the microfoundations of the "exchange-rate disconnect puzzle" (Obstfeld and Rogoff, 2001), second, the international transmission of shocks (Chari et al., 2002), and, third, the design of monetary policy in an open economy (Devereux and Engel, 2003; Engel, 2012). Our paper is thus related to Strasser (2013). The author uses survey data to show managers who feel more credit constrained are more likely to raise export prices in response to currency depreciations in destination countries. However, the academic debate on the relation between financial constraints and the exchange-rate pass-through is still open. For instance, in a recent discussion, Gopinath (2013) concludes that "the empirical results relating financial constraints to pass-through must be viewed with skepticism." Our study does not only propose a novel

empirical setting but also an economic mechanism to address several major concerns pointed by Gopinath (2013).[20]

# 2 Institutional Background

In this section, we introduce institutional backgrounds relevant to our empirical setting. In section 2.1, we discuss China's exchange-rate regime. In section 2.2, we discuss the background for the split-share structure reform. In section 2.3, we discuss the background for collateral shares.

## 2.1 China's Exchange-Rate Regimes

Before July 2005, China followed a fixed-exchange-rate regime with the RMB pegged to the US dollar. On July 21, 2005, the State Administration of Foreign Exchange launched a movement from a fixed to a managed floating exchange-rate regime. Under the new regime, based on market supply and demand, exchange rates of RMB against USD were set with reference to a basket of foreign currencies.

Figure 1 plots the time series of monthly nominal and real exchange rates of RMB against USD from January 2001 through December 2006. Before July 2005, nominal exchange rates between RMB and USD did not change. Nominal rates started to fluctuate only after the regime shift. Real exchange rates, however, had fluctuated over the entire sample period. The increasing trend after July 2005 implies an appreciation of RMB.

## 2.2 Split-Share Structure Reform

The opening of the Shanghai Stock Exchange and the Shenzhen Stock Exchange in the early 1990s facilitated the privatization of SOEs. To retain the government's control over the economy, policymakers created a unique ownership structure by splitting total initial public-offering shares into those that are not allowed to be traded, including state and legal shares, and A or B shares that can be freely traded by both domestic and foreign investors.

[20] Strasser (2013) uses survey data to show managers who feel more credit constrained are more likely to raise export prices in response to currency depreciations. The author, however, does not offer a theoretical explanation about his results.

Under this ownership structure, controlling shareholders' incentives are at odds with those of the minority shareholders, because large shareholders cannot gain security benefits by selling their shares on the stock market. Moreover, such a structure puts public investors in an inferior position relative to controllers in making investment and dividend policies.

To address the prevailing governance problems, the Chinese government implemented the split-share structure reform. The idea of introducing the reform was, as early as February 2, 2004, addressed in the Several Opinions of the State Council on Promoting the Reform, Liberalization, and Stable Development of the Capital Market (known as the Nine Provisions of the State Council). On April 30, 2005, the CSRC instituted a plan entitled "Directive on Problems in Trying to Solve the Split-Share Structure of Listed Companies." The plan mandated that non-tradable shares be freely tradable.

Four listed companies served as a pilot project, and 42 large corporations were subsequently chosen to undertake the reform.[21] After the two pilot programs, the CSRC submitted the formal plan to the State Council of People's Republic of China, seriously rolling out the reform. According to a *People's Daily* article dated on August 16, 2005, the CSRC warned that it "cannot exclude the possibility that firms that fail to reform will be subject to delisting." the CSRC set the end of 2006 as the target deadline. By July 18, 2007, 84.3% of the 1,250 firms listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchanges had undertaken the reform.

In Figure 2, we show the timeline of the reform by following Li et al. (2011). We illustrate the general case in Panel A and a case study of Shanghai Baoshan Iron & Steel. We refer to the "post-reform period" as the time period after the announcement of the start of the reform.

The reform took place in batches. For firms in the same batch, the announcement of the start of the reform took place on the same day. For each batch, the name list of focal firms was publicly announced through the *China Securities Journal*. Individual firms had less flexibility in choosing the timing of reform for several reasons. First, local government coordinated the timing among firms from the same province. Second, SOEs had to apply to the SASAC for approval.

[21]The reform plan mandated a one-year lock-up period for holders of formerly non-tradable stocks. After the expiration of the lock-up period, the holders of non-tradable A shares who held more than 5% of outstanding shares were allowed to sell no more than 5% in the first 12 months and no more than 10% in the first 24 months.

### 2.3 Collateral Shares

Chinese shareholders are allowed to pledge shares in companies they own as collateral to lenders, including commercial banks and trust companies. By doing so, large shareholders bear three types of costs. First, they are entitled to receive dividends only after debt is paid off. Second, the CSRC mandates that a firm make a public announcement about the details of collateralized shares. Stock prices usually plunge following such an announcement, because it signals to investors that the pledgers, usually the company's controlling shareholders, are in deep financial trouble. Third, and most important, the foreclosure of collateral involves the transfer of ownership to commercial banks. As such, unless they are extremely financially constrained, the large shareholders of a Chinese public company are less willing to borrow using their own shares as collateral.

One issue is how to evaluate collateral shares, especially when they are not tradable. Before 2005, commercial banks required very high collateral-to-debt ratios for two reasons. The first is that non-tradable shares are illiquid and, if borrowers default, banks must sell the shares at huge discounts outside the stock market. Thus, the value of non-tradable, collateralized shares assessed by lenders is much lower than the market value of the stock.[22]

In the 2003-2011 sample period, Zheng et al. (2014) document a strongly positive relationship between collateral shares and tunneling among Chinese public firms. In our data, untabulated statistics report similar results.

## 3 Data and Descriptive Statistics

### 3.1 Data

We use three datasets: the Chinese customs data for Chinese exporters and importers; data on intragroup credit (i.e., related-party transactions), ownership information, and financial data collected from the China Stock Market and Accounting Research (CSMAR) database; and country-level macro data collected from DataStream.

[22] On July 4, 2000, China Construction Bank issued guidance to standardize the procedure involved with loans against which non-tradable shares are pledged. However, how to determine the value of collateralized, non-tradable shares remains a controversial issue. The current consensus has been to determine the value based on the book value of net assets or to impose a discount rate on stock price to reflect the illiquidity.

### 3.1.1 Customs Data

One of our major data sources is information on Chinese firms that entered into bilateral trade relations with the rest of the world from 2000 to 2006. The data are collected and made available by the Chinese Customs Office. For each monthly transaction, the data report the USD-denominated free-on-board values of firm exports and imports by product and trade partner for 243 destination or source countries and more than 7,500 different products in the 6 digit Harmonized System. The dataset also provides information about the quantities traded in one of 13 different units of measurement (e.g., kilograms, square meters, etc.). In addition, the dataset provides contact information for the firms, types of enterprises, and customs regimes.[23]

To match the customs data with public firms, we create an algorithm to match the firm names in the customs data with the names of public firms and their subsidiaries in the CSMAR database. During the 2000-2006 period, among the 277,595 distinct names for exporting or importing firms that appear in the customs dataset, we identify 606 Chinese publicly listed firms that either directly export or through a total of 877 subsidiaries. The number of export-related firms is about 50% of the total number of firms listed on Shanghai and Shenzhen Stock Exchanges during our sample period.

### 3.1.2 Intragroup Trade Credit

To track the direction and amount of intragroup credit provided to, or received by, public firms, we rely on highly disaggregated related-party transaction data. Chinese public companies have been required to disclose related-party transactions since 1997. Most firms report in a special footnote to their financial statements the identity of their related parties, the relation with these parties (e.g., percentage of shares held), and the types and amounts of related-party transactions.[24]

The great advantage of China's mandatory disclosure of related-party transactions is that public firms must break out intragroup trade credit involving related parties at a highly granular level. Although the borrowing and lending activities among related parties occur on a daily basis, Chinese public firms are required to report receivables claimed to each related party at an annual

[23]Examples include ordinary trade, import-and-assembly processing trade, and pure assembly processing trade.
[24]This disclosure was incomplete and irregular in the first year but more systematic thereafter (Yuan, 1998).

frequency. As a result, we observe the outstanding balance of intragroup receivables between a public firm and each of its related parties.

In our main analysis, intragroup receivables include several items disclosed by public firms in their financial statements. We measure the intragroup trade credit in a spirit similar to Li et al. (2004), Jiang et al. (2010), and Chen et al. (2017). To compute the outstanding balance of intragroup credit (in RMB), we collect from the related-party transaction data accounts receivable, other accounts receivable, notes receivable, and accounts prepaid. These four items represent the major types of trade credit occurring between public firms and their various related parties.

### 3.1.3 Collateralized Shares and Other Financial Data

We use the share-split structure-reform database from CSMAR, which provides detailed characteristics for firms embarking on the reform agenda, to obtain the collateral shares pledged by large shareholders to lenders (e.g., commercial banks and investment banks). For each public firm, the CSMAR provides the total number of nontradable shares pledged by all large shareholders to lenders before the reform.

We also collect financial and stock price data from the CSMAR: total assets, total liabilities, net income, monthly and daily stock prices, total tradable shares outstanding, distress identification (coded as "ST" firms), and cross-listing information. We manually check the public firm managers' resumes to identify whether a chief executive officer (CEO) was promoted from within the business group. We exclude ST firms to address the concern that corporate restructuring is driving the flow of intragroup credit associated with these firms. We also exclude firms cross-listed on a B- or H-share market, because the reform only targeted previously non-tradable A shares.

## 3.2 Measuring Tunneling

Johnson et al. (2000) use the term "tunneling" to describe the transfer of assets and profits out of firms for the benefit of those who control them. For the following two reasons, we measure tunneling using trade credit provided by Chinese publicly listed firms to entities that are economically related to the group parent.

First, as extensively discussed by Chen et al. (2017), the way group owners reallocate capital within a business group varies across countries based on accounting standards, stock market listing rules, and the tax code. China's rules favor short-term intra-group loans; other ways, such as transfer pricing, dividends, or equity investments, are uncommon. To illustrate, prices charged internally diverge from arms-length prices by less than 5%. Less than 3% of publicly listed firms had provided either loans or guarantees for their controlling shareholders over our sample period. About 75% of public firms, however, experienced non-zero changes in the four types of receivables, as we discussed in section 3.1.2.

Second, ample anecdotes also suggest group owners could indirectly tunnel resources out of public firms by first transferring resources to other related parties or even seemingly unrelated parties. A notice issued by CSRC on January 6, 2004, revealed the prevalence of the issue.[25] In the notice, CSRC urged auditors to pay particular attention to usual transactions that "seem to be arm's length."

For each year across various related parties, we take the sum of the four items of receivables (as described in section 3.1.2) claimed by public firms to the collection of future cash from entities that are economically related to the group parent. These entities include (1) group parents themselves, (2) other firms (excluding public firms' own subsidiaries) controlled by the same parent group, (3) key investors and managers, (4) the family members of key investors and managers, and (5) entities controlled by either key investors and managers or their family members.

For each public firm, we aggregate the granular data of intragroup receivables to calculate the outstanding balance as follows:

$$Tunnel_{j,t} = \sum_{i=1}^{n} Receivables_{i,j,t}, \tag{1}$$

where $Receivables_{i,j,t}$ is the sum of the four items of receivables claimed by publicly listed firm $j$ to related party $i$ as of the end of fiscal year $t$. Thus, *Tunnel* is the outstanding balance of receivables (in RMB) claimed by public firms from borrowers (1)-(5) as discussed above.

To measure the extent to which public firm $j$ extends credit to large shareholders in year $t$,

[25]The notice was entitled "CSRC Notice 2004/No.1 on Further Improvements to Listed Company Financial Reporting Quality."

we calculate the change in the outstanding balance of receivables (as in equation 1) from year $t$-1 to $t$ and scale it by lagged total assets:

$$\Delta Tunnel_{j,t}\% = (Tunnel_{j,t} - Tunnel_{j,t-1})/Assets_{j,t-1}. \quad (2)$$

A positive value of $\Delta Tunnel_{j,t}\%$ means public firm $j$ increases intragroup lending to large shareholders relative to year $t$-1; a negative value means public firm $j$ decreases lending relative to the last year.

Two notes are worth mentioning. First, we scale changes in trade credit in equation 2 using public firm $j$'s lagged total assets. Expressing tunneling as a percentage of the public firm's book value of assets helps estimate the implication of tunneling for the financial health of public firms, which also extend financing to their own subsidiaries (see section 5.9).

Second, we do not calculate net trade credit by subtracting payables from receivables, because borrowing terms by public firms from related parties could be very different from lendings terms. Examples of these terms include maturities and default rates, which are unobservable in the data. As a robustness check, we also use net credit and our results survive.

# 4 Collateral Shocks and Tunneling Activities

In this section, we demonstrate that, via the collateral channel, the share-split structure reform reduces large shareholders' incentive to tunnel. The effect from the collateral channel is temporary and varies across public firms.

## 4.1 Descriptive Statistics

Figure 3 presents the distribution of export-related firms over reform months. Export-related firms are public firms that export either directly or through their subsidiaries. The figure shows the occurrences of share-split structure reform were concentrated between late 2005 and early 2006. Prior to the reform, about 35% of firms have non-tradable shares pledged by large shareholders. Conditioning on firms with large shareholders pledging shares, the collateralized ownership is about 20%, the average value of which is approximately 188 million RMB.

Panel A of Table 1 presents descriptive statistics for characteristics of export-related firms

in the year in which public firms announced the start of the reform. These firms either directly export or export through subsidiaries. On average, each public firm in our sample owns two exporting subsidiaries. Sixty-two percent of firms are SOEs. Eighty-seven percent of CEOs are promoted from within the business group. The outstanding balance of receivables claimed by public firms to group owners (and their economically related entities) amounts to 1.1% of total assets. Percentage changes in tunneling credit can take a value of zero. Eighty-four percent of sample firms are associated with non-zero values. Although the mean of $\Delta\, Tunnel\%$ is around 0, the standard deviation is around 0.032.

Panel B of Table 1 compares the export-related firms in Panel A with the rest of the CSMAR firms in several dimensions. The two groups of firms are not statistically different in the change in intragroup credit around the reform, the percentage of collateralized shares, and profitability. Compared to the remaining firms, however, export-related firms are of a larger size and are more leveraged.

Panel A of Figure 4 plots the frequency distribution of collateralized shares across publicly listed firms. Panel B of the figure compares the frequency distribution of changes in tunneling behavior ($\Delta\, Tunnel\%$) around the reform between publicly listed firms with and without pledging shareholders.

### 4.2 Large Shareholders' Loan-to-Collateral Ratio

We first verify that, given the *same* number of shares pledged to lenders, the reform indeed increases large shareholders' borrowing amount. We collect data from the Wind Datafeed Service. This dataset provides detailed information about 12,131 loans against which collateral shares have been pledged by large shareholders.[26] We calculate the book value of collateral shares based on public firms' net assets as of the beginning of the year.

The loan-to-collateral ratio is large shareholders' borrowing amount divided by the book

[26] Each loan contains the following details: public firm name and stock code, the start and end dates of the loan, and the number of shares pledged. One limitation of this dataset is that only 10% of loans have the exact amount borrowed by pledging shareholders in footnotes. We manually read the footnotes and collected transactions with the available borrowing amount.

value of a public firm's shares pledged by large shareholders.[27] An increase in the loan-to-collateral ratio implies firms can borrow more using the *same* number of shares. We employ the following OLS regression specification to verify the conjecture:

$$ln(\textit{Loan-to-Collateral}_{j,s}) = \alpha + \beta \times \textit{Post-Reform}_{j,s} + X_{j,t-1} + \theta_j + \epsilon_{j,s}, \tag{3}$$

where $\textit{Post-Reform}_{j,s}$ is a dummy variable indicating whether the loan is borrowed by large shareholders of public firm $j$ in month $s$ after the reform. $X_{j,t-1}$ includes the debt ratio and logarithm of total assets for firm $j$ as of the beginning of year $t$ in which loan contracting took place. We also control for firm fixed effects ($\theta_j$). Standard errors are clustered at the reform-year-month level.[28]

Table 2 presents the estimation results. In columns (1)-(2), we set the sample period to 2000-2014. The logarithm of the loan-to-collateral ratio is significantly higher after the reform, regardless of whether we exploit within-firm variation. In columns (3)-(4), we restrict our sample period to be 2000-2007, and the results are very similar.

## 4.3 Collateral Shocks and Tunneling Behavior

### 4.3.1 Baseline Results

We lay out the following regression model. However, equation 4 is not our first stage of the IV estimation. Rather, this regression tells us the impact of collateral shares on tunneling on the sample of firm-year observations.

$$\Delta\, \textit{Tunnel\%}_j = \alpha + \beta \times \textit{Collateral\%}_j + \gamma \times X_j + \theta_k + \theta_m + \theta_s + v_{j,t}, \tag{4}$$

where *Collateral%* is the number of non-tradable shares, as a percentage of total shares, pledged by all large shareholders of public firm $j$ several years prior to the announcement of the share-split structure reform. The number of pledged shares is disclosed by public firm $j$ during the reform

[27] Note that book value is not the true collateral value accessed by lenders. Rather, lenders will adjust the assessed value by multiplying the book value with a factor, which is unobservable to an econometrician. However, if lenders indeed discount the value of collateralized, non-tradable shares due to illiquidity, they would multiply the book value by a smaller factor during the pre-reform period. In other words, we expect the ratio to increase after the reform.

[28] We also cluster standard errors at either the industry or firm level, and our estimation results are similar.

announcement. We also replace *Collateral%* with a dummy variable equal to 1 if a public firm is associated with collateral shares before the reform, and zero otherwise. A third measure is ln(*Collateral Value*). *Collateral Value* is the number of collateralized shares multiplied by the net assets per share, as measured immediately prior to the reform.[29]

$X_j$ is a vector of characteristics for public firm $j$ in the reform year. These observables are the size of public firms (total assets), leverage ratio, and return on total assets (ROA). We also control for industry fixed effects ($\theta_k$), province fixed effects ($\theta_m$), and reform-year-month fixed effects ($\theta_s$). The standard errors are clustered at the industry level.

Estimation results in Table 3 indicate that in the reform year, the change in tunneling credit is strongly negatively correlated with collateralized shares. Panel A presents the results on the sample of export-related public firms. In column (1) of Panel A, the point estimate on the regression is -0.042. This number implies that a one-percentage-point increase in the fraction of collateralized shares is associated with a reduction in tunneling credit by 4.2 percent of the public firm's total assets. In column (2), we regress the indicator of *Collateral* on $\Delta$*Tunnel*%, and the point estimate is -0.01, which is about one-thirds of one standard deviation of the dependent variable. In column (3), we report similar effects of log(*Collateral Value*) on tunneling..

Next, we perform two placebo tests to check whether the results reported in columns (1)-(3) are spurious. First, we create pseudo measures of collateralized shares by drawing random numbers from a normal distribution in which the mean and standard deviation are estimated from firms with either non-zero *Collateral%* or non-zero *Collateral Value*. Columns (4)-(6) of Panel A show the effect of pseudo collateral shares is zero. Second, conditioning on export-related public firms, we randomly draw 15% of observations from the entire sample of firm-year observations. Changes in tunneling credit are calculated from $t$-1 to $t$, where $t$ is any year. We then regress collateral shares on $\Delta$*Tunnel%*. Columns (7)-(9) indicate collateral shares do not constrain tunneling activities during pseudo reform years.

Panel B presents the results on the entire sample of CSMAR firms. Compared to estimates in Panel A, coeffcients in columns (1)-(3) of Panel B are less economically significant but more statistically significant. We also perform the same placebo tests in Panel B.

[29]The net assets per share immediately before the reform is collected by the database for share-split structure reform in CSMAR, not from balance sheets. Several firms in our sample have missing values.

### 4.3.2 Dynamics of the Collateral Channel

To evaluate the duration of the collateral channel, as well as to assess the parallel-trends assumption, we perform the same regression analysis as in equation 4 but separately estimating the impact of collateral shares on changes in tunneling credit (from year $t$-1 to $t$) for each year over the window (-2, +2) relative to the reform year.

Figure 5 plots the dynamics of estimated $\beta$ in -2, -1, 0, 1, 2 year relative to year 0. As the three panels show, collateralized shares have little impact on $\Delta\,Tunnel\%$ until the reform year. After year 0, the impact of collateral shares on $\Delta\,Tunnel\%$ again disappears. The pattern in Figure 5 suggests the collateral channel only causes a *one-time* cut in tunneling during the reform year.

In Figure 6, we report results from estimating the following equation year by year over the window (-2, +2) relative to the reform year:

$$Tunnel_{j,t}/Assets_{j,t-1} = \alpha + \beta \times Collateral\%_j + \gamma \times X_j + \theta_k + \theta_m + \theta_s + v_{j,t}, \qquad (5)$$

where $Tunnel_{j,t}/Assets_{j,t-1}$ is the total amount of receivables claimed by public firm $j$ to large shareholders, scaled by lagged total assets. If our conjecture is right, collateral shares should be positively associated with the level of tunneling in years prior to the reform. Such a positive association should disappear after year 0. The dynamic pattern of the estimated $\beta$ lends support to our conjecture. In Panel A, for example, unreported statistics show that $\beta$ in year -2, 0, and +2 is 0.09 (t=1.98), 0.01 (t= 0.84), and -0.02 (t=-1.59), respectively.

### 4.3.3 Shareholder Value

If intragroup trade credit poorly measures tunneling behavior, an anticipated decline of it will not materially affect shareholder value. In Table A.1, we regress the three measures of collateral shares on cumulative abnormal returns over the daily window (-5, +5) relative to the day the focal firms announce the compensation scheme. The event day corresponds to $t_1$ in Panel A of Figure 2, which illustrates the timeline of reform. In practice, $t_1$ is very close to $t_0$, as shown by the case study in Panel B of the figure.

Because the success of the reform crucially depends on the compensation scheme, we regard

$t_1$ as the date the bulk of uncertainty regarding the success of the reform for public firm $j$ is resolved. Our estimation results show collateral shares is strongly positively associated with abnormal returns around the announcement of compensation scheme.

### 4.4 Regulatory Costs of Tunneling

Is tunneling costly for group owners? If not, large shareholders engage in tunneling regardless of their capacity of borrowing from banks. Regarding the sample period of 2000-2014, we manually read 2,750 fraud events from the *Enforcement Action Research Database* provided by the Chinese Security Regulatory Commission. We identified 274 cases in which publicly listed firms were involved in tunneling scandals, and about 40% were SOEs. Figure 8 plots the number of tunneling-related fraud events over years.

We specify the following probit regression model:

$$\begin{aligned} Pr(Saction_{j,t} = 1) = \Phi(\alpha + \beta \times Tunnel_{j,t}/Asset_{j,t-1} + \\ \gamma \times Tunnel_{j,t}/Asset_{j,t-1} \times SOE + \eta \times SOE + \theta \times X_{j,t-1} + \theta_k + \theta_m + \theta_s + v_{j,t}), \end{aligned} \tag{6}$$

where $Saction_{j,t}$ is an indicator variable coded as 1 if export-related firm $j$ is punished for tunneling-related reasons from year $t$ to $t$+2. Because regulatory sanction is based on the extent to which minority shareholders are expropriated, we use the total amount of receivables claimed by public firm $j$ to the collection of future cash from entities that are economically related to the group parent, scaled by lagged total assets.[30]

As shown by Table A.2, our measure of tunneling successfully predicts punishments. SOEs are less likely to be punished. Given the same level of *Tunnel/Assets*, however, SOEs are more likely to be punished. But the incremental effect is not statistically significant. Column (3), for example, indicates a 10 percentage-point increase in *Tunnel/Assets* increases the punishment probability by 0.84 percentage points — about 18% of the sample mean.

[30]Our sample period is from 2004 through 2008, because the identify of the ultimate owner is only available since 2004.

# 5 Tunneling and Pricing-to-Market

Section 5.1 present descriptive statistics on our customs-CSMAR matched samples. Sections 5.2, 5.3, 5.4, 5.5, and 5.6 focus on our main findings, namely, that the elasticity of export price and also volume to exchange-rate changes varies with tunneling. Section 5.7 discusses the issue concerning exporters that are simultaneous large importers. Section 5.8 compares the effects of tunneling credit on exchange-rate pass-through between SOE and non-SOE exporting subsidiaries. Section 5.9 verifies the adverse impact of tunneling of public firms on their subsidiaries' access to intragroup trade credit.

## 5.1 Descriptive Statistics

### 5.1.1 Exports: Public Firms vs. Subsidiaries

Table 4 compares the frequency, scope, and value of exports between public firms and their subsidiaries on the sample period from January 2000 through December 2006. We identify 3,248 firm-year observations for public firms that are included by the Chinese customs data either because they directly export or because they export through subsidiaries. We separately calculate export-related metrics for public firms and their subsidiaries. If several exporting subsidiaries are owned by the same public firm, we sum these metrics across these subsidiaries in the same year.[31]

A striking pattern emerges: Subsidiaries export by a greater scope and achieve more export revenues than their publicly listed parents. In each year, we calculate the total value of exports for both public firms and their subsidiaries, and scale export values by the *public firm's sales*. Foreign sales only consist of 4.5% of public firms' revenues, suggesting they mainly focus on domestic product markets. Surprisingly, subsidiaries bring in three times more export revenues than public firms. Compared with public firms, subsidiaries deliver two times more shipments, ship two times more products abroad, and sell goods to a greater number of destination countries.

The pattern in Table 4 indicates exporting activities by subsidiaries are highly likely to be financed by domestic sales made by their publicly listed parents. Given the average size of less than 10 million RMB, subsidiaries have difficulty raising enough capital externally. The

[31] Metrics are set to zeros if an entity does not export in a particular year.

statistics seem to be consistent with the wide-spread phenomenon of "Carry-Along Trade" in which firms sell more products to the market than they actually produce (Bernard et al., 2019). Subsidiaries first purchase products from public firms and then export them to foreign countries.

### 5.1.2 CSMAR-Customs Matched Sample

Table 5 presents descriptive statistics for the customs-CSMAR matched sample. The sample unit is at the firm-product-destination-shipment-month level. Panel A presents summary statistics for export price and volume for goods either directly exported by publicly listed firms or indirectly exported through their subsidiaries. To match with the temporary drop in tunneling as shown by Figure 5, we restrict the timing of shipment to be after the announcement of the reform but within the reform year. Eight-four percent of observations are associated with non-zero $\Delta Tunnel\%$. About 30% of observations have non-tradable shares pledged by large shareholders, and, conditioning on non-zero collateral shares, the collateralized ownership is about 18.4%.

In Panel B, we compare exports between customs-CSMAR matched firms/subsidiaries and the rest of Chinese exporters. The sample period is from June 2005 through December 2006. Compared with other exporters, exporters entering into our sample have larger export values, export to more destination countries, use more shipments, and sell more products, consistent with the intuition that publicly listed firms are more productive.

In Figure A.1, we list the top-10 destination countries and 4-digit Harmonization Code products, respectively. The ranks are formed based on the total free-on-board exported values (in millions of USD) in each country or product on the sample of exporting subsidiaries during the post-reform period. Figure A.2 describes the spatial distribution of the number of subsidiary-product-destination-shipment-month observations in our sample (see Table 1). The unit in the map is destination country. The darker a country, the higher frequency with which a destination country enters into our sample.

## 5.2 Regression Specification

We outlay the regression model using the following empirical specification:

$$ln(p_{j,p,d,q,s}) = \alpha + \mu \cdot ln(RER_{s,d}) + \phi \times ln(RER_{s,d}) \times \Delta Tunnel\%_j + \rho \times \Delta Tunnel\%_j + \theta \times X_j + \kappa \times Z + \epsilon_{j,p,d,q,s}, \tag{7}$$

where $ln(p_{j,p,d,q,s})$ represents the logarithm of the RMB price of product $p$ exported by firm $j$ to destination country $d$ in shipment $q$ as of month $s$. Month $s$ is between the month in which the reform is announced and the end of the reform year. The Chinese Customs Office reports the f.o.b. value of export in USD. We convert the currency for value per unit into RMB.[32] When we study the response of volume, the dependent variable in equation 7 becomes $ln(q_{j,p,d,q,s})$, the logarithm of volume of product $p$ exported to destination country $d$ by subsidiary $i$ of public firm $j$ in shipment $q$ as of month $s$.

The right side of equation 7 contains several sets of variables. The first set includes our main independent variables of interest: the logarithm of the real exchange rate, changes in tunneling in the reform year, and their interactions. The real exchange rate of destination country $d$ as of month $s$ is defined as

$$RER_{s,d} = ER_{s,d} \times CPI_s / CPI_{s,d}. \tag{8}$$

$ER_{s,d}$ is the nominal exchange rate defined as the price of the domestic currency (RMB) in terms of the foreign currency of country $d$ as of month $s$. For example, $ER_{s,\text{US}}$ was 0.125 in 2006; that is, one Chinese RMB was worth 0.125 USD in 2006. Therefore, an increase in $ER_{s,d}$ implies an appreciation of the RMB. $CPI_s$ and $CPI_{s,d}$ represent the monthly consumer price index of China and that of the corresponding destination country $d$, respectively. We are interested in estimating, separately, the effects of tunneling credit on the elasticity of export price and volume in month $s$ to the real exchange rate in the same month.

$X_j$ is the same set of control variables as in equation 4. We control for $X_j$ to capture unobserved heterogeneities that potentially affect exporting subsidiary $i$'s pricing decisions, including marginal costs, managerial abilities, firm technologies, and geographical factors. Because our sample period spans less than two years, the most powerful control is the firm

[32] See Manova and Zhang (2012) for similar discussions.

fixed effect. However, we control for $X_j$ in specifications in which we cannot include firm fixed effects, which fully absorb variations in the main independent variable of interest ($\Delta Tunnel_j\%$).

$Z$ is a vector of characteristics for the exported product, including a dummy variable indicating ordinary trade, product-destination fixed effects, firm fixed effects, and year fixed effects. In two alternative specifications, we include either *public-firm* or *subsidiarity* fixed effects.

Year fixed effects absorb the time-varying, macroeconomic shocks that all exporters face. We do not control for year-month fixed effects, because they fully absorb variations in exchange rates at the monthly frequency. The main coefficient of interest ($\phi$), however, is not changed by alternative specification of time fixed effects.

### 5.3 OLS Estimation

In Panel A of Table 6, we present the ordinary least square (OLS) estimations. The OLS estimate, however, corresponds to a regression of export price on the interaction between exchange rate and *total* tunneling credit variation, induced by all factors including those that are correlated with errors in equation 7. For example, the controlling shareholders might want the subsidiary to maintain optimal export pricing in line with the group-wide capital costs and just siphon off excess cash otherwise paid as dividends to shareholders.

In columns (1)-(4), we report regression results by including exports either directly exported by public firms or through exporting subsidiaries. In column (1), we estimate the effect of tunneling credit on export price. The estimated coefficient of $\Delta\, Tunnel\%$ bears a negative sign and is both statistically and economically significant. Our IV estimation later on, however, delivers point estimates consistent with trade financing reducing export prices.

In column (2), we report OLS estimates of the elasticity of export price to real exchange rates. The estimated price elasticity is about -0.193, which is both statistically and economically significant. This number suggests firms reduce export prices by 19.3 cents when RMB appreciates by one Yuan. Therefore, an average exporter in our sample "prices to market." The interaction term, however, is positive but statistically insignificant. In columns (3)-(4), we focus on the volume elasticity. The OLS estimates show that $\Delta Tunnel\%$ negatively but insignificantly affects export quantity, and tunneling bears a negative correlation with the volume elasticity.

In columns (5)-(8), we exclude goods directly exported by public firms. We document a much stronger pricing-to-market for exporting subsidiaries. The estimated price elasticity at zero tunneling is about -0.312, the magnitude of which is about 55% larger than that in column (2). Both the price and volume elasticities are not statistically sensitive to the total tunneling credit variation.

### 5.4 IV Estimation

In this subsection, we present IV-estimation results. More specifically, we use various measures of collateral shares, pledged by large shareholders to lenders several years before the reform, to instrument for their change in tunneling behavior in the reform year. The decision to pledge, at both intensive and extensive margins, is made by large shareholders located at least several levels away from exporting subsidiaries along the controlling chain of the business group. The exclusion restriction therefore is that the cross-sectional distribution in the amount of collateralized shares during the pre-reform period is uncorrelated with errors in the price regression as in equation 7, where dependent variables are measured during the post-reform period.

Before presenting the second stage of our IV-estimation results, we report in Table A.3 the results of the first-stage regression. The F-statistics suggest collateral shares are a strong instrument regardless of how we measure it.

Panel A of Table 7 reports the IV estimates of tunneling on the price and volume elasticities, where the instrument is the number of collateral shares as a percentage of total shares. Columns (1)-(4) present estimations on all exported goods including those made by publicly listed firms themselves; columns (5)-(8) report our *main findings* on exports solely made by subsidiaries owned by public firms.

In column (1), we report a statistically positive relation between the intensity of tunneling and export prices. The positive coefficient of $\Delta\,Tunnel\%$ can be consistent with Melitz and Ottaviano (2008) in the sense that tunneled firms face higher marginal costs. In column (2), we report the IV-estimation coeffcients regarding the impact of $\Delta\,Tunnel\%$ on the price elasticity. The point estimate of the interaction term is 8.98, which is statistically significant at the 1% level. A one standard deviation increase in $\Delta\,Tunnel\%$ reduces the magnitude of elasticity by 0.13 ($0.015 \times 8.98$) — approximate 67% of the size of the elasticity without tunneling.

In columns (3)-(4), we report IV estimates for the volume elasticity to the real exchange rates. As reported by column (3), tunneling significantly reduces export volume. This finding is consistent with Amiti and Weinstein (2011), Chor and Manova (2012b), and Paravisini et al. (2014) that credit constraint hinders exports. In column (4), we document a negative impact of tunneling credit on volume elasticity. A one standard deviation increase in $\Delta\,Tunnel\%$ reduces volume elasticity by 0.18 – approximately 53% of the size of elasticity when $\Delta\,Tunnel\%$ is at zero (-0.34).

Columns (5)-(8) report our main findings on exports made by exporting subsidiaries. The purpose of doing so, as we mentioned earlier, is to mitigate the concern that economic reasons for large shareholders to pledge shares might be correlated with errors in price (and volume) regressions. As column (5) shows, following a 10% exchange rate appreciation, the average exporting subsidiary cuts its export price (in RMB) by 3.5%. More interestingly, we document a more sensitive price, and also volume, elasticity to tunneling. As column (6) shows, for example, a one standard deviation increase in tunneling credit as a fraction of the public firm's total assets reduces the magnitude of price elasticity by 0.18 ($0.015 \times 12.1$), which is about 51% of the size of elasticity without tunneling. In column (8), we witness a much larger impact of tunneling on the volume elasticity.

In Panel B, we use the discrete version of *Collateral%* as the instrument. In Panel C, we use the book value of collateralized shares as the instrument. Our estimation results are not quantitatively different from our estimates in Panel A, especially on the subsample of goods exported solely by subsidiaries.

### 5.4.1 OLS Bias

We compare coefficients of the interaction term ($ln(RER) \times \Delta Tunnel\%$) between the OLS (Table 6) and IV estimates (Panel A of Table 7). The IV estimate of the price elasticity to tunneling is much larger than the OLS one. The IV estimate corresponds to the change in price elasticity due to changes in tunneling under the collateral shock – variation in other factors is fully absorbed by firm and product-destination dummies. The OLS estimate, however, corresponds to a regression of changes in price elasticity on changes in *total* intragroup credit, including changes induced by other factors (e.g., subsidiary's trade opportunities and public

firms' financial conditions) that affect controlling shareholders' decision to reallocate capital. In the simplest scenario, where tunneling and other economic factors are uncorrelated, credit variation due to factors other than tunneling is equivalent to measurement error, and the OLS estimate is biased toward zero. This is exactly what we observe in most of the even-numbered columns in Table 6: except for column (4), other interaction terms are zero.[33]

As for odd-numbered columns, our OLS estimates on the relation between price and $\Delta Tunnel\%$ (columns (1) and (5)) are also different from the IV estimate. In particular, the OLS estimate in column (1) of Table 6 switches sign from positive to negative and go down by a magnitude of factor of 8. In these regression specifications, we do not exploit variations within firms or within subsidiaries. This is because firm- or subsidiary-fixed effects will fully absorb cross-firm variation in *Tunnel%*. Therefore, omitted variables bias the coefficient in column (1). Turning to columns (3) and (7), the OLS estimate on the relation between volume and *Tunnel%* carries the same sign as the IV estimate but goes down in magnitude by factors of 7 and 2.3, respectively.

### 5.5 Parallel-Trends Assumption

A necessary condition for identification is the *parallel-trends* assumption, which states that the evolution of exchange-rate pass-through of treated and controlled exporters would have followed common trends before and after the share-split structure reform, had the reform not happened. The potential outcome absent the reform is unobservable, and hence we cannot test this assumption directly. However, we can assess the extent to which the trends of exchange-rate pass-through across the two groups are parallel before the reform. If we are convinced that the pre-trends are parallel, our identifying assumption would be that any divergence in the trends after the reform is due to the reform itself, and not to other possible concurrent shocks. Under this identifying assumption, the evolution of pass-through of controlled firms represents a valid counterfactual to the evolution of pass-through of treated firms had they not been exposed to the reform.

Figure 7 proposes a visual assessment for whether the trends in exchange-rate pass-through

[33] In column (4) of Table 6, the sign of $ln(RER) \times Tunnel\%$ is consistent with the sign of IV estimate but the magnitude is much smaller.

are parallel across treated and controlled exporters in the months before the announcement of reform. On the window of [-24, +9] months relative to the event, we estimate the following OLS specification separately on exporters *with* and *without* collateral shares.[34] We divide the 33-month period into 11 bins, with each bin spanning three months. We exclude the month in which firms announce the reform. We estimate the regression on each bin and then plot the estimated coeffcients, $\hat{\mu}$, over the 11 bins and the 90% confidence intervals. Standard errors are clustered at the product-destination level.

$$ln(p_{j,p,d,q,s}) = \alpha + \mu \cdot ln(RER_{s,d}) + \theta \times X_j + \kappa \times Z + \epsilon_{j,p,d,q,s}. \tag{9}$$

We fail to reject the null hypothesis that the pass-through coefficients are equal prior to the reform announcement. Most of the estimated coefficients within two years before the reform are insignificantly different from zero, which decreases the likelihood that pre-trends drive our result. For exporters with collateral shares, the estimated coeffcients for the first, second, and third three months following the reform are 0.15 (t=0.24), -0.89 (t=-2.49) and -1.72 (t=-3.00), respectively.

### 5.6 Weighted Regressions

Two reasons justify weighted regressions. First, our sample is not a random sample of all exports made by exporters in China. Weights are necessary to adjust the sample so that it is representative of the entire population of Chinese exporters. Because aggregated trade flows are typically determined by large firms, people might be skeptical of regressions that treat small and large firms as equally informative about exchange-rate pass-through. We therefore weight our regressions by the book value of total assets of the publicly listed firm.

Second, weighted regressions can correct for heteroskedastic error terms. Export prices, our key dependent variable, are unit values and are computed as the ratio of export value divided by export volume. The averages for different groups (bilateral transactions) are computed using

[34] Our sample period ends on December 31, 2006. Therefore, we do not have many observations for goods exported by firms entering into the reform around the end of 2006. This is the reason why we end the window in the 9th month after the reform announcement.

highly varying, within-group sample sizes (volume). In such a situation, the group-average error term is heteroskedastic. We therefore also weight our regressions by export volume.

Panel A of Table 8 reports the asset-weighted regression results. The regression is weighted by the public firm's total assets as of the beginning of the reform year. As the IV-estimation coefficients suggest, the average exporting subsidiary cuts export prices by 4% in response to a 10% exchange-rate appreciation. The estimation results suggest a price elasticity of -0.4. A one-standard-deviation increase in tunneling credit reduces the number by 0.18, which is 45% of the size of elasticity without tunneling. However, the volume elasticity becomes less sensitive to tunneling.

Panel B of Table 8 presents the IV-estimation coefficients from the volume-weighted regressions. The regression is weighted by the export volume of each bilateral transaction. We only report the price regression. The average exporting subsidiary cuts export price by 58 cents when RMB appreciates by one yuan. A one-standard-deviation increase in tunneling credit reduces the size of the elasticity by 0.55, suggesting exchange-rate fluctuations will be completely passed on to consumers.

### 5.7 Excluding Large Importers

Our interpretation of results in Table 7 relies on one critical assumption; that is, the movement of the real exchange rate does not affect an exporter's marginal cost. Although we control for product-destination and firm fixed effects, the assumption is valid, strictly speaking, only when firms exporting to a country do not simultaneously import from the same country. In real life, however, the assumption might not be valid. Amiti et al. (2014), for example, find import-intensive firms, which are also the largest exporters, face offsetting exchange-rate effects on marginal costs and set high markups and actively move them in response to changes in exchange rates.

To address the above concern, we perform the same IV estimation as in Table 7 and 8 by excluding exporters that are simultaneous importers. To exclude "exporters that are simultaneous large importers," we calculate the value for each exporter's import from country $d$ as a percentage of exports to $d$ in the same month $s$. We define exporters as simultaneous

large importers if the percentage is greater than either 50%. We also focus on exports made by subsidiaries, because these exports acount for more than 80% of sample size.

Table 9 shows our results are not sensitive to the exclusion of large importers. After excluding simultaenous large importers, our main findings still hold for both equal- and assets-weighted regressions. In fact, export prices become move negatively sensitive to exchange-rate movements. In column (1) of Panel B, for example, the average exporting subsidiary cuts export price by 70 cents when RMB appreciates by one Yuan, a one standard deviation increase in tunneling credit scaled by total assets reduces the size of price elasticity by almost 80%.

### 5.8 SOE vs. Non-SOE Exporters

In this subsection, we aim to compare the effects of tunneling credit on price elasticities between exporting subsidiaries affiliated with state- and non-state-owned business groups. The prediction, however, is ex-ante ambiguous. On one hand, SOEs often face soft budget constraints and, as a result, are less financially constrained (Allen et al., 2005; Kornai et al., 2003), in which case we would expect tunneling to have less of an impact on price and volume elasticities for SOE than non-SOE exporters.

On the other hand, however, exporters owned by SOE business groups face more stringent financial constraints due to capital misallocation. By contrast, owners of private business groups more efficiently allocate internal capital because of the high costs of external financing. Chen et al. (2017) document evidence that although private groups allocate more capital to units with better investment opportunities, state groups do the opposite. Zhu (2018) finds resource allocation within a business group of SOEs internalizes the government's political goal of maintaining social stability at a cost to shareholder value. Both Chen et al. (2017) and Zhu (2018) use a dataset on Chinese related-party transactions that is similar as ours. If the resources-misallocation story is true, we would expect a decrease in tunneling credit to have a larger impact on elasticities for SOEs.

Starting from 2003, CSMAR discloses the identities for public firms' controlling shareholders and ultimate owners. It also indicates whether the nature of the controlling shareholder, or ultimate owner, is an SOE or a non-SOE. However, CSMAR does not distinguish between companies and state asset-management companies within SOEs or between legal entities and

natural persons within non-SOEs. For this reason, we manually read the names of shareholders to further verify their identities and double-check their government or private nature.

Our findings are consistent with owners of state-owned business groups misallocating resources. We also find SOE subsidiaries price to market much more. As we discuss in section 6, pricing to market is expected to be more pronounced for firms with high profit margins.

Panel A of Table 10 reports IV estimates from equal-weighted regressions on the two subsamples of exports made by SOE and non-SOE subsidiaries. We only report estimation results for price elasticities. In columns (1)-(2), we report the IV estimates using collateral shares as a percentage of total shares as an instrument. Compared to non-SOEs, SOE exporters price to market more and by larger amounts. The price elasticity is around -0.512 for SOE subsidiaries but only -0.244 for non-SOE subsidiaries. More important, we observe a large effect of tunneling on price elasticities only for SOE and not for non-SOE subsidiaries. We report similar results for SOEs in other columns of the same panel.

Surprisingly, the $ln(RER) \times \Delta Tunnel\%$ turns out to be negative for non-SOE subsidiaries. This puzzling finding, however, disappears in Panel B, where we use assets of the public firm to weight regressions. In addition, the phenomenon of "pricing-to-market" only exists in SOE-affiliated exporters — following a 10% exchange-rate appreciation, the average subsidiary cuts its export price by 9.5%. A one-standard-deviation increase in tunneling reduces the size of the elasticity by 44%.

### 5.9 Tunneling Crowds Out Propping of Subsidiaries

In this subsection, we examine whether tunneling by large shareholders crowds out subsidiaries' access to credit from tunneled firms. To do so, we calculate the percentage change in credit supplied by export-related, public firm $j$ to their own subsidiaries, including both exporting and non-exporting ones, from year $t$-1 to $t$ as follows:

$$\Delta Propping_{j,t}\% = (Propping_{j,t} - Propping_{j,t-1})/Assets_{j,t-1}. \tag{10}$$

*Propping* is the outstanding balance of receivables claimed by publicly listed firms to the collection of future cash from their own subsidiaries. We outlay the regression model using

the following empirical specification:

$$\Delta Propping_{j,t}\% = \alpha + \beta \times \Delta Tunnel\%_{j,t} + \theta \times X_{j,t} + \kappa \times Z + \epsilon_{j,t}, \tag{11}$$

$X_{j,t}$ is a standard set of controls as in Table 3. Because around 50% of firm-year observations are associated with zeros of $Propping_{j,t}\%$, we create an indicator coded as 1 if a public firm $j$ provides no credit to subsidiaries in year $t$-1, and zero otherwise. We include this indicator in $X_{j,t}$.

Table 11 reports our estimation results. Panel A reports the estimation results for export-related, publicly listed firms in their reform years. Estimation results on this sample are more relevant for the interpretation of our results in previous tables. In columns (1), the dependent variable is the change in propping credit from year $t$-1 to $t$, scaled by lagged total assets. The estimation coefficient of $\Delta\, Tunnel\%$ turns out to be strongly negative and economically meaningful. A one standard deviation increase in $\Delta\, Tunnel\%$ reduces $\Delta Propping\%$ by 0.2 percentage points. Since subsidiaries are very small firms, 0.2% of the public firm's total assets is a sizable shock to credit supply.

In columns (2), we replace our dependent variable using an indicator coded as 1 if $\Delta$Propping% is greater than zero, and zero otherwise. We then perform linear probability model regressions. A one standard deviation increase in $\Delta\, Tunnel\%$ reduces the probability of all subsidiaries (owned by a pubic firm) experiencing a credit expansion (relative to the previous year) by 3.2 percentage points — approximately 17% of the sample mean. In Panel B, we restrict our sample on export-related firms on the sample period of 2004-2008. We arrive at the same conclusion.

# 6 Economic Mechanism

We rationalize our empirical findings in a theoretical framework. Before discussing the model, we summarize our empirical results. First, exporters price to market. The sensitivity of export price to real exchange-rate changes is negative. Second, exporters price to market more if they

are less tunneled. Third, tunneling affects volume elasticity in an opposite direction. Fourth, tunneling crowds out credit supplied by tunneled firms to subsidiaries.

### 6.1 Model

We present a simple static model of export pricing and show how the exporter's external financial constraints affect responses of export prices to exchange-rate movement. Trade finance mainly involves borrowing using trade credit (accounts receivable) as collateral. Exporters obtain working capital loans, credit lines, discounted prepayments, or credit guarantees provided by the importer's bank (Ahn et al., 2011). Costs of this external financing, however, can be substantially reduced by either of the following cases. First, an exporting subsidiary can directly borrow from less tunneled public firms, rather than from banks. Second, an exporting subsidiary can borrow from a bank under the guarantee of a less tunneled public firm.

In a similar vein as Berman et al. (2012), we extend Melitz and Ottaviano (2008) and include exchange-rate movement and the firm's heterogeneity in financial constraints. For simplicity, external financial constraints are introduced through the working-capital channel. Firms must borrow a fraction of labor bill $\theta_i$ with an interest rate $r$ up-front, before production takes place. The larger the fraction they need to borrow up-front, the more financially constrained they are. Therefore, the marginal cost of the firm is given by

$$mc_i = w(1 + \theta_i r),$$

where $w$ is unit labor cost. Without loss of generality, the marginal cost is rewritten as $mc_i = \frac{w}{\varphi_i}$, where $\varphi_i = \frac{1}{1+\theta_i r}$, which implies a firm with better financial conditions will have a higher $\varphi_i$ and therefore a lower marginal cost. Furthermore, firms are assumed to be indexed by financial-constraint parameter $\varphi_i$.

Following Melitz and Ottaviano (2008) and Berman et al. (2012), the inverse demand function for variety produced by firm $i$ exported to destination country $d$ is

$$p_{id}S_d = a - bx_{id} - kX_d, \tag{12}$$

where $p_{id}$ is the export price in home currency and $S_d$ is the nominal exchange rate between

the home country and destination country $d$, which is the price of the domestic currency in terms of the currency of country $d$. Hence, a rise in $S_d$ implies the appreciation of domestic currency. $x_{id}$ is the consumption demand in country $d$ for variety produced by firm $i$, and $X_d$ is the consumption demand in country $d$ over all varieties. $a, b, andk$ are positive parameters. The individual firm will maximize the following profit function:

$$\max_{p_{id}} \ (p_{id} - mc_i)x_{id}.$$

This optimization problem yields

$$p_{id} = \frac{1}{2}\frac{w}{\varphi_i} + \frac{(a - kX_d)}{2S_d}. \tag{13}$$

Substituting equation 13 into the profit function, we can show a threshold $\varphi_d^*$ exists for which operating profits are zero. For the firm with zero operating profit, we have the following conditions:

$$\frac{w}{\varphi_d^*} = \frac{(a - kX_d)}{S_d}.$$

Given the demand function in equation 12, only those firms that cover their marginal cost (have better financial access such that $\varphi_i > \varphi_d^*$ ) can survive and produce. All other firms exit the industry. Surviving firms maximize their profits. The threshold $\varphi_d^*$ summarizes the effects of both the average price and number of firms on the performance measures of all firms.

Using this condition, we can rewrite the optimal export price for firm $i$ as below:

$$p_{id} = \frac{w}{2}(\frac{1}{\varphi_i} + \frac{1}{\varphi_d^*}).$$

Denoting the real exchange rate $q_d = \frac{S_d P}{P_d}$, where $P$ is the CPI of domestic country and $P_d$ is the CPI price of destination country $d$. Firms will take $P$, $P_d$, and $w$ as given. We can derive the elasticity of export price to the real exchange rate as

$$e(p_{id}) = \frac{d\ln(p_{id})}{d\ln(q_d)} = \frac{-\varphi_i}{\varphi_i + \varphi_d^*} < 0. \tag{14}$$

The relation between the elasticity of export price to the real exchange rate $e(p_{id})$ and financial

condition ($\varphi_i$) can be expressed as follows:

$$\frac{\partial e(p_{id})}{\partial \varphi_i} < 0. \tag{15}$$

Equations 14 and 15 suggest the export price (in domestic currency) increases when the real exchange rate depreciates (a decrease in $S_d$ ) and firms with better financial conditions increase their export price more. Similarly, in the face of a real appreciation, firms that are less financially constrained will decrease their export price more in order to stabilize the demand. In other words, firms with a better financial condition can "price to market" more. We summarize the first prediction we bring to the data:

***Prediction 1:*** *As a firm becomes more (less) financially constrained, the elasticity of the export price in home currency to a real exchange-rate change increases (decreases).*

The export price in the destination (local) currency, or the currency of country $d$, is given by $p^*_{id} = p_{id}S_d$. Then the elasticity of the export price in terms of destination-country currency to the real exchange rate can be defined as

$$e(p^*_{id}) = \frac{d\ln(p^*_{id})}{d\ln(q_d)} = \frac{\varphi^*_d}{\varphi_i + \varphi^*_d} > 0.$$

The better the financial condition (the smaller $\theta_i$ is or the higher $\varphi_i$ is), the lower the exchange-rate pass-through to the price of home variety $i$ in country $d$. In other words, for firms that are less financially constrained, the price of export good $i$ in destination country $d$ will be more stabilized because better financial conditions improve their ability to "price to market."

For the trade volume, we have

$$x_{id} = \frac{wS_d}{2b}\left(\frac{1}{\varphi^*_d} - \frac{1}{\varphi_i}\right) \tag{16}$$

$$e(x_{id}) = \frac{d\ln(x_{id})}{d\ln(q_d)} = \frac{-\varphi^*_d}{\varphi_i - \varphi^*_d} < 0. \tag{17}$$

Note $\varphi_i - \varphi^*_d > 0$, which implies the elasticity of trade volume to the real exchange-rate change is negative. More important, the value of the volume elasticity increases with the financial

condition $\varphi_i$:

$$\frac{\partial e(x_{id})}{\partial \varphi_i} > 0. \tag{18}$$

The result in equation 16 shows that when the real exchange-rate depreciates, the trade volume will increase. This effect is easy to understand because the home goods become cheaper after the real depreciation. Nevertheless, as illustrated by equation 18, when firms are facing different financial conditions, the export volume of those firms that are less constrained will increase less because their prices are more stabilized. Similarly, in the face of a real appreciation, demand for home goods will fall. But demand for goods produced by less financially constrained firms will decrease less. We therefore make the following predictions:

***Prediction 2:*** *As a firm becomes more (less) financially constrained, the elasticity of the export volume to a real exchange-rate change decreases (increases).*

### 6.2 Discussion

In sum, firms with better financial conditions price to market more to stabilize their export price in the destination/local market. For these firms, the exchange-rate pass-through to export price (in destination currency) will be lower (lower elasticity of export price in local currency to exchange-rate changes); the exchange-rate pass-through to trade volume will also be lower (less negative elasticity of trade volume to exchange-rate changes).

The intuition is simple. As in Melitz and Ottaviano (2008) and Berman et al. (2012), a linear demand system with horizontal product differentiation implies the price elasticity of demand increases with prices faced by consumers, which is in contrast to the case of constant elasticity of substitution (CES) demand.[35] When all exporters in the home country benefit from a decrease in the relative cost of production (a real exchange-rate depreciation with respect to a specific destination), prices faced by consumers fall, so the price elasticity of demand falls.

This effect implies exporters can increase their markup to maximize their profits in the face

[35]Note that other theories, such as the nested CES demand system under imperfect competition in Helpman and Krugman (1985), the dynamic demand-side effect emphasized by Froot and Klemperer (1989), translog preference proposed by Bergin and Feenstra (2001), and the distribution cost in terms of non-tradable goods suggested by Corsetti and Dedola (2005) can also generate firms' pricing-to-market behavior and variable markup.

of a real depreciation. We can define the markup of export price to marginal cost as $\mu_{id}$. From equation 13, we can get:

$$\mu_{id} = \frac{p_{id}}{\frac{w}{\varphi_i}} = \frac{1}{2} + \frac{a - kX_d}{2S_d}\frac{\varphi_i}{w} = \frac{1}{2}(1 + \frac{\varphi_i}{\varphi_d^*}). \tag{19}$$

Equation 19 implies $\frac{\partial \mu_{id}}{\partial S_d} < 0$; that is, when an exchange rate depreciates, the markup $\mu_{id}$ increases. The reason is that $\frac{\partial \mu_{id}}{\partial S_d} < 0$, and exporters react by increasing their markup in this destination so that pricing to market and incomplete pass-through of exchange-rate changes into prices faced by consumers occur. Furthermore, because firms with better financial access have a lower marginal cost and thus charge a lower price, they face a lower demand elasticity. This implies that when a real exchange rate depreciates, less financially constrained firms can increase their markup more than others, or $\frac{\partial \mu_{id}^2}{\partial S_d \partial \varphi_i} < 0$ indicated by equation 19. Similarly, when a real appreciation occurs, price faced by consumers increases and exporters respond by decreasing their markups, and less financially constrained firms will decrease more.

# 7 Conclusion

Do internal capital markets affect exporters' price adjustment to exchange-rate shocks? The question is important for us to understand the implication of exchange-rate fluctuations for export dynamics during financial crisis. As Gopinath (2013) notes, however, assessing the relation between firms' access to financing and their export-pricing behavior requires both solid theoretical evaluation and careful identification strategies.

In this paper, we exploit an ownership-structure reform that constitutes a collateral shock differentially, although temporally, reducing large shareholders' economic incentives to tunnel resources out of publicly listed firms. We show this collateral channel largely relaxes financial constraints of subsidiaries owned by tunneled firms, at least within the reform year. We then examine whether exporting subsidiaries tend to stabilize local currency export prices in response to exchange-rate changes. Our IV estimation results show that compared with otherwise similar exporters, those with better access price to market more. We rationalize our findings using a

simple static model of export pricing. In the model, the key driver of our empirical results is that price elasticity of demand increases with the price hat consumers face.

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Table 1: **Descriptive Statistics: Export-Related Public Firms**

*The sample period is from June 2005 through December 2006. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. Panel A presents descriptive statistics for public firms satisfying two criteria to enter into our regression sample: (1) Firms had announced reforms in the sample period and (2) firms are included by customs data. Panel B compares financial characteristics between firms reported in Panel A and other firms that announced the reform in the same period but are not included by the customs data. No. of Export Sub is the number of exporting subsidiaries owned by each publicly listed firm. $\Delta$Tunnel% is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. Tunnel/At is the intragroup credit in the reform year scaled by lagged total assets. Collateral% is the number of collateralized shares, as a percentage of total shares outstanding, immediately prior to the reform. Collateral is a dummy variable equal to 1 if a public firm has at least one large shareholder pledging shares immediately prior to the reform, and zero otherwise. Collateral Value is the number of collateralized shares multiplied by the net assets per share before the reform. SOE is a dummy variable equal to 1 if the ultimate owner of a business group is either SOE or government or state asset-management companies, and zero otherwise. ln(Total Assets) is the logarithm of book value of the firm assets in millions of renminbi (RMB). Market-to-Book is the market capitalization over book value. Leverage is total debt over total assets. ROA is the ratio of net income to total assets. Group CEO is a dummy variable equal to 1 if chief executive officers previously worked for group parents, and zero otherwise.*

**Panel A. Characteristics of Export-Related Firms**

| | N | Mean | SD | Min | p10 | p25 | p50 | p75 | p90 | Max |
|---|---|---|---|---|---|---|---|---|---|---|
| No. of Export Sub | 320 | 0.941 | 2.108 | 0 | 0 | 0 | 0 | 1 | 2 | 19 |
| $\Delta$Tunnel% | 320 | −0.001 | 0.032 | −0.032 | −0.014 | 0 | 0 | 0.000 | 0.009 | 0.019 |
| Tunnel/At | 320 | 0.010 | 0.032 | 0 | 0 | 0 | 0.000 | 0.005 | 0.028 | 0.050 |
| Collateral% | 320 | 0.073 | 0.133 | 0 | 0 | 0 | 0 | 0.091 | 0.301 | 0.361 |
| Collateral | 320 | 0.350 | 0.478 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| ln(Collateral Value) | 311 | 6.437 | 8.839 | 0 | 0 | 0 | 0 | 17.911 | 19.446 | 19.723 |
| SOE | 318 | 0.613 | 0.488 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| ln(Total Assets) | 320 | 21.466 | 0.838 | 20.203 | 20.466 | 20.904 | 21.416 | 22.029 | 22.565 | 22.848 |
| Market-to-book | 320 | 1.720 | 0.937 | 0.776 | 0.839 | 1.128 | 1.469 | 2.062 | 2.887 | 3.642 |
| Leverage | 320 | 0.519 | 0.165 | 0.208 | 0.298 | 0.430 | 0.524 | 0.647 | 0.716 | 0.771 |
| ROA | 320 | 0.034 | 0.059 | −0.060 | −0.013 | 0.011 | 0.032 | 0.060 | 0.100 | 0.131 |
| Group CEO | 320 | 0.853 | 0.355 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |

**Panel B. Non-Export-Related vs. Export-Related**

| | Non-Export-Related | | | Export-Related | | | (1)-(4) | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | N | Mean | SD | N | Dif | t-stat |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $\Delta$Tunnel% | −0.002 | 0.002 | 560 | −0.001 | 0.002 | 320 | 0.000 | −0.147 |
| Tunnel/At | 0.015 | 0.002 | 560 | 0.010 | 0.002 | 320 | 0.005* | 1.910 |
| Collateral% | 0.065 | 0.005 | 560 | 0.073 | 0.007 | 320 | −0.007 | −0.792 |
| Collateral | 0.325 | 0.020 | 560 | 0.350 | 0.027 | 320 | −0.025 | −0.756 |
| ln(Collateral value) | 5.859 | 0.368 | 560 | 6.437 | 0.501 | 320 | −0.578 | −0.938 |
| SOE | 0.667 | 0.020 | 560 | 0.613 | 0.027 | 320 | 0.054 | 1.607 |
| ln(Total Assets) | 21.349 | 0.045 | 560 | 21.559 | 0.048 | 320 | −0.210*** | −3.033 |
| Market-to-Book | 1.921 | 0.056 | 560 | 1.720 | 0.052 | 320 | 0.201** | 2.397 |
| Leverage | 0.485 | 0.008 | 560 | 0.519 | 0.009 | 320 | −0.035*** | −2.840 |
| ROA | 0.040 | 0.003 | 560 | 0.034 | 0.003 | 320 | 0.005 | 1.222 |
| Group CEO | 0.898 | 0.013 | 560 | 0.853 | 0.020 | 320 | 0.045** | 1.995 |

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 2: **Large Shareholders' Loan-to-Collateral Ratio**

*This table presents estimates of the effect of the passage of share-structure split reform on large shareholders' loan-to-collateral ratio. The sample period appears at the top of columns. The sample only includes loans against which non-tradable shares are pledged by large shareholders of publicly listed firms. The dependent variable is the logarithm of the loan-to-collateral ratio. The loan-to-collateral ratio is calculated as the loan amount borrowed by large shareholders divided by the book value of nontradable shares pledged to lenders. The book value of collateralized shares is the number of collateralized shares multiplied by net assets per share of the public firm as of the beginning of the reform year. Post-Reform is a dummy variable equal to 1 if loans are contracted after the share-split reform, and zero otherwise. ln (Total Assets) is the logarithm of book value of the firm assets in millions of renminbi (RMB). Leverage is total debt over total assets. Financial variables are taken as of the beginning of the year in which loans are contracted. Standard errors are clustered at the calendar month in which the reform was annouced.*

| | 2000–2014 | | 2000–2007 | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Post-Reform | 0.631*** | 0.504** | 0.687*** | 0.392* |
| | (7.12) | (2.83) | (6.45) | (2.02) |
| Leverage | 0.792** | 0.623 | 0.534 | 2.350** |
| | (2.27) | (1.32) | (0.93) | (2.45) |
| ln(Total Assets) | −0.071 | 0.090 | −0.016 | −0.292 |
| | (−1.11) | (0.72) | (−0.18) | (−0.83) |
| Constant | −0.271 | −3.528 | −1.312 | 3.711 |
| | (−0.21) | (−1.33) | (−0.69) | (0.51) |
| Public Firm FE | No | Yes | No | Yes |
| N | 606 | 606 | 363 | 363 |
| adj. $R^2$ | 0.11 | 0.24 | 0.16 | 0.42 |

standard errors in parentheses

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 3: **Collateral Shocks and Tunneling Behavior**

*This table presents the OLS estimates of the effect of collateralized shares on changes in the supply of intragroup credit by public firms around the year of share-split structure reform. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. The sample period is from June 2005 through December 2006, during which public firms in the sample had announced the share-split structure reform. In Panel A, only export-related firms are included. In Panel B, all firms are included. The dependent variable is $\Delta$Tunnel%, which is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. Collateral% is the number of non-tradable shares, as a percentage of total shares outstanding, pledged by large shareholders to lenders immediately prior to the reform announcement. Collateral is a dummy variable equal to 1 if a public firm is associated with collateral shares immediately prior to the reform announcement, and zero otherwise. Collateral Value (in millions RMB) is the number of collateralized shares multiplied by the net assets per share before the reform. All other financial variables are as of the beginning of the reform year. In columns (4)-(6), Pseudo Treatment is created by drawing random numbers from a normal distribution in which the mean and standard deviation are estimated from firms with non-zero Collateral% in column (1) and Collateral Value in column (3). Pseudo Collateral is defined analogously. In columns (7)-(9), Pseudo Event year is identified by randomly drawing 15% of observations from all firms on the period of 1999-2008. Control variables include ln(Total Assets), Leverage, and ROA. Please refer to Table 1 for definitions of other variables. Standard errors are clustered at the industry level.*

**Panel A: Export-Related Firms**

| | True Experiment | | | Pseudo Treatment | | | Pseudo Event | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Collateral% | −0.042** | | | −0.001 | | | 0.011 | | |
| | (0.016) | | | (0.014) | | | (0.022) | | |
| Collateral | | −0.010** | | | 0.005 | | | 0.002 | |
| | | (0.005) | | | (0.007) | | | (0.005) | |
| ln(Collateral Value) | | | −0.002** | | | 0.000 | | | 0.000 |
| | | | (0.001) | | | (0.000) | | | (0.001) |
| ln(Total Assets) | 0.004 | 0.004 | 0.005 | 0.004 | 0.004 | 0.004 | 0.001 | 0.001 | 0.001 |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) |
| Leverage | −0.018 | −0.020 | −0.023 | −0.021 | −0.020 | −0.019 | −0.023 | −0.022 | −0.019 |
| | (0.019) | (0.018) | (0.019) | (0.020) | (0.020) | (0.019) | (0.014) | (0.014) | (0.015) |
| ROA | −0.066 | −0.068 | −0.074 | −0.062 | −0.062 | −0.063 | −0.079 | −0.079 | −0.071 |
| | (0.045) | (0.045) | (0.047) | (0.052) | (0.050) | (0.050) | (0.049) | (0.050) | (0.053) |
| Constant | −0.061 | −0.055 | −0.069 | −0.053 | −0.058 | −0.057 | −0.008 | −0.009 | −0.008 |
| | (0.066) | (0.063) | (0.072) | (0.060) | (0.056) | (0.063) | (0.065) | (0.064) | (0.067) |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Province FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Reform-month FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 320 | 320 | 311 | 320 | 320 | 320 | 496 | 496 | 479 |
| *adj* $R^2$ | 0.15 | 0.15 | 0.15 | 0.13 | 0.13 | 0.13 | 0.03 | 0.03 | 0.04 |

**Panel B: All Firms**

| | True Experiment | | | Pseudo Treatment | | | Pseudo Event | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Collateral% | −0.022** | | | 0.000 | | | −0.004 | | |
| | (0.009) | | | (0.010) | | | (0.011) | | |
| Collateral | | −0.008*** | | | 0.001 | | | −0.000 | |
| | | (0.002) | | | (0.003) | | | (0.003) | |
| ln(Collateral Value) | | | −0.002*** | | | −0.000 | | | −0.001 |
| | | | (0.001) | | | (0.000) | | | (0.001) |
| log(Total Assets) | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | −0.000 | −0.000 | 0.000 |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.002) | (0.002) | (0.002) |
| Leverage | −0.002 | −0.002 | −0.006 | −0.002 | −0.002 | −0.002 | 0.009 | 0.009 | 0.004 |
| | (0.012) | (0.012) | (0.011) | (0.013) | (0.013) | (0.013) | (0.008) | (0.008) | (0.006) |
| ROA | 0.011 | 0.009 | 0.001 | 0.017 | 0.017 | 0.016 | 0.005 | 0.005 | 0.004 |
| | (0.022) | (0.022) | (0.022) | (0.022) | (0.022) | (0.023) | (0.024) | (0.023) | (0.022) |
| Constant | −0.048 | −0.051 | −0.064 | −0.048 | −0.049 | −0.048 | 0.008 | 0.008 | −0.006 |
| | (0.050) | (0.050) | (0.051) | (0.050) | (0.051) | (0.048) | (0.038) | (0.039) | (0.039) |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Province FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Reform-month FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 879 | 879 | 853 | 879 | 879 | 878 | 1277 | 1277 | 1227 |
| *adj* $R^2$ | -0.02 | -0.01 | -0.01 | -0.02 | -0.02 | -0.02 | 0.02 | 0.02 | 0.02 |

standard errors in parentheses

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 4: **Exporting Activities: Public Firms vs. Subsidiaries**

*This table compares the characteristics of exports between publicly listed firms and their own subsidiaries in the sample period from January 2000 through December 2006. 3428 firm-year observations are identified for public firms. Subsidiaries owned by the same public firm are classified into one group. 3428 group-year observations are identified for subsidiaries. Export characteristics are measured at the firm/group-year level. Value-FOB% is the total free-on-board value of goods exported scaled by annual sales reported by the public firm in the same year. Export values are adjusted to RMB dollars. No. of Shipments, No. of Destinations, No. of Products, and No. of Product Destinations are the number of shipments, the number of destination markets, the number of 6-digit Harmonization Code products, and the number of product-destination markets. For firm- or group-year observations without exports, values are set at zeros.*

| | Public Firms | | | Subsidiaries | | | (1)-(4) | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std | N | Mean | Std | N | Dif | t-stat |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Value – FOB% | 0.045 | 0.004 | 3428 | 0.161 | 0.026 | 3428 | -0.116*** | -4.384 |
| No. of Shipments | 111.795 | 11.952 | 3428 | 346.202 | 23.534 | 3428 | -234.407*** | -8.881 |
| No. of Products | 15.173 | 1.314 | 3428 | 42.203 | 2.252 | 3428 | -27.030*** | -10.369 |
| No. of Destinations | 3.987 | 0.158 | 3428 | 7.803 | 0.226 | 3428 | -3.816*** | -13.834 |
| No. of Product-Destinations | 35.582 | 3.761 | 3428 | 103.562 | 7.123 | 3428 | -67.980*** | -8.440 |

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 5: **Descriptive Statistics: Customs-CSMAR Matched Sample**

*Panel A presents descriptive statistics on the Customs-CSMAR matched sample. To be matched with the customs data, CSMAR firms have to satisfy two criteria: (1) Firms had announced reforms in the sample period and (2) firms are export-related and are included by customs data. Panel B compares the characteristics of exports between exporting subsidiaries of publicly listed firms (identified in Panel A) and other exporters that are neither public firms nor subsidiaries of any public firms in the sample period. From June 2005 through December 2006, public firms in the sample had announced the share-split structure reform. The sample unit is at the level of firm/subsidiary-product-destination-shipment-month. The timing of shipment is restricted to between the reform announcement and the end of the reform year. ln(Price) and ln(Volume) are the logarithms of export price [renminbi (RMB) dollars] and quantity of the exported product.* $RER_{s,d}$ *is defined as* $ER_{s,d} \times CPI_t/CPI_{s,d}$. $ER_{s,d}$ *is the nominal exchange rate defined as the price of the domestic currency (RMB) in terms of the foreign currency of country d as of month s.* $CPI_s$ *and* $CPI_{s,d}$ *represent the monthly consumer price index of China and of the corresponding destination country d, respectively.* $\Delta Tunnel\%$ *is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. Collateral% is the number of collateralized shares, as a percentage of total shares outstanding, immediately prior to the reform. Collateral is a dummy variable equal to 1 if a public firm has at least one large shareholder pledging shares immediately prior to the reform, and zero otherwise. Collateral Value is the number of collateralized shares multiplied by the net assets per share before the reform. Ordinary is a dummy variable equal to 1 if the export is ordinary trade, and zero otherwise. SOE is a dummy variable equal to 1 if the exporter is affiliated to the state-owned business groups, and zero otherwise. Value - FOB (M US$) is the total free-on-board value of goods exported in millions of USD. No. of Shipments, No. of Destinations, No. of Products, and No. of Product Destinations are the number of shipments, the number of destination markets, the number of 6-digit Harmonization Code products, and the number of product-destination markets. Volume (M unit) is the total number of units exported in millions. Other volume categories are defined analogously. Variables describing firm characteristics are taken from CSMAR public firms. Please refer to Table 1 for definitions of other variables.*

**Panel A: Customs-Firm Matched Sample**

| | N | Mean | Std | Min | P10 | p25 | p50 | p75 | p90 | Max |
|---|---|---|---|---|---|---|---|---|---|---|
| ln(Price) | 70602 | 3.624 | 1.961 | -4.529 | 1.676 | 2.533 | 3.435 | 4.406 | 6.018 | 18.984 |
| ln(Volume) | 70599 | 7.656 | 2.577 | 0 | 4.419 | 6.174 | 7.774 | 9.313 | 10.682 | 19.454 |
| ln(RER) | 70602 | -1.414 | 1.764 | -3.061 | -2.767 | -2.453 | -2.161 | -0.603 | 0.544 | 4.942 |
| Ordinary | 70602 | 0.886 | 0.318 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| ΔTunnel% | 70592 | 0.000 | 0.015 | -0.208 | -0.003 | 0.000 | 0 | 0.001 | 0.008 | 0.214 |
| Collateral% | 70602 | 0.051 | 0.118 | 0 | 0 | 0 | 0 | 0.006 | 0.244 | 0.518 |
| Collateral | 70602 | 0.282 | 0.450 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| ln(Collateral Value) | 70602 | 5.066 | 8.166 | 0 | 0 | 0 | 0 | 15.099 | 18.751 | 21.294 |
| ln(Total Assets) | 70602 | 21.850 | 0.737 | 19.537 | 20.908 | 21.351 | 21.786 | 22.144 | 22.815 | 24.886 |
| Market-to-Book | 70602 | 1.269 | 0.497 | 0.573 | 0.895 | 1.018 | 1.177 | 1.350 | 1.700 | 5.029 |
| Leverage | 70602 | 0.582 | 0.150 | 0.078 | 0.390 | 0.474 | 0.610 | 0.676 | 0.785 | 0.817 |
| ROA | 70602 | 0.036 | 0.045 | -0.202 | 0.006 | 0.031 | 0.038 | 0.049 | 0.065 | 0.238 |
| Group CEO | 70602 | 0.962 | 0.191 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| SOE | 70504 | 0.785 | 0.411 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |

**Panel B. CSMAR-Custom Matched vs. Unmatched**

| | Unmatched | | | Matched | | | (1)-(4) | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std | N | Mean | Std | N | Dif | t-stat |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Value- FOB (M US$) | 12.68 | 240.58 | 199,573 | 77.77 | 213.37 | 412 | -65.09*** | -5.49 |
| No. of Shipments | 184.87 | 1172.78 | 199,573 | 1186.01 | 140.40 | 412 | -1001.14*** | -17.22 |
| No. of Destinations | 9.72 | 13.28 | 199,573 | 31.26 | 31.01 | 412 | -21.54*** | -32.76 |
| No. of Products | 27.23 | 70.65 | 199,573 | 117.51 | 224.10 | 412 | -90.28*** | -25.67 |
| No. of Product-Destinations | 54.62 | 244.93 | 199,573 | 330.36 | 809.57 | 412 | -275.75*** | -22.60 |
| Volume (M Unit) | 11.96 | 302.57 | 134,020 | 26.68 | 97.66 | 346 | -14.71 | -0.90 |
| Volume (M Litre) | 4.34 | 47.06 | 565 | 39.61 | 41.67 | 2 | -35.27 | -1.06 |
| Volume (M Meter) | 1.58 | 10.71 | 27,113 | 4.23 | 13.42 | 145 | -2.65*** | -2.97 |
| Volume (M Square Meter) | 0.16 | 1.17 | 12,313 | 0.30 | 1.20 | 78 | -0.15 | -1.11 |
| Volume (M Kilogram) | 10.30 | 403.87 | 178,673 | 50.14 | 313.69 | 401 | -39.84** | -1.97 |
| Volume (M Gram) | 8.18 | 66.72 | 3,621 | 2.30 | 7.82 | 25 | 5.89 | 0.44 |
| Volume (M Cubic Meter) | 0.01 | 0.07 | 6,990 | 0.03 | 0.08 | 53 | -0.02*** | -2.24 |

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 6: **Tunneling and Pricing to Market: OLS Estimation (Post-Reform Period)**

*This table presents the OLS estimates of the effect of the supply of intragroup credit by public firms to large shareholders on the elasticity of export price and volume to exchange-rate changes. From June 2005 through December 2006, public firms in the sample had announced the share-split structure reform. The sample unit is at the level of firm/subsidiary-product-destination-shipment-month. The timing of shipment is restricted to between the reform announcement and the end of the reform year. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. In columns (1)-(4), goods exported by both public firms and their exporting subsidiaries are included. In columns (5)-(8), only goods exported by subsidiaries are included. The dependent variables are the logarithms of export price per unit [renminbi (RMB) dollars] and number of exported units. $RER_{s,d}$ is defined as $ER_{s,d} \times CPI_s/CPI_{s,d}$. $ER_{s,d}$ is the nominal exchange rate defined as the price of the domestic currency (RMB) in terms of the foreign currency of country d as of month s. $CPI_s$ and $CPI_{s,d}$ represent the monthly consumer price index of China and of the corresponding destination country d, respectively. $\Delta$Tunnel% is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. Ordinary is a dummy variable equal to 1 if the export is ordinary trade, and zero otherwise. All other financial variables are measured as of the beginning of the reform year. Please refer to Table 1 for definitions of other variables. Standard errors are clustered at the product-destination and year levels.*

| | All | | | | Subsidiaries | | | |
|---|---|---|---|---|---|---|---|---|
| | ln(Price) | | ln(Volume) | | ln(Price) | | ln(Volume) | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| ln(RER) | | −0.193*** | | −0.261*** | | −0.312*** | | −0.382 |
| | | (0.068) | | (0.068) | | (0.066) | | (0.383) |
| ln(RER)× ΔTunnel% | | 0.090 | | −0.457** | | −0.062 | | 0.314 |
| | | (0.089) | | (0.194) | | (0.178) | | (0.211) |
| Tunnel% | −1.560** | | −2.263 | | 0.609 | | −4.377** | |
| | (0.654) | | (1.499) | | (0.705) | | (1.872) | |
| ln(Total Assets) | −0.021*** | | 0.091*** | | −0.021*** | | 0.003 | |
| | (0.007) | | (0.019) | | (0.006) | | (0.020) | |
| Market-to-Book | 0.091* | | −0.063 | | 0.051 | | −0.014 | |
| | (0.054) | | (0.150) | | (0.048) | | (0.076) | |
| Leverage | −0.540*** | | 0.115 | | −0.538*** | | 0.200*** | |
| | (0.074) | | (0.111) | | (0.022) | | (0.063) | |
| ROA | 0.222** | | −0.933*** | | 0.492*** | | −1.867*** | |
| | (0.095) | | (0.084) | | (0.135) | | (0.310) | |
| Group CEO | −0.314*** | | 0.079** | | −0.481** | | 0.137 | |
| | (0.120) | | (0.039) | | (0.219) | | (0.276) | |
| Ordinary | −0.238*** | | −0.062*** | | −0.260*** | | −0.024 | |
| | (0.044) | | (0.008) | | (0.061) | | (0.016) | |
| Constant | 4.670*** | 2.134*** | 5.875*** | 8.749*** | 4.936*** | 3.334*** | 7.324*** | 9.484*** |
| | (0.134) | (0.271) | (0.884) | (0.522) | (0.212) | (1.081) | (0.966) | (1.866) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Product-Destination FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Public Firm FE | No | Yes | No | Yes | No | No | No | No |
| Subsidiary FE | No | No | No | No | No | Yes | No | Yes |
| N | 72663 | 72902 | 72739 | 72978 | 59934 | 60173 | 59933 | 60172 |
| *adj.* $R^2$ | 0.86 | 0.86 | 0.60 | 0.61 | 0.85 | 0.87 | 0.57 | 0.59 |

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 7: **Tunneling and Pricing-to-Market: IV Estimation, Second Stage (Post-Reform Period)**

*This table presents the instrument variable (IV) estimates of the effect of intragroup credit on the elasticity of export price and volume to exchange-rate changes. From June 2005 through December 2006, public firms in the sample had announced the share-split structure reform. The sample unit is at the level of firm/subsidiary-product-destination-shipment-month. The timing of shipment is restricted between the reform announcement and the end of the reform year. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. In columns (1)-(4), goods exported by both public firms and their exporting subsidiaries are included. In columns (5)-(8), only goods exported by subsidiaries are included. The dependent variables are the logarithms of export price per unit [renminbi (RMB) dollars] and number of exported units.* $RER_{s,d}$ *is defined as* $ER_{s,d} \times CPI_s/CPI_{s,d}$. $ER_{s,d}$ *is the nominal exchange rate defined as the price of the domestic currency (RMB) in terms of the foreign currency of country* $d$ *as of month* $s$. $CPI_s$ *and* $CPI_{s,d}$ *represent the monthly consumer price index of China and of the corresponding destination country* $d$*, respectively. Both* $\Delta Tunnel\%$ *and* $\Delta Tunnel\% \times ln(RER_{s,d})$ *are instrumented.* $\Delta Tunnel\%$ *is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. In Panel A, B, and C, instruments are Collateral%, Collateral, and ln(Collateral Value), respectively. Collateral% is the number of collateralized shares, as a percentage of total shares, immediately prior to the reform. Collateral is a dummy variable equal to 1 if a public firm has at least one large shareholder pledging shares immediately prior to the reform, and zero otherwise. Collateral Value is the number of collateralized shares multiplied by the net assets per share before the reform. In odd-numbered columns, control variables include ln(Total Assets), Market-to-Book, Leverage, ROA, Group CEO, and Ordinary. In even-numbered columns, Ordinary is the only control variable. Ordinary is a dummy variable equal to 1 if the export is ordinary trade, and zero otherwise. All other financial variables are measured as of the beginning of the reform year. Please refer to Table 1 for definitions of other variables. Standard errors are clustered at the product-destination and year levels.*

| | All | | | | Subsidiaries | | | |
|---|---|---|---|---|---|---|---|---|
| | ln(Price) | | ln(Volume) | | ln(Price) | | ln(Volume) | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| **Panel A: Collateral% as Instrument** | | | | | | | | |
| ln(RER) | | −0.193*** | | −0.341** | | −0.350*** | | −0.345 |
| | | (0.066) | | (0.135) | | (0.094) | | (0.255) |
| ln(RER) × ΔTunnel% | | 8.976*** | | −12.355*** | | 12.075*** | | −26.208*** |
| | | (0.211) | | (2.136) | | (1.439) | | (2.484) |
| ΔTunnel% | 21.758*** | | −16.373*** | | 13.944*** | | −9.993*** | |
| | (1.930) | | (3.240) | | (1.670) | | (2.336) | |
| N | 70129 | 64368 | 70215 | 64446 | 57060 | 52500 | 57061 | 52501 |
| **Panel B: Collateral as Instrument** | | | | | | | | |
| ln(RER) | | −0.198*** | | −0.346** | | −0.364*** | | −0.320 |
| | | (0.065) | | (0.138) | | (0.098) | | (0.259) |
| ln(RER) × ΔTunnel% | | 6.025*** | | −15.682*** | | 16.601*** | | −34.140*** |
| | | (0.946) | | (2.315) | | (2.460) | | (4.037) |
| ΔTunnel% | 25.232** | | −14.966 | | 24.008*** | | −30.945*** | |
| | (11.432) | | (20.035) | | (0.553) | | (4.224) | |
| N | 70129 | 64368 | 70215 | 64446 | 57060 | 52324 | 57061 | 52325 |
| **Panel C: ln(Collateral Value) as Instrument** | | | | | | | | |
| ln(RER) | | −0.199*** | | −0.345** | | −0.355*** | | −0.331 |
| | | (0.064) | | (0.138) | | (0.096) | | (0.257) |
| ln(RER) × ΔTunnel% | | 5.567*** | | −15.013*** | | 13.792*** | | −30.826*** |
| | | (0.840) | | (2.233) | | (1.835) | | (3.388) |
| ΔTunnel% | 25.195*** | | −11.479 | | 23.893*** | | −25.992*** | |
| | (9.074) | | (14.781) | | (1.171) | | (3.532) | |
| N | 70129 | 64368 | 70215 | 64446 | 57060 | 52324 | 57061 | 52325 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Product-Destination FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Public Firm FE | No | Yes | No | Yes | No | No | No | No |
| Subsidiary FE | No | No | No | No | No | Yes | No | Yes |

standard errors in parentheses

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 8: **Tunneling and Pricing to Market: IV Estimation, Second Stage (Weighted Regressions)**

*This table presents the instrument variable (IV) estimates of the effect of intragroup credit on the elasticity of export price and volume to exchange-rate changes. In Panel A, regressions are weighted by the public firm's total assets as of the beginning of the reform year. In Panel B, regressions are weighted by export volumes of each sample unit. From June 2005 through December 2006, public firms in the sample had announced the share-split structure reform. The sample unit is at the level of firm/subsidiary-product-destination-shipment-month. The timing of shipment is restricted in the reform year, including months both before and after the reform announcement. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. Only goods exported by exporting subsidiaries are included. The dependent variables are the logarithms of export price per unit [renminbi (RMB) dollars] and number of exported units. The name of dependent variables appears at the top of each column.* $RER_{s,d}$ *is defined as* $ER_{s,d} \times CPI_s/CPI_{s,d}$. $ER_{s,d}$ *is the nominal exchange rate defined as the price of the domestic currency (RMB) in terms of the foreign currency of country d as of month s.* $CPI_s$ *and* $CPI_{s,d}$ *represent the monthly consumer price index of China and of the corresponding destination country d, respectively. Both* $\Delta Tunnel\%$ *and* $\Delta Tunnel\% \times ln(RER_{s,d})$ *are instrumented.* $\Delta Tunnel\%$ *is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. The name of instruments appears at the top of each column. Instruments are Collateral%, Collateral, and ln(Collateral Value), respectively. Collateral% is the number of collateralized shares, as a percentage of total shares, immediately prior to the reform. Collateral is a dummy variable equal to 1 if a public firm has at least one large shareholder pledging shares immediately prior to the reform, and zero otherwise. Collateral Value is the number of collateralized shares multiplied by the net assets per share before the reform. Ordinary is the only control variable. Ordinary is a dummy variable equal to 1 if the export is ordinary trade, and zero otherwise. All other financial variables are measured as of the beginning of the reform year. Please refer to Table 1 for the definition of other financial variables. Standard errors are clustered at the product-destination and year levels.*

**Panel A: Assets-Weighted Regressions**

| | Collateral% | | Collateral | | Collateral Value | |
|---|---|---|---|---|---|---|
| | ln(Price) | ln(Volume) | ln(Price) | ln(Volume) | ln(Price) | ln(Volume) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ln(RER) | −0.407 ∗ ∗ | −0.333 | −0.386 ∗ ∗ | −0.338 | −0.381 ∗ ∗ | −0.349 |
| | (0.066) | (0.414) | (0.065) | (0.427) | (0.064) | (0.429) |
| ln(RER) ×ΔTunnel% | 11.938 ∗ ∗ | −7.580∗ | 10.339 ∗ ∗ | −7.181∗ | 10.000 ∗ ∗ | −6.337∗ |
| | (1.408) | (4.415) | (1.202) | (3.939) | (1.110) | (3.792) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Product-Destination FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Subsidiary FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 52500 | 52501 | 52500 | 52501 | 52500 | 52501 |

**Panel B: Volume-Weighted Regressions**

| | Collateral% | Collateral | Collateral Value |
|---|---|---|---|
| | ln(Price) | ln(Price) | ln(Price) |
| | (1) | (2) | (3) |
| ln(RER) | −0.576 ∗ ∗ | −0.575 ∗ ∗ | −0.578 ∗ ∗ |
| | (0.056) | (0.056) | (0.056) |
| ln(RER) × ΔTunnel% | 35.423 ∗ ∗ | 37.266 ∗ ∗ | 32.288 ∗ ∗ |
| | (4.745) | (4.956) | (3.684) |
| Controls | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes |
| Product-Destination FE | Yes | Yes | Yes |
| Subsidiary FE | Yes | Yes | Yes |
| N | 52500 | 52500 | 52500 |

standard errors in parentheses

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 9: **Excluding Simultaneous Importers: Subsidiaries (Post-Reform Period)**

*This table presents the instrument variable (IV) estimates of the effect of the supply of intragroup credit by public firms on the elasticity of export price to exchange-rate changes by excluding exporters that are simultaneous large importers. Observations about exports are excluded if Import% is greater than 50%. Import% is the ratio of total imports over total exports made by the same subsidiary with the same destination country in the same month. In Panel A, regressions are equal-weighted. In Panel B, regressions are weighted by public firm's total assets as of the beginning of the reform year. From June 2005 through December 2006, public firms in the sample had announced the share-split structure reform. The sample unit is at the level of firm/subsidiary-product-destination-shipment-month. The timing of shipment is restricted to between the reform announcement and the end of the reform year. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. Only goods exported by subsidiaries are included. The dependent variables is the logarithms of export price per unit [renminbi (RMB) dollars]. $RER_{s,d}$ is defined as $ER_{s,d} \times CPI_s/CPI_{s,d}$. $ER_{s,d}$ is the nominal exchange rate defined as the price of the domestic currency (RMB) in terms of the foreign currency of country d as of month s. $CPI_s$ and $CPI_{s,d}$ represent the monthly consumer price index of China and of the corresponding destination country d, respectively. $\Delta Tunnel\%$ is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. Both $\Delta Tunnel\%$ and $\Delta Tunnel\% \times ln(RER_{s,d})$ are instrumented. In columns (1)-(2), (3)-(4), and (5)-(6), instruments are Collateral%, Collateral, and ln(Collateral Value), respectively. Collateral% is the number of collateralized shares, as a percentage of total shares, immediately prior to the reform. Collateral is a dummy variable equal to 1 if a public firm has at least one large shareholder pledging shares immediately prior to the reform, and zero otherwise. Collateral Value is the number of collateralized shares multiplied by the net assets per share before the reform. All other financial variables are measured as of the beginning of the reform year. Ordinary, the only control variable, is a dummy variable equal to 1 if the export is ordinary trade, and zero otherwise. Standard errors are clustered at the product-destination and year levels.*

**Panel A: Equal-Weighted Regressions**

| | Collateral% | | Collateral | | ln(Collateral Value) | |
|---|---|---|---|---|---|---|
| | ln(Price) | ln(Volume) | ln(Price) | ln(Volume) | ln(Price) | ln(Volume) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ln(RER) | −0.491*** | −0.409 | −0.527*** | −0.489* | −0.510*** | −0.482* |
| | (0.053) | (0.257) | (0.062) | (0.287) | (0.057) | (0.284) |
| ln(RER) ×ΔTunnel% | 29.838*** | −29.291*** | 39.009*** | −8.933*** | 34.550*** | −10.727*** |
| | (6.324) | (3.633) | (5.716) | (2.978) | (5.299) | (2.333) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Product-Destination FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Subsidiary FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 49608 | 49609 | 49608 | 49609 | 49608 | 49609 |

**Panel B: Weighted Regressions, Weight=Assets**

| | Collateral% | | Collateral | | ln(Collateral Value) | |
|---|---|---|---|---|---|---|
| | ln(Price) | ln(Volume) | ln(Price) | ln(Volume) | ln(Price) | ln(Volume) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ln(RER) | −0.682*** | −0.304 | −0.643*** | −0.395 | −0.636*** | −0.393 |
| | (0.204) | (0.359) | (0.169) | (0.406) | (0.167) | (0.404) |
| ln(RER) ×ΔTunnel% | 35.100*** | −19.901** | 31.459*** | −11.328** | 30.831*** | −11.603** |
| | (12.682) | (8.712) | (9.390) | (4.637) | (9.459) | (4.739) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Product-Destination FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Subsidiary FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 49608 | 49609 | 49608 | 49609 | 49608 | 49609 |

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 10: **Tunneling and Pricing to Market: IV Estimation, SOE vs. Non-SOE Subsidiaries (Post-Reform Period)**

*This table presents the instrument variable (IV) estimates of the effect of intragroup credit on the elasticity of export price and volume to exchange-rate changes on subsamples of exporters affiliated with SOE and non-SOE business groups. In Panel A, regressions are equal-weighted. In Panel B, regressions are weighted by public firm's total assets as of the beginning of the reform year. From June 2005 through December 2006, public firms in the sample had announced the share-split structure reform. The sample unit is at the level of firm/subsidiary-product-destination-shipment-month. The timing of shipment is restricted between the reform announcement and the end of the reform year. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. SOE is a dummy variable equal to 1 if the ultimate owner of a business group is either SOE or government or state asset-management companies, and zero otherwise. Only goods exported by subsidiaries are included. The dependent variable is the logarithms of export price per unit [renminbi (RMB) dollars]. $RER_{s,d}$ is defined as $ER_{s,d} \times CPI_s/CPI_{s,d}$. $ER_{s,d}$ is the nominal exchange rate defined as the price of the domestic currency (RMB) in terms of the foreign currency of country d as of month s. $CPI_s$ and $CPI_{s,d}$ represent the monthly consumer price index of China and of the corresponding destination country d, respectively. $\Delta Tunnel\%$ is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. Both $\Delta Tunnel\%$ and $\Delta Tunnel\% \times ln(RER_{s,d})$ are instrumented. In columns (1)-(2), (3)-(4), and (5)-(6), instruments are Collateral%, Collateral, and ln(Collateral Value), respectively. Collateral% is the number of collateralized shares, as a percentage of total shares, immediately prior to the reform. Collateral is a dummy variable equal to 1 if a public firm has at least one large shareholder pledging shares immediately prior to the reform, and zero otherwise. Collateral Value is the number of collateralized shares multiplied by the net assets per share before the reform. Ordinary, the only control variable, is a dummy variable equal to 1 if the export is ordinary trade, and zero otherwise. Please refer to Table 1 for definitions of other variables. Standard errors are clustered at the product-destination and year levels.*

**Panel A: Equal-Weighted Regressions**

| | Collateral% | | Collateral | | ln(Collateral Value) | |
|---|---|---|---|---|---|---|
| | SOE | Non-SOE | SOE | Non-SOE | SOE | Non-SOE |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ln(RER) | −0.512*** | −0.244 | −0.519*** | −0.218 | −0.517*** | −0.219 |
| | (0.181) | (0.290) | (0.178) | (0.271) | (0.179) | (0.272) |
| ln(RER)×ΔTunnel% | 20.353*** | −2.994 | 21.268*** | −5.530*** | 20.984*** | −5.433*** |
| | (4.879) | (2.456) | (4.516) | (1.223) | (4.745) | (1.255) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Product-Destination FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Subsidiary FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 44251 | 11327 | 44251 | 11327 | 44251 | 11327 |

**Panel B: Weighted Regressions, Weight=Assets**

| | Collateral% | | Collateral | | ln(Collateral Value) | |
|---|---|---|---|---|---|---|
| | SOE | Non-SOE | SOE | Non-SOE | SOE | Non-SOE |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ln(RER) | −0.945** | −0.086 | −0.922** | −0.078 | −0.922** | −0.078 |
| | (0.444) | (0.060) | (0.378) | (0.057) | (0.382) | (0.057) |
| ln(RER)×ΔTunnel% | 28.825 | 3.497 | 27.780* | −2.033 | 27.776* | −1.724 |
| | (17.874) | (8.113) | (14.665) | (2.806) | (14.897) | (3.088) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Product-Destination FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Subsidiary FE | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 44251 | 11327 | 44251 | 11327 | 44251 | 11327 |

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 11: **Tunneling and Propping: Export-Related Firms**

*This table presents the estimates of the effect of tunneling of publicly listed firms on subsidiaries' access to intragroup credit. Public firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. Only export-related public firms are included. In columns (1) and (2), the sample period is in the reform year. In columns (3)-(4), the sample period is from 2004 through 2008. In columns (1) and (3), the dependent variable, $\Delta Propping\%$, is the difference between intragroup credit in year $t$ and $t-1$ (scaled by lagged total assets), provided by public firms to their own subsidiaries. In columns (2) and (4), the dependent variable is a dummy variable equal to 1 if $\Delta Propping\%$ is greater than zero, and zero otherwise. $\Delta Tunnel\%$ is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. Pre-Zero is a dummy variable equal to 1 if the balance of propping credit in year t-1 is zero, and zero otherwise. All other financial variables are as of the beginning of the reform year. Please refer to Table 1 for definitions of other variables. Standard errors are clustered at the industry level.*

| | Reform year | | 2004-2008 | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ΔTunnel% | −0.027** | −0.461* | −0.048** | −0.527*** |
| | (0.011) | (0.235) | (0.017) | (0.115) |
| Pre-Zero | 0.002 | 0.543*** | 0.006*** | 0.602*** |
| | (0.001) | (0.054) | (0.001) | (0.031) |
| ln(Total Assets) | −0.000 | −0.012 | 0.000 | −0.012*** |
| | (0.001) | (0.011) | (0.000) | (0.004) |
| Leverage | −0.002** | −0.049 | −0.001 | −0.022 |
| | (0.001) | (0.081) | (0.002) | (0.030) |
| ROA | 0.016** | 0.166 | 0.014*** | 0.066 |
| | (0.006) | (0.339) | (0.005) | (0.107) |
| Constant | 0.005 | 0.281 | −0.009** | 0.258*** |
| | (0.012) | (0.241) | (0.004) | (0.072) |
| Year FE | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes |
| N | 323 | 323 | 1669 | 1669 |
| *adj.* $R^2$ | 0.04 | 0.46 | 0.06 | 0.55 |

standard errors in parentheses

$*p < 0.10, **p < 0.05, ***p < 0.01$

Figure 1: **China's Bilateral Exchange Rates against U.S. Dollar**

*This chart plots the monthly nominal and real exchange rates of RMB against U.S. dolars over the sample period of January 2001 through December 2006.*

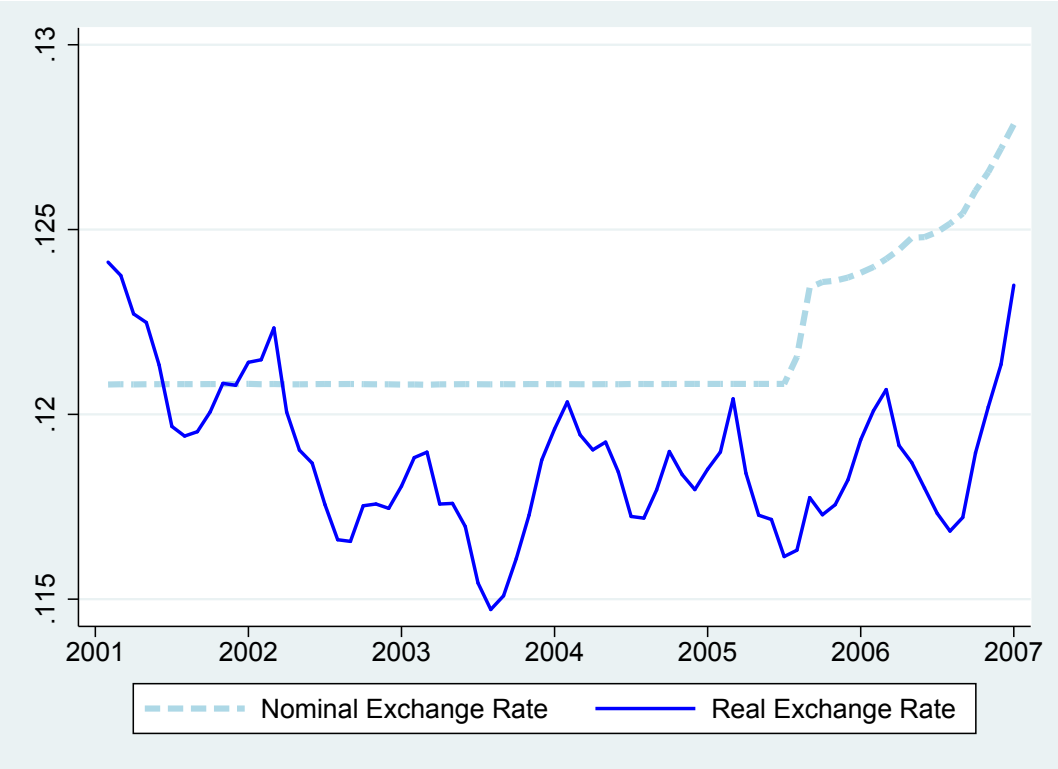
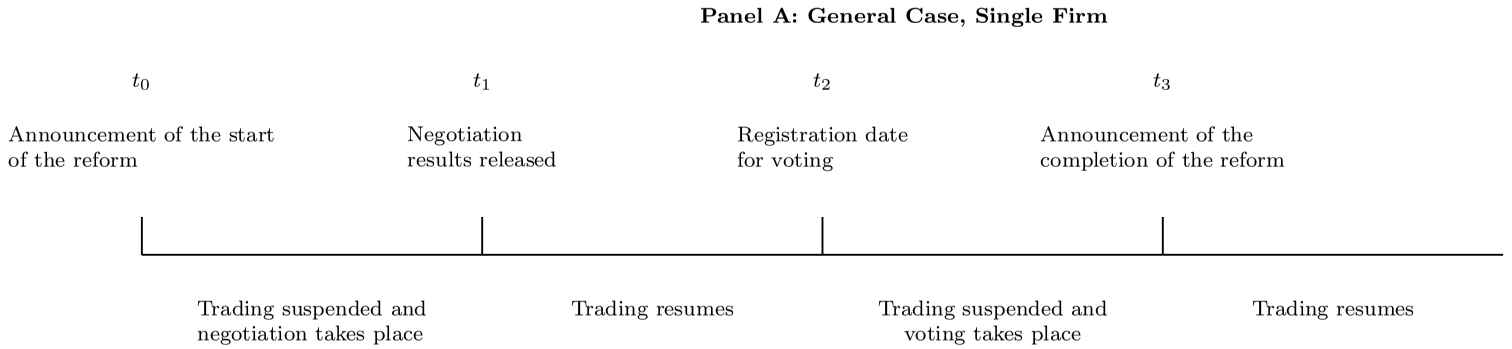


Figure 2: **Timeline of China's Share-Split Structure Reform**



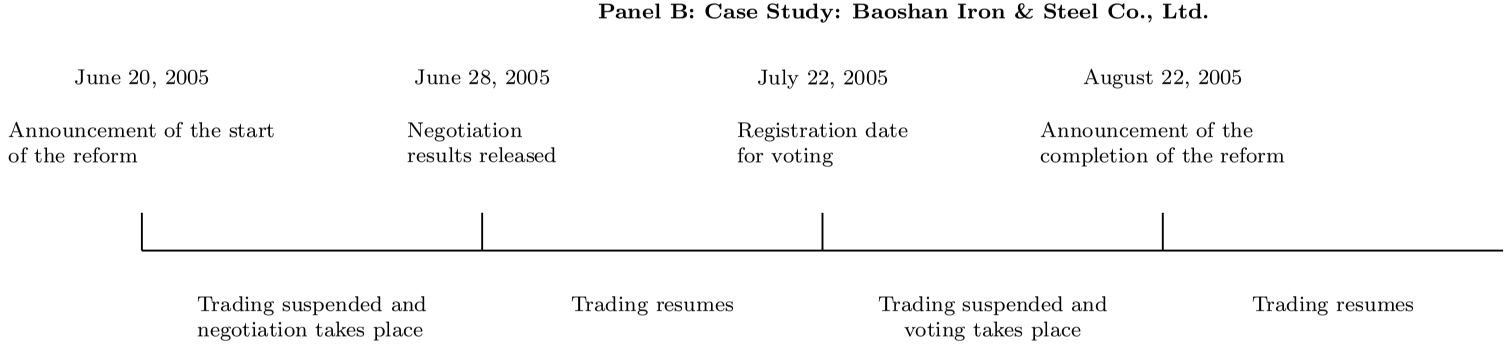



Figure 3: **Distribution of Export-Related Firms over Reform Months**

*This chart plots the distribution of export-related firms over calender months in which they made reform annoucements. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. The light-blue bar represents the number of focal firms. The blue bar represents the number of focal firms whose large shareholders pledged non-tradable shares to lenders before the reform.*

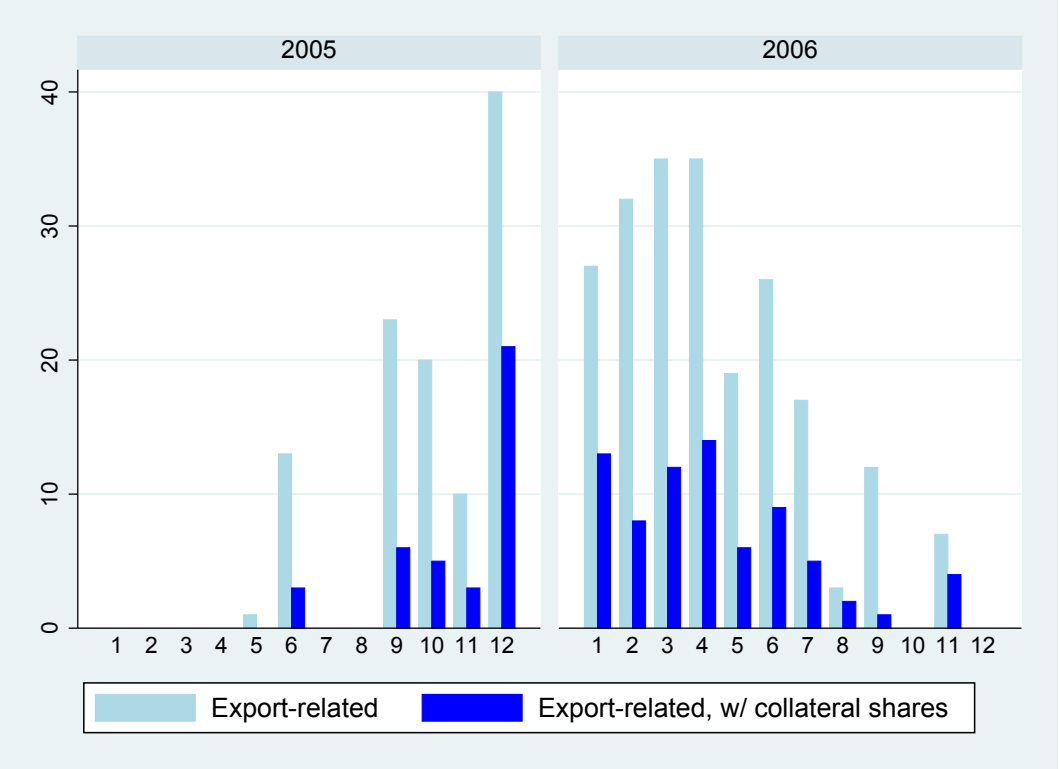
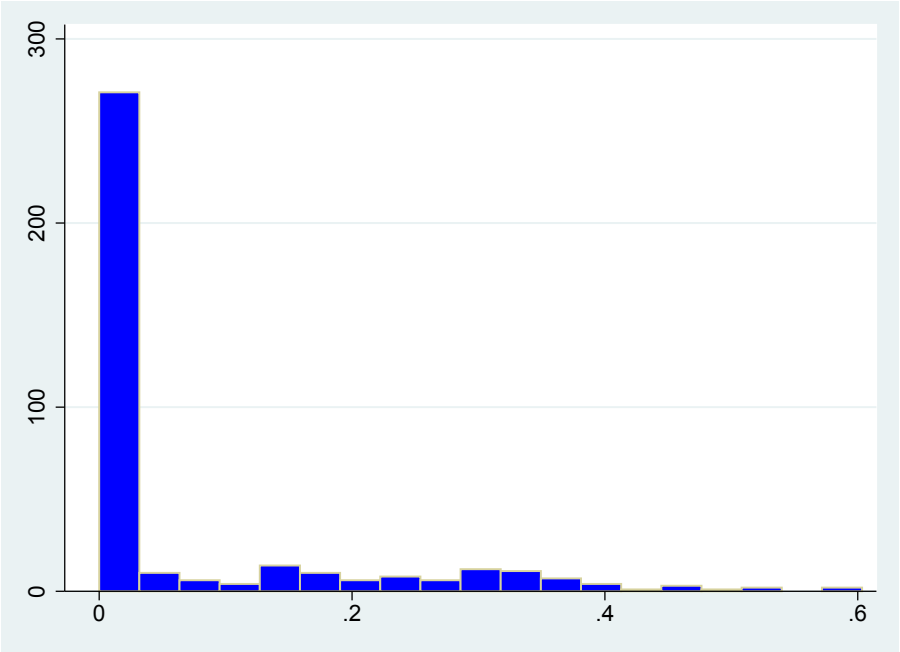


Figure 4: **Firm-level Distribution of Tunneling and Collateral Shares**

*Non-export-related public firms are excluded. For each variable, the Y axis represents its frequency and the X axis represents its value. Panel A plots the distribution of collateral shares across Chinese public firms that embarked on the share-split structure reform. Collateral shares (Collateral%) is the number of shares pledged by large shareholders to lenders, as a percentage of total shares, immediately prior to the reform. Panel B compares distributions of percent changes in tunneling credit ($\Delta$Tunnel%) between public firms with and without collateral shares immediately prior to the reform announcement. $\Delta$Tunnel% is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable.*

**Panel A: Collateral Shares**




**Panel B: Tunneling**

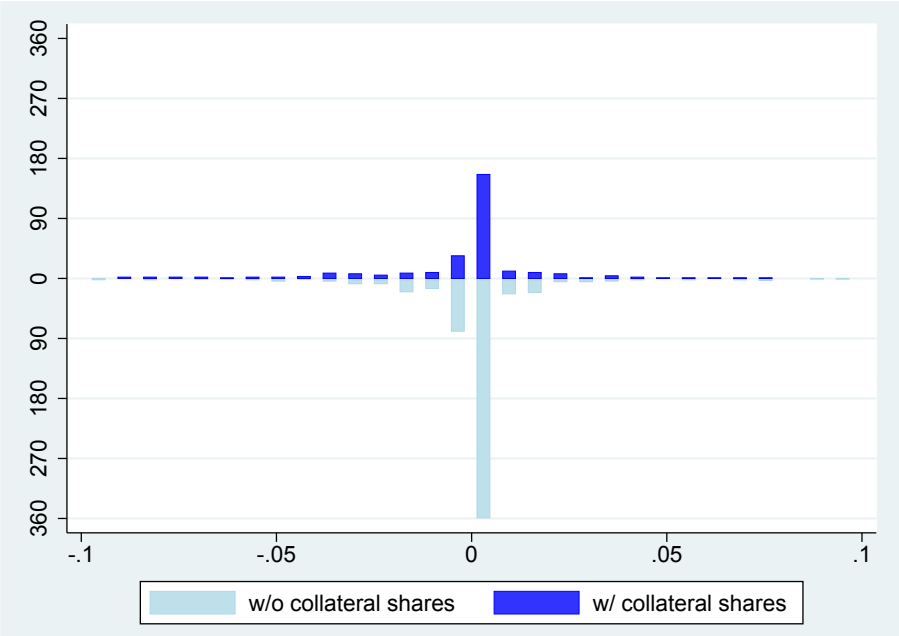
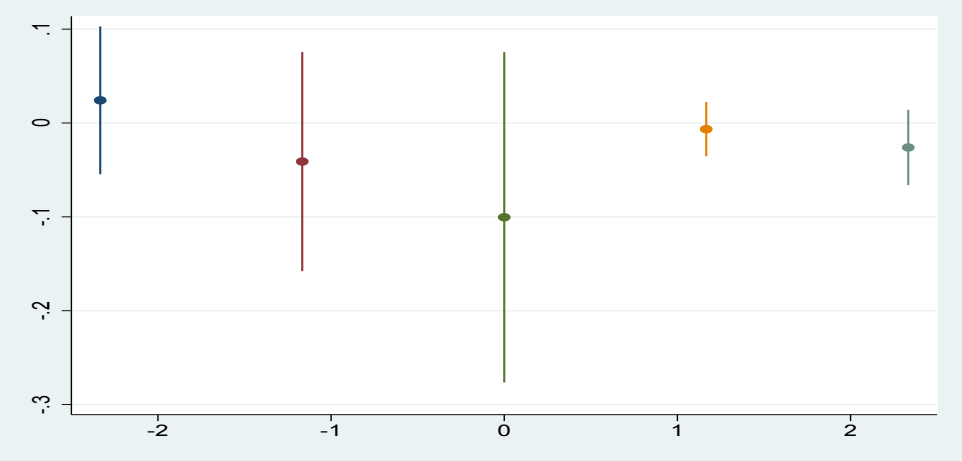


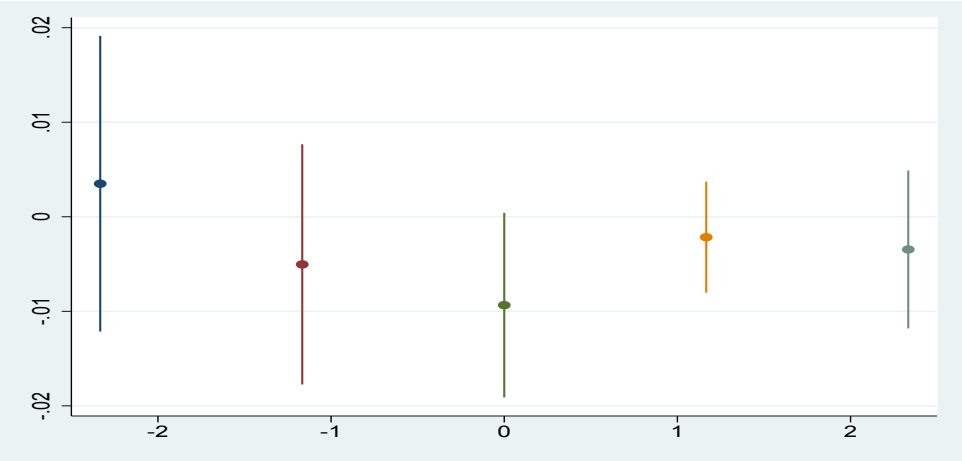
Figure 5: **Impact of Collateral Shares on ΔTunnel/Asset**

*The chart plots the estimates of β as in equation 4 separately for each event year over the window (-2, +2) relative to the reform year.*

**Panel A: Collateral%**




**Panel B: Collateral**




**Panel C: ln(Collateral Value)**

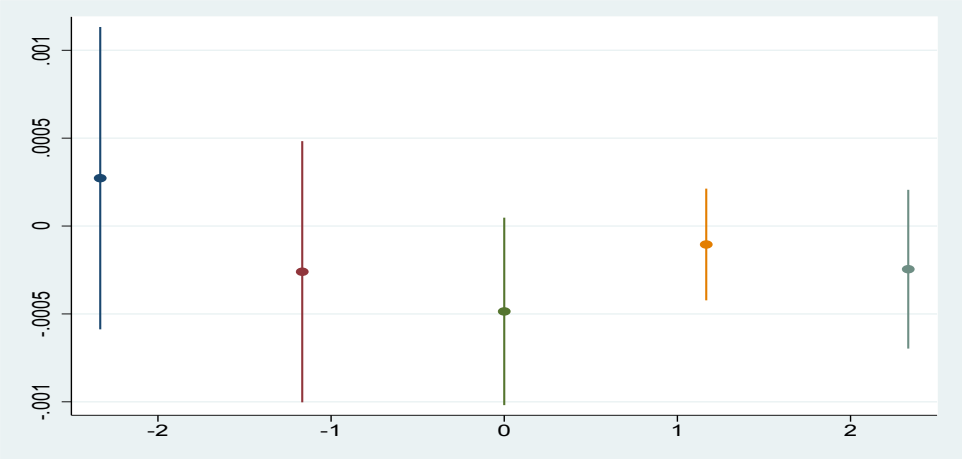
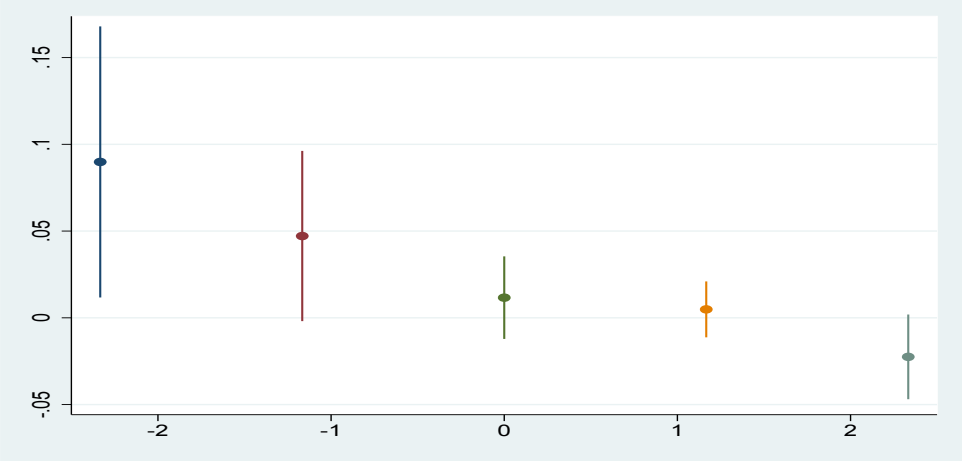


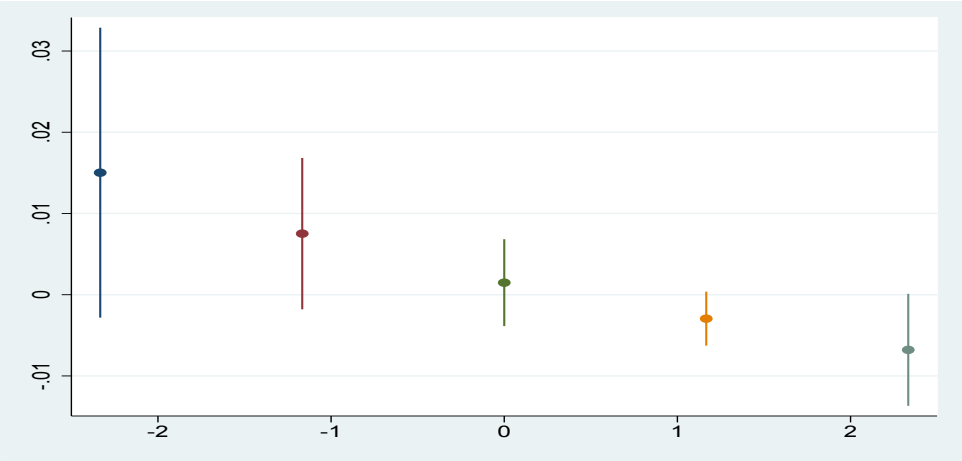
Figure 6: **Impact of Collateral Shares on Tunnel/Assets**

*The chart plots the estimates of $\beta$ as in equation 5 separately for each event year over the window (-2, +2) relative to the reform year.*

**Panel A: Collateral%**




**Panel B: Collateral**




**Panel C: ln(Collateral Value)**

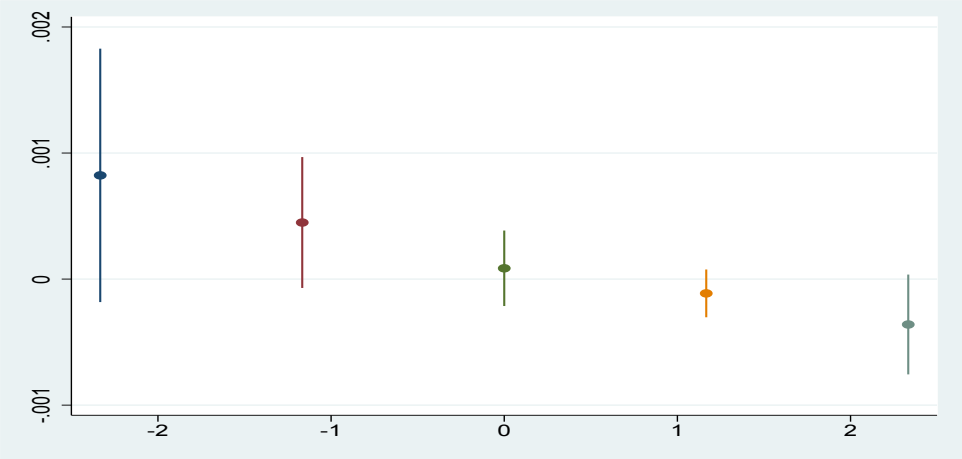
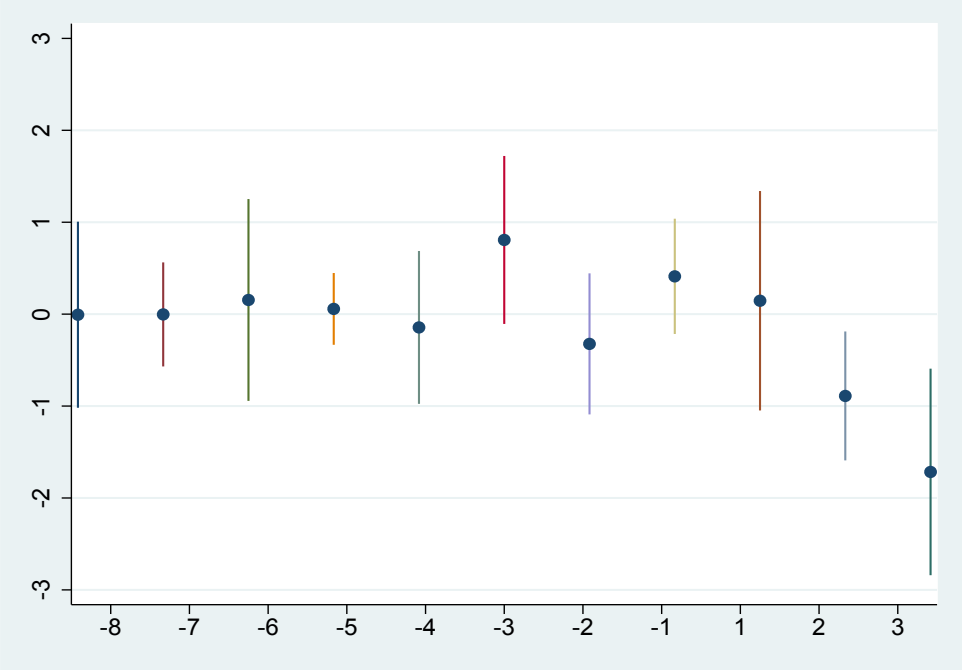


Figure 7: **Parallel Trends Assumption: Assessment of Pre-Trends**

*The chart plots the estimates of $\mu$ and the 90% confidence intervals as in equation 9 separately for each 3 months over the window of [-24, +9] months relative to the month in which firms announce the reform. The event month is excluded. The numbers on the x-axis indicate the 3-month windows relative to the event month. For example, "-8" indicates the window of [-24, -21] and "1" indicates the window of [1, 3].*

**Panel A: Exporters with Collateral Shares**




**Panel B: Exporters without Collateral Shares**

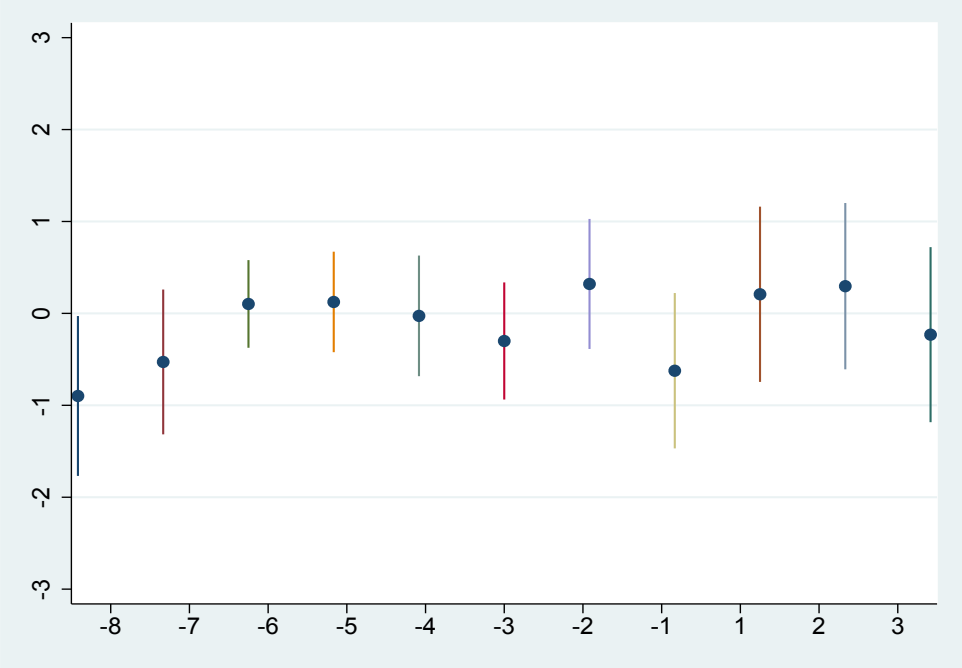
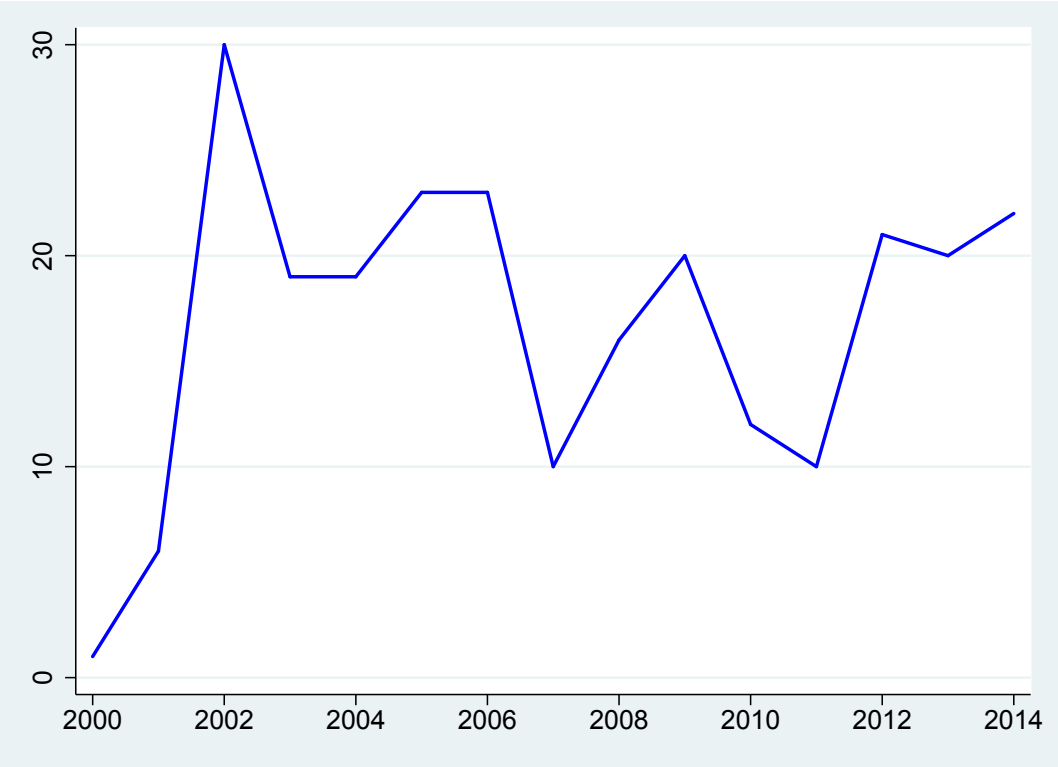


Figure 8: **Number of Tunneling-Related Fraud Events over Time**

*The chart plots the distribution of the number of tunneling-related fraud events over years. The data are from CSRC's Enforcement Action Research Database, which is part of CSMAR.*



# Internal Capital Markets and the Transmission of Exchange-Rate Shocks: Evidence from Chinese Business Groups

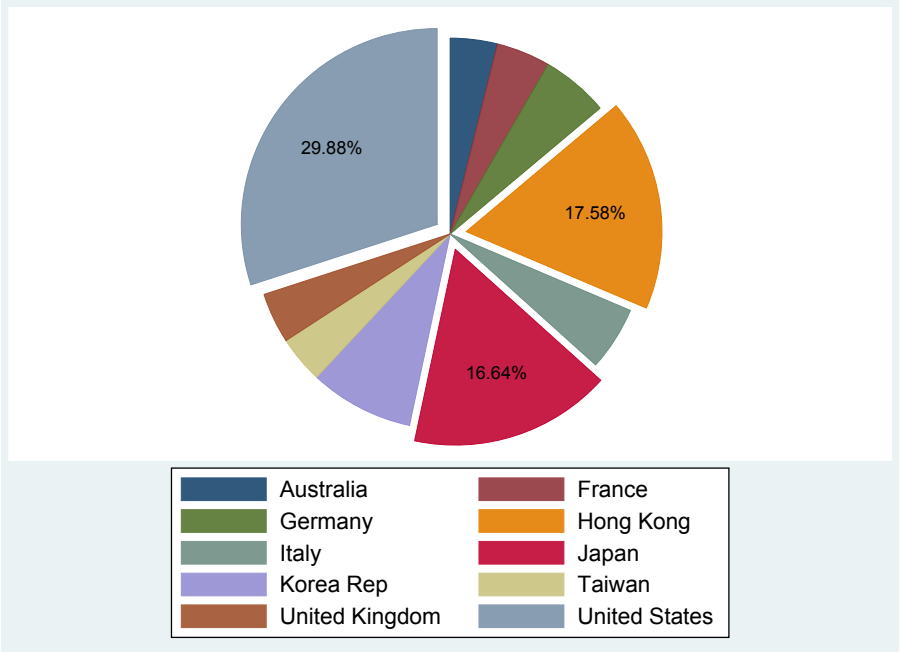
Kang Shi, Jin Xie and Juanyi (Jenny) Xu

*For Online Publication*

Figure A.1: **Top-10 Exports**

*This chart plots the top-10 destination countries (Panel A) and 4-digit Harmonization Code products (Panel B), respectively. The ranks are formed based on the total free-on-board exported values (in millions of USD) in each country or product. The sample is the customs-firm matched sample (see Panel A of Table 2). The sample period is from June 2005 through December 2006.*

**Panel A: Top-10 Destinations**




**Panel B: Top 10 Products**

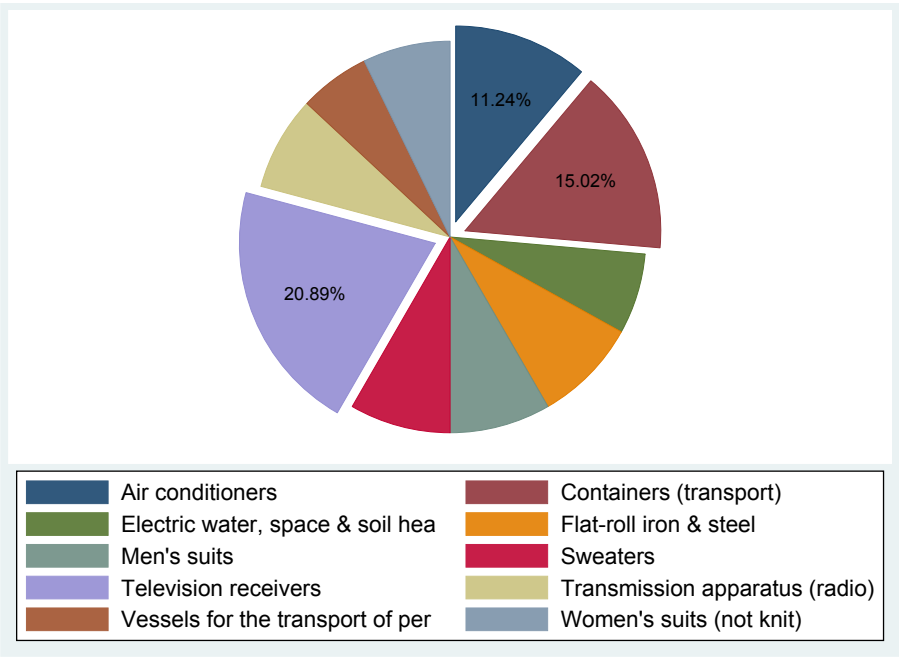


Figure A.2: **Distribution of Sample Units across Countries**

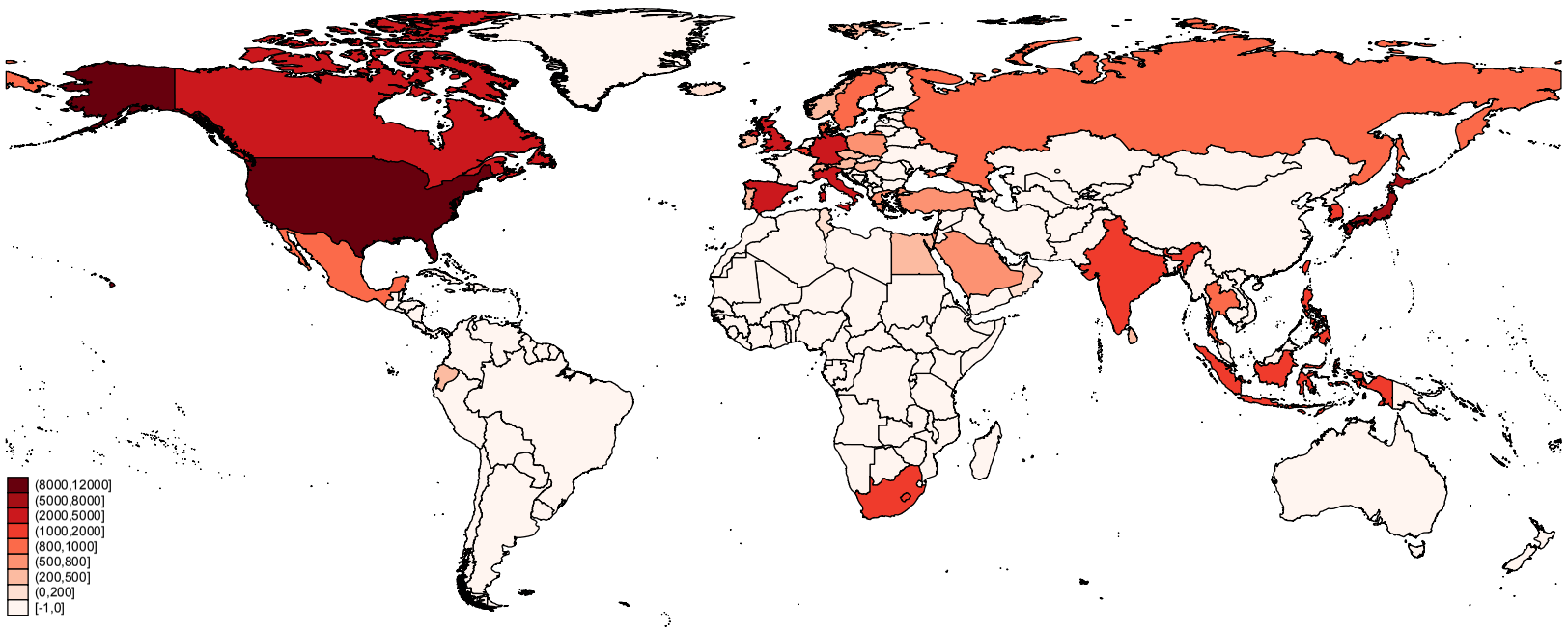


Table A.1: **Collateral Shocks and Firm Value**

*This table presents the OLS estimates of the effect of collateral shares on accumulative abnormal returns around the date on which focal firms announce the compensation package. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. Only export-related firms are included. The dependent variable is the cumulative abnormal returns (winsorized at 1% and 99% percentiles) for public firms over the window (-5, +5). Abnormal returns are obtained by estimating the market model residuals using A-share daily stock returns and the returns of the value-weighted market index in the window of (-180, -31). Collateral% is the number of collateralized shares, as a percentage of total shares outstanding, immediately prior to the reform announcement. Collateral is a dummy variable equal to 1 if a public firm is associated with collateral shares immediately prior to the reform announcement, and zero otherwise. Collateral Value is the number of collateralized shares multiplied by the net assets per share before the reform. All other financial variables are as of the beginning of the reform year. Please refer to Table 1 for definitions of other variables. Standard errors are clustered at the level of the month in which the reform was announced.*

| | (1) | (2) | (3) |
|---|---|---|---|
| Collateral% | 0.063*** | | |
| | (0.019) | | |
| Collateral | | 0.013** | |
| | | (0.006) | |
| ln(Collateral Value) | | | 0.001** |
| | | | (0.000) |
| ln(Total Assets) | −0.010* | −0.010* | −0.011** |
| | (0.005) | (0.005) | (0.005) |
| Market-to-Book | −0.008** | −0.008** | −0.007* |
| | (0.003) | (0.003) | (0.003) |
| Leverage | 0.043** | 0.045** | 0.038* |
| | (0.020) | (0.020) | (0.019) |
| ROA | 0.046 | 0.046 | 0.040 |
| | (0.051) | (0.050) | (0.052) |
| Group CEO | 0.014** | 0.014* | 0.015* |
| | (0.006) | (0.007) | (0.007) |
| Constant | 0.220** | 0.228** | 0.256** |
| | (0.096) | (0.093) | (0.096) |
| Reform-month FE | Yes | Yes | Yes |
| N | 320 | 320 | 311 |
| *adj.* $R^2$ | 0.09 | 0.07 | 0.10 |

standard errors in parentheses

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table A.2: **Tunneling and Fraud Punishment**

*This table presents the Probit regression-model estimates of the effect of tunneling on the probability that export-related public firms will be punished by Chinese regulatory authorities for reasons related to tunneling. The sample period is from 2004 to 2008. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. The sample unit is at the level of firm-year. The dependent variable is a dummy variable equal to 1 if a public firm is punished for reasons related to tunneling within three years, and zero otherwise. Tunnel/At is intragroup credit in year t, provided by public firms to entities that are economically related to large shareholders, scaled by lagged total assets. Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. SOE is a dummy variable equal to 1 if the ultimate owner of a business group is either SOE or government or state asset-management companies, and zero otherwise. Control variables include Ln(Total Assets), Market-to-Book, Leverage, ROA, and Group CEO. Please refer to Table 1 for definitions of other variables. Standard errors are clustered at the industry level.*

| | (1) | (2) |
|---|---|---|
| Tunnel/At | 5.731*** | 3.763** |
| | (1.746) | (1.779) |
| Tunnel/At × SOE | | 3.638 |
| | | (2.774) |
| SOE | | −0.420 |
| | | (0.287) |
| Ln(Total Assets) | −0.013 | −0.017 |
| | (0.148) | (0.136) |
| Market-to-Book | −0.070 | −0.074 |
| | (0.089) | (0.091) |
| Leverage | 2.143*** | 1.879*** |
| | (0.580) | (0.614) |
| ROA | −7.423*** | −7.665*** |
| | (0.982) | (1.165) |
| Group CEO | 0.583 | 0.620 |
| | (0.447) | (0.448) |
| Constant | −8.035*** | −7.426*** |
| | (2.580) | (2.668) |
| Year FE | X | X |
| Industry FE | X | X |
| Province FE | X | X |
| N | 974 | 974 |
| *Pseudo* $R^2$ | 0.36 | 0.37 |

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table A.3: **Tunneling and Pricing-to-Market: IV Estimation, First Stage (Post-Reform Period)**

*This table presents estimates of first-stage regression of the IV estimation. From June 2005 through December 2006, public firms in the sample had announced the share-split structure reform. The sample unit is at the level of firm/subsidiary-product-destination-shipment-month. The timing of shipment is restricted to between the reform announcement and the end of the reform year. Firms cross-listed on a B- or H-share market or with distress identification (ST) are excluded. Instruments are Collateral% (columns (1)-(2)), Collateral (columns (3)-(4)), and ln(Collateral Value) (columns (5)-(6)), respectively. Collateral% is the number of collateralized shares, as a percentage of total shares, immediately prior to the reform. Collateral is a dummy variable equal to 1 if a public firm has at least one large shareholder pledging shares immediately prior to the reform, and zero otherwise. ln(Collateral Value) is the number of collateralized shares multiplied by the net assets per share before the reform. In odd-numbered columns, the dependent variable is $\Delta Tunnel\%$. In even-numbered columns, the dependent variable is $\Delta Tunnel\% \times ln(RER_{s,d})$. $\Delta Tunnel\%$ is the difference between the intragroup credit in the announcement year and one year before, scaled by total assets as of the beginning of the reform year (see equation 2 for details). Intragroup credit is defined as the sum of four items of receivables claimed by public firms to the collection of future cash from entities that are economically related to the group parent. The four items are accounts receivable, notes receivable, accounts prepaid, and other receivable. $RER_{s,d}$ is defined as $RER_{s,d} = ER_{s,d} \times CPI_s/CPI_{s,d}$. $ER_{s,d}$ is the nominal exchange rate defined as the price of the domestic currency (renminbi) in terms of the foreign currency of country d as of month s. $CPI_s$ and $CPI_{s,d}$ represent the monthly consumer price index of China and of the corresponding destination country d, respectively. In odd-numbered columns, control variables include ln(Total Assets), Leverage, ROA, and Ordinary. In even-numbered columns, Ordinary is the only control variable. Ordinary is a dummy variable equal to 1 if the export is ordinary trade, and zero otherwise. All other financial variables are measured as of the beginning of the reform year. Please refer to Table 1 for definitions of other variables. Standard errors are clustered at the product-destination and year levels.*

| | Collateral% | | Collateral | | ln(Collateral Value) | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Instrument | −0.013*** | | −0.002*** | | −0.160*** | |
| | (0.001) | | (0.001) | | (0.000) | |
| Instrument × ln(RER) | | −0.016*** | | −0.004*** | | −0.263*** |
| | | (0.003) | | (0.001) | | (0.000) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Product-Destination FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Public Firm FE | No | Yes | No | Yes | No | Yes |
| N | 70129 | 64755 | 70129 | 64755 | 70129 | 64755 |
| *adj.* $R^2$ | -0.12 | 0.51 | -0.12 | 0.51 | -0.12 | 0.51 |
| F-stat (weak-instrument test) | 114.77 | 21.48 | 13.44 | 25.12 | 20.59 | 25.77 |

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$