Tiered Intermediation in Business Groups and Targeted SME Support*

Yu Shi†, Robert Townsend‡, Wu Zhu§

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Abstract

Using business registry data from China, we show that internal capital markets in business groups can play the role of financial intermediary and propagate corporate shareholders' credit supply shocks to their subsidiaries. An average of 16.7% local bank credit growth where corporate shareholders are located would increase subsidiaries investment by 1% of their tangible fixed asset value, which accounts for 71% (7%) of the median (average) investment rate among these firms. We argue that equity exchanges is one channel through which corporate shareholders transmit bank credit supply shocks to the subsidiaries and provide evidence to support the channel.

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†International Monetary Fund, yshi2@imf.org

‡Economics Department, Massachusetts Institute of Technology, rtownsen@mit.edu

§Economics Department, University of Pennsylvania, zhuwu@upenn.sas.edu

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1 Introduction

The recent COVID-19 pandemic has posed an unprecedented challenge to policymakers' ability to provide support to businesses in crisis. In particular, the pandemic has led to a complete if temporary shutdown of many businesses, hitting small and medium-sized enterprises (SMEs) with a smaller balance sheet much harder than larger corporates. While monetary easing in general alleviate stress on corporate balance sheets, SMEs tend to benefit little. Governments and central banks have thus designed various schemes, including credit guarantees, debt payment deferrals, and directed lending through special purpose vehicles, to support small businesses[1]. However, these programs can expose the governments to credit risks, and, in addition, efficient targeting is quite difficult to accomplish, as it relies on pre-existing, traditional intermediation infrastructure for implementation, with inherent shortcomings. For example, banks are more familiar with larger corporate entities, so getting them to lend others is difficult. The real outcomes of these schemes has shown mixed evidence on their effectiveness (Banerjee and Duflo, 2014; Bhue, Prabhala, and Tantri, 2016; Chatzouz et al., 2017; SBA, 2020).

Thus, the basic questions are posed: how to provide targeted and effective support to SMEs and through what intermediaries? Our contribution in this paper is to show that bank credit in some countries can reach relatively smaller firms through an alternative intermediation mechanism: smaller firms in business groups without direct credit access but with high returns can be reached through the internal equity markets, with the parent firm as intermediary. To the best of our knowledge, this channel has thus far been left out of current discussions.

Elaborating on this background in a bit more detail, direct bank credit comes with the advantage of risk-bearing and diversification, yet this has traditionally played a limited role in SME financing, especially during crises. Bank credit generally favors larger, older, and more connected firms over the smaller and younger ones (Gilchrist and Zakrajšek, 1998; Borensztein and Lee, 2002). Moreover, small business lending tends to be particularly sensitive to bank liquidity shocks (Khwaja and Mian, 2008; Greenstone et al., 2020). The situation deteriorated further in the aftermath of the global financial crisis as bank supervisors across the world have tightened regulatory requirements (BIS, 2018). Furthermore, changes in bank risk appetite in a crisis favors larger corporates instead of the smaller ones (de Haas and van Horen, 2009; Bassett, et

[1]World Bank: SME-Support Measures in Response to COVID-19

al., 2014). Finally, even with government guarantees, SMEs may receive bank financing but with little impact on real outcomes, such as output or investment (D'Ignazio and Menon, 2013; Chatzouz et al., 2017).

We provide in this paper a new angle for supporting SMEs through the banking sector. We show that SMEs partly owned by other corporates, although unable to directly borrow from banks, can benefit indirectly from an increase in bank credit supply through the internal capital markets of their business groups. A business group is formed by a parent company together with a group of legally independent firms under the common ownership. We show that the parent companies in business groups can function as intermediaries. When bank credit becomes more available, large corporates increase borrowing from banks and channel credit to profitable subsidiaries in need. Business groups have become a common corporate governance structure in many countries, including Japan (Hoshi, Kashyap, and Scharfstein, 1991), South Korea (Almeida, Kim, and Kim, 2015), and Italy (Santioni, Schiantarelli, and Strahan, 2017). In France, over 50 percent of the non-financial corporate loans are originated from other non-financial corporates, among which a significant fraction have the lender and the borrower in the same business group (Eurostat, 2018). The corporate finance literature has studied the operation and effectiveness of internal capital markets extensively (see Related Literature). Nevertheless, the relationship with bank lending and its implication for providing targeted external supports to SMEs has yet to be analyzed. Our paper fills in the gap.

Using an administrative business registry data from China, we show that internal capital markets in business groups utilize an increase in bank lending to pass credit to the smaller businesses in their groups. Controlling for local economic conditions, we find that when bank lending increases by 16.7%, parent companies exposed to such an event would see their unexposed subsidiaries increasing investment by addition of 1 percent of their fixed assets. That increase is substantial compared to the median (mean) value of their investment-to-fixed asset ratio, 1.4 (14) percent. That is because the subsidiaries are mostly smaller businesses with fewer assets so the size of investment is substantial.

What is the intuition behind the observed tiered intermediation by parent companies? Parent companies in business groups have more of an incentive and more of an ability to finance their subsidiaries compared to banks. Arguably, they have more direct control over subsidiary decisions and returns as equity shareholders and may have superior information over subsidiaries' investment projects. In addition, a parent com-

pany can not only claim returns from subsidiaries generally but rather, with cashflow rights, directly from their specific named investment projects. This in turn provides the parent companies with more information for better targeting and with more incentives, especially when seeing a higher upside risk. To summarize, if extra bank credit is available to the parent companies, they borrow from banks and channel the credit to subsidiaries. The financially constrained subsidiaries then engage in the investment projects with the received capital from their parent companies, and finally pass returns back to parent equity holders.

Our findings have an important and ironic implication for better-targeted SME support schemes: provide capital to SMEs in a business group through the usual bank lending channel. Again, increased bank credit supply can be helpful for SMEs who reside in business groups, as larger companies in the groups act as intermediaries to channel bank credit[2]. Moreover, such a scheme avoids the unwanted consequences of direct government lending to SMEs, such as inefficient credit allocation and excessive government risk-taking. Government-led schemes can thus be smaller and focus on stand-along SMEs that are badly hit in the pandemic. By numbers those in business groups may be small, but business groups in some countries nevertheless contain the larger group of profitable high return entities.

In our empirical analyses, we begin by documenting that a significant fraction of Chinese firms reside in business groups. A business group typically consists of a parent company and legally independent subsidiaries, possibly operating in different sectors, that function through a common source of control. We adopt a broader definition of shareholders in this paper, which includes both majority controlling shareholder (>50% shares) and minority shareholders (50% shares)[3]. The business registry data we use, unlike public firm disclosure data, identifies business groups among all registered firms in China (Bai, Hsieh, Song, and Wang, 2018). As of 2017, 16% out of the universe of over 35 million firms were part of business groups. In our merged sample, these firms in business groups contribute to 60% of output, 70% of total fixed assets, and 60% of employment. Shareholders in the groups are much larger compared to subsidiaries or

[2]There is an example during the current crisis. The BlueJeans is a B2B videoconferencing company embracing a great opportunity due to the stay-at-home policy. However, the Bluejeans is subject to a strong financial constraint to expanding business and research. Verizon has stepped in and acquired Bluejeans at 500 million to support its long-term investment plans. https://www.wsj.com/articles/verizon-to-buy-zoom-conferencing-rival-bluejeans-11587041218

[3]In the robustness checks, we separate the majority controlling shareholder and minority shareholders and find that the significant result in the baseline is primarily driven by the majority shareholder.

out-of-group firms: the average value of total assets for shareholders, subsidiaries, and out-of-group firms, are 712 million, 512 million, and 134 million RMB, respectively. We also verify that the subsidiary firms out-perform the shareholders in terms of total factor productivity (TFP) and return on assets (ROA) on average. Nevertheless, they have lower leverage ratios (1) and thus would need help from their shareholders.

Next, we provide causal evidence that a positive bank credit supply shock to a corporate shareholder benefits subsidiary firms that are unexposed to the shock. Our identification relies on the geographical diversification of the business-group network and the regional segmentation of China's banking system. According to the business registry data, 38% of the shareholder-subsidiary pairs have the shareholder and the subsidiary located in two different municipal cities. The network spans the entire country without following a particular pattern. The regional segmentation of the banking system is a result of the localized business model of Chinese banks and inefficiency in the inter-bank market. Local bank branches have substantial decision-making power, and thus even large commercial banks make lending decisions on a regional basis (Huang, Pagano, and Panizza, 2019). Regulation of the 75% ceiling in loan-to-deposit ratio and limited competition on the repo market further prevent the inter-bank market from smoothing funding gaps across the country (Acharya, Qian, and Yang, 2016; Ruan, 2017; Chen, Ren, and Zha, 2018).

We implement our identification strategy using variations in local bank credit growth as a proxy for positive credit supply shocks. Taking the existing network of business groups as given, we compare similar subsidiary firms located in the same city but having their shareholders in different other cities experiencing varying levels of bank lending growth. Our results suggest that the higher bank credit growth the parent companies are subject to, the higher investment their un-shocked subsidiaries make. If idiosyncratic credit demand shocks are uncorrelated across cities, such evidence would suggest the transmission of bank credit supply shocks from parent companies to subsidiaries. Finally, we control for city-by-year and industry-by-year fixed effects to control for any city- or industry-specific trends in the baseline.

The validity of our identification hinges on the assumption that credit demands across cities are uncorrelated. To mitigate any concerns on this identifying assumption, we also construct a Bartik-type instrument for local bank credit supply shocks (similar to Greenstone et al., 2020). We rely on the expansion of commercial banks at the national level as proxy for bank credit supply, which should not be affected by local credit demands of individual cities. A commercial bank that expanded fast in China

is considered to be more ambitious in providing new credits to firms. If this bank had also controlled a significant fraction of the credit market in a given city before its credit expansion, the city would have experienced a more substantial positive bank credit supply shock. The estimates using this Bartik-type instrument support our hypothesis that corporate shareholders pass along a positive credit supply shock from banks to their subsidiaries.

Another challenge is that other networks, such as input-output networks (Alfaro et al., 2019), may overlap with the business-group network. To deal with this challenge, we control for other networks in additional robustness tests. The controls include estimates of upstream supply shocks and downstream demand shock as proxies for supply chain linkages; trade credit measures (account payable and receivable) as proxies for credit from trading partners; shareholder industry cross subsidiary industry fixed effects, and shareholder city cross subsidiary city fixed effects to control for any geographical overlay of industries; and a common shareholder dummy to control for the tunneling effects.

The effectiveness of tiered credit intermediation in business groups depends on two elements: subsidiary firms' financial constraints and investment opportunities. We construct various proxies for firm financial constraint and investment opportunities following Manova, Wei, and Zhang (2015) and Giroud and Mueller (2015). Our findings indicate that subsidiary firms with more substantial long-term external financial constraints, proxied by the Rajan-Zingales measure (Rajan and Zingales, 1998) tend to invest more following a positive credit supply shock to their shareholders. In contrast, the short-term liquidity constraints, as indicated by the inventory ratio, the trade credit ratio, and the tangible asset ratio, matter less. Among the group of financially constrained subsidiaries, the ones with good investment opportunities also invest more following a credit supply shock to their shareholders.

We do not observe significant reverse credit intermediation from subsidiaries to parent companies, nor among subsidiaries in the same business group. The finding suggests that the parent company is the only one playing the role of a financial intermediary in a business group.

Last but not least, and crucial in terms of the crucial intermediation mechanism, we show that explicit active equity transfers between parent companies and subsidiaries are the other side of credit intermediation flows within business groups. We establish this channel using the same identification strategy but replace the left-hand side with total equity shares held by corporate shareholders. We find that for an average subsidiary firm, total equity shares held by corporate shareholders increases following a positive

credit supply shock to these shareholders. This is the smoking gun.

Related Literature

This paper contributes to the literature studying bank lending and its effectiveness. We further emphasize the importance of the bank lending channel (Bernanke, 1983; Peek and Rosengren, 2001; Morgan, Rime, and Strahan, 2004; Ashcraft, 2005; Paravisini, 2008; Chava and Purananadam, 2008; Khwaja and Mian, 2008; Cingano, 2016; Chodorow-Reich, 2014; Greenstone et al., 2020), but beyond the direct bank-firm relationship. We show that an increase in bank credit supply could further indirectly benefit SMEs in business groups with large and connected firms.

This paper is also closely related to the literature on corporate ownership and internal capital markets. There has been an extensive literature focusing on the how internal capital markets allocate resources, either to maximize the entire group's profit by directing capital to the most profitable projects (Hoshi, Kashyap, and Scharfstein, 1991; Shin and Stulz, 1998; Ozbas and Scharfstein, 2009; Giroud and Mueller, 2015; Almeida, Kim, and Kim, 2015; Santioni, Schiantarelli, and Strahan, 2017), or just to maximize the controlling shareholder's cash-flow benefits (Fedenia, Hodder, and Triantis, 1994; Porta and Shleifer, 1999; Claessens, Djankov, and Lang, 2000; Gopalan, Nanda, and Seru, 2007; Jiang, Lee, and Yue, 2010; Gul, Kim, and Qiu, 2010). We bring in the interaction between the internal capital market and the external financial market and shed light on the macroeconomic implication of liquidity provision to SMEs through internal capital markets.

Our paper complements the literature studying the financing of SMEs. Small and medium-sized enterprises, often with features such as highly variable returns, asymmetric information, and a lack of collateral, tend to have poor access to debt financing (Carpenter and Peterson, 2002). Banks do lend to SMEs sometimes, but many require a lengthy period of relationship building (Peterson and Rajan, 1994) and this can be sensitive to bank liquidity shocks and credit cycles (Khwaja and Mian, 2008; Greenstone et al., 2020). SMEs rely more on other forms of non-bank financing, including intercompany lending (Canales and Nanda, 2012), trade credit (Carbo-Valverde et al., 2016), informal finance through social networks and industrial clusters (Long and Zhang, 2011; Banerjee, Duflo, and Jackson, 2013), among which intercompany and network financing act as substitutes for bank investment loans. The above-mentioned arguments suggest that financial and monetary policies, which traditionally work through the banking

sector, are difficult to reach the SMEs during crises. We contribute to the literature by showing that large non-financial corporates pass bank credit to their smaller subsidiaries, thus overcoming various of the shortcomings of direct bank lending to SMEs.

Our paper also contributes to the recent burgeoning discussion on shadow banking activities in China. Shadow banking involves financing activities that are not subject to regulatory oversight and has been attributed to play a key role in financing rising private sectors in China (Allen, Qian, and Qian, 2005; Chen, He, and Liu, 2020). Chen, Ren, and Zha (2018) documents a rapid rise in shadow banking activities in terms of entrusted loan during 2009-2015 and justify that contractionary monetary policy in that period caused the rising shadow bank loans. Allen et al. (2019) argue that most of the entrusted loans by listed companies are affiliated loans between parents and subsidiaries or suppliers and customs. Our paper contributes to this discussion in three-fold. First, the entrusted-loan activities boomed only after 2009 as a response to series of contractionary monetary policy and the scale was very small before 2008 (Chen, Ren, and Zha, 2018). There is little knowledge on the financing activities among non-financial firms before the global financial crisis which is the period studied in our paper. Second, different from the intercompany lending channel, we document that the equity-transfer channel is important for credit transfer among non-financial firms in our sample 2001-2008, which is facilitated by the equity shareholding relationship. Finally, we show that non-bank lending could be a way to effectively channel bank credit to the needed enterprises.

Finally, this paper fits broadly into the literature on financial linkages. Interlinked financial activities can expose the financial sector into more substantial systemic risks and raise challenges on financial stability (Allen and Gale, 2000; Eisenberg and Noe, 2001; Gai, Haldane, and Kapadia, 2011; Elliott, Golub, and Jackson, 2014; Acemoglu, Ozdaglar, and Tahbaz-Salehi, 2015). In our paper, we emphasize the bright side of the financial intermediary ownership of networks and the importance of monitoring firm-to-firm investment in equity shares. That is, we show the existence of a sizable cross-holding network and its effect in linking the financial sector to the real economy.

The rest of this paper is organized as follows: in section 2, we discuss the theoretical framework of this paper and develop hypotheses for the empirical analyses. Section 3 describes our identification strategy and provides a detailed overview of our innovative data sets. In section 4, we discuss our empirical findings. Finally, section 5 concludes the paper.

2 Business Groups and Hypotheses Development

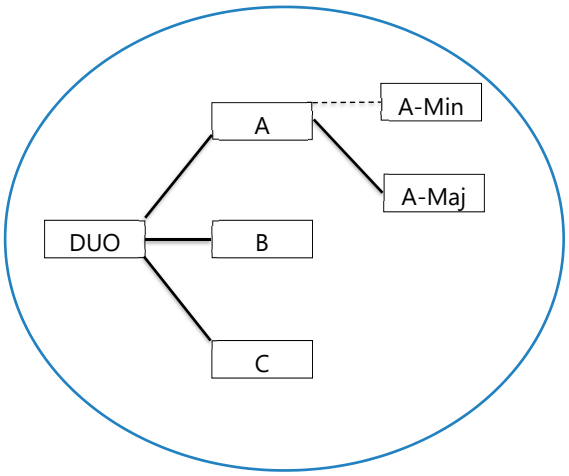
In this section, we briefly explain the definition of business groups and how they connect firms in China. Then we provide a theoretical framework to help understand how firms in a business group would react to credit supply shocks from the banking sector. Last but not least, we develop hypotheses for our empirical analyses.

2.1 Business Groups in China

A business group refers to a group of legally independent firms under common ownership. In order to identify business groups, one needs to know about each company's corporate shareholders and their shares of equity holdings. A corporate owning more than 50% of another corporate is often referred to as the controlling majority shareholder, who effectively has the absolute control right. Thus it can easily interfere with the other corporate's financing and investment decisions. In defining business groups, the literature has used various equity shareholding thresholds, such as 50% and 20%, as the cutoff levels (Kalemli-Ozcan et al., 2015; Helwege, Pirinsky and Stulz, 2005), as some argue that many corporates do not have a controlling majority shareholder. In our baseline, we don't distinguish between the majority and the minority shareholders, which ensures that our results are not driven by the cutoff shareholding levels. In our attempt to further understanding the mechanism, we do find that the minority shareholders with less than 50% of equity holdings have no significant effect in passing bank credit to subsidiaries. Figure 1 provides an example of a business group under our baseline definition. Each line in the figure represents one shareholder-subsidiary linkage. A solid line indicates a controlling majority shareholding, whereas a dashed line implies a minority shareholding linkage. The business group presented in figure 1 is in a pyramid structure, which refers to the case when subsidiaries do not own any equity shares of their shareholdings. The pyramid-like business groups are prevalent in Asian countries, including Thailand, South Korea, Singapore (Claessens, Fan, and Lang, 2002), and China (Allen et al., 2019).

Information on corporate shareholders in China is available in the State Administration of Industry and Commerce Database (hereafter the SAIC). The SAIC provides a complete record for all enterprises registered in China on the original shareholders, including both individuals and corporates, their capital contributions, and each up-

Figure 1: Example: A Business Group



Note: Thick solid line - equity shareholding >50%; dashed line - equity shareholding <= 50%.
"DUO" is the ultimate parent company of the business group;
"A", "B", and "C" refer to the direct subsidiaries of "DUO";
"A" is the controlling majority shareholder of "A-Maj", and the minority shareholder of "A-Min".

date of the shareholding structure[4]. The data spans from 1950 to 2017[5]. Besides the shareholders information, it also contains basic information on enterprises, including the company name, the legal person, the start-up capital, the domicile of the enterprise (location), the business scope, and the year of establishment.

We take advantage of the SAIC to identify equity shareholding relationships between firms in the non-financial sectors, and track the evolvement of business groups in China over time. From 2000 to 2017, this network of business groups has explained rapidly and almost tripled its size. As of 2017, out of the 36 million registered enterprises in China, there are roughly 5.5 million pairs of shareholder-subsidiary linkages. A total of 2.55 million firms hold equity shares of other companies, while the total number of subsidiary firms is 3.79 million. On average, each corporate shareholder connects to 1.5 subsidiary firms and holds 57.9% of the equity shares of each subsidiary firm.

Despite that there is only a small fraction of firms (roughly 15.6%) associated with any business groups, these firms make a major economic contribution: 80% of the registered capital, 60% of the output, 70% of the total fixed asset, and 60% of the employment in our merged sample are from firms within business groups. Table 1 provides a detailed comparison between the out-of-business-group firms and the within-business-group firms, based on firm characteristics from the SAIC and the Annual Survey of Chinese Industrial Enterprises (ASCIE)[6]. We further divide firms within business groups into subsidiary firms and corporate shareholders to compare their differences. Overall, firms that are part of the business groups tend to be older and much larger than the stand-alone ones. Compared to the corporate shareholders, the subsidiary firms have better performance (in terms of TFP and ROA), but they borrow less from the banking sector (lower leverage ratio).

[4]Including any updates or changes in shareholder capital contribution, shareholding status, and their holding shares.

[5]By 2017, there have been approximately 40 million registered enterprises in the SAIC, among which 28 million are private entities.

[6]A detailed description of the Annual Survey of Chinese Industrial Enterprises database and the construction of firm level variables is available in section section 3.2.

Table 1: Firm-level Summary Statistics

	Mean	Median	S.D.	25th	75th	No. of Obs.	Data Source
Out-of-business-group Firms:							
Log(Firm Age)	1.868	1.946	0.818	1.386	2.398	1.722e+06	ASCIE
Log(Total Asset Value)	9.413	9.288	1.204	8.587	10.12	1.621e+06	ASCIE
Subsidiary Firms:							
Log(Firm Age)	2.160	2.197	0.836	1.609	2.639	620,208	ASCIE
Log(Total Asset Value)	10.43	10.31	1.481	9.378	11.39	599,636	ASCIE
Leverage Ratio	0.572	0.571	0.296	0.358	0.767	620,252	ASCIE
ROA	0.0460	0.0175	0.120	-0.193	0.842	599,636	ASCIE
TFP	0.00495	0.0553	0.483	-0.205	0.298	397,298	ASCIE
Investment	0.146	0.014	0.301	0	0.140	395,638	ASCIE
R&D	0.177	0	0.743	0	0	305,745	ASCIE
Corporate Shareholders:							
Log(Firm Age)	2.451	2.398	0.889	1.792	3.091	409,878	ASCIE
Log(Total Asset Value)	10.83	10.73	1.553	9.691	11.89	399,288	ASCIE
Leverage Ratio	0.618	0.620	0.277	0.432	0.794	409,955	ASCIE
ROA	0.0426	0.0165	0.107	0	0.199	399,288	ASCIE
TFP	-0.0071	0.0558	0.521	-0.228	0.315	267,056	ASCIE
Investment	0.159	0.015	0.317	0	0.161	275,070	ASCIE
R&D	0.261	0	0.876	0	0	214,948	ASCIE

Notes: This table summarizes a partial list of variables used in the empirical exercises. For a complete summary, please see the appendix for more details. The data sources are the Annual Survey of Chinese Industrial Enterprises by the Chinese National Bureau of Statistics, CompuStat, and the SAIC database. Firm age is measured as the number of years since establishment. The construction of leverage ratio, investment, and R&D is described in section 3.2; the construction ROA and firm-year TFP is discussed in section 4.4.

2.2 Hypothesis Development

We make two assumptions to capture theoretically the transmission of credit supply shocks within business groups. The first assumption is that each individual firm within business groups face a binding credit constraint. This assumption is necessary to generate a positive response to bank credit supply shocks and it can be micro-founded with limited pledgeability or weak legal and regulatory environment outside of firms.

The second assumption is that shareholder has both the ability and the incentive to transfer capital to subsidiaries for more profits (Stein, 1997; Gertner, Scharfstein, and Stein, 1994). The are many circumstances under which the second assumption would hold. One example, which is the context of our empirical analysis, is that subsidiaries could have a higher marginal return on capital yet they cannot benefit directly from a lending boom in other cities. Their shareholders in other cities might have access to the newly available credit, but they may not have new projects to invest in. It could also happen when banks are more willing to lend to the shareholders, given that they are older firms with more assets as potential collaterals.

The first question of our interest is why parent companies could function as intermediaries between banks and smaller subsidiaries. A non-financial corporate shareholder is also a company producing with capital and labor. When it faces a positive credit supply shock from the banking sector, its marginal return on capital would decline. At the same time, their subsidiaries' returns on capital remain high if these subsidiaries are not exposed to the positive shock to bank lending. The corporate shareholder thus has more incentives to transfer capital to their subsidiaries for higher capital returns, and the expansion in bank lending allows it to do so. Once receiving capital from shareholders, the financially-constrained subsidiaries would increase their investment to generate more profits for both themselves and the shareholder. Our first hypothesis is thus:

- When shareholders experience a positive local bank lending shock, their subsidiaries unexposed to the shock would increase their capital expenditure more compared to stand-alone firms or other subsidiaries with no bank lending shocks to their shareholders.

The winner-picking feature of the internal capital market implies that subsidiaries have different likelihoods of receiving capital transfers from the parent company depending on their marginal returns on capital. A higher marginal return on capital implies a larger gap between firm's financing capacity and its desired investment, which could be the result of either a higher firm productivity or a tighter firm financial constraint. Thus we develop two additional testable hypotheses:

- When shareholders experience a positive local bank lending shock, subsidiaries with greater investment opportunities increase their capital expenditure more.

- When shareholders experience a positive local bank lending shock, subsidiaries with tighter external financial constraints increase their capital expenditure more.

How does the tiered intermediation take place is another question of our interest. We propose that one possible channel of credit transfer is through the equity exchanges between parent companies and subsidiaries. The SAIC provides information on the equity shareholding structure of all companies, including both corporate and individual shareholders. Shareholders increase their fraction of equity shareholdings when transferring credit to subsidiaries, which lead to higher equity shareholdings of corporate shareholders. We thus hypothesize the following:

- When shareholders experience a positive local bank lending shock, the individual shareholders of their subsidiaries hold less equity shares to facilitate capital transfers to subsidiaries compared to stand-alone firms or subsidiaries with no credit growth shocks to their shareholders.

The actual amount of credit transfer through exchanges of equity shares should depend on the marginal return on capital of the subsidiaries. However, given that our sample contain mostly private firms without market valuation, we cannot compute the amount of credit transferred from shareholders to subsidiaries following a bank credit supply shock.

3 Empirical Strategy and Data

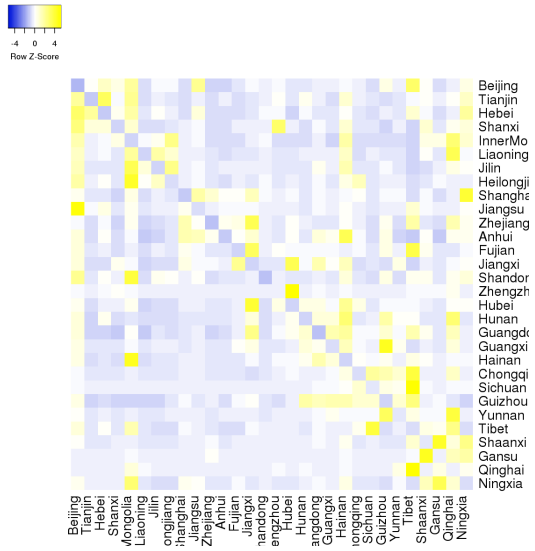
In this section, we provide an overview of our unique data set and empirical strategy for testing the theoretical hypotheses.

3.1 Identification Strategy

Our identification strategy exploits the geographical dispersion of business groups in China. Recall from Section section 2.1 that a business group refers to a group of legally independent firms under common ownership. In other words, firms in the same group are bounded by equity shareholdings but not geographical approximity. Figure 2 below illustrates the shareholder-subsidiary linkages across different provinces in China[7], indi-

[7]Provinces with higher intensities of shareholder-subsidiary linkages, defined as the number of linkages divided by the total number of firms in the province, are marked as yellow; and the ones with lower intensities of the linkages are marked as purple.

Figure 2: The Geographical Diversification of Business Groups



cating that business groups indeed span all across the country. In our baseline analysis, we compare similar subsidiary firms located in the same city with shareholders in other cities experienced different credit supply shocks. The network of business groups is fixed at the beginning of the sample period. Assuming that the credit supply shocks to shareholders are uncorrelated across cities, we infer the transmission of these shocks from the various responses of their subsidiary firms located in other cities. For example, consider two textile firms in Guangzhou similar in both scale and exporting status, but they are owned by two separate shareholding companies in Beijing and Chengdu. In 2009, following the four-trillion Yuan stimulus, bank lending in Chengdu grew by 62 percent. Beijing, on the contrary, experienced a smaller credit boom with a credit growth of only 24 percent. The difference in the two textile companies' investment behaviors are then used to identify the pass-through of bank lending shocks to the two shareholders in Beijing and Chengdu. We add city cross year fixed effects to control for any local credit market and macroeconomic conditions. We also include firms that are not in any business groups in our control group to estimate local average trends and fixed effects.

We argue that the above-mentioned identification strategy is valid in testing the transmission of bank credit within business groups in tow-fold. First, the Chinese

financial system operate at a regional level due to institutional and regulatory constraints, thus local credit growth is unlikely to depend on credit demand in other cities. To further eliminate any potential impacts of credit demand on bank lending growth, we also construct an additional Bartik-type IV. Second, our findings will not be fully explained by other business relationships between cities. After controlling for other possible business linkages, including the input-output linkages, industrial agglomerations, etc., we still find parent companies playing significant roles in passing credit from the banking sector to subsidiaries.

The first argument is supported by the large literature documenting the geographical segmentation of the Chinese financial system and its distortionary effects on capital allocation. The geographical segmentation is a result of both institutional and regulatory restrictions. From the institutional perspective, both local financial institutions and large policy and commercial banks tend to operate within cities (Dobson and Kashyap, 2006; Roach, 2006). The inter-bank market is dominated by the four largest Chinese banks, which makes it harder for smaller banks to smooth local funding gaps. Several regulations also limit financial institutions to conducting businesses at the national level. First, there has been a loan-to-deposit ratio requirement until 2015: Chinese banks could not lend more than 75% of their deposits. Second, interest rate ceilings were present on both deposits and loans (Huang et al., 2019).

While our identification suffices as long as city-level credit growth depends only on local supply and demand, we construct an instrument orthogonal to local credit demand to further mitigate the concern. Our Bartik-type instrument exploit the opening of new local bank branches across cities, which is in a similar spirit to the shift-share instrument in Greenstone et al. (2020). A commercial bank that expanded fast in China is regarded as being more ambitious in providing new credits to firms. If the bank had controlled a large fraction of the credit market in a city, we consider the city as experienced a larger credit supply shock. The estimates using this Bartik-type instrument support our hypothesis that corporate shareholders would pass though a positive credit supply shock to their subsidiaries.

For the second argument, we show that the shareholding relationships still have a significant effect after controlling for other types of business networks in the robustness tests. We include in estimates for upstream supply shocks and downstream demand shocks as proxies for the supply chain linkages, trade credit measures (account payable and receivable) as proxies for credit from trading partners, shareholder industry cross subsidiary industry fixed effects and shareholder city cross subsidiary city fixed effects

to control for any geographical overlay of industries, and a common shareholder dummy to control for the tunneling effects[8].

3.2 Firm-level Data and Key Variables

In Section section 2.1, we have discussed how to identify business groups from the business registry data - the SAIC. In this section, we explain the construction of other firm-level variables and how we merge different firm-level data sets.

To capture firm investment and financing activities, we use corporate balance sheet information from the Annual Survey of Chinese Industrial Enterprises (ASCIE) data. The ASCIE is an annual survey conducted by the Chinese National Bureau of Statistics since 1995. It covers all state-owned enterprises (SOEs), and private firms in the manufacturing, mining and energy sectors with an annual operating revenue over 5 million RMB. After 2011, the operating revenue cutoff was lifted to 20 million RMB. We delete all observations beginning 2010[9] to avoid any bias due the change in the sampling criteria. We also drop the observations before 2000 to preserve consistency in data quality. All observations in 2009 are dropped out of the sample due to insufficient coverage of variables. Finally, we remove the outliers following Brandt, Van Biesebroeck, and Zhang (2014), which leaves us with an unbalanced sample of 688,560 firms and 2,602,126 observations spanning 9 years (2000 - 2008)[10]. Roughly 95% of the firms appear in the sample for at least two years[11].

We merge SAIC and ASCIE data sets using the legal name of each firm, the name of legal representative, the domicile of the firm, and the year of establishment[12]. We are able to match 547,411 out of the 658,678 firms in ASCIE to the SAIC database, which accounts for 83 percent of our sample. After merging the SAIC database with

[8]Specifically, we attempt to control the tunneling effect through any additional common shareholders of subsidiaries and their shareholders.

[9]The data for 2004 and 2008 are from the national industrial census. We match the census data with the annual survey using firm ID, firm name, legal person, address at six digital county level, phone, zip, 4 digital industrial code, founding year suggested by Brandt, Van Biesebroeck, and Zhang (2014).

[10]The total number of observations in our results is smaller because firm fixed effects absorbed firms only appeared once in the data set; and certain variables are missing for some firms in certain years.

[11]The average number of observations that one firm contributes to is 5.7 and the corresponding standard deviation is 2.8.

[12]According to the corporate law in China, each registered enterprise has a unique legal representative, who has the full responsibility in dealing with the enterprise's legal issues.

ASCIE, we are left with a total of 138,453 holding firms[13] and 151,604 subsidiaries[14].

In our empirical analysis, the firm-level outcome variables of subsidiaries include investment, R&D expenditure, profit margin, leverage ratio, and the book value of total debt. Investment is constructed as the net formation of tangible fixed asset, normalized by the one-year lagged value of total tangible fixed asset. The real value of total tangible fixed asset is recovered from the nominal tangible fixed asset using the program suggested by Brandt et al. (2014). R&D expenditure is directly reported by firms as an item in their operating costs. We normalize R&D expenditure using also the one-year lagged total asset value. Firm-level profit margin is the ratio of operating profit divided by operating revenue; the book value of debt includes long-term and short-term bank loans and corporate bonds; and finally, leverage ratio is constructed as the ratio of total book value of debt divided by the total book value of liabilities and equity.

We also study the equity transfers between shareholders and subsidiaries. Our data set, unfortunately, does not allow us to directly observe the equity trading between firms. We test the equity transfer channel by looking into the changes in the total fraction of equity shares (0 to 100) held by the corporate shareholders of a given subsidiary company. When a subsidiary company sells its equity in exchange for capital injection, the total equity shares held by the corporate shareholders of the firm would increase with or without new stock issuance.

3.3 Local Credit Supply Shocks and Economic Condition

For local credit growth and economic conditions, our main data source is the province and city year books from the China Data Center, which cover 312 prefecture-level cities from 2000 to 2016.

In the baseline analysis, we use city-level bank lending growth as a proxy for local credit supply shock. Note that our identification strategy allows the measured city-level credit supply shocks to depend on local credit demand, as long as they are orthogonal to the investment opportunities of subsidiary firms located in other cities. Bank lending growth is thus measured as the growth rate of the total amount of bank loans outstand-

[13]They are roughly 20 percent of our ASCIE sample and 43 percent of the whole sample of holding firms in the SAIC database.

[14]These firms account for 18 percent of our ASCIE sample and 26 percent of the whole sample of subsidiary firms in the SAIC.

ing in each city. The outstanding bank loans in nominal terms is directly available in the city year books. For subsidiary firms with multiple shareholders, we compute the weighted average bank lending growth in shareholders' cities using city-level bank loan volumes at a one-year lag as weights (see section 4.1 for details).

In an alternative specification, we construct a Bartik-type instrument to isolate the local credit demand shocks from the local credit supply shocks. Our instrument shares the spirit in Greenstone et al. (2020) to proxy changes in local credit supply with a shift-share setup. A bank that expands fast at the nationwide is considered to have been providing more credits to firms and the expansion should be less relevant to credit demand in individual cities. The national-level credit demand shocks are controlled with year fixed effects. We obtain bank branch information from the bank branch registry database provided by the China Banking Regulatory Commission. The bank branch registry data includes the name, location (specific to street names), date of establishment, cancellation for each bank branch in China. section 4.2 discusses in detail the construction of the Bartik-type instrumental variable.

Table 2 summarizes the equity shareholding conditions and local credit growth in shareholders' cities for the group of subsidiary firms.

Table 2: Equity Holding and Credit Growth Statistics

	Mean	Median	SD	Min	Max	No. of Obs.	Data Source
Subsidiary Firms:							
Avg. Credit Growth in Holding Firms' Cities (%)	16.7	15.4	17.3	-21.7	60.6	428,735	ASCIE, CDC
Log (Equity Held by Corporate Shareholders)	6.211	8.007	4.413	0.001	12.19	574,748	ASCIE, SAIC
Equity Shares Held by Corporate Shareholders (%)	57.9	84.3	45.2	0	100	562,682	ASCIE

Notes: This table summarizes additional variables on the equity shareholding and credit growth for the subsidiary firms. Section 3.2 provides a detailed discussion on the measurement of equity shareholdings. The construction of credit growth is available in section 4.1. "CDC" refers to the China Data Center.

4 Empirical Analysis

4.1 Baseline Specification and Results

Our baseline specification (1) is designed to study if subsidiary firms respond to credit supply shocks to its parent companies located in other cities:

$$Y_{it} = \alpha_{ct} + \theta_i + \gamma CreditGrowth_{pt} + \kappa' X_{it} + \epsilon_{it}, \tag{1}$$

We define the average local credit growth that shareholders exposed to as follows:

$$CreditGrowth_{pt} = \log(\sum_{j \in H_{i0}, c(j) \neq c} LoanVolume_{c(j),t}) - \log(\sum_{j \in H_{i0}, c(j) \neq c} LoanVolume_{c(j),t-1}) \tag{2}$$

where H_{i0} is the set of firms holding equity shares of firm i at the beginning of the sample period[15], and $c(j)$ is the city where shareholder j locates[16]. c is the home city of subsidiary i. $LoanVolume_{c(j),t}$ is the total value of the outstanding loans in city $c(j)$ at the end of year t. We include in firm fixed effect θ_i to control for firm heterogeneity, and city cross year fixed effect α_{ct} to capture any local credit market and macroeconomic shocks. Other controls, X_{it}, are standard controls for investment regressions (Denis and Sibilkov, 2010; Gulen and Ion, 2016; Chaney, Sraer, and Thesmar, 2012), which include the firm ownership and age fixed effects, an one-year lagged firm size dummy, one-year lagged debt-to-asset ratio, and two-digit industry cross year fixed effects for any industry-specific time trends.

We use the baseline specification to study the effect of shareholders' local credit supply shocks on subsidiaries. The left-hand-side variables of interests include investment, R&D expenditure, profit margin, leverage ratio, and the growth rate of total debt outstanding. A positive γ_1 implies that when shareholders experience a positive local credit growth, subsidiaries located in other cities increase their investment or other relevant measures in response.

[15] We use the shareholder-subsidiary linkages established at the beginning of the sample period to avoid the concern that business groups formation might endogenously respond to local credit supply shocks.

[16] Companies in China usually register with local registries. When a company moves to another city, it will acquire a new ID and thus be identified as a different firm in the data set. Thus shareholders changing location will not affect the validity of our estimation.

Table 3 reports our baseline results. Column (1) indicates that controlling for local credit market dynamics, an average 16.7% annual total credit growth in shareholders' cities would lead to subsidiaries spending an additional 1% of their fixed asset value on investment. This additional 1 percentage point accounts for 71% of the median investment rate (1.4%) and 7% of the average investment rate (14%) of all subsidiary firms. In terms of the magnitude, our result is comparable to Cingano, Manaresi, and Sette (2016) who study the direct effect of bank lending on corporate investment. They find that a 10% credit contraction would lead to a fall in investment that is equivalent to 24% of median investment rate. This suggest that financial intermediation within business groups is economically significant as well.

Table 3: The Baseline Results

	(1)	(2)	(3)	(4)	(5)
	Investment	R&D	Profit Margin	Leverage Ratio	Debt Growth
Avg. Credit Growth in Holding Firms' Cities	0.0619***	0.0144	-0.0061*	0.0366	0.872
	(0.014)	(0.012)	(0.003)	(0.023)	(0.841)
Number of Observations	1,379,261	1,015,249	1,535,540	1,528,291	1,516,490
City × Year FE	YES	YES	YES	YES	YES
2-digit Industry × Year FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES	YES

Notes: This table presents how holding firms pass credit supply shocks to subsidiary firms. Holding firms' cities credit growth is computed as the weighted average of the growth rate of total bank loans. Column (1) to column (5) reports the baseline estimates of the effect of credit growth shocks to parent companies on subsidiary firms' investment, R&D expenditure, profit-to-sales ratio, leverage ratio, and the growth rate of external debt. Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, and one-year lagged net profit margin. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

The treatment variable, $CreditGrowth_{pt}$, is constructed using the sizes of local bank lending ($LoanVolume_{c(j),t-1}$) as shareholder weights (equation 2) to avoid any outliers from extreme credit condition changes in small cities. Table 4 shows the effect of shareholders' local credit growth shock on subsidiary investment using different shareholder weights. Column (2) adjusts the baseline weights using the size of each parent company relative to the size of an average firm in their city (in terms of initial registered capital[17]), taking into account the relative importance of the shareholder in their local credit market. Column (3) and (4) ignore the differences in local credit markets but weight each shareholder by their relative cash-flow rights and by an equal weight, respectively. These estimates using alternative shareholder weights are still positive and significant and statistically indifferent from our baseline estimate, indicating a positive outcome in subsidiary investment following credit supply shocks to shareholders.

[17]We do not use the value of total asset here because it is not provided in SAIC, and thus not available for firms below a certain scale.

Table 4: Alternative Shareholder Weights

	(1)	(2)	(3)	(4)
	Baseline	Size-adjusted Weights	Cash-flow Rights Weights	Simple Average
Avg. Credit Growth in Holding Firms' Cities	0.0619***	0.0710***	0.0755***	0.0570***
	(0.014)	(0.0167)	(0.021)	(0.0163)
Number of Observations	1,314,458	1,314,458	1,314,458	1,314,458
City × Year FE	YES	YES	YES	YES
2-digit Industry × Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES

Notes: This table presents estimates of holding firms passing credit supply shocks to subsidiary firms using different shareholder weights. Holding firms' cities credit growth is computed as the average growth rate of total bank loans, weighted by the size of local credit market, the size of local credit market multiplied by firm total asset value relative to city average, shareholders' cashflow rights, and an equal weight in column (1) to column (4). Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, and one-year lagged net profit margin. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Besides firm investment, we also study the impact on subsidiary firms' R&D expenditure, profit margin, leverage, and the total amount of outstanding debt. Subsidiary firms' average profit margin declines slightly following a positive credit supply shock to their parent companies. This finding could be explained by a similar rationale as in Caballero and Hammour (1994): when the external condition improves[18], subsidiary firms tend to slowdown the destruction of outdated projects and thus results in a lower profit margin on average.

Other variables of our interests were not affected by the credit market conditions in holding firms' cities. R&D expenditure on average is not as sensitive to changes

[18]This explanation would have effects either when parent companies pose a positive demand shock to subsidiary firms or when they lower the cost of finance of subsidiary firms. We distinguish the specific mechanism in section 4.4.

in external financing conditions as investments (Table 3, Column (3)) and subsidiary firms' bank financing are not affected by shocks to their parent companies (Table 3, Column (4) and (5)). Compared to capital investment, R&D requires more consistent spending in human capital and is more likely to create intangible assets, thus it tends to depend more on internal financing (Hall and Lerner, 2010). In our sample, less than 10% of the firms have ever actively engaged in R&D activities. It is then not surprising that credit supply shocks to parent companies on average have insignificant impacts on the R&D expenditures of subsidiary firms.

Another important finding is that subsidiary firms' external debt financing is not affected by credit supply shocks to their parent companies in other cities (Table 3, Column (4) and (5)). This finding implies that subsidiary firms do not face an easier external financing environment following the positive credit supply shock to their parent companies.

Although the geographical segmentation of local financial markets works in favor of our identification, we still face the challenge that subsidiaries and shareholders may not locate randomly across cities. For example, two cities with more synergies may have more firms investing in each other. In such case, parent companies' and the subsidiary firms' cities may have positively correlated local credit demand. If such a correlation is due to similar industry layouts in these cities, our 2-digit industry cross year fixed effects can deal with it. For other possibilities, we construct a Bartik-type instrument and estimate the effect using an instrumental variable approach. Section 4.2 discusses the instrument for local credit supply shocks and the estimation results. Another concern is that other types of networks, such as the input-output network, could also overlap with the business-group network. It is more of a challenge to interpreting the estimates in Table 3 rather than to the identification itself. To address this concern, we add other types of networks in our baseline specification and discuss the estimation in section 4.3. For the rest of the empirical analysis, we focus only on the investment of subsidiary firms.

4.2 Instrument for Local Credit Supply

In this section, we use an instrumental variables approach to address possibly correlated credit demand across cities. As discussed in section 3.1, our baseline specification is valid as long as local bank lending growth does not depend on credit demand in other cities. To further mitigate the identification challenge, we construct a Bartik (shift-share)

instrument Z_{pt} for local credit growth $CreditGrowth_{pt}$ using bank branch information from CBRC:

$$Z_{pt} = \sum_{j \in H_{i0}, c(j) \neq c} \frac{\sum_b B_{b,c(j),t-3}}{\sum_{c(j) \neq c} \sum_b B_{b,c(j),t-3}} gBranch_{c(j),t},$$

where $B_{b,c,t}$ is the total number of branches of bank b in city c at time t, H_{i0} is the set of firms holding equity shares of firm i at the beginning of the sample period, and $c(j)$ is the home city of j. $gBranch_{c(j),t}$ is the projected growth rate of the total number of bank branches in city $c(j)$ at time t (defined below), and $\frac{\sum_b B_{b,c(j),t-3}}{\sum_{c(j)} \sum_b B_{b,c(j),t-3}}$ is the weight of city $c(j)$ among all parent companies' cities, which is the number of bank branches in city $c(j)$ relative to the total number of branches in all parent companies' cities. $gBranch_{c(j),t}$ is defined as:

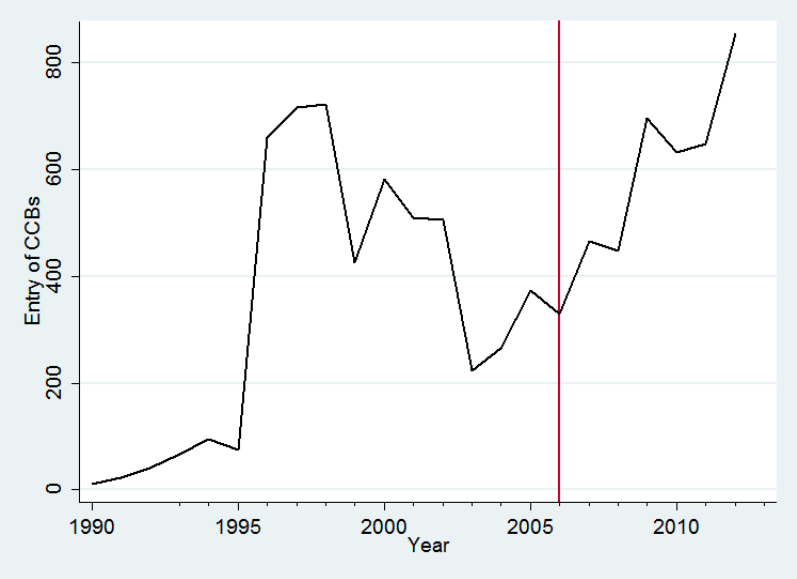
$$gBranch_{c(j),t} = \sum_b \frac{B_{b,c(j),t-3}}{\sum_b B_{b,c(j),t-3}} \cdot \frac{\sum_{c' \neq c(j)} (B_{b,c',t} - B_{b,c',t-1})}{\sum_{c' \neq c(j)} B_{b,c',t-1}}.$$

We use time $t-3$ to compute the share of bank branches to mitigate the concern of endogenous initial conditions. Branches of policy banks and trusts are excluded to ensure the economic relevance of the instrument. Finally, we drop cities that only have one bank branch, which leaves us with a sample of 249,785 firm-year observations.

The construction of the shift-share instrument takes advantage of the heterogeneous expansion of city commercial banks (CCBs) and other banks following the 2006 deregulation. Before 2006, the CCBs were only allowed to conduct businesses within the city where their headquarters locate in. Then with the real estate markets commercialized across the country, the China Banking Regulatory Commission lifted the CCBs' constraints on setting up inter-city branches. At the end of 2005, the new regulation "Notice of the China Banking Regulatory Commission on Issuing the Measures for the Administration of Non-Home-City Branches of City Commercial Banks" authorized qualified CCBs to open new branches in other cities. Following the branching deregulation, there began a large wave of inter-city branch openings in China. For example, as of 2014, Bank of Beijing, an city commercial bank established in 1996 in the city of Beijing, has set up 116 out of its 136 branches in 9 other provinces since the branching deregulation in 2006. Figure 3 presents the number of newly established cross-city CCB branches in each year since 1990. The deregulation of CCB branching accelerated the expansion of these city commercial banks at the national level. Moreover, CCBs also increase their footprint in the banking sector faster compared to the state-owned banks following the

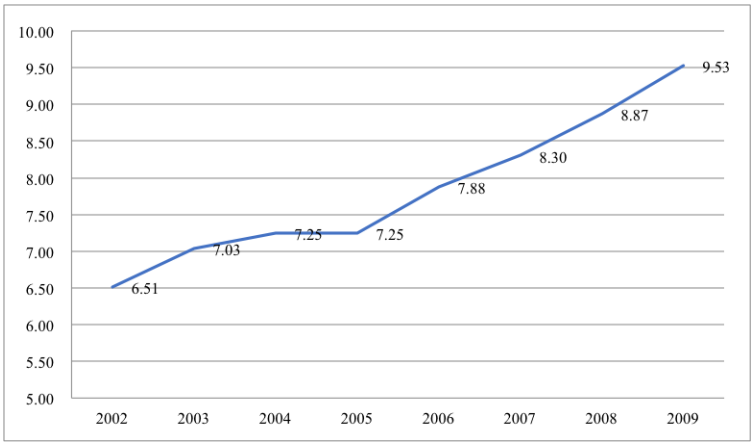
deregulation (Figure 3).

Figure 3: New Bank Branches Established by CCBs



Note: The figure shows the total number of new branches established by city commercial banks in China from 1990 to 2013.

Figure 4: CCBs' Share of Total Banking Sector Assets



Note: The figure presents the ratio of CCBs' total asset value relative to the value of total assets held by the "Big Five" state-owned banks, the 12 big national commercial banks, all CCBs, and all foreign banks. The ratio is only shown from 2002 to 2009 due to data availability.

The first-stage and second-stage results are summarized in Table 5:

Table 5: The Instrumental Variables Approach

	(1)	(2)	(3)	(4)
	First Stage	Second Stage		
	Avg. Credit Growth of Hol. Firms' Cities	Investment	Leverage Ratio	Debt Growth
Branch Bartik IV	1.643***			
	(0.019)			
F-Value	1.2e+04			
Avg. Credit Growth in Hol. Firms' Cities		0.258**	-0.017	0.017
		(0.102)	(0.015)	(0.053)
Number of Observations	249,785	249,785	285,555	284,536
City × Year FE	YES	YES	YES	YES
2-digit Industry × Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES

Notes: This table presents the results of the instrumental variables approach. Column (1) reports the first-stage outcome that the Bartik IV constructed based on bank branch formation can significantly predict local credit growth. Column (2) to column (4) reports the IV estimates of the effect of credit supply shocks to parent companies on subsidiary firms' investment, leverage ratio, and the growth rate of external debt. Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, and one-year lagged net profit margin. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

The estimated effect of credit supply shocks to the shareholders on subsidiary firms is four times larger compared to the baseline estimates. For an average 16.7% annual growth of total credit in shareholders' cities, a subsidiary firm is expected to invest 4.3% more of their fixed asset value, which is 29% of the average investment rate among all

subsidiary firms. There are two possible explanations for the OLS estimate to be downward biased: first, local credit growth of shareholders' cities is often a noisy measure of the actual credit supply shocks, which can create an attenuation bias; second, credit demand in shareholders' cities and subsidiaries' cities could be negatively correlated if banks also face limited resources. Column (3) and (4) of Table 5 again imply that subsidiary firms' external financing is not affected by the positive credit supply shocks to their shareholders. So the positive and significant impact on subsidiaries' investment is not driven by subsidiary firms having a more relaxed borrowing constraint following the credit supply shocks to their parent companies.

4.3 Other Robustness Tests

Another challenge we need to address is about interpreting the findings as a result of credit transfers within business groups. The connections between shareholders and subsidiaries may overlap with other networks across cities. Even if we establish the causality between credit supply shocks to shareholders and investment of subsidiaries, it might have been driven by other business linkages. Therefore in this section, we rule out other explanations by controlling for various possible networks in our robustness tests.

Supply chain linkages and trade credit Clayton and Jorgensen (1999) argue that shareholder-subsidiary relationships are often found between firms along the same supply chain. Therefore, a significant γ in eq (1) may not necessarily imply that holding firms pass along the credit supply shocks to their subsidiary firms, but could be the result of holding firms passing a supply-side shock (a decrease in the cost of capital) or a demand-side shock (an increase in production scale) to the upstream or to the downstream. Another reason that the supply chain linkages matter is that firms sometimes rely on trade credit for external financing. If the shareholders and subsidiaries are also trading partners, they can finance each other through trade credit instead of equity transfers.

To control for demand and supply shocks along the supply chain, we compute for each firm the weighted average of upstream and downstream output growth using the approach in Acemoglu, Akcigit, and Kerr (2016) and 2002 China Input-Output Table (3-digit industry level). For the trade credit channel, we add firm account payable and receivables (normalized by the one-year lagged total asset value) as measures of trade

credit. Column (1) and (2) in table 6 indicates that controlling for supply chain linkages, local bank credit growth affecting the holding firms still has a positive and significant impact on the subsidiary firms. Compared to the baseline estimate in Column (1) of Table 3, the effect is slightly smaller but statistically indifferent. Therefore, supply chain linkages and trade credit are not sufficient to explain our baseline findings.

Geographical network Acemoglu et al. (2016) point out that the geographic overlay of industries (i.e. how industries co-locate in various local labor markets) is also an important type of business network because any industry-to-industry effects can show up in firm-level analysis relying on cross-region variation. They control for the geographic overlay between different industries based on the industry composition in each region. We use a more general approach to directly control for shareholder industry cross subsidiary industry fixed effects and shareholder city cross subsidiary city fixed effects, to take into account any possible industry-to-industry or city-to-city spillover effects.

Column (3) and (4) in Table 6 summarizes the results of the robustness test for the geographical network channel. The geographical overlay of industries does contribute partially to the impact, but our main finding still holds.

Table 6: Robustness Tests

	(1)	(2)	(3)	(4)	(5)
	Investment				
Avg. Credit Growth in Holding Firms' Cities	0.0571***	0.0624***	0.0413***	0.0480***	0.0625***
	(0.0143)	(0.0143)	(0.0157)	(0.0144)	(0.0144)
Log (Demand from downstream)	0.00213				
	(0.00212)				
Log (Supply from upstream)	0.00213				
	(0.00211)				
Account Payable		-0.0992***			
		(0.00679)			
Account Receivable		-0.986***			
		(0.0135)			
Number of Observations	1,306,201	1,299,605	1,233,051	1,306,169	1,306,201
Shareholder Ind. × Subsidiary Ind. FE	NO	NO	YES	NO	NO
Shareholder city × Subsidiary city FE	NO	NO	NO	YES	NO
Common Shareholder Dummy	NO	NO	NO	NO	YES
City × Year FE	YES	YES	YES	YES	YES
2-digit Industry × Year FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES	YES

Notes: This table presents additional robustness tests on how holding firms pass credit supply shocks to subsidiary firms. Column (1) and column (2) control for supply and demand shocks along the supply chain and trade credit (normalized by one-year lagged total assets), respectively. Column (3) and (4) include shareholder industry cross subsidiary industry fixed effects and shareholder city cross subsidiary city fixed effects, respectively, to control any industry-to-industry or city-to-city spillover effects. Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, and one-year lagged net profit margin. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

The Tunneling effect Last but not least, we make efforts to rule out the tunneling effect from the literature of cross-holding relationships. A large corporate finance lit-

erature (Porta and Shleifer, 1999; Claessens et al., 2000; Gopalan et al., 2007; Jiang et al., 2010; Gul et al., 2010) argue that in a cross-holding network, there exists conflicts of interest between voting rights and cash-flow rights. A controlling shareholder may divert the resources from one subsidiary firm with low cash-flow rights to another subsidiary with high cash-flow rights and benefit much more, which creates a distortion in internal investment decisions. The tunneling effect works against our argument if the holding firm and the subsidiary firm have the same controlling shareholder who may have incentive to divert the resources from the holding firm to the subsidiary firm.

To control for the tunneling effect, we create a common shareholder dummy between subsidiaries and their shareholders and add to specification (1). The regression result in column (5) of table 6 shows that the key coefficient of our interest is unchanged after controlling for the common shareholder dummy.

4.4 The Equity Transfer Channel

We argue that an important channel for reallocating capital from shareholders to subsidiaries following a positive credit supply shock to the shareholders is through equity investments. For example, a holding firm can purchase additional equity stakes of its subsidiaries as way to pass along cash to subsidiaries (Almeida et al., 2015). Compared to commercial banks, the holding firms are typically more inclined to finance subsidiaries due to an information advantage or additional shareholder benefits (Stein, 1997). When facing good investment opportunities or positive credit market shocks, holding firms might increase external borrowing and finance subsidiaries through the internal capital markets (Shin and Zhao, 2013; Manova et al., 2015).

To show that holding firms reallocate capital to subsidiaries through equity transfers, we repeat the baseline and IV analyses but replacing the left-hand side variable with the total equity shares held by corporate shareholders. Intuitively, subsidiaries transfer or issue new equity stakes to holding firms in exchange for more cash. Therefore, the coefficient of our interest is expected to positive and significant, indicating that the total equity shares held by corporate shareholders increases following a positive credit supply shock to the shareholders. The results of the analyses are summarized in table 7. 0.5% additional equity shares are sold by the subsidiaries to their shareholders following an average 16.7% credit growth in shareholders' cities, which is worth of 2.5 millions RMB based on the average book value of subsidiary firms in our sample.

Table 7: Equity Transfer in Response to Credit Supply Shocks

	(1)	(2)
	OLS	IV
	Equity Shares Held by Corporate Shareholders (%)	
Avg. Credit Growth in Holding Firms' Cities	3.380***	10.070***
	(0.084)	(0.127)
Number of Observations	748,829	379,261
City × Year FE	YES	YES
2-digit Industry × Year FE	YES	YES
Firm FE	YES	YES
Firm-level Controls	YES	YES

Notes: This table presents how holding firms exchange equity shares with subsidiary firms following a positive credit supply shock. Holding firms' cities credit growth is computed as the weighted average of the growth rate of total bank loans. Column (1) and column (2) reports the OLS and IV estimates, respectively. Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, and one-year lagged net profit margin. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

4.5 The Effectiveness of Financing within Business Groups

Finally, we look into the conditions under which parent companies can be an effective intermediary between banks and subsidiaries. An effective intermediation should see subsidiaries responding to credit supply shocks to their shareholders.

A direct implication based on the internal capital market theory (Stein, 1997) is that we should expect a larger effect when a shareholder claims a larger fraction of subsidiaries' returns or the shareholder itself less financially constrained. To test for such an implication, we compare the financially more constrained versus less constrained shareholders, and controlling versus minority shareholders. [PLACE HOLDER: Add the narrative and table comparing constrained vs unconstrained shareholders.] Similarly, Table 9 implies that a positive credit shock to controlling shareholders who own more than 50% of the subsidiaries' equity shares would significantly increase the in-

vestment of subsidiary firms; while the same shock to minority shareholders generates a positive yet insignificant effect. We also compare SOE versus POE (privately owned enterprises) shareholders. Interestingly, although the SOEs are considered generally as financially unconstrained compared to POEs, we don't find subsidiaries benefitted from SOE shareholders passing bank credit to subsidiaries (Table 8). This finding is intuitive, given that by definition the SOEs could have other incentives instead of the business group's best interests in mind (Megginson, 2016). Ljungqvist et al. (2019) document a similar result that the state groups are less efficient in capital allocation compared to private groups, based on a smaller sample of stock market listed firms

Table 8: SOE versus Non-SOE Shareholders

	(1)	(2)	(3)	(4)
	Baseline	Size-adjusted Weights	Cash-flow Rights Weights	Simple Average
Avg. Credit Growth in SOE Holding Firms' Cities	-0.0638	-0.0119	-0.0870	-0.0602
	(0.0532)	(0.0741)	(0.0768)	(0.0650)
Avg. Credit Growth in Non-SOE Holding Firms' Cities	0.0664***	0.108***	0.0918***	0.0739***
	(0.0191)	(0.0238)	(0.0255)	(0.020)
Number of Observations	1,314,458	1,314,458	1,314,458	1,314,458
City × Year FE	YES	YES	YES	YES
2-digit Industry × Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES

Notes: This table compares SOE and non-SOE holding firms in passing credit supply shocks to subsidiary firms using different shareholder weights. Holding firms' cities credit growth is computed as the average growth rate of total bank loans, weighted by the size of local credit market, the size of local credit market multiplied by firm total asset value relative to city average, shareholders' cashflow rights, and an equal weight in column (1) to column (4). Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, and one-year lagged net profit margin. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Table 9: Controlling versus Minority Shareholders

	(1)	(2)	(3)	(4)
	Baseline	Size-adjusted Weights	Cash-flow Rights Weights	Simple Average
Avg. Credit Growth in Controlling Holding Firms' Cities	0.0917***	0.0800***	0.0791***	0.0923***
	(0.0248)	(0.0246)	(0.0227)	(0.0248)
Avg. Credit Growth in Minority Holding Firms' Cities	0.0329	0.0855	-0.0635	0.0331
	(0.0414)	(0.0557)	(0.0585)	(0.0406)
Number of Observations	1,314,458	1,314,458	1,314,458	1,314,458
City × Year FE	YES	YES	YES	YES
2-digit Industry × Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES

Notes: This table compares controlling and non-controlling holding firms in passing credit supply shocks to subsidiary firms using different shareholder weights. Holding firms' cities credit growth is computed as the average growth rate of total bank loans, weighted by the size of local credit market, the size of local credit market multiplied by firm total asset value relative to city average, shareholders' cashflow rights, and an equal weight in column (1) to column (4). Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, and one-year lagged net profit margin. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Another important feature of the internal capital market is that its significance depends on subsidiary firms' financial constraints as well as their investment opportunities (section §2).

To understand the importance of subsidiaries' financial constraints, we construct four measures of industry-level financial vulnerability following Manova et al. (2015): the external financial dependence (the Rajan-Zingales measure), the inventory ratio,

the tangible asset ratio and the trade credit ratio. Conceptually, the four measures capture different types of financial vulnerabilities. The external financial dependence is measured as the share of capital expenditure that is not financed by the cash flows in operations, which matters more to long-term investment activities. The other three remaining variables imply the short-term financial constraints of corporates. The inventory ratio, calculated as the ratio of inventory value over total sales, signals the needs for working capital due to variable costs in the production process. The tangible asset ratio indicates the collateral value of the industry, which is defined as the ratio of fixed asset[19] value to total book value. Finally, the trade credit ratio, computed as the ratio of the change in accounts payable to the change in total assets, is the proxy for average firm access to credit from trading partners.

We modify the baseline specification (1) to study the impacts of subsidiaries' financial vulnerability on the pass-through of credit supply shocks from shareholders to subsidiaries:

$$Y_{it} = \alpha_{ct} + \theta_i + \gamma_0 CreditGrowth_{pt} + \gamma_1 CreditGrowth_{pt} \times FinVul_{is} + \kappa' X_{it} + \epsilon_{it}, \quad (3)$$

where $FinVul_{is}$ equals to 1 if the financial vulnerability measure of industry s ($i \in s$) is above median, and 0 otherwise. We construct the four non-time varying measures at the industry level using CompuStat data for US public firms to avoid endogeneity concerns.

Table 10 summarizes the results. We only include in private subsidiary firms given that SOEs face atypical constraints on the credit market. Column (1) in the table implies that following an average 16.7% annual growth of total credit in shareholders' cities, subsidiaries in industries with an above-median external finance dependence invest 1.9% more of their fixed asset value compared to subsidiaries in industries with a below-median external finance dependence. The two short-term financial vulnerability measures, the inventory ratio and the trade credit ratio, appear to have insignificant effects on the pass-through of credit supply shocks from shareholders to subsidiary firms (Column (2) and (4) in Table 10). The ability to collateralize has limited impact as well (Column (3)), which complements our baseline finding (Table 3, Column (4)) that the subsidiary firms' bank financing condition is not affected by shocks to their parent companies in other cities.

[19]Fixed asset value refers to the value of plant, property and equipment on the balance sheet.

Table 10: Financial Vulnerabilities and the Pass-through of Credit Supply Shocks

	(1)	(2)	(3)	(4)
	Investment			
Avg. Credit Growth in Holding Firms' Cities	0.0463	0.110***	0.0994***	0.107***
	(0.0371)	(0.0316)	(0.0351)	(0.0310)
Avg. Credit Growth in Hol. Firms' Cities ×				
High External Finance Dependence	0.116**			
	(0.0493)			
High Inventory Ratio		-0.0149		
		(0.0542)		
High Tangible Asset Ratio			0.0141	
			(0.0523)	
High Trade Credit Ratio				-0.00737
				(0.0567)
Number of Observations	753,316	753,316	753,316	753,316
City × Year FE	YES	YES	YES	YES
2-digit Industry × Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES

Notes: This table presents how holding firms pass credit supply shocks to subsidiary firms. Holding firms' cities credit growth is computed as the weighted average of the growth rate of total bank loans. "High" indicates that the financial vulnerability measure of the sector is above median. Column (1) to column (4) reports the effect of credit growth shocks to parent companies on subsidiary firms' investment, conditional on external finance dependence, inventory ratio, tangible asset ratio, and trade credit ratio, respectively. Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, one-year lagged net profit margin, and one-year lagged financial vulnerability measures. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

For subsidiary firm investment opportunities, we construct four proxies following Giroud and Muller (2015): return on asset (ROA), return on capital (ROC), sales growth, and estimated TFP. The ROA is calculated as the ratio of net profit to one-year lagged total asset value; the ROC is measured as the ratio of net profit to lagged total fixed capital stock, and the sales growth is computed as the annual growth rate of

total revenue. To estimate TFP, we follow the literature (Bertrand and Mullainathan, 2003; Syverson, 2004; Foster, Haltiwanger, and Syverson, 2008; Giroud and Mueller, 2015) to estimate the linear production function at the 2-digit industry level:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \mu_{it}, \tag{4}$$

where l_{it}, m_{it}, k_{it} represent labor, intermediate input, and capital, respectively. The firm-year TFP estimates is obtained by computing the residual term $\hat{\mu}_{it}$, from production function (4). For robustness, we have also imposed an $AR(1)$ process on productivity μ_{it} and the same results hold.

Next we extend again the baseline specification (1) to study the impacts of firm investment opportunities on the pass-through of credit supply shocks from shareholders to subsidiaries::

$$Y_{it} = \alpha_{ct} + \theta_i + \gamma_0 CreditGrowth_{pt} + \gamma_1 CreditGrowth_{pt} \times InvOpp_{i,t-1} + \kappa' X_{it} + \epsilon_{it}, \tag{5}$$

where $InvOpp_{i,t-1}$ equals to 1 if the investment opportunity measure of firm i at time $t-1$ is above median, and 0 otherwise.

Table 11 summarizes the results. As expected, the better-performing subsidiary firms make a significantly larger investment following the same credit supply shock to the parent companies.

Table 11: Investment Opportunities and the Pass-through of Credit Supply Shocks

	(1)	(2)	(3)	(4)
	Investment (high external financial dependence firms)			
Avg. Credit Growth in Holding Firms' Cities	0.111**	0.110***	0.123**	0.0777*
	(0.0466)	(0.0428)	(0.0480)	(0.0451)
Avg. Credit Growth in Hol. Firms' Cities ×				
High ROA (t-1)	0.097***			
	(0.0470)			
High ROC (t-1)		0.089***		
		(0.0506)		
High TFP (t-1)			0.071***	
			(0.0466)	
High Sales Growth (t-1)				0.064***
				(0.0467)
Number of Observations	376,189	376,189	371,944	265,616
City × Year FE	YES	YES	YES	YES
2-digit Industry × Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Firm-level Controls	YES	YES	YES	YES

Notes: This table presents how holding firms pass credit supply shocks to subsidiary firms depending on the investment opportunities of subsidiaries. We focus on the group of firms with above-median external finance dependence for more significance. Holding firms' cities credit growth is computed as the weighted average of the growth rate of total bank loans. "High" indicates that the investment opportunity measure of the firm is above median. Column (1) to column (4) reports the effect of credit growth shocks to parent companies on subsidiary firms' investment, conditional on one-year lagged ROA, ROC, TFP, and sales growth, respectively. Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, and one-year lagged investment opportunity measures. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

To further understand the differential responses of subsidiary firms, we divide the subsidiaries into three groups: SOEs, domestic private companies, and foreign-invested companies. Compared to the domestic private firms, both SOE subsidiaries and foreign-invested companies should be less financially constrained due better access to non-bank capitals. Table 12 shows that only the domestic private subsidiary firms positively

respond to credit supply shocks to their shareholders, while SOEs and foreign-invested companies are largely unaffected.

Table 12: Heterogeneous Response of Subsidiaries

	(1)	(2)	(3)
	Domestic Private Firms	SOEs	Foreign-invested Companies
Avg. Credit Growth in Holding Firms' Cities	0.0946***	0.00945	0.00724
	(0.0217)	(0.0329)	(0.0229)
Number of Observations	970,214	115,653	209,310
City × Year FE	YES	YES	YES
2-digit Industry × Year FE	YES	YES	YES
Firm FE	YES	YES	YES
Firm-level Controls	YES	YES	YES

Notes: This table presents how different subsidiary firms respond differently to holding firms' credit supply shocks. Holding firms' cities credit growth is computed as the weighted average of the growth rate of total bank loans. Column (1) to column (5) reports the baseline estimates of the effect of credit growth shocks to parent companies on subsidiary firms' investment for domestic private subsidiaries, SOE subsidiaries, and foreign-invested subsidiaries, respectively. Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, and one-year lagged net profit margin. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Finally, we look at whether subsidiaries can also play the role of a financial intermediary. Column (1) of Table 13 examines whether subsidiaries' investment responds to the bank lending shocks to other subsidiaries located in other cities under the umbrella of the same corporate shareholder. We find that the coefficient is insignificant and much smaller compared to subsidiaries responding to the credit supply shocks to their parent companies. There could be several explanations. First, subsidiaries tend to be smaller and face a tighter financial constraint, so they may gain limited extra external financial support during a bank lending boom. Second, moving capital from one subsidiary to another might be more closely given that the subsidiaries do not hold each others' equity shares. Even a small fixed transaction cost of equity exchanges could discourage capital transfer from one subsidiary to the shareholder, then to another subsidiary. In Column

(2), we examine whether the corporate shareholder's investment respond to the bank lending shocks exposed to subsidiaries located in other cities. The result shows that the response is small, negative, and insignificant both economically and statistically.

Table 13: Subsidiaries are not Effective Intermediaries

	(1)	(2)
Dependent Variable:	Subsidiary Firms Investment	Shareholders Investment
Avg. Credit Growth in Cities of Other Subsidiaries under Common Ownership	0.00733	
	(0.0237)	
Avg. Credit Growth in Subsidiaries' Cities		-0.0157
		(0.0236)
Number of Observations	121,485	200,717
City × Year FE	YES	YES
2-digit Industry × Year FE	YES	YES
Firm FE	YES	YES
Firm-level Controls	YES	YES

Notes: This table presents the effect of subsidiaries as potential financial intermediaries in business groups. Other subsidiaries' cities credit growth is computed as the weighted average of the growth rate of total bank loans. Firm-level controls include firm size, ownership, and age fixed effects; one-year lagged debt-to-asset ratio, and one-year lagged net profit margin. All specifications include city cross year fixed effects, 2-digit industry cross year fixed effects, and firm fixed effects. The standard error clustered at firm level are reported in parentheses.

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

5 Conclusion

In this paper, we document a large network of business groups in China in which non-financial corporates hold equity stakes of each other. We show the existence of tiered intermediation within business groups: corporate shareholders could play the role of financial intermediaries, propagating credit from the banking sector to their subsidiaries.

The equity transfers between corporate shareholders and subsidiaries serve as an important channel of the tiered intermediation within business groups. Intermediation is more effective when subsidiaries face higher financial constraints or greater investment opportunities.

Our paper touches an important question on the interaction between the internal and external capital markets. More specifically, we sheds light on how internal capital markets could facilitate the transmission of monetary or fiscal policies that intend to stimulate the economy through bank lending. Parent companies in large corporate groups could complement banks by allowing their credit to reach the smaller firms in the group through the internal markets. Policies supporting SMEs can thus focus more on standalone firms to improve their efficiencies.

An interesting area of future research could look into how to incorporate the internal capital markets in optimal policy design more generally. For example, Garcia et al. (2020) propose systematically evaluating the value of government subsidies and risk exposures for development banks to facilitate policy designs. Mature development banks such as the Korean Development Bank and German KfW often lend to large conglomerates that span many economic sectors. Understanding the operations of these large groups' internal capital markets could help better assess the costs and benefits of fiscal supports through the development banks.

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