Determinants of the guarantee circles: the case of Chinese listed firms

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Abstract

China's external capital market has been developing rapidly since the establishment of its stock markets. However, financing from the internal capital market, especially through the guarantee system provided by other associated firms (the guarantee circle), remains significant for some Chinese firms. We analyze the importance associated with the guarantee system in China with a focus on the macro and micro determinants that affect Chinese firms' participation in the guarantee circle. Our findings suggest that both macroeconomic and microeconomic factors have significant impact on a firm's involvement in the guarantee circle. Firms in regions with higher economic growth, less developed banking system and worse legal protection are more likely to receive guarantee from firms associated with the controlling shareholders. On the other hand, firms controlled by the state are less likely to receive guarantee but more likely to provide guarantee, while firms with alternative financing sources are more likely to provide guarantee. Firms within a complex group with more pyramidal layers are more likely to get involved in the guarantee circle, either as a guarantor or a guarantee. Our findings have implications to general guarantee systems with the presence of agency and moral hazard problems.

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1. INTRODUCTION

China's external capital market has been developing rapidly since the establishment of its stock markets. However, despite the additional sources of external financing, many Chinese firms are still reliant on the internal capital market for their financing. To obtain more funds, they are also involved in the guarantee circle,[1] where Chinese firms provide guarantee to one another for bank loans, thus forming a large circle of guarantee-related parties.

Although not all companies are involved in loan guarantee, for those in the guarantee circle, the amount of guarantee provided or received could be strikingly huge. Take year 2004 as an example. Among the 1,103 listed firms that disclosed their annual reports of 2004 in our sample, around half were involved in guarantee (552 firms, or 50.05%). The total amount of guarantee exceeded RMB 14.5 trillion, which highlighted the importance of the guarantee circle among Chinese firms. Among those firms in the guarantee circle, the amount of guarantee was strikingly huge. 53 (12) of them were involved in guarantee of a size more than 100% of their equities (total assets), while 151 (29) firms were involved in guarantee that exceeds 50% of their equities (total assets). Some firms, although with negative equity, did provide significant amount of guarantee to others (11 firms with negative equity provided guarantee to others at the end of 2004). One of the extreme cases is Guangdong Sunrise Holdings. Co., Ltd (000030) listed on the Shenzhen Stock Exchange. In year 2004 it had to shoulder contingent liability of more than 1.8 billion with its 0.298 billion of total assets and negative shareholders' equity of 1.5 billion. This results in a guarantee-to-asset ratio of 6.04.

The guarantee circle could be an extension of the internal capital market developed within a group of firms, which allocates internal financial resources, i.e. retained earnings, to a company's various divisions, or to different firms within a group. According to Shin and Stulz (1998), the internal capital market is efficient if it gives priority to the allocation of funds to divisions with the best investment opportunities. This works similarly within a group of related firms when the ultimate shareholder usually has the right to divert the resources from one firm to another. The internal capital market can even be viewed as a strategic alliance formed among a group of 'independent' firms, which provides more flexibility and synergy to firms within the alliance. Financial assistance can be provided by one firm to another in the form of direct loan, although it increases the costs of the firms due to the

[1] We adopt the term guarantee circle from the English translation of WANFANG DATA.

commitments they make to the alliance. In contrast, guarantee circle is an alternative different from the usual mechanisms of internal capital market, in that only loan guarantees are provided, not real capital. Therefore, to the guarantee provider, it is less of a burden and to the shareholders of the guarantee provider, there might be less concern of direct tunneling but if not properly disclosed and abused, the shareholders, especially minority shareholders, might overlook the underlying risks and then have to bear unnecessary risks. Viewing from this perspective, guarantee provider bear similar risks as do creditors, who are the real capital providers.

As a partial collateral substitute that reduces the lender's risk of not recovering the loan, the loan guarantee system was originally designed to stimulate lending to SMEs who lack access to formal loans in the developed markets such as the U.S. and U.K. The role of SMEs in economic development is more important in emerging markets, in which SMEs tend to suffer more in accessing source of finance due to lack or insufficient collaterals accepted by banks. In view of this, either the government or some private banks/firms will provide loan guarantee to help such firms overcome the obstacles in financial markets. For example, the Mexican government's banks offer loan guarantees to private banks in order to spur credit directed to non-financial SMEs (Benavides and Huidobro, 2009). An analogy to the Chinese guarantee circle is observed in Korea. Doh and Ryu (2004) provide evidence on the corporate loan guarantees among the Korean chaebol affiliates. They find that related loan guarantees have negative as well as positive effects. Our investigation might have implications on other guarantee systems around the world and how these systems are affected by the institutional environment in which the firms operate.

In contrast to prior research which mainly examine the consequences of the guarantee system in China, for example, as a means of expropriation of minority shareholders (Berkman, Cole, and Fu, 2009), in this paper we focus on the determinants of a firm's involvement in the guarantee circle. Specifically, we aim at identifying which macroeconomic and microeconomic factors tend to affect the firms' decision to be involved in the guarantee circle. Berkman, Cole, and Fu (2009) find that the issuance of related guarantees is less likely at smaller firms, at more profitable firms and at firms with higher growth prospects. In contrast to their study of 88 Chinese listed firms as guarantee providers in 1999, we investigate all the Chinese listed firms either as guarantee provider or as guarantee receiver from 1997 to 2005. Besides the firm-specific characteristics such as size and profitability, we deepen the understanding of the Chinese guarantee circles by further

examining the macroeconomic differences among the different provinces where the listed firms locate.

Our analysis shows that both microeconomic and macroeconomic factors play important roles in a firm's decision regarding guarantee circle involvements. As regard to the disparity at the firm level, firms controlled by the state and firms with alternative financing sources are more likely to provide guarantee, but firms controlled by the state are less likely to receive guarantee than other firms. Moreover, firms within a complex group with more pyramidal layers are more likely to get involved in the guarantee circle, either as a guarantee provider or a receiver. As for the regional disparity, firms in provinces with higher economic growth, less developed banking system and worse legal protection are more likely to receive guarantee.

The rest of the paper is organized as follows. Section 2 presents the institutional background along with the importance and the inherent problems of the guarantee circle among Chinese firms. In section 3, we develop our hypotheses relating to macroeconomic and microeconomic effects on a firm's decision to participate in the guarantee circle. In section 4, we discuss the empirical results of our hypothesis testing and their implications before we conclude the paper in section 5.

2. INSTITUTIONAL BACKGROUND AND LITERATURE REVIEW

Before the economic reform in the late 1970s, the product, labor and financial markets were basically non-existent in China. Most Chinese firms were state-owned and the government directed all aspects of a firm's operating, investing and financing decisions. Financial markets did not exist, although banks acted as state agencies to enact and enforce government monetary policy (Lardy, 1998). State-owned enterprises (SOEs) and state-owned banks (SOBs) operated on a credit transfer system controlled by the government bureaus (Keister, 2004). Specifically, constraints on firm spending were not wholly binding because the state could readily reallocate funds to cover additional expenditures. The state used its network of administrative bureaus to control the flow of resources throughout the economy and to redistribute funds from profitable firms to underperformed ones. This virtually guaranteed firms' survival but created resource shortages and intense pressure for firms to increase production (Kornai, 1986).

In the reform that started in 1978, reformers warned that direct transfers of state funds would be gradually reduced and might be eventually eliminated (Goldie-Scott, 1995). Early reductions in state funds and a handful of visible bankruptcies underscored this message. Even in the largest firms, the state began to transform its role to that of a shareholder with limited responsibility and liability (Jefferson and Xu, 1991). Although the state did not stop direct transfers entirely, firm managers began to realize that sources of funds from the state should not be taken for granted. With the emergence of Chinese stock markets, public equity financing becomes an important way to support the firms' operation and growth.

Previous studies have shown a causal relationship between financial development in a country and the financing constraints faced by the firms. Harris, Schiantarelli, and Siregar (1994) argue that financial liberalization in Indonesia improves the financing conditions for Indonesian firms. Haramillo, Schiantarelli, and Weiss (1996) reinforce this point as they show that the financing constraints for Ecuadorian firms have lessened due to the financial liberalization. In China, small and medium enterprises (SMEs) have developed at a fast pace in the past few decades and we expect that financial liberalization would help relieve the financing constraints of the huge number of small firms and make them gradually rely less on the funds from internal capital market and/or guarantee circles (Gelos and Werner, 2002; Laeven, 2003).

However, Jiang (2003) finds that the listing odds of Chinese firms depend on their size, profitability and leverage, but not their revenue growth, while the regional listing odds are substantially different among the 31 provinces. The capital allocation system in Chinese public listings, though improved in recent years, is generally inefficient. Specifically, limited access to equity financing faced by SMEs in China increases their credit constraints. In September 1999 a series of measures were enacted in order to restructure the SME sector. Those include the promotion of firm groups, the exit of non-viable small firms as well as the setup of business development services to assist the SMEs in information consulting, marketing, funding, credit guarantee schemes, technical support and services. Although our sample consists of listed firms which are mostly relatively large in size, SMEs still play an important role in the Chinese market and the listed firms are likely to work closely with SMEs in their businesses.

2.1 **The Importance of Guarantee Circle**

Keister (2004) argues that in the fast-growing China, internally generated funds might not be sufficient to support the quick development of the aggressive enterprises. In spite of

the development of Chinese securities markets, the financial assistance from related parties is still important for the Chinese firms as indicated by the significant size of the guarantee circle. In this section, we discuss the importance of the guarantee circle to the Chinese firms.

Firstly, the access to financing from SOBs is heavily determined by a firm's political connections. According to Goldie-Scott (1995) and Yi (1994), even after the reform of the big four SOBs, namely the Industrial and Commercial Bank, the Agricultural Bank, the People's Bank and the Construction Bank, these banks remain as government agencies. Their lending decisions are, at times, made to support the state policies rather than to fulfill the financial objectives of the banks themselves. As a result, it is not easy for firms other than SOEs to get the loans directly from SOBs. Such firms have to borrow from other non-state-owned banks, which are usually unwilling or unable to provide huge loans that the big four SOBs could offer, unless with additional guarantees from a third party such as an SOE.

Secondly, even for SOEs which can gain access to bank loans from SOBs, their corporate autonomy may be significantly retarded. Dutton and Duncan (1987) and Tichy (1983) suggest that strategic decision making involves drawing on unique knowledge and capabilities internal to the firm while Mizruchi and Strearns (1994) add that it also requires firms to avoid dependency on external entities and resources. In fact, reliance on SOBs might introduce undesired intervention by the government, which could affect the autonomy and the performance of SOEs. Also, political burdens might be loaded to the firms so that corporate resources are diverted to serve social or political goals. Therefore, reducing dependencies is an important motivation for SOEs seeking for external financing other than loans from SOBs. The guarantee circle could support these firms' access to the external financial resources.

Thirdly, there is a lack of proper credit rating assessments for SMEs in China even though a nationwide credit assessment system for SMEs was proposed in 2001 (Garcia-Fontes, 2005). Without a credit rating system, SMEs might have low incentives to build a good credit reputation as it does not have a direct effect on future borrowings due to a lack of information exchange among the banks, or even among the different branches of the same bank. For example, if an SME defaults on its loan payment to one bank, this information might not be communicated to other banks. Lack of credit assessment negatively affects the loan quality and decreases further the credibility of SMEs as a whole. This could generally result in banks being more skeptical towards issuing loans to SMEs, even if they have tremendous growth potential. Consequently, many SMEs are involved in the guarantee circle as they would need to provide additional security such as a guarantor for their bank loans.

Finally, Nanda (2002) states that coinsurance, which is similar to the context of guarantee circle, makes diversification attractive by allowing integrated firms to borrow at lower cost than stand-alone firms by reducing cash flow risk and the probability of costly bankruptcy. Likewise, members in the guarantee circle are provided with guarantee by others in obtaining bank loans, which could be at a lower interest rate since risk level is reduced by embedded guarantee. This adds to the benefit of borrowing through the guarantee circle, which motivates the firms to get involved in it.

Although starting from year 2000 the Chinese Securities Regulatory Commission (CSRC) issued a series of rules to discipline and/or prohibit listed companies from issuing new loan guarantees to their controlling shareholders or the controlling shareholders' affiliates, loan guarantees among related parties continue to exist in China. In particular, in the CSRC rule No. 120 issued in late 2005, it is promulgated that loan guarantees provided by the listed companies to the controlling shareholders, actual controlling parties and other related parties should be approved by both the board and the general shareholders' meeting, which suggests that providing guarantee is allowed as long as it goes through a proper approval process. Of course, using related party transaction, including related party guarantee, to expropriate minority shareholders becomes more difficult with better corporate governance. However, it is not clear whether CSRC rigorously enforces the rules so that the phenomenon of guarantee circle should cease to exist in Chinese firms. As suggested by Berkman, Cole, and Fu (2010), such rules might apply rigorously only to those listed firms and controlling shareholders without political connections. In summary, we cannot overlook the importance of loan guarantee in at least some listed companies in China.

2.2 Inherent Problems of the Guarantee Circle

Despite of the benefits mentioned in the previous subsection, there exist some problems associated with the guarantee circle. We will discuss these inherent problems in this section.

2.2.1. Cross-subsidization or Socialism

While the firms in the guarantee circle receive guarantees for loans from other firms, they commit to (and are expected to) provide similar guarantees to the other firms within the guarantee circle when needed. This might create 'cross-subsidization' or 'socialism' discussed by Scharfstein (1998). As competition for funds within an organization can distort internal investment decisions, such a problem is also applicable in the guarantee context. Less profitable group members are more likely to engage in rent-seeking activities since their

opportunity costs are lower than more profitable counterparts. As a result, profitable group members might be burdened with the obligation to subsidize non-profitable members, which in the end could affect the profitable firms' performances.

In addition, since transactions in the guarantee circle are generally relationship-based and each member who receives the guarantee is also expected to provide guarantee when needed, a firm could provide guarantee to another group member without fully assessing the underlying risks. The lack of information about the guarantee's risk profile implies that the guarantor might not be able to conduct a proper assessment, which results in poor risk management.

2.2.2. Agency Costs

Tian (2005) finds that bank loans from SOBs increase managerial agency costs in both SOBs and SOEs. The state ownership in the banks motivates the bankers to provide loans to SOEs and accept any form of guarantee provided by SOEs without careful considerations of the profitability of the banks. Jia (2009) reinforces this point by showing that SOBs have been less prudent in issuing loans compared to non-state-owned banks. Similarly, the managers of SOEs would accept risky projects with low expected returns using the huge guaranteed loans, even though it might not be in the best interest of SOEs. With the support of the government, the possibility of bankruptcy of both SOBs and SOEs is pretty low.

In the guarantee circle, if the guarantors or the guarantees are SOEs, it is expected that most banks including non-state-owned banks would be willing to issue loans even if such loans are riskier, since it is perceived that the government would bail out SOEs should they default in payments.

2.2.3. Moral Hazard

Balkenhol (2007) argues that guarantee systems actually increase the moral hazard instead of mitigating it. Rather than making good use of the funds from a guarantee circle which is set up to aid the members, some firms might misuse the funds. For example, a borrower could deviate from a contract-conforming behavior to take higher than expected risks knowing that a third party, which is the government, guarantees the loan. This can be applied to the guarantee circle context as funds are taken with a third party as the guarantor who shares the consequences of default payments. Thus, firms might increase their risk appetite unnecessarily in using the guaranteed loans.

The moral hazard could be more serious in a mutual guarantee contract in which firms provide additional security to one another's bank loans. In other words, they bear the risks that the opposite parties default on the loan payment. According to game theory, because of this coinsurance structure and asymmetric return system, each firm in the guarantee circle might anticipate that the other parties tend to take potentially high-risk and high-return projects, which might not be consistent with the guarantor's risk management strategy. Anticipating this, all firms involved in the mutual guarantee might take on risky projects that might deliver higher returns in some situations, in response to others' reaction. As a result, the firms might end up accepting projects with risks beyond their level of risk tolerance. However, the best outcome under full cooperation should be that both parties take on projects with manageable risk and reasonable returns, rather than bearing the risks beyond their risk profiles. Zecchini and Ventura (2006) find consistent results that risk-averse SMEs are reluctant to enter into mutual guarantee agreements with other firms, knowing that close monitoring of their peers' performance is difficult and that such guarantee systems attract risk-seeking firms, or firms that become risk-seekers due to the guarantee systems.

2.2.4. Exploitation of Minority Shareholders

Berkman, Cole, and Fu (2009) suggest that loan guarantee provided to controlling shareholders benefit the controlling shareholders by means of lower interest rates and the option to default the loan, leaving the burden of repayment to the listed firm. Hence, it is possible that loan guarantee could be used as a means of tunneling by the controlling shareholders. Their empirical results show that firms that provide loan guarantee to their related parties experience lower industry-adjusted Tobin's Q, lower ROA and higher leverage than other firms in 1999. With similar arguments, Berkman, Cole, and Fu (2010) show that rules designed to improve minority shareholder protection in China have bigger impacts on firms with more related party transactions. However, firms with strong political connections do not benefit from the regulations, suggesting the regulations be selectively enforced to firms without connections. The results indicate that tunneling and minority shareholder expropriation could also be important underlying driving forces for loan guarantee.

In summary, firms have to balance between the costs and benefits of the loan guarantees when they decide whether they should get involved in a guarantee circle. When the benefits overweigh the costs, they tend to rely more on the guaranteed funds, otherwise they will be less likely to get involved. Since the costs and benefits of the loan guarantees could be associated with both the firm-specific characteristics and the economic and institutional environment in which the firm operates, we then try to identify a set of

microeconomic and macroeconomic factors that will determine the firm's involvement in the guarantee circle.

3. HYPOTHESIS DEVELOPMENT

In this section, we turn to discuss the internal and external factors that could affect the firm's decision to be involved in the guarantee circle, namely the microeconomic and macroeconomic factors. Firm-specific characteristics, such as state ownership, group structure and availability of alternative financing sources, could be the internal factors that affect the costs-benefits trade-off in a firm's guarantee decisions. On the other hand, the regional disparity is substantial in China. The difference in the development of provincial economy, the development of external capital market, the quality of legal protection, and the extent of government intervention could introduce different costs and benefits to a firm, which ultimately determines whether it joins the guarantee circle or not.

3.1 The Effects of Microeconomic Factors

3.1.1. State Ownership

As mentioned in section 2, the access to financing from state-owned banks (SOBs) is heavily determined by a firm's political connections. The lending decisions of SOBs are sometimes made to support the government policies instead of improving their own profitability (Sapienza, 2004; Dinç, 2005; Khwaja and Mian, 2005). It is therefore easier for firms with close relationships (e.g. SOEs) with the government to receive loans from SOBs (Cull and Xu, 2005). Other firms have to rely more on non-state-owned banks which are usually unwilling or unable to provide huge loans that the big four SOBs could offer, unless with additional guarantees from a third party such as an SOE.

Moreover, firms with state ownership are more likely to be bailed out than other firms in cases of default in payments. As a result, lenders are generally more willing to provide financing to firms in which the government has significant ownership because they can reasonably anticipate a future bailout of the troubled loans by the government. As such, firms with state ownership are less likely to be required to provide additional security, such as a guarantor, for the bank loans.

The percentage of state ownership also matters when the firm managers make the financing decisions. Tian and Estrin (2008) argue that state-ownership can be both detrimental and beneficial to corporate value. The government's political interference might drive diversion of corporate wealth for political uses (the grabbing hand) while its high

financial interests based on corporate profits might create incentives to closely monitor the firms operation and provide preferential treatments when setting policies (the helping hand). When the ownership of the government shareholder is sufficiently large, the government has no incentives to use its "grabbing hand" but has incentives to help by monitoring the managers and providing preferential treatments, including biased regulations as a regulator or preferential loans as a creditor. This would in turn improve firms' financial position and provide easier access to external capital market.

Hence, we use a dummy variable *STATE*[2] which indicates whether a firm is controlled by the government, and have the following hypothesis about the influence of state control on guarantee circle:

H1: Firms controlled by the government are less likely to rely on the guarantee circle as a source of financing than non-state-controlled firms do.

3.1.2. Group Structure

Governments and entrepreneurs build up corporate group pyramids for different reasons. Fan, Wong, and Zhang (2005) state that for a local government, building up pyramidal layers between the ultimate shareholder and the controlling firm in the corporate groups is a commitment for decentralization. In other words, government would only have minimal intervention with the firms' operations. By contrast, China's private entrepreneurs' pyramid structure is more likely caused by their needs for property rights protection and as a solution for external financing constraints. Building pyramids then allows an entrepreneur to create an internal capital market that facilitates cross-subsidization. For both types of groups, the related firms in the groups become a source of guarantor for a particular firm's bank loans. Therefore, it is easier for firms that belong to a large group to obtain bank loans as they have little difficulties in finding a guarantor. Moreover, the pyramid structure of the group provides higher incentive for the controlling shareholder to tunnel resources at the expense of minority shareholders, if tunneling is a driving force for loan guarantee.

Thus, we conjecture that for both the state-owned and non-state-owned firms, the number of pyramidal layers (denoted as *LAYER*) between ultimate shareholder and the listed

[2] We follow Fan, Wong, and Zhang (2005) and trace the ultimate owner to the largest shareholder (government, individual or private entities). Based on the nature of ultimate shareholder, we make the classification between state (central government, local government, government agents such as state assets management bureau, and state-owned enterprises) and non-state controlling shareholder (others).

firm should be positively associated with the likelihood of firm's involvement in a guarantee circle.[3] The following hypothesis is then set up.

H2: Firms in a group with more corporate layers are more likely to involve in the guarantee circle.

3.1.3. Alternative Sources of Financing

In addition to bank loans and equity financing in the domestic markets, which are common among the Chinese listed firms, funding is also available from the bond market, the B-share market as well as cross-listing in the overseas markets. These markets not only provide alternative financing resources but also enhance the firms' credibility for direct borrowing and hence reduce the firms' reliance on the guarantee circle.

When a firm joins the guarantee circle, it implies not only receiving guarantees for its loans but also committing to reciprocate when needed. If such costs of the guarantee circle are high, for example, due to considerable risk associated with contingent liability when providing guarantees to members within the guarantee circle, alternative sources of financing from bond issues, B-share market or cross-listing would probably substitute the role played by the guarantee circle. In China, the corporate bond market is relatively small. Hence, we focus on the discussion of the cross-listing (including B-share) as the alternative source of financing.

Empirical studies find that companies with access to global capital markets experience substantial benefits besides relieving financial constraints. Leuz and Oberholzer-Gee (2006) suggest that firms with U.S. cross-listings enjoy a lower cost of capital, improved visibility and reputation, and better growth opportunities. However, global financing opportunities do not necessarily provide firms with more options in addition to domestic financing since domestic opportunities significantly reduce the net benefits of financing from the overseas market for some firms. For instance, firms with political ties often receive cheaper loans from SOBs, so they do not need to tap into foreign capital markets. It is also possible that global financing imposes extra costs on these firms because in order to cross-list on foreign exchanges, firms are often required to adapt to the regulations that govern these markets and are subject to more monitoring. Similarly, firms with overseas listing attract the attention of foreign analysts and the international business press. High levels of public scrutiny can be difficult to reconcile with political favors of often dubious legality. These

[3] We use the variable *LAYER* developed by Fan, Wong, and Zhang (2005) in our analysis. This variable is defined to be one when a state asset management agency directly controls the listed firm, two when there is an intermediate company between the government agency and the listed firm, and so on.

hidden costs of foreign financing can partly explain why only a few companies finance themselves globally despite the apparent benefits of doing so.

We use a dummy variable *ALT* to denote the availability of alternative financing sources and develop the following hypothesis:

H3: Firms that are cross-listed (including in the B-share market) are less likely to rely on the guarantee circle than firms that are listed in the domestic A-share market only.

3.2 The Effects of Macroeconomic Factors

3.2.1. Provincial Economic Development

Firstly, firms in less developed provinces are less able to borrow directly from banks in the external capital market than their peers in provinces with better economic growth. Even if they could obtain bank loans, additional security might be requested. Wang (2004) shows that in provinces with better economic development, such as Guangdong Province, the non-state-owned firms received more direct financial support from financial institutions compared to their counterparts in the less developed provinces. Therefore, it is more likely that firms in less developed provinces seek a guarantor for their bank loans.

Secondly, in less developed provinces, uncertainties due to the lack of credibility information of the firms could discourage banks from accepting the risk of unsecured loans. Even if firms manage to obtain direct loans from the bank, they might be charged a higher interest rate. In contrast, banks tend to charge a lower interest rate when these firms can provide a guarantor as an additional security. As a result, such firms might turn to guaranteed financing for the lower interest costs.

Lastly, ventures in less developed provinces are usually the first of their kind to be operated within the province, and information regarding its viability and profitability is lacking, which increases the uncertainties and risks of business failure. This could in turn lead to a higher required level of security to be attached to the loans.

Based on the above analysis, we use the natural log of GDP per capita (denoted as *GDP*) in 31 provinces to proxy for the provincial economic development and then develop the following hypothesis:

H4: The higher the GDP is in the province where the firms operate, the less likely such firms will involve in the guarantee circle.

3.2.2. Development of External Capital Market

One function of the internal capital market is to provide funds to firms that have growth potential but are financially constrained or temporarily financially distressed due to underdevelopment of the external financial market or information asymmetry (Claessens, Fan, and Lang. 2006). Guarantee circle can provide a similar function. Therefore, a well-developed external capital market can lower the necessity of the development of the guarantee circle since the external market serves as a direct source of capital and a mechanism to ensure that investors have access to information about firms' activities.

Demirgüç-Kunt and Maksimovic (1998) find that firms use more external financing in countries with large banking sectors. In a region with a more developed banking system, there should be more sufficient supply of bank loans, more available information about the firms' performance, and more efficient financial intermediaries. Hence, it is more likely that firms with better growth opportunities obtain financing directly from the banks. Applying data from surveys from developing and transitional economies, Clarke, Cull, and Martinex Peria (2001) find that foreign bank penetration in a country improves the financing conditions of firms. China's official entry to the WTO in 2001 has introduced a reform to the banking system, particularly the reduction of barriers to foreign banks' entry into China. Foreign banks are expected to compete on equal footage as the Chinese banks. As foreign banks increase the competition in the banking industry, the local banks have to make more loans to firms in order to secure their customer base. Li, Yue, and Zhao (2009) find a strong positive relation between the banking development index developed by Fan, Wang, and Zhu (2007) and short-term leverage, which implies that it is easier for firms to obtain bank loans when the banking system is more developed.

In our study, we also use the banking development index (denoted as *BANK*) from Fan, Wang, and Zhu (2007) to measure the different extent of development of the external capital market in 31 provinces. Based on the above arguments, we have the following hypothesis:

H5: The more developed the external capital market is in the province where the firms operate, the less likely the firms will rely on the guarantee circle.

3.2.3. Quality of Legal Protection

Nanda (2002) finds a highly significant negative correlation between the law and order variable and rate of return on long-term capital, which is consistent with the conjecture that a well-functioning legal system reduces political risks and, therefore, reduces required

rate of return on investment. Hence, we expect that a good legal system can effectively lower financing cost in the external market and then reduce the need for guarantee circles.

On the supply side, banks in provinces with better legal environment are more willing to issue loans to firms as the bank's risks and costs involved in non-payment are much lower, as the financial system is better governed by the law and regulations. In contrast, provinces with poor legal environment provide little legal protection to the banks so that the risks and costs involved in non-payment are much higher, as the banks have to find ways to enforce repayments. In these provinces with poor legal environment, therefore, the banks might require higher security such as a guarantor for the loans.

Demirgüç-Kunt, Laeven, and Levine (2003) suggest that property rights contribute to the efficiency in the operation of financial contracts, which in turn has a positive effect on financial market development. Beck and Levine (2004) also show that external financing increases with property rights protection because the banks are better protected in recovering their assets should the borrowers default. Accordingly, we expect that banks would be more willing to issue direct loans to firms in provinces with higher property rights protection. We then apply the property rights index (denoted as *PROPERTY*) developed by Fan, Wang, and Zhu (2007) to represent the quality of legal protection and have the following hypothesis:

H6: The higher the quality of legal protection is in the province where the firms operate, the less likely firms will rely on the guarantee circle.

3.2.4. Government Intervention

In a fully marketized economy, the pool of funds is available to all firms and the selection criteria adopted by the banks should be strictly based on unbiased profitability evaluation. However, China is in transition from a planned economy to a market economy. Bargaining for scarce resources is common, and financing is highly uncertain because funding varies with state political whims and the personal allegiances of high-ranking officials (Keister, 2004). Although the intervention from local government has recently declined, central government intervention in allocating credit has continued (Shirai, 2002). It is widely perceived that SOBs tend to favor SOEs over other firms in terms of credit allocation. For example, it was reported that the SOEs in China accounted for less than a quarter of industrial output in 2000.[4] However, they absorbed three-quarters of all bank

[4] Business China, "Grossly Distorted Product", dated 18th February 2002, retrieved from Economist Intelligence Unit database.

lending in the late 1990s (Boyreau-Debray, 2003). This implies that SOBs have been supportive of the SOEs despite of the low profitability and even their inability to repay their debts, which results in significant percentage of non-performing loans. This is especially the case in regions with more government intervention due to credit rationing. The non-state-owned firms then need to provide additional security as guarantors to compete for the limited funds left in SOBs.

Deregulation was initialized in 1995 when the SOBs were given greater decision-making autonomy and encouraged to participate more actively in the economic development process. Bank credit analysis gradually overtook SOEs budgetary allocations and banks themselves were expected to become more profit-oriented. According to Chen, Skully, and Brown (2005), deregulation appeared to have enhanced cost efficiency and allocation efficiency of Chinese banks especially in the early period of deregulation. The better allocation efficiency and less costly access to bank loans for firms in need of funding will result in lesser need for the firms to involve in the guarantee circle. We then conjecture that the extent of government intervention should matter when the firms decide whether to join the guarantee circle or not. Deregulation Index (denoted as *DEREG*) developed by Demurger et al. (2002) is used as a proxy for the extent of government intervention. The higher the deregulation index is, the greater the extent of marketization in the province is, and the less the extent of government intervention is. Then we set up the following hypothesis:

H7: The more government intervention is in the province where firms operate, the more likely the non-state-owned firms will rely on the guarantee circle.

3.3 Control Variables

Besides the microeconomic and macroeconomic factors aforementioned, we also consider the other firm-specific characteristics that might affect the decision of the firms' involvement in the guarantee circle.

3.3.1 Profitability

Besides abundant retained earnings of their own, more profitable firms are generally more capable of securing other sources of financing in the external capital market such as bank loans, equity issuances or bond issuances (Zou and Xiao, 2006). As a result, the more profitable the firms are, the less likely they will need to rely on the guarantee circle for loans.

3.3.2 Size

Stiglitz and Weiss (1981) suggest that information asymmetries and agency costs are the major reasons for the lack of funds flowing to small enterprises. In addition, SMEs have a limited amount of collateral to be provided to the banks, thus blocked access to external financing (Mu, 2002). On the contrary, large firms have the ability to provide collateral to the banks as a form of security for their loans and are often more credible and financially robust from the banks' point of view. Therefore, larger firms are more likely to obtain direct loans from the bank. On the supply side, banks generally would prefer to issue larger-sized loans to larger enterprises since they would enjoy economy of scale or lower per-dollar loan cost per transaction (Mu, 2002). Therefore, as compared to small firms, large ones are less likely to seek loans through the guarantee circle. However, it is worth noting that they are more likely to be the provider of the guarantee service for smaller related firms.

3.3.3 Age

Younger firms are more likely to be in the growing stage and be in need of financing for their expansion plans. However, as young firms generally do not have the financial or cash flow stability compared to blue chip firms, they have more difficulties in obtaining bank loans unless they have a credible guarantor. In addition, information asymmetry coupled with the lack of credit history makes it even more difficult for young firms to get financing directly from banks. Thus, the access to the other funds is more important for them than for more mature firms (Claessens, Fan, and Lang, 2006) and many of them might have no other choice but rely on the guarantee circle. In contrast, the more mature firms could be the good guarantors.

3.3.4 Financial Leverage

Between two firms, ceteris paribus, the firm that operates at a higher financial leverage is generally considered riskier in terms of insolvency. Thus, banks may require a guarantor as an additional security or otherwise charge a higher interest rate to justify the risks that they bear. Therefore, firms with a higher financial leverage are more likely to rely on the guarantee circle for loans. On the other hand, when a firm is deeply involved in providing loan guarantee to other firms, the higher default risk might require it to provide more for the possible liabilities from the guarantee provided, hence resulting a positive relation between leverage and guarantee provided.

3.3.5 Tangibility

Firms with more tangible assets are more capable of providing collaterals for financing, which results in easier access to direct bank loans that requires an additional form of security. On the other hand, firms with few tangible assets might need to have a guarantor for loans.

3.3.6 Related Party Loans

Besides financing from the external capital market, firms could receive 'internal' loans from related parties. Firms are generally more willing to make loans to associated firms as they are in the same group and have closer relationship with each other. Likewise, firms might also be under pressure from the parent company to make loans to related firms with the same controlling shareholder. Related party guarantee and related party loans could serve as alternative financing sources.

On the other hand, prior research such as Berkman, Cole, and Fu (2010) argue that the total value of related party loans could reflect the degree of exploitation of minority shareholders. If a large amount of related party loans are used for tunneling, it is more likely that the firm is subject to serious expropriation by controlling shareholders. Then it is expected that the firm could be deeply involved in the guarantee circle as well since loan guarantee could be another way for tunneling.

3.3.7 Incentive and ability of tunneling

Besides the total value of related party loans, the cash flow rights of the controlling shareholder and the control rights of the non-controlling block shareholders can also help to measure the strength of corporate governance and probability of expropriation by the controlling shareholders indirectly. Following Berkman, Cole, and Fu (2010), we define two variables, *CF30* and *DOMINANCE*, as proxies for the incentive of controlling shareholder and the monitoring from non-controlling block shareholders. *CF30* equals one if the cash flow right of the largest shareholder is larger or equal to 30% of total shares outstanding, and it equals zero otherwise. *DOMINANCE* represents the sum of total shareholding percentage of the second to tenth shareholder of the firm. If *CF30* equals zero and/or *DOMINANCE* is smaller, the worse the firms' governance is, which implies that the controlling shareholders have more ability and incentive to expropriate the minority shareholders. In other words, if related party guarantee is used as a means to expropriate minority shareholders, we should observe less related part guarantee when *CF30* equals one and/or *DOMINANCE* is bigger.

3.3.8 Industry Dummies

Different industries are exposed to different risks. In general, firms in a growing industry, though in higher demand for external funds, face much more uncertainties in their expected rate of returns compared to firms in a mature industry, which would in turn affect the probability of getting bank loans to support their growth.

In addition, industry dummies help capture the existence of significant differences in state protection and capital structure of various industries. Firms in government-protected industries, e.g. agriculture industry, are more likely to obtain bank loans, especially from the SOBs. This is because the government is willing to bail out the firms in the event of default payments. Moreover, these industries are more likely to obtain subsidies from the government.

The abovementioned variables to be used in the analysis are summarized in Table 1.

[Insert Table 1 Here]

4. EMPIRICAL TESTS

4.1. Data

Our sample covers all Chinese firms listed in the Shanghai and Shenzhen stock exchanges from 1997 to 2005 with the required financial data from CSMAR database. Group structure information is from Fan, Wong, and Zhang (2005). The regional statistics and other macroeconomic information are obtained from China Data Online and Fan, Wang and Zhu (2007). The data of loan guarantees are manually collected from the listed companies' annual reports. The industry distribution of our sample is shown in Table 2.

[Insert Table 2 here]

According to the CSRC industry classification, our original sample firms are from 22 different industries. After excluding firms in the financial industry, the final 9,060 firm-years are from 21 different industries, ranging from 714 firms in year 1997 to 1,129 firms in year 2001, respectively. The largest industry in our sample is Machinery, Equipment and Instrument Manufacturing industry with 1,397 firm-years in total. Wood and Furniture industry has fewest observations of only 15 firm-years throughout the whole sample period.

Table 3 shows the summary statistics of loan guarantee. *GRT_received/TA* is the ratio of the amount of guarantee received divided by total assets, while *GRT_provided/TA* is the ratio of the amount of guarantee provided divided by total assets.

[Insert Table 3 here]

Although not reported in the table, it is worth pointing out that the average loan guarantee including both guarantee received and guarantee provided throughout the whole sample period amounted to approximately RMB 87 million. 7% to 53% of listed firms were involved in the guarantee circle from 1997 to 2005, in which 4% to 43% of the firms acted as guarantee receiver while 4% to 24% of the firms acted as guarantee provider. To some extent, this explains why the average net guarantee (not reported in the table), measured by the difference between guarantee received and the guarantee provided, scaled by total assets, has a positive value of 1.45%.

Contrary to our expectation, listed firms on average tend to borrow with a guarantor rather than act as guarantor in other firms' financing activities. As shown in Panel A of Table 3, the mean of *GRT_received/TA* is larger than that of *GRT_provided/TA* every year except for the year 2005. Before 2005, the average percentage of loan guarantee received increases dramatically over time while the average percentage of loan guarantee provided remains relatively stable, as shown in Figure 1. The mean of *GRT_received/TA* is 5.4550% in 2004, the largest in the nine years. In contrast, the mean of *GRT_received/TA* drops to only 0.0110% in the next year. Similarly, the mean of *GRT_provided/TA* decreases from 1.6950% to 0.0250% in 2005 as well. This is consistent with the government enforcement of the loan guarantee regulations among listed firms since 2005.

[Insert Figure 1 here]

Panel B of Table 3 shows the comparison between firms controlled by the state and those not controlled by the state. Non-state-controlled firms on average receive and provide significantly higher guaranteed loans than state-controlled firms.

Panel C of Table 3 presents the average guarantee ratios across 21 industries. The amounts of guarantee received or provided vary significantly across different industries. Other Manufacturing industry has the highest average borrowing using guarantee at 3.467% of total assets while Wood and Furniture industry has none. In view of the great difference in the guarantee ratio across 21 industries, it is necessary to include industry dummies in the regression analysis.

Table 4 presents the summary statistics of all the variables to be used in the regression analysis. In this study, we define two dummy variables of loan guarantee. One dummy variable is *RECEIVER*, which is set to be one if the firm acts as the guarantee receiver and zero otherwise. The other dummy variable is *PROVIDER*, which is set to be one if the firm provides guarantee to other firms and zero otherwise. Both variables are restated on an annual basis. The mean of *RECEIVER* is 0.228, much larger than that of *PROVIDER* (0.140). This confirms that the number of firms as guarantee receivers is greater than that of firms as guarantors.

[Insert Table 4 here]

The natural logarithm of GDP per capita (*GDP*) has a mean of 8.37 varying from 4.344 to 9.683. Bank development index (*BANK*) varies from 0.19 to 7.94, with a standard deviation of 2.25. The mean of property rights protection index (*PROPERTY*) is 6.706 whereas deregulation index (*DEREG*) has a mean of 1.275. As indicated by the mean of variable *STATE*, on average, the state controls 78.1 percent of the sample firms throughout the whole sample period, which is consistent with the observation that more state-owned firms gain access to the Chinese equity market. The mean of *LAYER* is 2.223, varying from one to five. It is consistent with the findings of Fan, Wong, and Zhang (2005) that the pyramidal corporate structure is prevalent in China. As for alternative financial resources (*ALT*), *ALT* is set to be one if the sample firms either issue B shares or cross list in overseas markets, and zero otherwise. There are no firms that do both. As such, the mean of *ALT,* suggests 11.3% of firms have alternative financial resources as mentioned above. The profitability variable, *PROFIT*, has a mean of 0.019. Some listed firms suffer from losses, as indicated by the minimum of *PROFIT* as -0.44. The average *SIZE* of the sample firms, measured by the natural logarithm of firms' total assets, is 21.798 (median as 21.006). This is approximately equivalent to RMB 2,930 million (median RMB 1,327 million). The average age of sample firms, measured by the number of listing years since IPO, is 4.937. The average leverage ratio (*LEV*) is 47.8%, as measured by total liabilities divided by total assets. The tangibility ratio (*TANG*) is 0.30 on average. The mean of *RPLOAN* is 0.025, which indicates that the related party loans are around 2.5% of total assets on average. The dummy variable *CF30* has a mean of 0.678 and a median of 1, which indicates that the largest shareholder owns more than 30% of cash flow rights in more than half of the Chinese firms. The statistics on *DOMINANCE* further confirm that the non-controlling block holders might not be able to control the tunneling activities of the controlling shareholder.

The correlation matrices presented in Table 5 suggest that bank development index (*BANK*), property rights index (*PROPERTY*), and deregulation index (*DEREG*) are highly correlated with a correlation coefficient varying from 0.40 to 0.69 ($p < 0.05$). Therefore, we check the variance inflation factor (VIF) when we include all the three variables into the regression. It turns out that the VIF is less than 5 for all the regressions, which implies that the multi-collineality is not a critical issue here.

[Insert Table 5 here]

The correlation matrices also show a significantly positive correlation ($p < 0.05$) between the three control variables, *SIZE*, *AGE* and *LEV*, and both dependent variables (*RECEIVER* and *PROVIDER*). This agrees with our conjecture that larger firms with longer history and higher leverage are more likely to be involved in the guarantee circle. On the other hand, we observe a significantly negative correlation ($p < 0.05$) between *PROFIT* and the two dependent variables, which again is consistent with our conjecture that more profitable firms are less likely to join the guarantee circle.

4.2. Regression Analysis

In this section we will discuss the multivariate regression results concerning the macroeconomic and microeconomic effects on the likelihood of a firm's involvement in the guarantee circle. Following prior studies, we start from the effects of firm-specific characteristics on the firm's decision and then extend the analysis to macroeconomic factors to investigate if these factors moderate the microeconomic effects.

4.2.1 Microeconomic Factors on Guarantee Circle

Table 6 shows the probit regression results about the effects of microeconomic factors on the involvement of the guarantee circle. The dependent variables are the dummy variables which indicate the firm's involvement in the guarantee circle as guarantee receiver or provider. Specifically, *RECEIVER* equals one if the firm acts as the guarantee receiver and zero otherwise, while *PROVIDER* equals one if the firm provides guarantee to other firms and zero otherwise. The key microeconomic factors to be examined include nature of the ultimate controlling shareholder (*STATE*), organizational layers of group (*LAYER*), and availability of alternative financial resources (*ALT*). For the sake of brevity, in all tables that report regression results, we suppress reporting of the coefficients on industry dummies. Our inferences are all based on *p*-statistics, which allows clustering by both firm and year following Cameron, Gelbach, and Miller (2011) and Thompson (2011).

[Insert Table 6 Here]

In Panel A, the dummy variable *RECEIVER*, which indicates whether the firm receives any loans with a guarantor (*RECEIVER*=1) or not (*RECEIVER*=0), is regressed on *STATE*, *LAYER*, *ALT* and other control variables. Consistent with our hypotheses, we find significantly negative coefficients on *STATE*, which suggests that firms with the government as the ultimate shareholder are less likely to be the guarantee receiver, probably because they have easy access to bank loans and other external financing sources. On the other hand, listed companies in a group with more layers are more likely to obtain loans through the help of other associated companies, as indicated by the significantly positive coefficient on *LAYER*. It is reasonable since there are more candidates who can act as guarantors for the loans within a more complex group. The coefficients on *ALT* are negative, but not significant. Results are qualitatively the same when all three microeconomic factors, *STATE*, *LAYER*, and *ALT*, are included in regression model (4).

In Panel B of Table 6, the dummy variable *PROVIDER*, which indicates whether a firm provides guarantee to others (*PROVIDER* = 1) or not (*PROVIDER* = 0), is regressed on the same set of independent variables as in Panel A. In Model 1, the coefficient on *STATE* is 0.085, significantly positive. This regression result of Model 1 shows that firms ultimately controlled by the state are more likely to act as a guarantor for other firms. This is consistent with the conjecture that state-controlled firms can levy on their relations with the government to gain access to the financial market and are in a better position to provide guarantee to other non-state-owned firms. Similar to the results in Panel A, the coefficient on *LAYER* is also significantly positive. Hence, firms in more complex groups (i.e. with more layers within the group) are more likely to act as a guarantor for other firms, probably due to the higher demand for funds from the 'siblings' and other associated firms. In addition, the significantly positive coefficient on *ALT* suggests that firms with alternative financial sources are more likely to act as guarantors for other firms. There are mixed results as to whether better standards and over-seas listing really promote good corporate citizenship (Ball, Robin, and Wu, 2003; Lang, Lins, and Miller, 2003; Ke, Rui, and Yu, 2009). Alternative financing sources, including B share and overseas listings, can play both the role of enhancing reputation and that of disciplining the listing firm. Our result is more consistent with the reputation enhancement argument. When all the three microeconomic factors, *STATE*, *LAYER*, and *ALT*, are put into the regression model together, the coefficients on *LAYER* and *ALT* remain significant.

Consistent with prior studies, larger firms and highly leveraged firms are also more likely to be involved in the guarantee circle. Firms with longer listing history are also more likely to act as a guarantor. It is consistent with the intuition that the more mature firms with track records tend to be good guarantors. As for the three variables that measure firms' corporate governance (*RPLOAN*, *CF30* and *DOMINANCE*), *DOMINANCE* is generally insignificant to affect a firm's decision to involve in the guarantee circle. Interestingly, when the controlling shareholder has higher cash flow rights in the listed company (*CF30*=1), the listed firm is more likely to receive guarantee from other firms but this cash flow rights effect is not significant in determining listing firm's decision to provide guarantee. The significantly positive coefficient on *RPLOAN* in Panel B of Table 6 suggests that firms with more related party loans might be subject to severe expropriation problem by the controlling shareholders and hence are more likely to provide guarantee to other firms as another way of tunneling.

4.2.2 Joint Impacts of Microeconomic and Macroeconomic Factors

Concerning the impact of macroeconomic factors on the firm's involvement in the guarantee circle, we run the probit regressions including both microeconomic and macroeconomic factors in the models. The regression results are shown in Table 7, in which the two dependent variables are the same as those in Table 6.

[Insert Table 7 Here]

In the first four models of Panel A of Table 7, we regress *RECEIVER* on each of the four macroeconomic variables, i.e. *GDP* (natural logarithm of GDP per capita), *BANK* (bank development index), *PROPERTY* (property rights index) and *DEREG* (deregulation index), along with the corresponding variables that represent their interactions with *STATE* (nature of ultimate shareholder). In Model 5, we then examine the parallel impacts of both microeconomic and macroeconomic variables. Model 6 includes all the interaction variables between *GDP* (natural logarithm of GDP per capita), *BANK* (bank development index), *PROPERTY* (property rights index) and *DEREG* (deregulation index) with *STATE* (nature of ultimate shareholder). The three microeconomic variables, *STATE*, *LAYER* and *ALT*, are included in all six models.

The results show that firms controlled by the state are less likely to be receiver of loan guarantees, probably due to their superior access to financing provided by the SOBs. However, when the interaction term *STATE⊗GDP* is added in the regression the coefficient

on *STATE* loses the significance. This might suggest that in regions with low economic development, both state-controlled and non-state-controlled firms receive similar amount of loan guarantee from other firms. But in more developed regions, the negative coefficient on the interaction term between *STATE* and *GDP* in Model 1 suggests that state-controlled firms in more developed regions are less likely to receive guaranteed loans than other firms. Surprisingly, firms in regions of better economic development, measured by natural logarithm of GDP per capita in the provinces, are more likely to obtain guaranteed loans (β = 0.169, p = 0.00). This could be due to higher demand of funds induced by higher level of economic activities and growth. Holding the development of banking system and availability of funds constant, firms might have more intensive competition in obtaining funding for their growths during the credit rationing process, which places more constraints on their own borrowing capacity. As a result, they might have to levy on another mechanism, e.g. a guarantor, to enhance their chances of getting the loan. In other words, the higher demand and competition for funding lead to the higher probability of borrowing using loan guarantee.

In addition, firms in regions with more developed external capital market (β = -0.025, p = 0.04), better property rights protection (β = -0.082, p = 0.00), and less government intervention (β = -0.046, p = 0.05) are also less likely to obtain loans through the guarantee circle. A significant positive coefficient on the interaction variable *STATE⊗PROPERTY* seems to suggest that the probability of a state-controlled firm receiving guaranteed loans does not vary with the change in property rights protection as the combined coefficient on *PROPERTY* and *STATE⊗PROPERTY* is slightly positive. Taken together, the results suggest that state-controlled firms are less likely to receive guaranteed loans than other firms, when the region's property protection is poor, but the gap between the two types of firms reduces as the property protection in the region improves. In other words, the property rights protection improvement mainly affects the non-state-controlled firms. The positive coefficient on *STATE⊗PROPERTY* remains significant in the complete Model 6 with all macroeconomic, microeconomic effects and their interactions. The coefficient on the interaction variable *STATE⊗DEREG* is also significantly positive in Model 4 but loses significance when all the variables are put into the regression model. The interactions between another macroeconomic variable *BANK* and state control do not have significant impact on the dependent variable *RECEIVER*.

Similar to Table 6, firms with more layers in the group are more likely to receive loan guarantee from other related firms.

In Panel B of Table 7, *PROVIDER* is regressed on the same set of independent variables as in Panel A. Similar to Table 6, firms with alternative financing sources are more likely to act as loan guarantors for other related firms. However, the coefficients on state control and pyramidal layer are no longer significant after adding the macroeconomic variables to the regression models. As for the general effects of macroeconomic factors, firms in regions with better property rights protection are more likely to act as guarantors for other firms. This indicates that firms might be more willing to act as guarantor when there is better property rights protection in the region and hence the different parties are better able to enforce the contracts.

When it comes to the interaction effects of macroeconomic and microeconomic factors, only the coefficient on the interaction term between *STATE* and *BANK* is significant. This is a little bit puzzling as it suggests that firms controlled by the state are more likely to act as guarantors for other firms in regions with a better developed banking system.

5. Conclusion

This paper investigates the various elements that determine the Chinese listed firms' involvement in the guarantee circle from 1997 to 2005. Both microeconomic and macroeconomic factors are examined and both are shown to have significant effects on whether the firms are involved in the guarantee circle or not. Besides the firm-specific characteristics which have already been studied in earlier literature, we further examine three microeconomic factors, state control, pyramidal corporate structure and availability of alternative financing sources. It turns out that firms controlled by the state are less likely to receive guarantee but more likely to provide guarantee, while firms with alternative financing sources are more likely to provide guarantee. Moreover, firms in a complex group with more pyramidal layers are more likely to get involved in the guarantee circle, either as a guarantee provider or a receiver. Our hypotheses regarding the three macroeconomic factors, i.e. provincial economic development, development of external capital market and property rights protection, are partially supported by our empirical results. Firms in regions with higher economic growth, worse financial market development, and worse property rights protection are found to be more likely to receive bank guarantee. The impacts of economic development and property rights protection, however, are less pronounced for state-controlled firms. Such results could be of interest to Chinese regulators who aim at coordinating the development of external and internal capital markets, and the by-product in between,

guaranteed loans. Specifically, constraints on the external capital market should be relaxed in order to even out the playground between different types of firms, promote further development and, in effect, to reduce the significance of loan guarantee. In addition, more disclosure and governance on the guaranteed loans should be imposed to ensure that such mechanism would not be abused. Consequently, moral hazards and other costs associated with the guarantee circle could be mitigated, for the benefits of the economy as a whole.

The relative macroeconomic environment remains fairly stable over the years in our sample period. Due to the limited data, we do not have sufficient time periods to observe the relation between institutional change of each region and change in firms' probability of involving in the guarantee circle. Hence, a rigorous time series analysis is impossible here. Instead, we conduct a cross-sectional analysis making use of the unequal institutional development of different regions in China. When data are available, further research could be done to examine the effects of change in institutional environments on the change in firms' decisions of joining the guarantee circle over time. Another interesting topic for further research is to examine the possible financial and non-financial consequences to members of the guarantee circle, so as to verify our conjectures about the costs and benefits of the guarantee circle more extensively.

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Table 1. Definition of variables

Panel A: dependent variables		
Guarantee dummies	*RECEIVER*	=1 if the firm receives guarantee; =0 otherwise
	PROVIDER	=1 if the firm provides guarantee; =0 otherwise
Panel B: microeconomic factors		
Nature of ultimate shareholder	*STATE*	=1 if the firm's ultimate controlling shareholder is the government; =0 otherwise
Group structure	*LAYER*	the number of layers from the ultimate shareholder to the listed firm
Alternative source of financing	*ALT*	=1 if the firm is cross-listed (including B-share); =0 otherwise
Panel C: macroeconomic factors		
Regional economic development	*GDP*	Natural logarithm of GDP per capita of the province
Development of external capital market	*BANK*	Banking Development Index
Legal protection	*PROPERTY*	Property Rights Index
Government intervention	*DEREG*	Deregulation Index
Panel D: control variables		
Profitability	*PROFIT*	Operating profit / Total assets
Size	*SIZE*	Natural logarithm of total assets
Age	*AGE*	Number of years since IPO
Leverage	*LEV*	Total liabilities / Total assets
Tangibility	*TANG*	Net fixed assets / Total assets
Related party loans	*RPLOAN*	Total amount of loan provided to/received from related parties / Total assets
Cash flow rights of the controlling shareholder	*CF30*	=1 if the percentage shareholding of the largest shareholder ≥ 30%; =0 otherwise
Dominance of the controlling shareholder	*DOMINANCE*	Total shareholding percentage of the 2nd to 10th largest shareholders

Table 2. Industry distribution

The table shows the number of firms in each industry in our sample from 1997 to 2005.

Industry	1997	1998	1999	2000	2001	2002	2003	2004	2005	Pooled
Farming, Forestry, Animal Husbandry, and Fishery	14	18	20	28	29	29	28	27	27	220
Mining	3	6	9	12	15	15	15	15	14	104
Food & Beverage	28	38	45	51	54	54	53	53	53	429
Textile, Apparel, Fur and Leather	25	33	40	52	58	58	58	58	58	440
Wood and Furniture	1	1	1	2	2	2	2	2	2	15
Paper and Allied Products; Printing	11	17	18	21	24	24	24	24	24	187
Petroleum, Chemical, Plastics and Rubber Products Manufacturing	81	93	103	118	129	128	128	127	125	1,032
Electronics	24	27	29	31	35	35	35	35	35	286
Metal , Non-metal	62	74	87	100	104	103	102	102	100	834
Machinery, Equipment and Instrument Manufacturing	109	129	143	162	172	171	170	171	170	1,397
Medicine and Biological Products	34	38	43	53	63	63	63	63	62	482
Other Manufacturing	7	7	11	14	16	16	16	15	13	115
Utilities	27	31	33	40	43	43	43	43	43	346
Construction	11	13	16	17	18	18	18	17	16	144
Transportation and Warehousing	20	25	32	39	45	44	44	44	43	336
Information Technology	39	43	47	54	56	56	55	53	53	456
Wholesale and Retail Trades	83	85	86	96	98	97	97	95	94	831
Real Estate	29	29	30	30	34	33	33	33	33	284
Public Facilities and other Services	26	28	33	39	39	39	39	39	39	321
Communication and Cultural Industries	9	9	10	10	11	11	10	10	9	89
Conglomerates	71	76	81	84	84	82	81	77	76	712
Total	714	820	917	1,053	1,129	1,121	1,114	1,103	1,089	9,060

Table 3. Statistics of loan guarantee

This table presents the summary statistics of loan guarantee, as a percentage of the listed firm's total assets. Panel A reports the average percentage of loan guarantee received or provided each year. *GRT_received/TA* is the ratio of guarantee received divided by total assets, while *GRT_provided/TA* is the ratio of guarantee provided divided by total assets. Panel B compares the average guarantee ratios between state-controlled (*STATE*=1) and non-state-controlled (*STATE*=0) firms. Panel C presents the average guarantee ratios across different industries.

Panel A: guarantee ratio over time

Year	Number of firms	Mean of *GRT_received/TA*	Mean of *GRT_provided/TA*
1997	714	0.3420%	0.2200%
1998	820	0.5840%	0.5500%
1999	917	1.5850%	0.7820%
2000	1,053	1.5630%	0.6710%
2001	1,129	3.1260%	0.7530%
2002	1,121	2.8350%	1.2830%
2003	1,114	3.5170%	0.8420%
2004	1,103	5.4550%	1.6950%
2005	1,089	0.0110%	0.0250%

Panel B: guarantee ratio for non-state-controlled and state-controlled firms

STATE	Number of firm-years	Mean of *GRT_received/TA*	Mean of *GRT_provided/TA*
0	1,970	2.6020%	1.0290%
1	7,090	2.1650%	0.7230%

Table 3. (Continued)

Panel C: guarantee ratio across industries

Industry	Number of firm-years	Mean of *GRT_received/TA*	Mean of *GRT_provided/TA*
Farming, Forestry, Animal Husbandry, and Fishery	220	2.7730%	0.8240%
Mining	104	0.5110%	0.0420%
Food & Beverage	429	1.8660%	0.4180%
Textile, Apparel, Fur and Leather	440	2.1750%	0.8840%
Wood and Furniture	15	0.0000%	0.0000%
Paper and Allied Products; Printing	187	2.0780%	1.5510%
Petroleum, Chemical, Plastics and Rubber Products Manufacturing	1,032	2.5310%	0.5400%
Electronics	286	1.8100%	0.6860%
Metal , Non-metal	834	3.0740%	0.5870%
Machinery, Equipment and Instrument Manufacturing	1,397	2.3690%	0.4750%
Medicine and Biological Products	482	2.8150%	0.7610%
Other Manufacturing	115	3.4670%	2.4920%
Utilities	346	1.2060%	0.4860%
Construction	144	3.4070%	1.0040%
Transportation and Warehousing	336	2.5920%	0.5690%
Information Technology	456	3.2510%	0.8010%
Wholesale and Retail Trades	831	1.4180%	0.9050%
Real Estate	284	2.0040%	1.5720%
Public Facilities and other Services	321	1.6160%	1.3940%
Communication and Cultural Industries	89	1.2970%	0.5840%
Conglomerates	712	1.7780%	1.3840%

Table 4. Descriptive statistics

The table presents the summary statistics of all the variables to be used in the analysis.

Variable	N	Mean	Std	Min	Median	Max
RECEIVER	9,112	0.228	0.420	0.000	0.000	1.000
PROVIDER	9,112	0.140	0.347	0.000	0.000	1.000
GDP	9,110	8.370	0.831	4.344	8.449	9.683
BANK	7,522	5.281	2.250	0.190	5.880	7.940
PROPERTY	9,047	6.706	1.463	2.530	6.820	8.845
DEREG	9,103	1.275	0.814	0.330	1.240	2.860
STATE	9,112	0.781	0.414	0.000	1.000	1.000
LAYER	9,110	2.223	0.725	1.000	2.000	5.000
ALT	9,103	0.113	0.316	0.000	0.000	1.000
PROFIT	9,060	0.019	0.086	-0.440	0.032	0.169
SIZE	9,060	21.798	2.513	18.902	21.006	29.511
AGE	9,112	4.937	3.120	0.000	5.000	12.000
LEV	9,060	0.478	0.231	0.073	0.462	1.596
TANG	9,060	0.300	0.174	0.007	0.275	0.767
RPLOAN	9,060	0.025	0.067	0.000	0.000	0.436
CF30	9,101	0.678	0.467	0.000	1.000	1.000
DOMINANCE	9,101	17.848	13.653	0.210	15.460	66.030

Table 5. Correlation analysis

The upper triangle of the matrix shows the Pearson correlation coefficients among all the variables whereas the lower triangle shows the Spearman correlation coefficients, where * represents significance at the 0.05 level.

	RECEIVER	*PROVIDER*	*GDP*	*BANK*	*PROPERTY*	*DEREG*	*STATE*	*LAYER*	*ALT*	*PROFIT*	*SIZE*	*AGE*	*LEV*	*TANG*	*RPLOAN*	*CF30*	*DOMINANCE*
RECEIVER	1	0.22*	0.11*	-0.01	0.01	0.02	-0.03*	0.07*	0.01	-0.08*	0.21*	0.13*	0.13*	0.02	-0.01	0.05*	-0.02
PROVIDER	0.20*	1	0.08*	0.07*	0.10*	0.10*	-0.02*	0.04*	0.06*	-0.13*	0.13*	0.19*	0.16*	-0.07*	0.01	-0.05*	0.02
GDP	0.09*	0.07*	1	0.47*	0.11*	0.53*	-0.04*	0.05*	0.13*	-0.04*	0.21*	0.30*	0.07*	0.05*	-0.06*	-0.04*	-0.02
BANK	-0.02	0.09*	0.59*	1	0.40*	0.47*	-0.01	0.02*	0.20*	0.04*	0.05*	0.15*	-0.02	-0.05*	-0.02	-0.01	-0.04*
PROPERTY	0.00	0.11*	0.18*	0.45*	1	0.58*	-0.01	0.08*	0.25*	-0.02	0.03*	0.21*	0.06*	-0.09*	0.02*	-0.02	0.00
DEREG	0.00	0.11*	0.57*	0.60*	0.69*	1	-0.06*	0.08*	0.22*	-0.04*	0.02*	0.21*	0.08*	-0.07*	0.03*	-0.10*	0.05*
STATE	-0.03*	-0.03*	-0.05*	-0.02*	0.00	-0.07*	1	-0.01	0.10*	0.11*	0.06*	-0.07*	-0.10*	0.13*	0.01	0.29*	-0.25*
LAYER	0.06*	0.03*	0.05*	0.03*	0.10*	0.08*	0.00	1	0.04*	-0.01	0.04*	0.09*	0.03*	-0.04*	0.01	-0.01	0.07*
ALT	0.00	0.06*	0.15*	0.22*	0.25*	0.24*	0.09*	0.04*	1	-0.04*	0.08*	0.18*	0.05*	0.03*	0.00	0.01	0.04*
PROFIT	-0.11*	-0.17*	-0.05*	0.03*	-0.01	-0.01	0.05*	-0.01	-0.04*	1	-0.04*	-0.26*	-0.57*	-0.01	-0.11*	0.16*	-0.09*
SIZE	0.16*	0.11*	0.21*	0.12*	0.09*	0.09*	0.15*	0.02*	0.14*	-0.01	1	0.40*	0.12*	0.11*	-0.15*	0.03*	-0.04*
AGE	0.07*	0.17*	0.30*	0.19*	0.23*	0.24*	-0.06*	0.06*	0.20*	-0.30*	0.26*	1	0.31*	0.03*	-0.11*	-0.20*	0.05*
LEV	0.15*	0.18*	0.08*	0.00	0.06*	0.08*	-0.08*	0.03*	0.04*	-0.48*	0.15*	0.31*	1	-0.04*	0.06*	-0.19*	0.09*
TANG	0.01	-0.08*	0.03*	-0.05*	-0.13*	-0.10*	0.15*	-0.06*	0.04*	0.04*	0.09*	0.00	-0.09*	1	-0.06*	0.09*	-0.02
RPLOAN	-0.03*	-0.04*	-0.16*	-0.03*	-0.01	-0.02*	0.03*	0.05*	-0.02	0.06*	-0.23*	-0.30*	-0.08*	-0.08*	1	0.05*	-0.05*
CF30	0.05*	-0.06*	-0.06*	-0.01	-0.01	-0.09*	0.30*	-0.02*	0.01	0.15*	0.11*	-0.22*	-0.18*	0.10*	0.14*	1	-0.55*
DOMINANCE	-0.02	0.03*	0.02	-0.04*	0.00	0.04*	-0.26*	0.06*	0.04*	-0.06*	-0.13*	0.08*	0.11*	-0.05*	-0.12*	-0.55*	1

Table 6. Microeconomic determinants of guarantee circle

In this table, we regress the dummy variable that indicates if a firm participates in the guarantee circle as a guarantee receiver (*RECEIVER*) or a guarantee provider (*PROVIDER*) on the microeconomic variables state control (*STATE*), group structure (*LAYER*), and alternative source of financing (*ALT*) along with control variables using probit regression. Industry dummies are included in the regressions but not reported for the sake of brevity. The *p*-values allowing clustering by firm and year are reported in parentheses. *, **, *** represent significance at the 0.10, 0.05 and 0.01 levels, respectively.

Panel A: *RECEIVER* as dependent variable

	(1)	(2)	(3)	(4)
STATE	-0.163			-0.158
	(0.00)***			(0.00)***
LAYER		0.112		0.113
		(0.00)***		(0.00)***
ALT			-0.101	-0.082
			(0.32)	(0.40)
PROFIT	-0.125	-0.184	-0.168	-0.140
	(0.66)	(0.51)	(0.55)	(0.64)
SIZE	0.086	0.084	0.084	0.086
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
AGE	0.029	0.027	0.031	0.028
	(0.20)	(0.22)	(0.18)	(0.21)
LEV	0.594	0.591	0.596	0.587
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
TANG	0.171	0.165	0.157	0.186
	(0.15)	(0.16)	(0.19)	(0.12)
RPLOAN	0.266	0.220	0.258	0.258
	(0.62)	(0.68)	(0.62)	(0.62)
CF30	0.302	0.265	0.278	0.300
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
DOMINANCE	0.002	0.002	0.003	0.002
	(0.18)	(0.14)	(0.02)**	(0.20)
Intercept	-3.351	-3.641	-3.419	-3.598
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
N	9,060	9,060	9,060	9,060
Pseudo R^2	0.07	0.07	0.07	0.07

Table 6. (Continued)

Panel B: *PROVIDER* as dependent variable

	(1)	(2)	(3)	(4)
STATE	0.085			0.071
	(0.09)*			(0.18)
LAYER		0.041		0.041
		(0.06)*		(0.07)*
ALT			0.168	0.158
			(0.00)***	(0.00)***
PROFIT	-0.698	-0.673	-0.683	-0.709
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
SIZE	0.041	0.042	0.042	0.042
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
AGE	0.074	0.073	0.070	0.070
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
LEV	0.531	0.526	0.524	0.526
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
TANG	-0.761	-0.742	-0.762	-0.763
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
RPLOAN	0.561	0.567	0.548	0.535
	(0.07)*	(0.08)*	(0.09)*	(0.10)*
CF30	0.005	0.018	0.010	-0.005
	(0.93)	(0.76)	(0.87)	(0.92)
DOMINANCE	0.001	0.000	0.000	0.000
	(0.75)	(0.87)	(0.88)	(0.90)
Intercept	-2.444	-2.493	-2.400	-2.513
	(0.00)***	(0.00)***	(0.00)***	(0.00)***
N	9,060	9,060	9,060	9,060
Pseudo R^2	0.08	0.08	0.08	0.08

Table 7. Joint impacts of different determinants on guarantee circle

In this table, we regress the dummy variable that indicates if a firm participates in the guarantee circle as a guarantee receiver (*RECEIVER*) or a guarantee provider (*PROVIDER*) on both macroeconomic and microeconomic variables (*STATE*, *LAYER*, *ALT*) along with control variables using the probit regression. The macroeconomic variables include natural logarithm of GDP per capita (*GDP*), Banking Development Index (*BANK*), Property Rights Index (*PROPERTY*), and Deregulation Index (*DEREG*). We also include the interaction of state control (*STATE*) and one of macroeconomic variables (*STATE⊗GDP*, *STATE⊗BANK*, S*TATE⊗PROPERTY*, and *STATE⊗DEREG*). Industry dummies are included in the regressions but not reported for the sake of brevity. The *p*-values allowing clustering by firm and year are reported in parentheses. *, **, *** represent significance at the 0.10, 0.05 and 0.01 levels, respectively.

Panel A: *RECEIVER* as dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)
GDP	0.169				0.159	0.224
	(0.00)***				(0.02)**	(0.00)***
BANK		-0.025			-0.032	-0.042
		(0.04)**			(0.00)***	(0.01)***
PROPERTY			-0.082		0.033	-0.046
			(0.00)***		(0.03)**	(0.01)***
DEREG				-0.046	-0.067	-0.033
				(0.05)**	(0.25)	(0.47)
STATE⊗GDP	-0.082					-0.088
	(0.06)*					(0.28)
STATE⊗BANK		0.019				0.013
		(0.24)				(0.43)
STATE⊗PROPERTY			0.100			0.105
			(0.00)***			(0.00)***
STATE⊗DEREG				0.056		-0.039
				(0.00)***		(0.54)
STATE	0.546	-0.255	-0.827	-0.234	-0.150	-0.115
	(0.13)	(0.00)***	(0.00)***	(0.00)***	(0.01)***	(0.89)
LAYER	0.114	0.097	0.107	0.112	0.095	0.089
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
ALT	-0.096	-0.046	-0.094	-0.085	-0.043	-0.052
	(0.32)	(0.64)	(0.28)	(0.34)*	(0.63)	(0.55)
PROFIT	-0.184	0.192	-0.169	-0.131	0.183	0.194
	(0.56)	(0.41)	(0.59)	(0.66)	(0.44)	(0.47)
SIZE	0.083	0.081	0.085	0.086	0.076	0.076
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
AGE	0.022	0.002	0.029	0.029	-0.004	-0.003
	(0.28)	(0.90)	(0.22)	(0.22)	(0.80)	(0.86)
LEV	0.587	0.670	0.586	0.587	0.669	0.674
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
TANG	0.157	0.106	0.180	0.185	0.068	0.075
	(0.18)	(0.35)	(0.13)	(0.12)	(0.54)	(0.49)
RPLOAN	0.260	0.113	0.274	0.268	0.156	0.171
	(0.60)	(0.83)	(0.58)	(0.60)	(0.74)	(0.71)
CF30	0.300	0.278	0.308	0.301	0.271	0.272
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
DOMINANCE	0.002	0.001	0.002	0.002	0.001	0.001
	(0.12)	(0.45)	(0.13)	(0.19)	(0.45)	(0.39)
Intercept	-4.920	-3.076	-3.006	-3.528	-4.356	-4.359
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
N	9,042	7,461	8,979	9,035	7,454	7,454
Pseudo R^2	0.07	0.06	0.07	0.07	0.06	0.06

Table 7. (Continued)

Panel B: *PROVIDER* as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
GDP	0.023				-0.021	-0.017
	(0.59)				(0.69)	(0.82)
BANK		0.003			0.017	-0.011
		(0.90)			(0.06)*	(0.54)
PROPERTY			0.044		0.028	0.062
			(0.08)*		(0.09)*	(0.13)
DEREG				0.046	0.054	0.004
				(0.43)	(0.39)	(0.96)
STATE⊗GDP	0.054					-0.003
	(0.26)					(0.96)
STATE⊗BANK		0.034				0.037
		(0.01)***				(0.03)**
STATE⊗PROPERTY			0.007			-0.042
			(0.82)			(0.35)
STATE⊗DEREG				0.066		0.063
				(0.23)		(0.47)
STATE	-0.389	-0.129	0.019	-0.019	0.058	0.083
	(0.32)	(0.08)*	(0.93)	(0.68)	(0.30)	(0.89)
LAYER	0.037	0.038	0.037	0.035	0.037	0.036
	(0.11)	(0.11)	(0.09)*	(0.14)	(0.14)	(0.13)
ALT	0.145	0.148	0.105	0.105	0.118	0.114
	(0.00)***	(0.00)***	(0.01)***	(0.02)**	(0.01)***	(0.01)***
PROFIT	-0.740	-0.634	-0.784	-0.753	-0.667	-0.658
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
SIZE	0.040	0.039	0.043	0.044	0.041	0.042
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
AGE	0.066	0.055	0.065	0.066	0.051	0.051
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
LEV	0.521	0.555	0.513	0.507	0.537	0.538
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
TANG	-0.779	-0.782	-0.733	-0.748	-0.753	-0.756
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
RPLOAN	0.544	0.352	0.489	0.490	0.292	0.303
	(0.09)*	(0.35)	(0.13)	(0.12)	(0.42)	(0.40)
CF30	-0.006	-0.027	-0.006	-0.002	-0.028	-0.032
	(0.92)	(0.65)	(0.90)	(0.97)	(0.62)	(0.57)
DOMINANCE	0.000	0.001	0.001	0.000	0.001	0.000
	(0.89)	(0.87)	(0.83)	(0.89)	(0.86)	(0.89)
Intercept	-2.633	-2.323	-2.814	-2.584	-2.520	-2.559
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
N	9,027	7,448	8,964	9,020	7,441	7,441
Pseudo R^2	0.09	0.08	0.09	0.09	0.08	0.08

Figure 1. Loan guarantee over time

The figure plots the average loan guarantee received or provided as a percentage of the listed firm's total assets each year. *GRT_received/TA* is the ratio of guarantee amount received divided by total assets, while *GRT_provided/TA* is the ratio of guarantee amount provided divided by total assets.