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Role of government in improving SME access to financing: Credit guarantee schemes and the way forward

กลไกการค้ำประกันสินเชื่อของภาครัฐและการเข้าถึงแหล่งเงินทุนของ SME

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"The opinions expressed in this paper are those of the authors and should not be attributed to the Bank of Thailand"

Abstract

Small and Medium Enterprises (SMEs) have limited access to financial institutions' loans due to lack of credit history, collateralization, as well as reliable financial statements. Among others, credit guarantee is the most common and arguably most effective tool for the government intervention in SME financing. The Portfolio Guarantee Schemes (PGS), which was first introduced by Thai Credit Guarantee Corporate (TCG) in 2009, has helped stimulate commercial bank loan to SMEs. The paper examines the effectiveness of Thailand's credit guaranteed mechanism from both theoretical and empirical aspects. The theoretical framework is developed to analyze the effects of government subsidy policies on credit allocation in the presence of asymmetric information and finds that the loan guarantee can perform a function of credit reallocation better than the interest subsidy. Using unique by-bank and firm level credit information combined with firm characteristics data, the effectiveness of the TCG's portfolio guarantee schemes is empirically assessed in three dimensions, i.e., SME credit additionality, ex-post performance of participating firms, and incentive misalignment among involved agents. The empirical results suggest that the availability of loan guarantees is related to the probability of acquiring additional credit (+), collateral ratio requirement (-), interest payment (-) and subsequent asset growth of SMEs (+). The paper also finds the existence of incentive misalignment that guaranteed borrowers tend to have higher delinquency probability. In additional, the reported guarantee effects vary across industry sectors and individual banks. To make the most economic use of guarantee funds, a more-targeted scheme may be specifically designed for the sectors that contribute most to the economy and benefit the most from guarantee schemes. Moreover, additional incentive alignment mechanism should be put in place to mitigate the negative impact of credit guarantee on the increase in likelihood of default, such as different coverage ratio based on past performance of each bank's portfolio.

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I. Introduction

Small and Medium Enterprises (SMEs) have limited access to financial institutions' loans due to lack of credit history, collateralization, and reliable financial statements. The problem of asymmetric information in the credit process is even worse with start-up, young firms, which do not have track records and are most likely not able to fully comply with the collateral requirements.[1] In addition, it seems that SMEs have not benefited from the financial deepening to the same degree as other borrower groups. To alleviate SMEs' financial constraints, the government in most (if not all) countries provides a subsidy in one form or another. Among many other subsidy policies, credit guarantee is the most common and arguably most effective tool for the government intervention to improve financial access of SMEs. Many previous studies conclude that credit guarantee incurs less public burden, relative to government's direct financing, while enhancing free-market mechanism. In Thailand, the credit guarantee has become sizable since 2009 when Thai Credit Guarantee Corporation (TCG) introduced "Portfolio Guarantee Scheme" (PGS) in order to stimulate bank loans to SMEs after the global financial crisis in 2008. The outstanding guarantee amount has been increasing over time from 21.9 billion Baht in 2008 to 257.3 billion Baht in June 2014. However, this amount, as a percentage of GDP, is still small, when compared with other Asian countries. Going forwards, designing the credit guarantee structures that ensure market-based credit allocation and economic efficiency is crucial because at the end guarantee funds are not tools to solve the problems of weak entrepreneurship or poorly performing banks.

One strand of research in this area focuses on evaluating the effectiveness of credit guarantee schemes, especially in three dimensions, namely SME credit additionality, ex-post performance of participating firms, and incentive misalignment among guarantors, lending banks, and borrowing firms. Nevertheless, there are only a few studies evaluating the effects of a loan guarantee program using by-bank, firm-level credit information and firm characteristics data.[2] To fill the gap, the objective of the paper is to examine the effectiveness of Thailand's credit guarantee mechanism in all three dimensions by using by-bank individual firms' credit information mapped to their business performance and characteristics data. The theoretical framework of credit market with government subsidy is also developed with an aim to better understand how government subsidy policies in the loan market affect the credit allocation in the presence of asymmetric information. Policy recommendations and implications are concluded from theoretical framework and empirical results as well as experiences in other countries where credit guarantee mechanisms are successful in supporting SME finance.

[1] With respect to the asymmetric information setting, collateral might be used as a signal to screen safe from risky borrowers if collateral is relatively more costly for risky borrowers.

[2] For examples, Lelarge, Sraer and Thesmar (2010) and D'lgnazio and Menon (2013) use firm level data to evaluate the credit guarantee schemes in France and Italy, respectively. Cowan , Drexler, and Yanez (2012) use bank-firm level credit information to quantify credit addition and evaluate incentive misalignment as a result of a credit guarantee scheme in Chile.

Our model finds that loan guarantees operate effectively in reallocating credit in both market clearing and rationing equilibria because guarantees do directly affect the risk-profile of borrowers and hence banks' expected returns which are the underlying problem of credit rationing. In contrast, interest rate subsidies operate primarily by reducing borrower payments and not directly affecting banks' expected returns. Therefore, credit guarantees are relatively more effective than interest subsidies in reallocating credit when the current SME market equilibrium is rationing. The framework also indicates that subsides to one group will partly crowd out other borrower groups. In other words, the government intervention can simply rearrange the credit allocation among borrower groups.

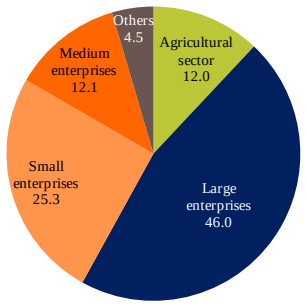
Our empirical results show that SMEs participating in the PGS have greater likelihood of receiving additional credit than those who are not participating. Guaranteed SMEs are found to receive better credit terms, i.e., less collateral to credit line requirement, lower interest rate, and enjoy subsequent higher asset growth. However, loan guarantees may have created risk-shifting incentive, as it is found that participating firms are more likely to default on their loans. The overall evaluation of the PGS is thus the trade-off question between the benefit from increased growth and access to credit versus the cost from increased risk. Interestingly, by-sector results show stronger positive effects of the PGS on the service sector, and by-bank results illustrate different degree of incentive misalignment across banks. To make the most economic use of guarantee funds, a more-targeted scheme may be specifically designed for the sectors that contribute most to the economy and benefit the most from guarantee schemes. Moreover, additional incentive alignment mechanism should also be put in place to help mitigate the negative impact of credit guarantee on the increase in likelihood of default, such as different coverage ratio based on past performance of each bank's portfolio.

The paper is organized as follows. Section II provides an overview situation of SME financing and gap in Thailand. Section III gives more details on the credit guarantee schemes both in Thailand and other countries. Section IV develops a framework of credit markets with government subsidies emphasizing on the credit guarantee program. The empirical test on effectiveness of portfolio credit guarantee schemes in Thailand is presented in Section V. And finally Section VI concludes with the policy recommendations and implications.

II. SME financing in Thailand

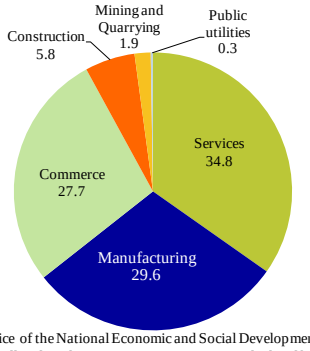
Small and medium enterprises (SMEs) have been the main engine driving the Thai economy. According to the 2013 Statistics by the Office of Small and Medium Enterprises Promotion and Customs Department, there were 2.76 million SMEs, which accounted for 97.2 percent of total number of enterprises. 37.4 percent of Thailand's Gross Domestic Products (GDP) (Figure 2.1) and 81 percent of employment were contributed by SMEs. They also play a significant role in Thailand's international trade by contributing 25.5 percent of exports and 30.9 percent of imports. Of all the SMEs, those in the service sector have been the largest contributor to the Thai economy (accounted for 34.8% of total SMEs' contribution to the GDP), followed by manufacturing (29.6%), commerce (27.7%), construction (5.8%), mining (1.9%) and public utilities (0.3%) (Figure 2.2). SMEs in the service sector have also been the main driver in terms of economic growth (Figure 2.3).

Figure 2.1 : SMEs' contribution to GDP in 2013 by size of enterprises



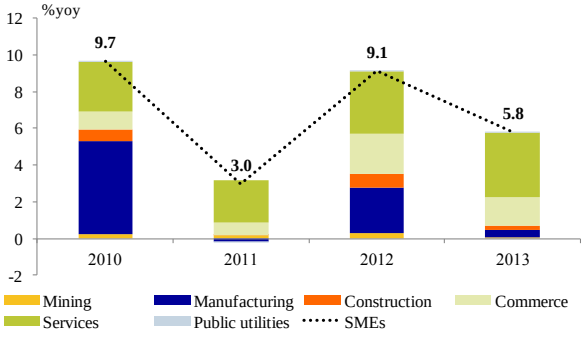
Source : Office of the National Economic and Social Development Board, Office of Small and Medium Enterprises Promotion, calculated by the authors

Figure 2.2 : SMEs' contribution to GDP in 2013 by business sector



Source : Office of the National Economic and Social Development Board, Office of Small and Medium Enterprises Promotion, calculated by the authors

Figure 2.3 : Growth of SMEs' contribution to GDP



Source : Office of Small and Medium Enterprises Promotion, calculated by the authors

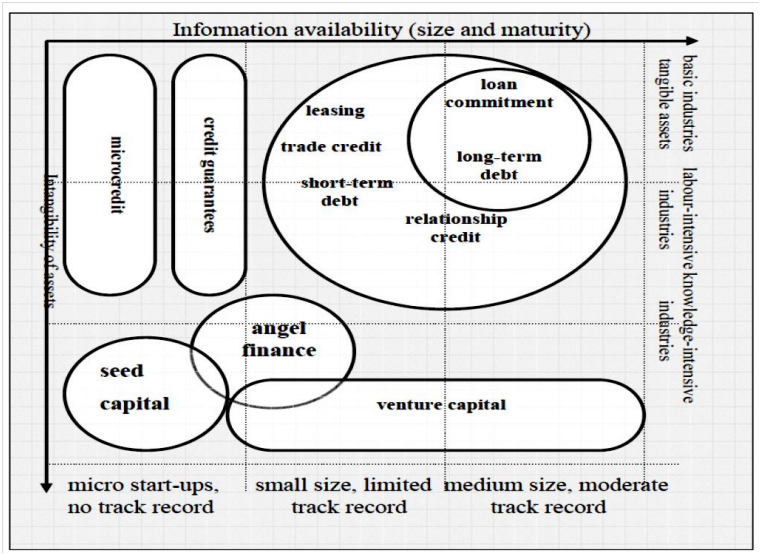
2.1 SME financing in Thailand

Suitable sources of funding could be different for SMEs at different stages of business and sizes.[3] Figure 2.4 shows that equity financing is more suitable for more knowledge-intensive firms, whose assets are mostly intangible, while loans from private financial institutions are more

[3] Szabo (2005) pointed out that suitable sources of funding for SMEs depends basically on the stage of maturity and size of firms; therefore, heterogeneous choices of SME financing should be available.

suitable for small and medium enterprises with track record. However, based on the available aggregate numbers in 2013 (Figure 2.5)[4], commercial bank credit has been the main source of external finance for Thai SMEs with an aggregate amount of 4.0 trillion Baht, followed by loans from specialized (public) financial institutions (SFIs) with a total amount of 0.43 trillion Baht. Available as another alternative for upper/larger SMEs is direct funding from capital market. The total market capitalization of Market for Alternative Investment (MAI) in 2013 was 0.18 trillion Baht. Saving co-operatives play a very small role with a total amount of only 8.6 billion Baht.

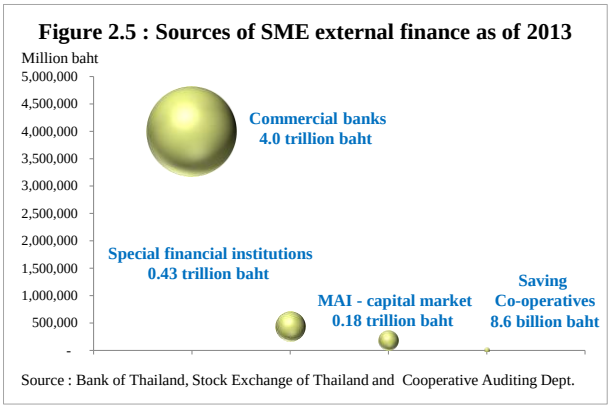
Figure 2.4 : Sources of fund for each stage of business

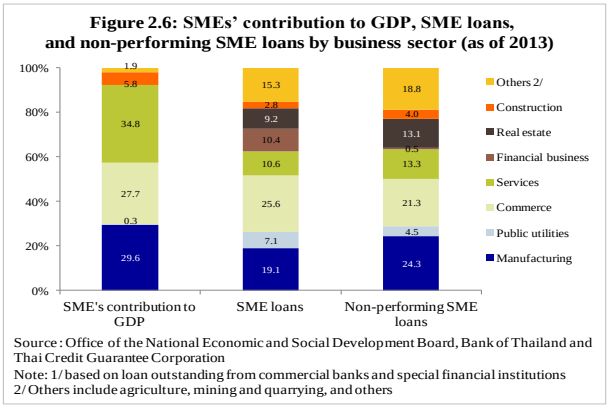


Source: Szabo (2005)

Since 2011, SME loans from commercial banks have been expanding at an annual rate of more than 10% (Table 2.1).[5] The outstanding amount reached 4 billion Baht in 2013 (37.3% of total bank loans, excluding interbank lending). Broken down by industry sectors, the largest share of SME loans (25.6%) is granted to those from the commerce sector, while SMEs from the service sector contributed the most to country's GDP (Figure 2.6). The average number of loan contracts each small enterprise has with banks is 0.38, compared with 7.8 contracts for each medium enterprise.

[4] gathered at our best effort
[5] All SME loan data are from the Bank of Thailand.





2.2 SME financing gap

Bank credit is an important funding source for SMEs. Although SME loan outstanding has been increasing overtime, the majority of SMEs, particularly smaller and micro enterprises, still do not have access to bank credit. In 2013, there were only 1.17 million SMEs' loan contracts with banks (41.2% of the total number of SMEs) (Figure 2.7). The ratio of SME loans to total loans of Thailand was considered low, when compared with Japan, Mainland China, South Korea and Indonesia (Figure 2.8).

The survey on debt burden and financial access of Thai SMEs[6] in 2012 by the Office of Small and Medium Enterprises Promotion finds that the major source of funding for large enterprises (LEs) and medium enterprises (MEs) is loan from financial institutions while only 35.7% of small enterprises (SEs)' funding is from bank credit (Figure 2.9). The Bank of Thailand's internal gap analysis[7] also suggests that most MEs have already had access to bank credit, but probably not at a reasonably risk-based price or normally be granted with high collateral requirement (price gap). Moreover, small and micro enterprises still have difficulty getting access to bank loans and financial advisory services (availability gap).

There are two main underlying reasons for those gaps. Firstly, it is relatively costly for banks to establish relationship with smaller and micro enterprises and to monitor small-sized loans. Considering that the business model of most commercial banks is not as flexible as other non-bank financial institutions, this smaller and micro enterprise segment may not be commercially attractive and therefore not a main target group of the commercial banks. In fact, non-bank financial institutions and specialized financial institutions have been playing a significant role in serving this segment.

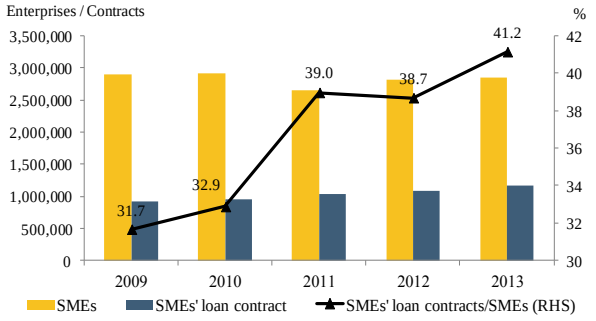
Secondly, banks cannot accurately assess firms' credit risk, as many SMEs, especially small or start-up firms, do not have credit history, financial track record, or reliable financial statements. Therefore, in many cases, banks decide not to grant credit to them or to charge excessively high price or require unreasonably high collateral requirement to cover the risk they cannot accurately

[6] The survey sample includes 805 enterprises across the country, of which 48.7% are in retail sales, 44.5% in service, and 6.8% in wholesales sectors.
[7] Based on interviews with bankers, enterprises, and some survey results

measure. As many SMEs do not have sufficient physical or financial collateral to pledge with banks, they are not able to obtain credit from commercial banks. The observed NPL to total loans ratio over 2010 – 2014 in Figure 2.10 suggests that SMEs are more likely to default and, thus, riskier than LEs. Figure 2.11 indicates that banks' credit underwriting standard is generally tighter for SMEs than for LEs.

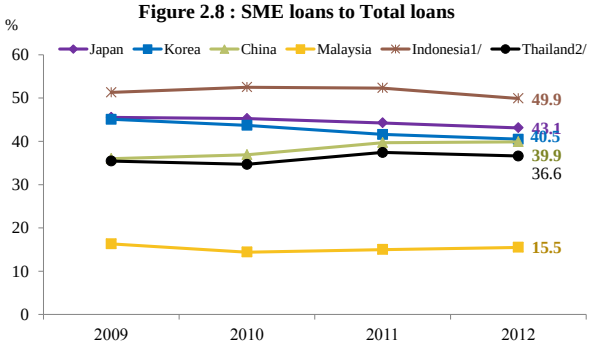
To alleviate the asymmetric information problem, several mechanisms/measures have been put in place and initiated. For example, the Bank of Thailand will collect credit information of all SME borrowers from banks, starting from September 2014, as having a complete set of SME credit information is a good start for understanding SME credit situation, and the data may further be used to develop credit scoring in the future. With regard to SMEs' lack of eligible collateral, the Business Security Act has been drafted, aiming to expand the list of eligible collateral and expedite the collateral foreclosure process. Another important shorter-term measure is enhancing credit guarantee schemes to better assist SMEs with insufficient collateral to get access to bank credit. Our paper will focus on the latter measure by assessing the effectiveness of the existing portfolio guarantee schemes and formulating policy recommendations for credit guarantee mechanism in Thailand going forward.

Figure 2.7 : Number of SMEs and SMEs' loan contracts with banks



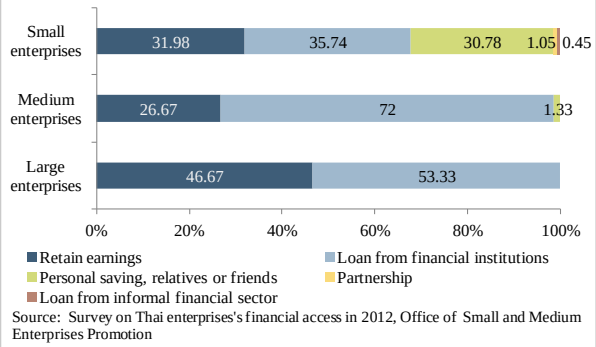
Source : Bank of Thailand and Office of Small and Medium Enterprises Promotion

Figure 2.8 : SME loans to Total loans



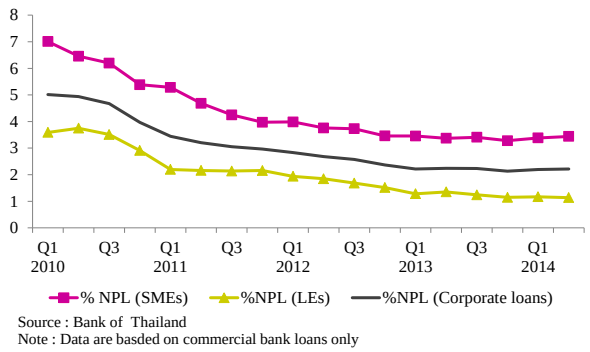
Source : Asian Development Bank and Bank of Japan
Note : 1/ Loans to micro, small and medium-sized enterprises

Figure 2.9 : Funding structure of small, medium and large enterprises



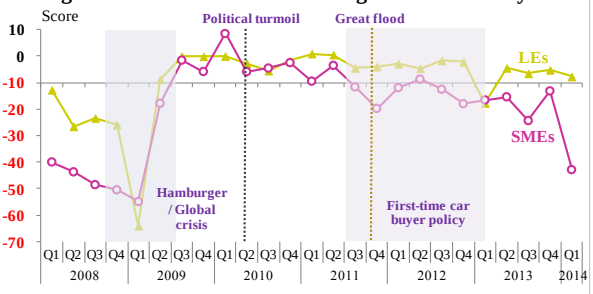
Source: Survey on Thai enterprises's financial access in 2012, Office of Small and Medium Enterprises Promotion

Figure 2.10 : Ratio of non-performing loans to total loans



Source : Bank of Thailand
Note : Data are basded on commercial bank loans only

Figure 2.11 : Credit underwriting standard survey[1/]



Source : Senior loan officer survey, Bank of Thailand
Note: 1/ Credit condition survey is conducted quarterly by the Bank of Thailand, reviewing opinions of senior loan officers from 24 banks and 24 non-banks. Lower score indicates tightened standard.

Table 2.1 : Overview of SME's contribution to the economy and SME Financing

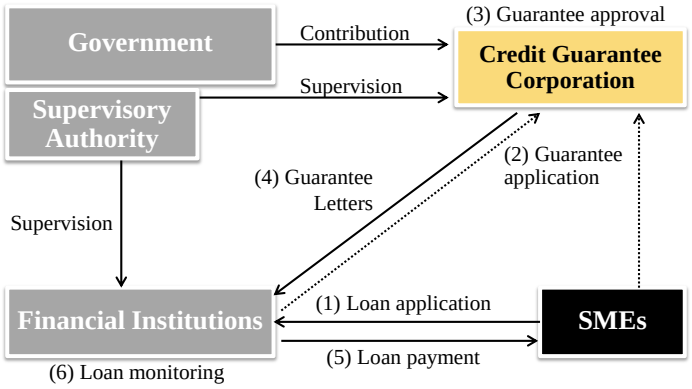
	2009	2010	2011	2012	2013
SME's contribution to the economy					
SMEs' GDP					
Thailand's GDP (million Baht)	9,041,551	10,104,821	10,540,134	11,375,349	11,898,710
Small and Medium Enterprises (million Baht)	3,417,861	3,747,694	3,859,588	4,211,263	4,454,940
- Small enterprises (million Baht)	2,300,196	2,491,158	2,583,873	2,824,898	3,014,096
- Medium enterprises (million Baht)	1,117,665	1,256,536	1,275,714	1,386,365	1,440,843
SME's contribution to GDP					
Small and Medium Enterprises (%)	37.8	37.1	36.6	37.0	37.4
- Small enterprises (%)	25.4	24.7	24.5	24.8	25.3
- Medium enterprises (%)	12.3	12.4	12.1	12.2	12.1
SME's international trade					
SME export to total export (%)	30.1	27.3	29.4	29.2	25.5
SME import to total import (%)	30.1	31.0	34.2	33.1	30.9
Number of SMEs and employment created					
Number of SMEs (% to total enterprises)	99.8	99.6	99.8	97.2	97.2
- Small enterprises	99.4	99.0	99.3	96.7	96.7
- Medium enterprises	0.4	0.6	0.4	0.5	0.5
Employment by SMEs (% total employment)	78.2	77.9	83.9	81.0	81.0
- Small enterprises	66.6	66.7	75.4	73.7	73.8
- Medium enterprises	11.6	11.1	8.5	7.2	7.2
SME financing					
SME loan by commercial banks					
Total SME loan by commercial banks (million Baht)	2,565,049	2,749,308	3,145,496	3,481,358	3,994,360
- Loan granted to Small enterprises (million Baht)	1,697,840	1,823,285	2,122,481	2,461,346	2,902,751
- Loan granted to Medium enterprises (million Baht)	867,209	926,022	1,023,016	1,020,012	1,091,609
Guaranteed loan (million Baht)	38,621	112,167	170,247	251,664	355,226
Guaranteed loan (%)	1.5	4.1	5.4	7.2	8.9
Growth of SME loan by commercial banks					
Total SME loan by commercial banks (%yoy)	-6.8	7.2	14.4	10.7	14.7
- Loan granted to small enterprises (%yoy)		7.4	16.4	16.0	17.9
- Loan granted to Medium enterprises (%yoy)		6.8	10.5	-0.3	7.0
Non-performing SME loan to total SME loan (%)	7.1	5.4	4.0	3.5	3.3

Source: Office of Small and Medium Enterprise Promotion and the Bank of Thailand

III. Credit guarantee and SMEs (International experience and Thailand's case)

To address the financing gap mentioned in Section II, credit guarantee scheme is designed to enhance financial access of SMEs, microenterprises and start-up enterprises, which are risk efficient but lack of collateral and financial records. Credit guarantee scheme also provides financial institutions with an opportunity to have more information and understanding of their SME clients regarding problems, operation and performance in order to help improve the banks' management of their SME loan portfolio. With more track records, creditors gradually learn how to lend profitably to SMEs without guarantee. Guarantee may help lenders realize that the perceived risk of lending to SMEs may not be as high as they thought. The guarantee agent will reimburse the contracting financial institutions for the default of loan to SMEs, microenterprises and start-up firms. Figure 3.1 illustrates how the credit guarantee corporation basically operates.

Figure 3.1 : Credit guarantee mechanism



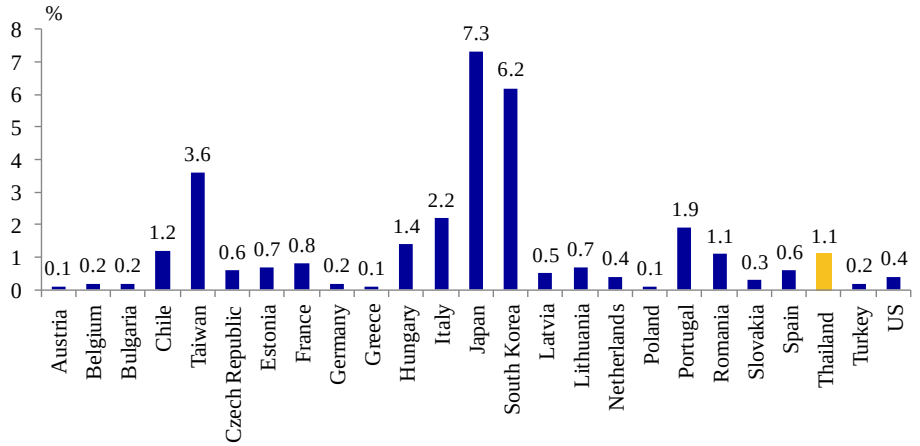
Source: Credit Guarantee Corporation Malaysia Berhad, modified by the authors

Apart from credit guarantee, government is able to improve SMEs' financial access by means of direct loan, interest-rate subsidy, government-sponsored enterprises (GSE)[8], and subsidies (e.g., tax-exempt credits and less provisioning) (Tunahan and Dizkirici (2012) and Saldana (2000)). However, credit guarantee schemes have become a popular policy instrument to address SME financing gap in many countries[9] since they incur less public burden, relative to government's direct financing, while least disturb free-market mechanism[10] (Tunahan and Dizkirici (2012), Zecchini and Ventura (2009), Kuo, Chen and Sung (2011) and Back et al (2010)). The study of Beck, Demirgüç-Kunt and Martinez Peria (2008), which examines 91 banks in 45 countries, identifies that 50% of banks in developed countries and 56% of banks in developing countries consider credit guarantee programs as the most common and effective tool, compared to the others used by the government, to support SME financing. Although all credit guarantees aim at improving access of small and micro enterprises to formal credit markets, there are a variety of

[8] For example, financial services corporation, which was created by the United States Congress. It helps improve targeted borrowers' access to housing, agricultural, and student loans.
[9] Green (2003) reported that there were more than 2,250 credit guarantee schemes in 100 countries.
[10] Government-support direct loans and credit subsidies have rarely had evidence of success, due to mis-targeting, rent-seeking and lack of fiscal sustainability (Khwaja and Mian (2005) and Zia (2008)).

designs, such as eligibility criteria, risk sharing arrangement[11], fees, and claim procedures[12]. Figure 3.2 shows cross-country outstanding guarantee amount as a percentage of GDP in 2011. It reflects that guarantee schemes are more popular in Asian economies than in European countries.

Figure 3.2 : Outstanding guarantee amount as percentage of GDP, 2011



Note : 1) For European countries, members of the European Association of Mutual Guarantee Societies, including mutual, public and private-public schemes. 2) For Chile, Taiwan, Japan and US the Data refer to 2010.
Source : AECM (2012), Pombo (2010) and OECD (2013), modified by the authors

3.1 Key features of credit guarantee schemes: International experience

This section provides a short survey on other countries' experience in implementing credit guarantees. We will focus on the evaluation of credit guarantee programs in two main areas, namely, economic and credit additionality and the program structure to address the incentive misalignment of involved agents.

Economic and credit additionality[13]

The most commonly-used measure of credit guarantee programs is credit additionality, which refers to additional loans made possible due to the guarantee. The justification of a credit guarantee would be questioned when additional amount of loans is granted either with or without such credit guarantee. Credit additionality can also be measured in different indirect dimensions, e.g., less stringent loan term, lower interest rate, extended loan maturity and lower collateralization. In addition to credit additonality, guarantee programs can be evaluated in term of economic additonality; for example, the contribution of guarantees to country's employment

[11] Another relevant issue about risk sharing is whether the guarantee should apply only to the loan principal (Thailand) or to some of the unpaid interest as well. Most credit guarantee schemes extend the scope of guarantee to cover up to 6 months of interest with the same risk-sharing proportion as the principal portion.
[12] Judicial processes are slow in most of the case (especially in developing countries) so that guarantor usually cannot insist on a legal judgment before paying a guarantee, but simply on the initiation of legal proceedings (this is also the case for Thailand).
[13] (Levitsky, 1997). Many have been written about the difficulty of additionality measurement (Meyer and Nagarajan, 1996). This might be due to the data availability and difficulty in measuring the clean impact of credit guarantee programs on the new loan underwriting.

and GDP, as well as their productivity and growth. According to Levitsky (1997), additionality of at least 60% should be the minimum acceptable. Previous studies show the evidence of additionality; however, most of them do not empirically estimate the causal effect of credit guarantees. However, there are only few more recent studies which try to do so using a firm-level data set. Using bank-firm level credit information, Larraín and Quiroz (2006) find that the Partial Credit Guarantee Fund (FOGAPE) in Chile could generate credit and economic additionality to Chilean SMEs in large cities, i.e., 14% increase in credit volume, 6% increase in the probability of SMEs to get additional loan and 6% increase in business's turnover. D'Ignazio and Menon (2013) use firm-level data and show that Italian Mutual Guarantee Associations for Artisans (Confidi) could improve financial condition and increase long-term loans of guaranteed firms, as well as reduce interest rate incurred on them. Table 3.1 provides a brief literature review of the evaluation of credit guarantee schemes around the world.

Table 3.1: Selected studies of the evaluation of credit guarantee schemes

Study	Region/Country	Objective	Methodology	Key findings
Beck, Klapper and Mendoza (2010)	Global	Global review of typologies of partial credit guarantees	Surveys of 76 PCG funds in 46 countries, descriptive statistics, correlation and multivariate regression	CGSs have varying features. Governments have role in funding and management, but limited role in risk assessment and recovery. Most credit guarantee funds restricted in terms of borrowers and areas.
Levitsky (1997)	International review	Cross – country review of credit guarantee schemes	International review but details of methodology were not described	Most schemes had 60-80% coverage. A quarter of schemes had 50% coverage; while 11% had 100% coverage. Generated loan leverage of 5 to 10 times and 30 – 35% additionality.
Green (2003)	International review	Assessment of the effectiveness and efficiency of credit guarantee scheme in promoting private sector-led growth	Analytical methodology was not discussed.	Evidence of additionality among well-implemented CGSs; identified good practices that can guide scheme design and implementation
Tunahan and Dizkirici (2012)	Turkey	Evaluation of the structure and performance of Turkey's credit guarantee fund	Evaluates Turkey's credit guarantee fund against international practice	Ineffectiveness in acceptance among banks; higher default rate; lower leverage ratio ; and lower share of fund to total loans
Saldana (2000)	Philippines	Analysis on how a Credit guarantee confers	Analyzed creditor's loss function	Loan guarantee improved creditor's welfare by reducing the amount and risk of loan

Study	Region/Country	Objective	Methodology	Key findings
		private benefits to creditors		loss and yielding positive economic value to risk-averse creditor.
D'Ignazio and Menon (2013)	Italy	Evaluation of the effectiveness of Italy's partial credit guarantee program	Empirical test using firm-level data	Improved financial condition of firms, increase in long-term loans, decrease in interest rates and increase of defaults
Cowan, Drexler and Yanez (2012)	Chile	Assessment of the impact of credit guarantees on credit additionality and incentives	Empirical tests using data at a bank-client-month level	Credit guarantees increased the amount of credit and decreased incentive for banks to collect loan repayment.
Lelarge, Sraer and Thesmar (2008)	French	Assessment of the impact of loan guarantee program (SOFARIS) on new business formation and growth	Empirical tests using data at a industry-firm level	French loan guarantee affected the development of newly created firm.

In order to optimize credit and economic additionality, many credit guarantee funds introduce guarantee which targets specific industries, such as exporters in Chile. The guarantee programs may be designed for different operations of business. For example, Korea Credit Guarantee Fund (KODIT) provides four categories of guarantees, including programs for indirect financing, bond issuance, commercial bills and tax payment.[14] In addition, credit guarantees are used to promote national economic development agenda in South Korea, Taiwan, Netherland, Canada and United Kingdom, which focus on start-up and micro-enterprises. Korea Technology Finance Corporation (KOTEC) guarantees loans for technology-oriented industry, innovative enterprises, green-technology industry, and culture-content production firms. KODIT and KOTEC also offer related services, such as consulting and advisory services to support SMEs. Table A.3.1 in the appendix summarizes target groups and eligibility criteria of guarantee programs in selected countries.

Incentive misalignment

As a result of information asymmetry, credit guarantee mechanism, if not well-designed, might cause the moral hazard at least in two dimensions. First, borrowers may have high incentive to default, since part of collateral, fulfilled by a credit guarantee corporation, is not belonged to clients. In addition, the loss as a result of their default will be covered by the guarantee corporation. Secondly, financial institutions may lack an incentive to maintain vigorous credit assessment, monitoring credit quality of guaranteed borrowers and collection of debt repayment

[14] http://www.kodit.co.kr/html/english/serv_kodit/credit_guar_serv/type/general_guar.jsp

because the defaulted loan can be reimbursed. Measures to alleviate the agents' incentive misalignment must be embedded in guarantee structure and procedures. Table A.3.2 in the appendix summarizes the design of credit guarantee schemes in selected countries. Japan, South Korea and Taiwan are successful cases of individual (loan-level) guarantee schemes. Germany's represents a guarantee system, in which chambers of commerce together with private banks have significant contribution to guarantee banks (Bürgschaftsbank). Meanwhile, Chile, Netherland, Canada, United Kingdom and Thailand are examples of countries using portfolio guarantee schemes.

Type of guarantee schemes

Individual guarantee and portfolio guarantee schemes have their own merits and drawbacks. The individual (or loan-level) guarantee model can minimize the banks' moral hazard in credit screening and monitoring process since a credit guarantee corporation also does the same process on case-by-case basis. However, this model is more time-consuming, more labor-intensive, and thus more costly than the portfolio guarantee model. In the case of a portfolio guarantees, approval processes usually take less time because the financial institutions do the approval process by following guidelines and rules prescribed by the fund. However, the main disadvantage of this model is that the funds have less control over quality of their guarantee portfolio. Beck at el (2010) find that among 76 credit guarantee funds across 46 countries, 72% of the funds used a loan or "selective" basis while 14% and 9% of the funds used a portfolio or "lump screening" approach and a hybrid approach, respectively.

Risk-sharing mechanisms among creditors, guarantors and the government

From the international experience, measures to improve risk-sharing mechanism among parties involved in credit guarantees can be summarized as follows:

- *Increase the participation/ownership of private sector in the guarantee program*. The credit guarantee corporations nowadays can be classified into three groups, namely a publicly-owned organization, a mutual guarantee association[15] and a private corporation. Beck (2010) found that the majority of the guarantee corporations in developed countries are mutual guarantees whereas most of emerging markets employ the state-run model. A few countries have private guarantee corporations. In addition, KODIT (Korean Credit Guarantee Fund) has gradually increased private enterprises' participation in its funding structure since 2009 by asking its large-corporate borrowers to pay an annual contribution.
- *Limit credit guarantee liability, i.e., coverage ratio.* When financial institutions must be responsible for risk, they will conduct vigorous credit origination and warily monitor credit quality to minimize loan losses. Limits on guarantee amount and coverage ratio are

[15] Mutual association is a group of private firms that grant collective guarantees to loans to their members. The government may subsidize or get involved in the fund. Examples of the mutual associations are Confidi in Italy and Bürgschaftsbank in Germany.

applied in all guarantee programs. Based on international experience, 50% risk-sharing (coverage ratio) tends to be unattractive to creditors since their administrative costs are high. Most credit guarantee corporations cover up to 50 – 90% of total SME loan (Shim (2006)). More interestingly, FOGAPE (Chilean Credit Guarantee Corporation) has introduced a "coverage ratio" auction system to allocate guarantee to banks. Tenders are selected based on the lowest coverage ratio offered by the banks.

3.2 Credit guarantee scheme in Thailand

In Thailand, credit guarantee service to SMEs has been solely operated by Thai Credit Guarantee Corporation (TCG). Established in 1991 under the Small Industry Credit Guarantee Corporate Act of B.E. 2534, TCG is a state-owned specialized financial institution under the supervision of the Ministry of Finance. Credit guarantee amount each year has increased from 21.6 billion Baht in 2009 to 87.1 billion Baht in June 2013. In 2013, TCG has about 300 staffs and 9 branches across the country.

Thailand's credit guarantee schemes have been evolved overtime. During 1991-2008, the guarantee scheme was "individual loan-level" in which TCG took part in credit underwriting, clients' risk assessment and guarantee approval processes. The guarantee claims were up to 100% of loans and interests, which are accrued until the end of lawsuit; while a flat annual guarantee fee had a step-up structure, i.e., higher fee for higher guarantee amount. Such individual loan guarantee scheme was not popular owing mainly to its time-consuming and repetitive approval processes as well as the requirement that the guarantee was limited to the clients of TCG's shareholding financial institutions. In 2004, the 100% individual loan guarantee was changed to "risk participation program". The modification included a reduction in guarantee fee, an increase in guarantee limits per customer, and a single guarantee fee broadly applied across all clients. However, the coverage ratio was lowered to control the incentive misalignment in participating agents. Furthermore, the approval process was streamlined from detail checklist to criteria checklist (i.e., transferring detail risk assessment to the financial institutions). In 2009, Portfolio Guarantee Scheme (PGS) had been in place to stimulate the shrinkage of SME loans during the global financial crisis. The coverage ratio was reduced to 8.5% – 50% (mostly 15%-18%) whereas the maximum guarantee period was limited to 5–7 years.

Since 2009, five sizable PGSs have been implemented. In addition to those general five PGSs, TCG also provides specific groups of SMEs with special guarantee programs, i.e., PGS flood in 2011, guarantee for start-up SMEs, guarantee for micro-enterprises, guarantee for SMEs Halal trade, and guarantee for OTOP enterprises. Table 3.2 and Appendix A summarize the development of the guarantee schemes in Thailand.

Table 3.2: Summary of the main TCG's guarantee services since its inception in 1991

	1st period: 1991-2003	**2nd period: 2004-2008**	**3rd period: 2009 - now**
Guarantee type	Individual loan guarantee		Portfolio guarantee
Registered capital	1992: 400 million Baht 2000: 4,400 million Baht		2009: 6,839.95 million Baht 95.49% held by Ministry of Finance
Eligible SMEs[16]	1991: Fixed asset (excluding lands) ≤ 50 million Baht 1999: Fixed asset	2006: Fixed asset (excluding lands) ≤ 200 million Baht	Fixed asset (excluding lands) ≤ 200 million Baht

16 The definition of SMEs in accordance with the Small Industry Credit Guarantee Corporate Act of B.E. 2534.

<table>
<tr><th></th><th>1st period: 1991-2003</th><th>2nd period: 2004-2008</th><th>3rd period: 2009 - now</th></tr>
<tr><td></td><td>(excluding lands) ≤ 100 million Baht</td><td></td><td></td></tr>
<tr><td>Guarantee coverage</td><td>100% of uncollateralized portion of loan</td><td>The coverage is 50% of uncollateralized portion of loan for the first three years and increases by 10% every year until the ratio reaches 80%</td><td>8.5% - 50% of annual average outstanding guarantee of total portfolio. The ratio varies with different guarantee program.
For PGS, phase 1-3 covered 15.5% of total portfolio per bank. Phase 4 and 5 covers 15% and 18% respectively.</td></tr>
<tr><td>Guarantee limit per customer (only the uncollateralized portion of loan is guaranteed)</td><td><u>1991</u>: ≤ 10 million Baht
<u>1999</u>: ≤ 20 million Baht</td><td>≤ 40 million Baht</td><td>≤ 40 million Baht</td></tr>
<tr><td>Collateral requirement</td><td>≥ 50% of total loan</td><td>≥ 50% of total loan</td><td>- depending on schemes
- For PGS 1-5, ≥ 30% of total loan (< 30% for clean loan program)</td></tr>
<tr><td>Guarantee fee (per cent of guarantee amount) / year</td><td><u>Step-up fee structure</u>
• 2% for guarantee amount ≤ 1 million Baht
• 2.5% for guarantee amount between 1-5 million Baht
• 2.75% for guarantee amount between 5-10 million Baht</td><td>1.75%</td><td>- 1.5% - 2.5% depending on schemes</td></tr>
<tr><td>Maximum guarantee period</td><td>-</td><td>-</td><td>PGS 1-4: up to 5 years
PGS 5: up to 7 years</td></tr>
<tr><td>Guarantee claim</td><td>100% of loan and accrued interest</td><td>50% of actual losses, net of foreclosed collateral value, but not more than guaranteed amount (25% after legal procedures have been concluded and 25% after collateral liquidation)</td><td>After legal procedures have been initiated, TCG will reimburse 50 – 100% of the guarantee amount for each loan contract to a lending bank based on the NPG level of each bank’s guaranteed loan portfolio. For example, for normal loan program under PGS 1-3, % of reimbursement is as follows.
<table>
<tr><th>NPG</th><th>claim</th></tr>
<tr><td>NPG≤12%</td><td>100%</td></tr>
<tr><td>12%<NPG≤14%</td><td>75%</td></tr>
<tr><td>14%<NPG≤18%</td><td>50%</td></tr>
</table>
</td></tr>
</table>

	1st period: 1991-2003	2nd period: 2004-2008	3rd period: 2009 - now
Guarantee approval process	Yes	Criteria checklist	Qualification checklist (Approval process time of less than 3 business days)
TCG performance • **Guarantee amount** • **Non-performing guarantee (NPG)**	2003 • 3,634 million Baht • 16.07%	2008 • 21,855 million Baht • 25.5%	2013 • 243,626 million Baht • 3.86%

Source: Thai Credit Guarantee Corporation

Overview of TCG operation and performance

This section briefly evaluates the TCG's portfolio guarantee schemes in three dimensions as mentioned above.[17]

Credit additionality

Since 2009 (PGS1), guaranteed loan amount has continuously increased. From Figure 3.3, the ratio of guaranteed loan amount to total SME loan from commercial banks and SFIs increases from 1.5% in 2009 to 9% in June 2014 Figure 3.4 shows that the number of approved guarantee contracts significantly increases from 1,366 contracts in 2008 (accounted for 1.0% of SME loan contracts with commercial banks) to 28,209 contracts in 2013 (accounted for 6.9% of SME loan contracts with commercial banks). Based on the number of approved guarantee contracts, about two-third are individuals and one-third are enterprises.

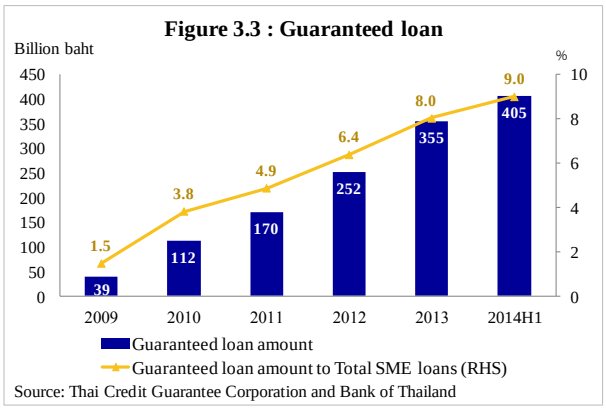
Figure 3.5 also shows that start-up (0-3 years) firms have a very limited access to the PGS. Table 3.3 indicates that the average guaranteed loan amount is 7.5 million Baht per customer whereas the average guarantee amount is 4.4 million Baht. Therefore, a unit of guarantee amount can generate 1.71 additional unit of loan amount. Figures 3.6 and 3.7 illustrate that guaranteed loan amount per customer is mostly in the range of 1-5 million Baht. For small enterprises[18], the guaranteed loan amount is relatively lower than that of medium and large enterprises.

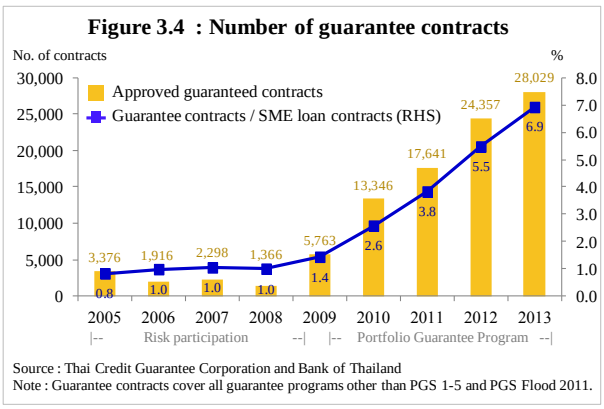
[17] Subject to the data availability, these three dimensions will be empirically tested in Section 5.

[18] In this paper, the size of enterprises is classified in accordance with the Regulation on The Amount of Employment and Value of Fixed Asset of Small And Medium Sized Enterprises B.E.2545 as follows:

Sector	Small enterprises		Medium enterprises		Large enterprises	
	Employee	Fixed asset (million Baht)	Employee	Fixed asset (million Baht)	Employee	Fixed asset (million Baht)
Manufacturing	Up to 50	Up to 50	51 - 200	More than 50-200	More than 200	More than 200
Services	Up to 50	Up to 50	51 - 200	More than 50-200	More than 200	More than 200
Wholesale	Up to 25	Up to 50	51 - 100	More than 50-100	More than 50	More than 100
Retail-sale	Up to 15	Up to 30	31 - 60	More than 30-60	More than 30	More than 60

Please note that TCG has its own definition of SMEs, which is classified in accordance with the Small Industry Credit Guarantee Corporate Act of B.E. 2534. By its definition, SMEs have fixed asset excluding land less than or equal to 200 million Baht.





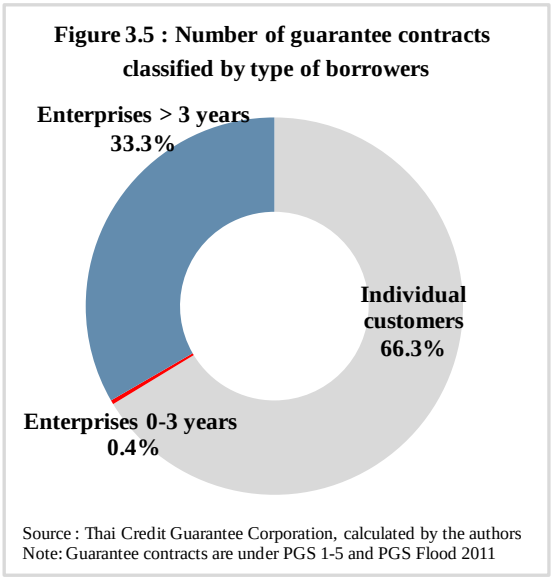


Table 3.3: Guaranteed loan amount and guarantee amount

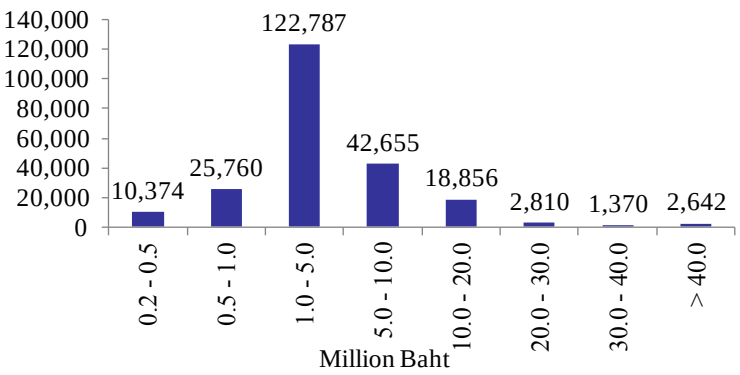
Number of Clients [1/]	Guarantee amount per client (million Baht)	Guaranteed loan amount per client (million Baht)	Ratio of guaranteed loan amount to guarantee amount
33,251	4.4	7.5	1.71

Source: Thai Credit Guarantee Corporation, calculated by the authors

Note: 1/ Figures are calculated based on data of existing clients as at end of 2011, covering PGS 1-4 and PGS Flood 2011.

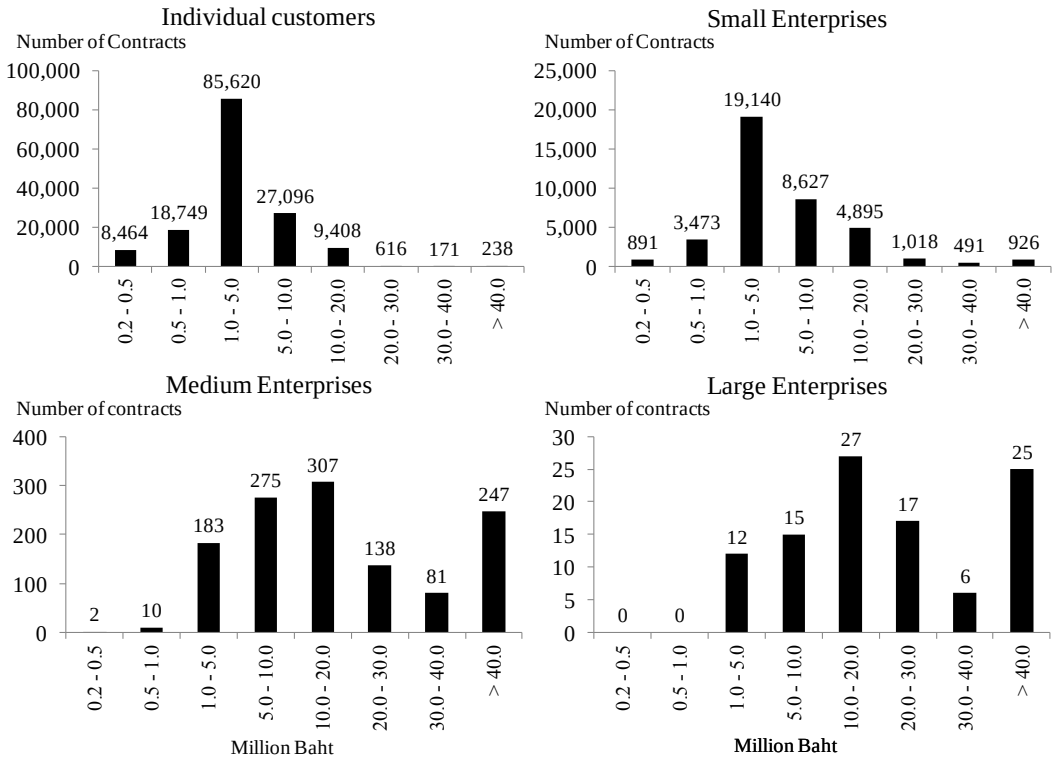
2/ In case that one client had many contracts, data of all contracts are summed up together.

Figure 3.6 : Distribution of guaranteed loan amount under PGS 1-5 and PGS Flood 2011



Source : Thai Credit Guarantee Corporation, calculated by the authors

Figure 3.7: Distribution of guaranteed loan amount under PGS 1-5 and PGS Flood 2011 based on type and size of borrowers [1/]



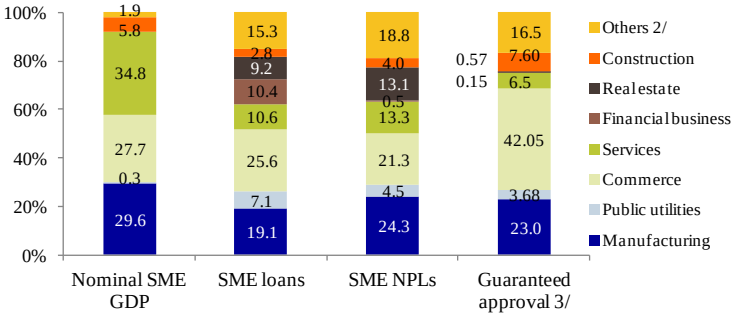
Source: Thai Credit Guarantee Corporation, calculated by the authors

Note: 1/ The size of enterprises is classified in accordance with the Regulation on the Amount of Employment and Value of Fixed Asset of Small and Medium Sized Enterprises B.E.2545 (Please refer to footnote 18 for more details). However, TCG has its own definition of SMEs, which is classified in accordance with the Small Industry Credit Guarantee Corporate Act of B.E. 2534, in which SME is an enterprise that has fixed asset excluding land less than or equal to 200 million Baht.

Economic additionality

Not only does the guarantee help improve access to credit for credit-constraint SMEs, but it also helps reallocate funds to particular types of firms or industries, which are productive to the economy. Figure 3.8 shows that the structure of SME guarantee by industry is in general in line with that of SME loan, but not so with that of SMEs' contribution to GDP. The service industry has contributed the most to the country's GDP (34.8%); nonetheless, service firms accounted for only 6.5% of the TCG portfolio.

Figure 3.8 : Structure of Thailand's SME GDP, total SME loans, NPLs [1/] and guarantee approval (as of 2013)



Source : Office of the National Economic and Social Development Board, Bank of Thailand and Thai Credit Guarantee Corporation
Note: 1/ based on loan outstanding from commercial banks and special financial institutions
2/ Others include agriculture, mining and quarrying, and others
3/ Guaranteed approval for corporate clients under PGS 1 - 4 and PGS Flood 2011.

Incentive misalignment

As discussed earlier, the main drawback of credit guarantee scheme is the moral hazard of involved agents. To briefly capture the effect, the measure, such as non-performance guarantee and likelihood of becoming delinquent, is used to compare between guaranteed SME loans and non-guaranteed ones. Table 3.4 displays the non-performing guarantee ratio of TCG portfolio and the ratio of non-performing SME loans to total SME loans of private commercial banks. We recognize limitation that those two ratios cannot be directly compared due to differences in the calculation details. Currently, the only finished program is the PGS (Phase 1) and its NPG ratio is 10.94%, which is somewhat higher than historical NPL ratios during 2009-2013. Based on evidence from the PGS (Phase 1), the credit quality of guaranteed SME loans was worse than the average credit quality of total SME loans. This may be implied that commercial banks select riskier clients (having more credit constraint and less collateral) into TCG's portfolio guarantee and/or there is an evidence of the moral hazard problem.

Table 3.4: Non-performing guarantee ratio[1/] of each PGS and Non-performing loan ratio of SME loan by commercial banks

Program 2/	Approval		Outstanding		Non performing guarantee ratio
	Number of contracts	Million Baht	Number of contracts	Million Baht	
PGS (Phase 1)	7,473	29,989	3,358	10,393	10.94
PGS (Phase 2)	10,152	30,000	6,301	16,252	6.53
PGS (Phase 3)	11,066	35,048	8,483	25,748	5.31
PGS Flood 2011	6,670	28,075	5,979	25,914	2.02
PGS (Phase 4)	7,647	24,000	6,670	20,141	4.83
PGS5/56	18,239	61,503	17,691	58,633	2.49
PGS5/57	11,340	29,375	11,252	29,134	0.02

Source: Thai Credit Guarantee Corporation and the data are as of August 7, 2014.

Note: 1/ Non-performing guarantee ratio of each PGS is the ratio of non-performing guarantee amount to the total outstanding guarantee amount of the same program. For example, NPG ratio of PGS Phase 1 equals to non-performing guarantee amount of PGS Phase 1 divided by outstanding guarantee amount of PGS Phase 1.

2/ PGS Phase 2 – 5 and PGS Flood are still ongoing; therefore, their NPG ratios may underestimate the actual ratio at the termination of the program.

NPL ratio of SME loan by commercial banks	
Year	% total loan
2009	7.1
2010	5.4
2011	4.0
2012	3.5
2013	3.3
2014H1	3.4

Source: Bank of Thailand

IV. Framework of credit market with government subsidies

4.1 Setting

The model is a variant of Stiglitz and Weiss (1981) and studies the competitive loan market, in which lenders have imperfect information about borrowers. The market consists of government and many borrowers, depositors, and financial intermediaries. All agents are risk-neutral. Depositors supply funds to the market which is a function of rate of return on bank deposits.

Borrowers are divided into 2 groups (the model can easily expand to *n* groups of borrowers): one target group for credit policy (in our case, "SME" business) and one non-targeted (general or "G") group. Borrowers are characterized by information of 1) their group identity and 2) their location within that group. Group identity is assumed to be public information and will provide a (noisy) signal of borrowers' riskiness. Location within a group refers to the riskiness of the individual's projects and is known only to the individual borrower. These information assumptions mean that banks (as well as government) can determine which groups are eligible for credit subsidy, but still face residual uncertainty within each group. And a project undertaken by individual j in group i (i = SME or G) can be characterized by $p_i(j)$ and $R_i(j)$, where $p_i(j)$ is probability that the project is successful and $R_i(j)$ is the gross return if the project succeeds. There is no return if the project fails. And the project is one unit size. Due to information asymmetry, banks cannot differentiate project j within group i however, we assume that banks know underlying distribution and density function of the projects ($F_i(j)$ and $f_i(j)$). Banks charge a gross interest rate r_i. We assume as in Stiglitz and Weiss (1981) and de Meza and Webb (1987) that in each group i, $p_i(j)\cdot r_i(j)\cdot$is constant across j. More discussion about information asymmetry and the expected bank return is presented in Box 1.

Expected bank return

Therefore, the expected bank return on loans to borrower group i (i = SME or G) is

$$\pi_r(r_i) = \theta_i(r_i)\cdot r_i$$

Where θ is the average repayment rate[19]

Demand for loan

The loan demand for each group is given by:

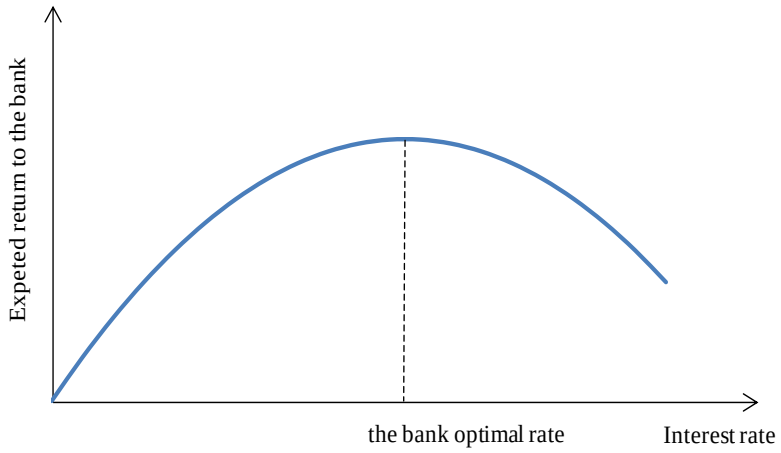
$$L_i(r_i) = \int_0^{j_i^*} f_i(j)dj = F(j_i^*)$$

[19] $\theta_i(r_i) = \dfrac{\int_0^{j_i^*(r_i)} p_i(j)\, f_i(j)dj}{F_i(j_i^*(r_i))}$, which yields $\partial\theta_i/\partial r_i < 0$ where j* is the marginal borrowing so that the project's expected net return, $p\cdot(R\text{-}r)$ to j* = 0. It indicates that each borrower group is characterized by adverse selection and the expected bank return may decrease or increase with the interest rate movement.

Box 1: Information asymmetry in the model

The interest rate a bank charges may itself affect the riskiness of the pool of loans by either: 1) sorting potential borrowers (adverse selection effect) or 2) affecting the actions of borrowers (the incentive effect).

The expected return to the bank depends on the probability of repayment and interest rate charges. So the bank would like to be able to identify borrowers who are more likely to repay. It is not easy to identify "good borrowers" and to do so the bank needs to pursue a variety of screening devices. The interest rate, which an individual is willing to pay, and collateral requirement may act as a screening tool. As the interest rate rises, the average "riskiness" of those who borrow increases, possibly lowering the bank's profits. Similarly, the behavior of the borrower is likely to change as the interest rate changes. This implies that the expected return to the bank may increase less rapidly than interest rate and beyond a point may actually decrease.



Consequently, it may not be profitable to raise interest rate or collateral requirement when a bank has an excess demand for credit. This is a situation frequently observed in the SME loan market where lenders limit the supply of additional credit to borrowers who demand funds, even if the borrowers are willing to pay higher interest rates. This credit rationing results from market imperfection as the price mechanism fails to function in the market equilibrium.

In the equilibrium, the competitive loan market assumption makes the banks' expected return equal to the cost of fund, i.e., deposit rate, ϕ. That means $\phi = \pi_r(r_i)$.

Therefore, the banks' derived (or effective) demand for fund to lend to group *i* is given by:

$$L_i^B(\phi) = L_i(\pi_r^{-1}(\phi)) \text{ if } \phi \le \bar{\phi}_i \text{ and } L_i^B(\phi) = 0 \text{ if } \phi > \bar{\phi}_i$$

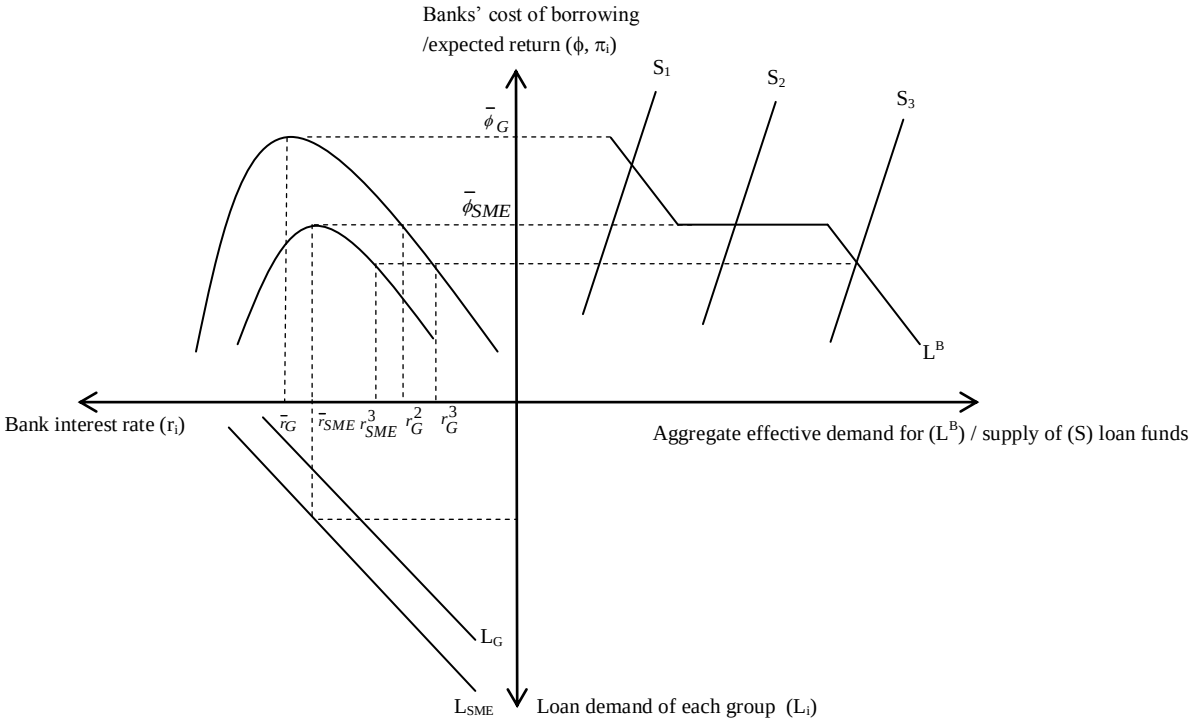
Where $\bar{\phi}_r$ is the maximum bank return on loan group *i*. Throughout this section, we assume that $\bar{\phi}_G > \bar{\phi}_{SME}$. And the aggregate demand for both groups is $L^B(\phi) = L_G^B(\phi) + L_{SME}^B(\phi)$.

Supply of fund

Supply of fund is a function of deposit rate, ϕ. All agents take prices as given. Therefore, the equilibrium is given by $L^B(\phi) = S(\phi)$.

Figure 4.1 plots aggregate banks' derived demand for fund, supply of loan, banks' cost of borrowing, interest rate and loan demand for each group of borrowers as discussed earlier. This figure also shows three different supply curves (S_1, S_2 and S_3), each of which generates a different type of equilibrium in the loan market.

Figure 4.1: Equilibrium in the loan market



In the case of S(p) = S_1, $L^B(\phi) = S(\phi)$ is where $\phi > \bar{\phi}_{SME}$. The general market is clear, but the SME group is redlined. The SME is not offered the loan because the banks' funding cost is greater than the maximum return on SME loans.

If S(p) = S_2, $L^B(\phi) = S(\phi)$ is where $\phi = \bar{\phi}_{SME}$. The general loans are cleared at r^2_G. SME loans are rationed at $\bar{r}_{SME}$. Allocation of funds to SME is $S(\bar{\phi}_{SME}) - L_G(r^2_G)$ which is less than $L_{SME}(\bar{r}_{SME})$. Banks will not increase interest rate to eliminate the exceed SME demand for loan because it will reduce their expected return, π_{SME}. A small reduction in supply will not change the interest rate level because its effect is absorbed by the reduction in SME lending. An increase in the SME loan demand has no impact on the existing equilibrium because it shifts the demand horizontally only in the region of $\phi < \bar{\phi}_{SME}$.

In the last case, where S(p) = S_3, the equilibrium happens at $\phi < \bar{\phi}_{SME}$. Both general and SME loan market are cleared because $\partial\theta_i/\partial r_i > 0$. The interest rate charged to each group is r^3_{SME} and r^3_G accordingly. A small reduction in supply increases interest rate and reduces quantity demanded by both groups. An increase in the SME loan demand (horizontal shift in banks' derived demand for lending to SME group) induces 1) an increase in the borrowing interest rate to both groups, 2) a reduction in quantity demanded by general borrowers and 3) an increase in credit volume to SME borrowers.

The model implies that the impact of supply and demand shifts on interest rate and credit volume of each type of borrower can be different depending on the initial market equilibrium. The market for SME loans may be characterized by redlining (S_1), rationing (S_2) and market clearing (S_3) depending on relative magnitudes of supply and banks' derived demand for fund.

4.2 Credit subsidy and allocation of credit

According to the model, government credit programs may have different impacts on the loan market equilibrium depending on existing credit allocation (redlining, rationing or market clearing). In addition, the form of government assistance may have different impacts on the credit allocation. The government may assist SME borrowers through various credit programs. The most commonly used are direct lending, interest rate subsidy, loan guarantee, or tax exempt status. For simplicity, our analysis here focuses on the guarantee and interest rate subsidy. For a credit guarantee, two main variables are as follows:

γ = coverage ratio of government loan guarantee, i.e., loss absorbed by the government as a percentage to the guaranteed loan amount

σ = proportion of default loss not covered by loan guarantee fee (if this equals to zero, it is a fair insurance scheme)

Both γ and σ range between 0 and 1.

For an interest rate subsidy, the government helps pay the borrower an amount of *s*, which is less than *r* when the loan is repaid. In this paper, we assume that the government credit subsidy program is funded by the program itself (for example, from the guarantee premium) and taxes collected from depositors. Without government credit program, the banks' return function is as follows: $\pi_{SME} = \theta_{SME}(r_{SME}) \cdot r_{SME}$,

in which only interest rate matters. With the credit subsidy, banks' return function become a function of *r, γ, σ* and *s* which can written in general form as follows:

$$\pi_{SME} = \theta_{SME}(r_{SME} - s) \cdot r_{SME} + (1 - \theta_{SME}(r_{SME} - s)) \cdot \gamma \cdot \sigma \cdot r_{SME}$$

The first component is the expected return if there is no default and the second one is the term representing expected guarantee support from government net of the guarantee fee, *[(1- θ)·(γ·r – (1-σ)·γ·r)]*. The equilibrium is where ϕ satisfies the following equation:

$$L^B(\phi) + \text{government direct loan} = S(\phi) - \text{government financing cost}$$

where the government financing cost (tax) reduces the available supply of private credit. In this model, assume that tax is financed from private saving.

4.3 Effect of credit subsidy

It is clearly that a credit subsidy has an impact only if the market equilibrium is either rationing ($L = S_2$) and market clearing ($L = S_3$) and when the program is subsidized. In the case of unsubsidized programs, the final effect is just a substitution of publicly-provided credit for private credit and there is no effect on credit allocation and interest rate. In the case of subsidized programs, the SME credit subsidies have three transmitting channels which are through 1) an increase in the banks' expected return curve (ϕ)[20] for SME lending, which, in effect, shifts demand (L^B) vertically, 2) a reduction in supply of fund (S) available for private lending for any level of interest rate and 3) in the case of interest subsidy, an increase in SME loan demand because borrowers pay relatively less and banks receive relatively. more. Please note again that the effect in 3) is applicable only to the interest rate subsidy program in the market-clearing equilibrium[21] and it shifts demand curve horizontally to the right and crowds out other borrower groups. Therefore, interest rate subsidy is relatively less effective than guarantee in allocating credit to SMEs when the SME group is rationed than when the SME market is clear. The intuition behind is that the credit guarantee more directly addresses the original cause of rationing or credit constraint, i.e., insufficient return on lending to SMEs. Hence, to increase SME lending, the government needs to increase the banks' return on SME lending (or shift the effective demand vertically). The same argument is also applied when the market equilibrium is SME redlining without credit subsidies. Figure 4.2 shows the vertical shift in the loan demand resulting from the credit guarantee program, which increases the banks' expected return on SME lending, and Table 4.1 summarizes the effects of changes in loan demand and supply and credit subsidy programs (interest rate subsidy and credit guarantee program) on the loan markets in different existing equilibria.

Through ϕ, credit subsidy can change the relative ordering of credit allocation to borrower groups. Imagine if we extend the model to more than one target groups, say two targeted groups, i.e., SME_1 and SME_2, that the government wants to promote. The subsidy in one group will have a crowding out effect on the other. For example, the government previously provided the loan guarantee for SME_1 and now guarantees SME_2's debts, the model suggests that some borrowing by general group and SME_1 is crowded out. In an extreme case, it might unintentionally drive all lending to SME_1 off the credit market. If the government wants to maintain previous lending to

[20] Guarantee increases the banks' received payments in case of default, whereas interest subsidy raises the repayment probability. A full (100% coverage) guarantee creates a horizontal bank expected return curve (ϕ). A partial guarantee shifts the ϕ curve, but does not change its shape.

[21] In the rationing equilibrium, there is no effect in 3) because the horizontal shift in SME demand does not change ϕ.

SME_1, the government needs to increase ϕ_{SME1}. Therefore, loan subsidies to one SME group may induce additional subsidies to the other groups of SMEs.

Figure 4.2: The vertical shift in effective demand (banks' derived demand) for funding due to the credit guarantee program

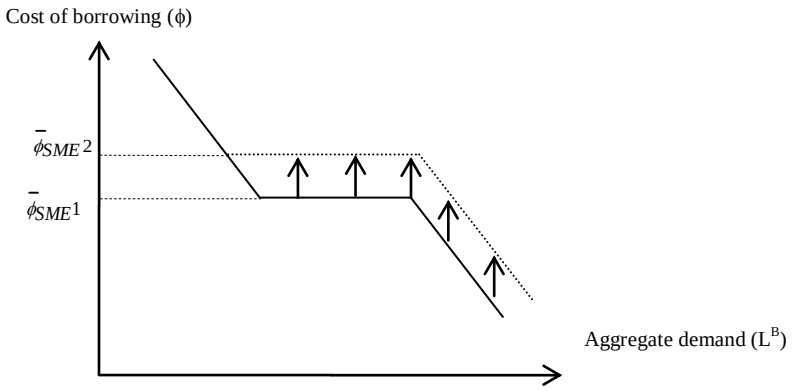


Table 4.1: The impacts of changes in demand and supply and SME credit program in different loan market equilibria

Existing SME loan market equilibrium	Small reduction in loan supply	Increase in the SME loan demand	Effect of credit subsidy	
			SME Interest rate subsidy (direct subsidy)	SME Credit guarantee (indirect subsidy)
Redlining: $L = S_1$	- Credit volume to G ↓ - r_G ↑ - No impact on SME	No impact on both G and SME	No impact on both G and SME	No impact on both G and SME
Rationing: $L = S_2$	- No change in interest rate - Credit volume to SME ↓	No impact on both G and SME	- ϕ ↑ (by ↑θ and effective demand shifts vertically)* - SME demand for loan ↑ (effective demand shifts horizontally) - S ↓	- ϕ ↑ (effective demand shifts vertically)* - S ↓
Market clearing: $L = S_3$	- Credit volume to G and SME ↓ - r_G and r_{SME} ↑	- r_G and r_{SME} ↑ - G loan demand ↓ (crowding out) - SME Credit volume ↑	- ϕ ↑ (by ↑θ and effective demand shifts vertically)* - SME demand for loan ↑ (and G is crowded out) - S ↓	- ϕ ↑ (effective demand shifts vertically)* - S ↓

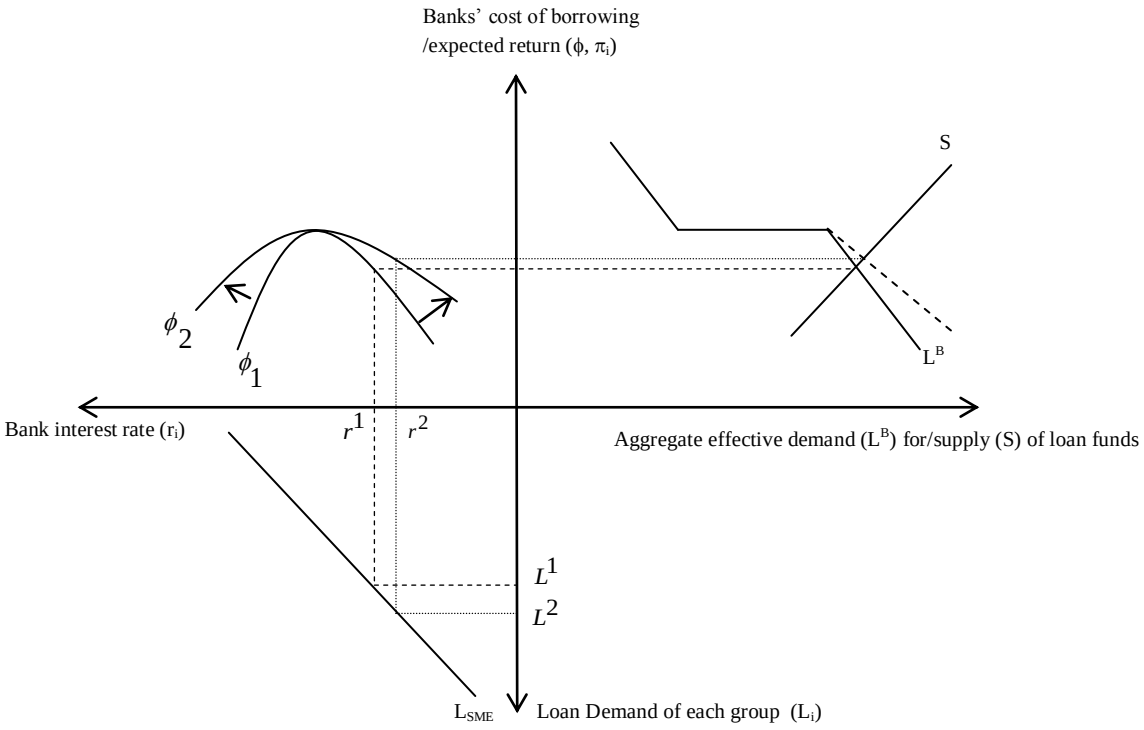
* The impacts of an increase in ϕ is the same as that of an increase in the SME loan demand in the market clearing equilibrium.

4.4 Asymmetric information in SME lending markets

If banks have more information on SMEs who are applying for loans, they will be able to evaluate SME customers more accurately. The improvement in adverse selection problem will

flatten the banks' expected return curve as shown in Figure 4.3 (in the upper left quadrant). It implies that an increase (as well as a reduction) in SME lending rates induce a less reduction in the bank's expected return. From Figure 4.3, when the equilibrium is market clearing, the interest rate charged to SME will be reduced from r^1 to r^2 and the SME loan demand (as well as bank's derived demand for loan) raises from L^1 to L^2. Although, aggregate volume of credit and deposit rate in the market rise, some of general loans are crowded out. Credit guarantee programs will also be more effective in reallocating credit to SME borrowers (i.e. more credit volume allocated) when banks face less asymmetric information problem in SME lending markets.

Figure 4.3: SME loan market equilibrium: less problem of information asymmetry (adverse selection)



4.5 Credit guarantee and welfare implications

One of key Implications from the model is that in equilibrium banks order borrower groups by their maximum rate of return and serve the groups sequentially. If the equilibrium cost of funding is ϕ^*, all borrowers j with $\phi_j > \phi^*$ have clearing credit markets, borrowers with $\phi_j = \phi^*$ are rationed, and those with $\phi_j < \phi^*$ are redlined. The credit guarantee simply rearranges loans among target borrowers by changing relative order of ϕ_j. The ordering of projects by borrower returns and social return in general will differ. As a result, credit subsidy can increase or decrease welfare (defined as total surplus) depending on the investment response and size of the subsidy (Gale (1990)). Therefore, the welfare effect of the credit guarantee program is ultimately an empirical question. The test is difficult because many assumptions about demand, supply and

current state of equilibrium must be imposed and data is limited.[22] Our empirical tests do not attempt to find the welfare effect and focus on the effectiveness of the credit guarantee program instead.

Another interesting question from welfare and policy-maker points of view is that should subsidies be targeted or general to borrowers? If we extend the model to the multiple borrower groups, the answer is obvious. For example, if there were several borrower groups already undertaking the efficient level of investment and one that invested too little, a general capital subsidy would crowd in investment by all groups and thus provide funding for many inefficient projects (as well as some efficient ones). Targeted, rather than general, subsidies can be welfare-improving.

Lastly, the government subsidy to the redlined group (borrowers j with $\phi_j < \phi^*$) may also be efficient. This happens because banks are unable to identify, or benefit from the upside gain of, projects with abnormally high returns, but are forced to absorb the cost when borrower are in default. Since bank payoffs are a concave function of *R*, while borrower payoffs are convex in *R*, it is possible for the total expected return ($p.R$) on a group's loans to exceed the bank borrowing rate (cost of funding), while the expected bank return (average repayment rate times interest rate charged to borrower) is less than cost of funding. In that case, the group will be redlined, but its project would nevertheless be socially efficient.

[22] With exception of Gale (1991) which tries to estimate the numerical welfare effects of federal subsidies in the U.S.

V. Evaluating the effectiveness of existing portfolio guarantee schemes: empirical tests

There are few papers which evaluates the effects of a loan guarantee program using firm and bank level data. In this section, we try to evaluate the impact of the portfolio credit guarantee program in Thailand.

5.1. Model Specification

We attempt to empirically assess the effectiveness of the TCG's portfolio guarantee schemes (PGS) using by-bank firm-level data in three aspects:

1) Credit additionality: how much the PGS help improve SME access to credit?
2) Contribution to the economy (economic additionality): how much the PGS contribute to the growth of SMEs and the economy?
3) Incentive misalignment: is the PGS well-designed enough to prevent incentive misalignment among the guarantor, banks and SME borrowers?

In particular, we would like to test if our variable of interest, whether or not an SME has joined the PGS ("treatment"), significantly drives the following outcome.

Table 5.1: Outcome variables

	Outcome	Measured by	Specification
1) Credit additionality (within the same year after the treatment)	Likelihood of receiving additional credit	Dummy variable indicating whether a firm has obtained additional credit line ("Credit addition dummy")	A
	Amount of additional credit received	Change in credit line	B
	Collateral pledged as a ratio of credit received	Change in collateral pledged to credit line ratio	C
	Price	Change in average interest rate	D
2) Contribution to the economy (next year after the treatment)	Growth of a firm	Asset growth	E
3) Incentive misalignment (next year after the treatment)	Likelihood of becoming delinquent	Dummy variable indicating whether one of a firm's facilities has been classified as special mentioned or worse according to the BOT loan quality classification over the period ("Become delinquent dummy")	F

We also control for firm characteristics and financial conditions, e.g., age, current ratio, as well as firm relationship and status with banks, e.g., number of banks each firm has a relationship with, collateral to credit line ratio.

Our outcome equation is of the following form:

$$Y_{b,i,t+N} = \alpha + \beta\, T_{b,i,t} + \delta\, X_{i,t-1} + \gamma\, R_{b,i,t-1} + BANK_b + YEAR_{t+N} + \varepsilon_{b,i,t+N} \qquad (1)$$

where i denotes firms, b their banks, t denotes the year before the treatment, and t+N denotes the year the outcome is observed, i.e., t+s and t+n meaning the outcome is observed within the same year, and next year after the treatment, respectively. Y is outcome variable as listed in Table 5.1. All changes in outcome variables are measured against the level at the year-end before the treatment. $T_{b,i,t}$ is a dummy variable indicating whether firm i has joined the PGS with bank b at time t. $X_{i,t-1}$ stands for a set of observable firm characteristics at time t-1, and $R_{b,i,t-1}$ stands for a set of observable lending relationship/status with bank b at time t-1. The choice of these control variables is determined by data availability, explanatory power and no multi-collinearity condition. Bank ($BANK_b$) and year ($YEAR_{t+N}$) fixed effects are controlled in all regressions.

If the selection of SME into the PGS is driven by some characteristics not included in the outcome equation (1), treatment variable, $T_{b,i,t}$, will be correlated with the error term ("endogeneity issue"), and OLS estimates will be biased. To address this endogeneity issue, we adopt Heckman-type treatment effect model, which is expressed in two equations:

Outcome equation:

$$Y_{b,i,t+N} = \alpha + \beta\, T_{b,i,t} + \delta\, X_{i,t-1} + \gamma\, R_{b,i,t-1} + BANK_b + YEAR_{t+N} + \varepsilon_{b,i,t+N} \quad (2a)$$

Selection equation:

$$T^*_{b,i,t} = \pi + \mu\, W_{i,t-1} + \lambda\, Z_{b,i,t-1} + BANK_b + YEAR_t + \nu_{b,i,t},$$

$T_{b,i,t}$ = 1 if $T^*_{b,i,t} > 0$, and $T_{b,i,t}$ = 0 otherwise (2b)

where $T^*_{b,i,t}$ t is a latent continuous variable indicating whether firm i has joined the PGS with bank b at time t. $W_{i,t-1}$ and $Z_{b,i,t-1}$ stands for a set of observable firm characteristics and bank-firm relationship/status at time t-1 that could affect the selection of a firm into the PGS. According to the TCG's general criteria and interviews with bankers, firms have joined or been selected into a PGS at least share some common characteristics, i.e., having insufficient collateral and being credit-constrained. A careful screening process is carried out by each bank before selecting a firm into the PGS. Therefore, we also include other observable firm characteristics and bank-firm relationship/status, as well as bank and year fixed effects in the treatment equation. All variables used are described in Table 5.2.

Table 5.2: List of variables used in the empirical test

Variable	Description
Outcome variables	
Credit addition dummy $_{b,i,\ t+s}$	Dummy variable indicating whether firm i has obtained additional credit line from bank b at time t+s
Change in credit line (million Baht) $_{b,i,\ t+s}$	Change in credit line amount granted by bank b to firm i from time t-1 to t+s

Variable	Description
Change in collateral pledged to credit line ratio $_{b,i,\ t+s}$	Change in the ratio of financial and physical collateral [23] pledged amount to credit line amount granted by bank b to firm i from time t-1 to t+s
Change in average interest rate (%)$_{b,i,\ t+s}$	Change in average interest rate across all facilities of firm i with bank b from time t-1 to t+s [average interest rate = mean [each facility's (minimum rate+ maximum rate)/2)]
Asset growth $_{i,\ t+n}$	% change of total assets of firm i from time t-1 to time t+n
Become delinquent dummy $_{b,i,\ t+n}$	Dummy variable indicating whether one of firm i's facilities has changed a status from normal to special mentioned or worse according to the BOT loan quality classification over the period t-1 to t+n
Treatment variables and factors determining treatment	
Treatment dummy (Join the PGS) $_{b,i,\ t}$	Dummy variable indicating whether firm i has joined the PGS with bank b at time t.
Under-collateralization dummy $_{b,i,\ t-1}$	Dummy variable indicating whether firm i has the ratio of financial and physical collateral pledged amount to credit line amount with bank b at time t-1 $< 100\%$. (Proxy for a firm's insufficient collateral)
Unused credit line (all banks) (%)$_{i,\ t-1}$	Credit line minus credit outstanding amount of firm i aggregated across all banks as a percentage of aggregate credit line at time t-1. The greater the ratio, the less credit-constrained firm i is. (Proxy for the whole firm i's level of credit constraint)
Financial Ratio	
Current ratio $_{i,\ t-1}$	Current assets to total assets of firm i at time t-1
Return on asset $_{i,\ t-1}$	Net profit to total assets of firm i at time t-1
Asset turnover ratio $_{i,\ t-1}$	Total revenue to total assets of firm i at time t-1
Debt to asset ratio $_{i,\ t-1}$ [24]	Total liabilities to total assets of firm i at time t-1
Size [25]	
Ln(Equity) $_{i,\ t-1}$	Natural log of total equity of firm i at time t-1
Other firm characteristics	
Asset growth $_{i,\ t-1}$	% change of total assets of firm i from time t-2 to time t-1
Age $_{i,\ t-1}$	Age for firm i at time t-1
Bank-firm relationship/status	
No. of banks $_{i,\ t-1}$	Number of banks that firm i has a relationship with at time t-1
Unused credit line (million Baht) $_{b,\ i,\ t-1}$	Credit line minus credit outstanding amount of firm i with bank b at time t-1
Over/under-collateralization ratio $_{b,\ i,\ t-1}$	The ratio of financial and physical collateral pledged amount

[23] According to TCG definition, financial and physical collateral includes cash, government securities, property, plant and equipment, property lease, and intellectual property.

[24] Debt to asset ratio is highly negatively correlated with ln(equity). Considering their relative explanatory power in each equation, we decide to include debt to asset ratio in treatment equation and ln(equity) in outcome equation, except for specification E, i.e., asset growth as an outcome variable, where we use debt to asset ratio in both equations. However, using ln(equity) in outcome equation does not change the main result.

[25] We select ln(equity) as a proxy for firm size instead of ln(assets) because ln(assets) is highly correlated with other financial ratio variables

Variable	Description
	minus credit line to total credit line of firm I with bank b at time t-1
Delinquency dummy $_{b, i, t-1}$	Dummy variable indicating whether one of firm i's facilities was classified as special mentioned or worse according to the BOT loan quality classification at time t-1.
Average interest rate (%)$_{b, i, t-1}$[26]	average interest rate across all facilities of firm i with bank b at time t-1

5.2 Data

Our samples are constructed from the following different set of data.

1) Monthly loan-level data on bank lending to a single borrower during 2008 – 2013 from the Bank of Thailand[27], which, for example, include credit line amount, credit outstanding amount, minimum and maximum interest rates, collateral pledged amount, loan quality classification, as well as economic sector code (ISIC). We construct by-bank and firm-level data by aggregating, averaging, or counting loan-level data for each firm.

However, only loan-level data on borrowers with aggregate credit line or outstanding amount at least 20 million Baht are currently reported to the Bank of Thailand.[28] Our constructed sample will therefore be biased toward large SMEs, who have already had access to bank credit.

We select the latest monthly observations found in the dataset within the same year and next year after the treatment to represent $Y_{b,i,t+s}$ and $Y_{b,i,t+n}$, respectively. As for control variables $R_{b,i,t-1}$, observable lending relationship/status with bank b at time t-1, we use December observations of year t-1. All change variables are measured against the December observations of the previous year.

2) Yearly firm characteristic data during 2008 – 2011[29] **from the Ministry of Commerce**, which include main items from each firm's financial statements, registration date, firm status, etc.

3) Yearly data of firms joining PGS during 2009 -2012 (i.e., PGS 1- 4 and PGS flood) from the TCG.[30]

4) Juristic IDs of SMEs according to the Ministry of Industry (MOI) definition from the Office of Small and Medium Enterprises Promotion (OSMEP)

[26] Average interest rate$_{t-1}$ is included in specification D (average interest rate) and E (likelihood of becoming delinquent). For specification D, the level of the interest rate in the previous period could have an impact on the level of interest rate in the following periods, e.g., mean-reverting effect. Also, the higher interest rate could adversely affect the ability and willingness of borrowers' debt repayment.

[27] Currently only loan-level data on borrowers with aggregate credit line or outstanding amount of at least 20 million Baht for commercial banks, foreign bank subsidiaries, and foreign bank branches, 5 million Baht for retail banks and finance companies, and 1 million Baht for credit foncier companies are reported to the Bank of Thailand.

[28] Loan-level data on all SME borrowers of commercial banks will be reported to the Bank of Thailand, starting from September 2014.

[29] Firm data from the Ministry of Commerce only available up to 2011.

[30] PGS5 just started in 2013. Therefore, it is still too early to assess its effectiveness.

We merge data from the above sources and kept only those who are SMEs according to the MOI definition. We then eliminate financial firms, government agencies, and international organizations, since they are of different nature, compared with those from the other sectors. We also drop observations from banks that do not participate in any PGS and those that, after data merging, do not have any observation of firms joining any PGS. Our full sample consists of 64,011 bank-firm-year observations, of which 63,336 observations are control observations. Only 675 observations or 1.05% of our full sample has joined one of the PGS with one of the banks during 2009-2012.

Although well-distributed by year, our sample is quite concentrated in commerce and manufacturing sectors. Tables 5.3 and 5.4 illustrate the distribution of our full sample by year and by industry sector, respectively. Due to data availability, not all types of outcome are observed from all bank-firm-year observations in the full sample. Our final sample for each outcome specification ranges from 27,341 to 63,914 observations, as shown in Table 5.5

Table 5.3: Distribution of full sample by year

	Year				Total
	2009	2010	2011	2012	
Control	14,572	15,058	16,038	17,668	63,336
Treated	213	130	54	278	675
Total	14,785	15,188	16,092	17,946	64,011

Table 5.4: Distribution of full sample by sector

	Agri-cultural	Mining	Manu-facturing	Com-merce	Con-struction	Real Estates	Utility	Services	Others	Total
Control	680	267	18,281	24,709	3,145	7,276	1,925	7,023	30	63,336
Treated	2	3	227	293	50	17	27	55	1	675
Total	682	270	18,508	25,002	3,195	7,293	1,952	7,078	31	64,011

Table 5.5: Final sample for each outcome specification

		Year					Total
		2009	2010	2011	2012	2013	
1) Credit additionality	Control	14,572	15,058	16,038	17,668		63,336
	Treated	154	125	43	256		578
	Total	14,726	15,183	16,081	17,924		63,914
2) Contribution to the economy	Control		13,954	14,257			27,071
	Treated		157	126			270
	Total		14,111	14,383			27,341
3) Incentive misalignment	Control		13,666	13,569	14,109	15,825	57,169
	Treated		149	119	38	252	558
	Total		13,815	13,688	14,147	16,077	57,727

5.3 Descriptive statistics

Table 5.6 reports descriptive statistics of the full sample by control and treated groups at year-end before the treatment. Compared with control firms, treated firms are smaller in size and of

younger age, as well as grow at a slower pace on average. Based on the average numbers, banks granted them less credit and charged them at a higher average interest rate before the treatment. They also have less collateral and were more credit-constrained. However, the treated group had higher average current ratio, return on asset, and asset turnover ratio.

Table 5.6: Descriptive statistics of the full sample by control and treated groups[31]
(at year-end before treatment)

	Control			Treated		
	Mean	Standard Deviation	No.of obs.	Mean	Standard Deviation	No.of obs.
Financial Ratios						
Current ratio$_{t-1}$	0.568	0.325	63,333	0.582	0.273	675
Return on asset $_{t-1}$	-0.0848	8.889	63,333	0.0150	0.0620	675
Asset turnover ratio $_{t-1}$	2.041	7.859	63,333	2.858	13.72	675
Debt to asset ratio $_{t-1}$	0.667	0.273	63,333	0.702	0.246	675
Size						
Total assets (million Baht) $_{t-1}$	345.6	2,569	63,336	113.7	114.4	675
Total equity (million Baht) $_{t-1}$	135.3	1,669	63,336	27.86	32.92	675
Ln(Assets) $_{t-1}$	18.46	1.391	63,336	18.13	0.975	675
Ln(Equity) $_{t-1}$	14.11	8.685	63,336	15.13	6.215	675
Other firm characteristics						
Asset growth $_{t-1}$	0.895	23.95	63,336	0.329	1.590	675
Age $_{t-1}$	15.99	10.69	63,316	13.81	8.887	675
Bank-firm relationship/status						
No. of banks $_{t-1}$	1.537	1.070	63,336	1.286	0.611	675
Credit line (million Baht) $_{t-1}$	97.77	419.6	63,336	62.68	61.99	675
Credit outstanding (million Baht) $_{t-1}$	56.39	223.4	63,336	44.57	42.84	675
Collateral pledged (million Baht) $_{t-1}$	36.88	92.97	63,336	28.31	31.80	675
Unused credit line (million Baht) $_{t-1}$	41.90	265.0	63,336	18.39	31.03	675
Over/under-collateralization ratio $_{t-1}$	-0.423	0.692	63,161	-0.448	0.533	674
Delinquency dummy $_{t-1}$	0.0723	0.259	63,336	0.0237	0.152	675
Average interest rate (%)$_{t-1}$	7.318	2.527	62,312	7.663	1.857	673
Factors determining treatment						
Under-collateralization dummy $_{t-1}$	0.810	0.392	63,336	0.905	0.293	675
Unused credit line (all banks) (%)$_{t-1}$	0.397	0.301	63,271	0.296	0.225	674

With the treatment, the treated firms could receive additional credit or better credit term, enabling them to grow at a higher pace. Table 5.7 shows descriptive statistics for outcome variables of control and treated groups after the treatment. Based on unconditional mean values, treated firms is more likely to receive additional credit than control firms. They are also granted greater amount of additional credit and/or are required less collateral, resulting in lower collateral pledged to credit line ratio. The average interest rate is also lower. Their average asset growth next year after the treatment (at time t+n) is also higher. However, on average, the likelihood of

[31] We correct for the outliners found in some variables by truncating them at +/- 3 standard deviations from the mean value.

becoming delinquent next year after the treatment is higher in the treated group than the control group.

Table 5.7: Descriptive statistics for outcome variables of control and treated groups (after the treatment)

Outcome	Outcome Variables	Control			Treated		
		Mean	Standard Deviation	No.of obs.	Mean	Standard Deviation	No.of obs.
1) Credit additionality (same year)	Credit addition dummy $_{t+s}$	0.253	0.435	63,336	0.841	0.366	578
	Change in credit line (million Baht) $_{t+s}$	2.256	122.6	63,336	18.95	37.72	578
	Change in collateral pledged to credit line ratio $_{t+s}$	-0.0108	0.713	63,304	-0.108	0.487	578
	Change in average interest rate (%)$_{t+s}$	0.0445	1.579	61,914	-0.687	1.430	576
2) Contribution to the economy (next year)	Asset growth $_{t+n}$	0.145	0.596	27,071	0.398	0.802	270
3) Incentive misalignment (next year)	Become delinquent dummy $_{t+n}$	0.0302	0.171	57,169	0.0323	0.177	558

5.4 Empirical results

We estimate parameters in treatment equation (2a) and outcome equation (2b) for each outcome specification A-F using Heckman-type treatment effect model. Our estimation results are presented below.

5.4.1 Treatment equation

Table 5.8 reports estimation results for the treatment equation under specification A (credit addition dummy) using observations from all sectors. The estimated coefficients of under-collateralization dummy and unused credit line aggregated across all bank are of expected sign and statistically significant, confirming that firms having insufficient collateral and greater credit constraint are more likely to join any of the PGS. In addition, younger firms and those having a relationship with less number of banks, i.e., firms lacking sufficient track records, are more likely to join the PGS. The results also show that each bank has carried out a careful screening process before selecting a firm into the PGS, as the estimated coefficients of current ratio, asset turnover ratio, and delinquent dummy are of expected conservative direction and statistically significant. [32]

[32] Results under other outcome specifications are similar. They are available upon request.

Table 5.8: Estimation results for treatment equation under specification A (credit addition dummy as outcome variable)

Factors determining treatment	Coefficient
Under-collateralization dummy	0.316***
	(0.0558)
Unused credit line (all banks) (%)	-0.786***
	(0.0658)
Current ratio	0.117**
	(0.0524)
Return on assets	0.0136
	(0.0332)
Asset turnover ratio	0.00254**
	(0.00127)
Debt to asset ratio	0.127*
	(0.0649)
Asset growth	-0.00698
	(0.00672)
Age	-0.00579***
	(0.00178)
No. of banks	-0.145***
	(0.0243)
Delinquency dummy	-0.439***
	(0.0884)
Bank fixed effect	Yes
Year fixed effect	Yes

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.

5.4.2 Outcome equation (Full results are reported in Tables A.5.1 to A.5.7 in Appendix)

The estimated treatment effects on outcome variables are summarized in Table 5.9. All sector results in column (1) of Table 5.9 suggest that, even after controlling for other factors and endogeneity problem, treated firms in our sample are still more likely to receive additional credit from banks (72.7% higher[33]). Collateral pledged to credit line ratio and average interest rate are significantly lower for treated firms (10.6% and 0.9% lower). However, the additional amount of credit received is not significantly higher for treated firms than for control firms. Treated firms also grow at a significantly faster rate (16.1% higher), but they are also more likely to become delinquent the year after the treatment (18% higher). Overall the PGS of TCG do help the SMEs who joined the program in terms of greater chance of receiving additional credit from banks, better credit terms (less collateral pledged, lower interest rate), and enhanced firms' growth potential. However, treated firms are more likely to become delinquent than control

[33] Estimated average marginal effect from probit regression

firms, suggesting that either 1) banks select risky SMEs into PGS ex ante or 2) there is some incentive misalignment among guarantor, lender, and borrower ex post. One explanation for the latter conjecture could be that, as treated borrowers pledge less of their collateral with banks, i.e., putting less of their stake at risk, they may be less willing to repay their debts. Or knowing that TCG will help bear some certain portion of losses, banks may be less stringent in the monitoring and/or collection process. This is an evidence of moral hazard when the guarantee transfers the risk-sharing from banks and SMEs to the guarantee agent.

By industry sector results in column (2) – (5) of Table 5.9[34] are largely consistent with all sector results. However, the benefit of receiving a treatment on credit addition is less obvious for construction, real estate and utility firms. The treatment effect is positive and statistically significant only in the change in average interest rate. Moreover, the cost in the form of greater likelihood of becoming delinquent is more pronounced for treated firms in those sectors. In contrast, the benefit for the treated firms in service sector is more evident both in terms of greater chance of receiving greater amount of credit (78.8% higher[33]), lower collateral required (20.5% lower), and higher asset growth (39.3% higher) the year after the treatment. The treatment effect on greater likelihood of becoming delinquent is also not statistically significant in the service sector**.** Based on these by-sector results, the TCG treatment seems to benefit the most (the least) to SMEs in the service sector (construction, real estate, utility sectors), and the incentive misalignment as a result of the treatment seems to be less (more) prominent in the service sector (construction, real estate, utility sectors). However, the TCG guarantee portfolio is currently concentrated in manufacturing and commerce. Considering that SME contribution to the GDP comes mostly from service sector, should TCG target more on the service sector?

Table 5.9: Estimated effect of treatment on outcome variables by sector

Outcome	Outcome variable	All sectors	Manu-facturing	Commerce	Construction, Real Estates, Utility	Services
		(1)	(2)	(3)	(4)	(5)
1) Credit additionality (same year)	Credit addition dummy $_{t+s}$	2.820***	2.685***	2.897***	1.469	3.250***
		(0.165)	(0.273)	(0.211)	(1.095)	(0.546)
	Change in credit line (million Baht) $_{t+s}$	4.255	0.994	-3.202	-9.621	36.36
		(8.064)	(9.104)	(9.668)	(28.84)	(32.50)
	Change in collateral pledged to credit line ratio $_{t+s}$	-0.106**	-0.117**	-0.108**	0.861***	-0.205**
		(0.0415)	(0.0563)	(0.0449)	(0.154)	(0.0948)
	Change in average interest rate $_{t+s}$	-0.896***	-1.070***	-0.919***	-0.885***	-0.283
		(0.111)	(0.188)	(0.191)	(0.280)	(0.468)
2) Contribution to the economy (next year)	Asset growth $_{t+n}$	0.161***	0.176	0.161	0.0111	0.393**
		(0.0617)	(0.173)	(0.127)	(0.132)	(0.153)
3) Incentive misalignment (next year)	Become delinquent dummy $_{t+n}$	1.113***	1.641*	1.133*	2.298**	0.635
		(0.407)	(0.944)	(0.685)	(1.163)	(0.856)

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.

[34] The number of observations for agricultural, mining, and the others is too small to produce reliable estimation results.

As the above results suggest that incentive misalignment as a result of the treatment seems to be pronounced, we explore more if the degree of incentive misalignment is different across banks by conducting by-bank estimations under specification F. Disguising all banks' names, the treatment effects on the likelihood of becoming delinquent from by-bank estimations[35] are presented in Table 5.10. Results in Table 5.10 show that the greater likelihood of becoming delinquent is statistically significant for treated firms with bank A and bank F, suggesting that some banks may perform worse than the other banks in mitigating or controlling such incentive misalignment. Would there be any additional mechanism, such as performance-based incentive structure, the TCG should put in place to help reduce, or give incentives for Bank A and Bank F to do a better job in reducing, such incentive misalignment?

Table 5.10: Estimated effect of treatment on outcome variables by bank

Outcome variable: Become delinquent dummy	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment dummy (Join the PGS)	3.100***	1.412	1.075	1.479	0.699	2.918***
	(0.728)	(1.340)	(0.887)	(1.261)	(0.934)	(0.237)

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.

Other than the TCG treatment, several firm characteristic and bank-firm relationship/status factors also significantly affect the outcome variables. As presented in Table 5.11, good financial ratios, particularly current ratio, have positive, significant effects on credit addition, lower likelihood of becoming delinquent, as well as asset growth. Bank-firm relationship/status factors , i.e., the number of banks each firm has a relationship with, collateralization ratio, and not-in-delinquency status, also have positive, significant impacts on credit addition. Age and size do matter. Older and larger firms grow at a slower pace than younger and smaller firms. Older firms may have other sources of funding, as they are more diversified, rely less on additional bank credit and are less likely to become delinquent. Moreover, high level of average interest rate in the previous period may cause the probability of becoming delinquent to increase.

[35] The estimation can be done for an individual bank that hase a sufficient number of observations.

Table 5.11: Estimated effects of other control variables on outcome variables using observations from all sectors

	Credit addition dummy	**Change in credit line (million Baht)**	**Change in collateral pledged to credit line ratio**	**Change in average interest rate**	**Asset growth**	**Become delinquent dummy**
	(1)	(2)	(3)	(4)	(5)	(6)
Current ratio$_{t-1}$	0.342***	5.997***	-0.0583***	-0.0884***	0.0846***	-0.0476
	(0.0183)	(1.564)	(0.00836)	(0.0181)	(0.0115)	(0.0351)
Return on asset $_{t-1}$	0.0110	-0.00837	0.000226	0.000410	0.000208	-0.000845
	(0.00935)	(0.0546)	(0.000292)	(0.000971)	(0.000308)	(0.00161)
Asset turnover ratio $_{t-1}$	0.00121*	0.0214	-0.000508	-0.000604	0.0242***	-0.0325***
	(0.000652)	(0.0609)	(0.000325)	(0.000735)	(0.00109)	(0.00502)
Ln(Equity) $_{t-1}$ (Debt to asset ratio $_{t-1}$ for asset growth equation)	0.0123***	0.0850	0.000389	-0.00240***	-0.202***	-0.0123***
	(0.000742)	(0.0591)	(0.000316)	(0.000685)	(0.0134)	(0.00110)
Asset growth $_{t-1}$	0.000266	0.0803***	-3.98e-05	-2.22e-05	0.00150***	0.000172
	(0.000215)	(0.0202)	(0.000108)	(0.000236)	(0.000482)	(0.000346)
Age $_{t-1}$	-0.00569***	-0.182***	0.000746***	0.000584	-0.00476***	-0.00586***
	(0.000541)	(0.0467)	(0.000250)	(0.000541)	(0.000350)	(0.00110)
No of banks $_{t-1}$	0.0468***	2.748***	-0.0247***	-0.0478***	0.00569	-0.0181
	(0.00529)	(0.480)	(0.00257)	(0.00561)	(0.00359)	(0.0122)
Unused credit line (million Baht) $_{t-1}$	-9.98e-06	-0.0398***	1.58e-05	5.62e-06	1.33e-05	-0.000227**
	(1.99e-05)	(0.00183)	(9.80e-06)	(2.13e-05)	(1.40e-05)	(0.000108)
Over/under-collateralization ratio $_{t-1}$	0.0834***	6.019***	-0.447***	0.0106	-0.00627	-0.0348
	(0.00897)	(0.747)	(0.00399)	(0.00858)	(0.00533)	(0.0214)
Delinquency dummy $_{t-1}$	-0.344***	-7.229***	0.000676	0.306***	-0.122***	n/a
	(0.0266)	(1.975)	(0.0106)	(0.0237)	(0.0140)	
Average Interest Rate$_{t-1}$	n/a	n/a	n/a	-0.180***	n/a	0.0392***
				(0.00303)		(0.00573)

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.

VI. Conclusions and policy implications

The role of government in imperfect capital markets is an issue of theoretical and practical concern. Our results suggest that the credit guarantee is an effective tool for government to alleviate SME funding constraint. Government direct subsidies are not cost effective to alleviate SMEs' financial constraints because of mis-targeting, rent-seeking and lack of fiscal sustainability (Khwaja and Mian (2005), Arping et al (2008) and Zia (2008)). Even though, there is no such market failures, our model still indicates that the loan guarantee can perform a function of credit reallocation better than the interest subsidy. This is because guarantee directly raises the bank's return and address the rationing problem.[36]

Empirical results in Section V show that the selection of SMEs in the PGSs is driven by available collateral (-), age (-), the number of banks they have relationship with (-) and quality of borrowers (+). It suggests that banks employ PGSs not only to raise its expected returns, but also to alleviate the adverse selection problem when the price alone (interest rate) cannot allocate and clear SME credit markets. However, PGSs do not reallocate risk between borrowers and banks, but to the guarantee agent (TCG) instead so that the PGSs reduce the overall risk faced by both private parties and do not alleviate moral hazard[37]. This explains why loans backed by credit guarantees may be riskier (higher delinquency rate) than non-backed loans. Therefore, the structure and institutional arrangements that take account of both adverse selection and moral hazard is crucial for any successful credit guarantee program. In addition, our results suggest that the availability of loan guarantees has significant impact on probability of getting additional credit (+), collateral ratio requirement (-), interest payment (-), subsequent asset growth of SMEs (+) and loan default probability (+). However, we do find the positive, but not significant, relationship between availability of credit guarantees and credit volume. In summary, loan-guaranteed SMEs may not see a substantial benefit of credit additionality in term of credit volume, but they enjoy another form of credit additionality, which is more favorable loan conditions (such as lower collateral requirement and reduction in the lending interest rate) and their asset grows faster than SMEs not backed by a guarantee. Regression results by industry sector indicate stronger credit and economic additionality impacts of the guarantee on SMEs in the service sector and find no significant evidence of incentive misalignment in this sector.

While recognizing that credit guarantee through banks cannot entertain all needs of SMEs because they are heterogeneous, government subsidy in the form of credit guarantee may probably be the best economic use of funds in financial support for SMEs, provided that an acceptable level of additionality is attained. Going forwards, here are our recommendations on the credit guarantee program model in Thailand.

[36] Rationing exits because of insufficient creditworthiness of borrowers, not their unwillingness pay. The interest subsidy affects primarily through the reduction of borrower payments.

[37] Moral hazard problem reduces the ability of prices alone to clear lending market as once the loan is extended, the actions of borrowers and lenders are not independent of the lending rate (Myers and Majluf (1985)).

Individual loan vs. portfolio guarantee?

From our results and current institutional set-up of TCG, we are in support of portfolio guarantee rather than individual loan guarantee despite the international popularity in loan-level approach. Portfolio guarantee schemes are obviously less labor-intensive for TCG since screening of clients is done by the lending bank. A portfolio scheme can only work if partner banks compete for clients and are able to accurately evaluate the SME business.

More incentive-based programs

The success of guarantee funds depends largely on their design and structure, i.e., how incentives and sanctions are set and how the fund is governed. From the international experience, there is a surprisingly low use of risk-based pricing and limited use of risk management mechanisms. Now only the risk management mechanism put in place to control the moral hazard problem faced by TCG is the relatively small and fixed coverage ratio at 18%. However, we reckon the necessity to introduce additional supplementary mechanisms for risk management if we would like to increase the coverage ratio to obtain more credit additionality. Such mechanism should be designed to minimize the adverse selection and moral hazard problems and hence depends on individual banks' performance in fulfilling their functions (credit evaluation, loan monitoring, debt collection etc.). Examples are as follows:

- Performance-based pricing with premiums or coverage ratios based on past portfolio performance of the respective institution
- Contribution of participating banks in TCG funds. In effect, the incentive of banks and TCG will be more aligned and hence the moral hazard is reduced. In Japan, banks' contributing to the guarantee fund is tax deductible.
- Even though, we find that guaranteed SMEs are more likely to default, this evidence does not significantly hold for every commercial bank in our sample. In the future of TCG setting if we find such strong evidence between guarantee and default rate across all banks, a possible suggestion would be the guarantee structure that demands a bank to absorb the first loss. Therefore, a bank will be more careful in assessing clients since it takes the first loss. The first loss limit may be set based on general loss rate of SME lending, say 5% in case of Thailand.
- In any case, collateral requirement, i.e., % stake each borrower puts at risk, should not be set to zero, as it serves as a tool to mitigate moral hazard problem at the borrower level. It could also help screen safe from risky borrowers.

Eligible group of SMEs

We believe that future PGS should be more targeted. Credit guarantee funds have a role to play in redirecting investments towards sectors that are considered important for employment creation and economic growth, i.e., small and medium sized enterprises and more targeted industry. Due to a resource constraint, rather than focus on "who wants credit?", it should be better for TCG to focus on the combination of "who needs credit and can put credit to work?". Our results

tentatively suggest that SME service industry may be one of the more-targeted industries to promote, as the share of SMEs' contribution to GDP from this sector is the highest, the impact of guarantee on its asset growth is the most evident, and the cost from incentive misalignment is not significant. A tailor-made loan credit program for the SME service industry may be introduced. Budget and guarantee amount allocated to this sector may be separately set. Their guarantee fee and coverage ratio (% risk sharing) on the service-industry PGS could also be set differently from other general PGS.

The start-up SME (age 0-3 years) is a group that is worth mentioning here. Figure 3.5 in Section III shows that start-up firms have very limited access to credit guarantees, even though TCG introduced a special PGS for them. If there is any modification in PGS which is in favor of SME borrowers, the start-up SME should be given the priority consideration, for example, lower collateral requirement and higher coverage ratio. For start-up firms, loan guarantees might correct for unequally distributed endowment, i.e., collateral (Craig, Jackson and Thomson (2005)). In addition, credit guarantees help starting relation-based relationship between banks and start-up SMEs, which may be fruitful in the future (Petersen and Rajan (1994)).

Guarantee fee and coverage ratio

Fee and coverage ratio should be considered in tandem in order to have prudent guarantee programs. As discussed earlier, fee and coverage ratio should be more performance-based. From PGS1 to PGS4 (of which the annual fee is 1.75% and maximum coverage is about 15.5% of total guarantee amount for each bank portfolio), the guarantee amount in each PGS has fully utilized. Therefore, if we maintain current fee and coverage ratio and just increase the total guarantee amount by TCG, the most likely case would be that banks will maintain the same quality pool in their guaranteed-SME portfolios. It means that riskier (but efficient) SMEs may not be selected by banks because the banks' expected return per unit of client is the same and not high enough to include riskier in their guarantee portfolio.

If the guarantee fund's objective is to target SMEs who have not been bank's client before and are categorized by banks as "too high risk", we need to increase guarantee coverage ratio and thus raise the banks' expected return in lending to those particular high risk SMEs. Please note that any proposal to broaden coverage ratio without adjusting annual fee should be carefully considered and implemented with a clear objective because it would not only unnecessarily induce more adverse selection and moral hazard problems, but also require more government subsidy.

To alleviate the SME financing constraint, any measure or policy to reduce the asymmetric information problem (both adverse selection and moral hazard) in SME credit information would be welfare improving because it allow price (interest rate) to have more power to clear the market and also increases the proportion of quality (risk-efficient) borrowers in the pool of prospective borrowers.

It is often difficult for banks to conduct risk assessment for SME borrowers due to the availability and limited reliability of data (SMEs' financial statements are generally not audited or even do not exist in most small SMEs). The centralized data of SME could be beneficial. For this, the Bank of Thailand has taken a more active role to centralize commercial banks' SME loan data. SME data benchmark may be developed and will help banks evaluate the SME business viability more accurately (and hence price accordingly). Moreover, the centralized reporting system that assists banks to verify and reconcile SMEs' cash flows through overall banking system should be further studied because with more complete and reliable data, banks will be able to accurately assess risks from SME lending, and this will only benefit risk-efficient SMEs and country welfare.

For future studies, perhaps the most important and most difficult extension is the connection between credit allocations (after the government subsidies) and real economic activity, such as the study of spill-over and externality effects of government guarantees on the private investment. In this example, a guarantee may serve to keep an SME viable now and raise investment in the future. In this case, investment rises by more than the change in guarantee amount. Last but not least, we recognize the limitation in our data set, which is more biased toward larger[38] and less-credit constraint SMEs. When banks' credit information of all SME borrowers is available in 2015, there should be an empirical test to ensure that our results and conclusions here are still robust and valid.[39]

[38] Only loan size of at least 20 million Baht for commercial banks is currently available.

[39] The conjecture is that the main results should hold, i.e., there still exist credit and economic additinality. However, the problem of incentive misalignment may be more pronounced when smaller SMEs are included because of more severe information asymmetry and moral hazard.

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Appendix

Table A.3.1: Economic and credit additionality[40]

Country	Eligible criteria in screening borrowers					Specific guarantee programs				Other services	Additionality
	Industry	Employee	Asset size / Capital size	Sale / Revenue	Remarks	Start-up	Tech-oriented	Specific industry	Others		
Japan CGC	Manufacturing and others	300 or less	Capital - up to JPY 300 Mln		– Agriculture, forestry, fisheries, financial industry as well as religious and non-profit organizations are not eligible. – Guarantees are reinsured by Japan Finance Corporation.				Bond	-	Increase SMEs credit access by 53% (KPMG (2011))
	Wholesale	100 or less	Capital - up to JPY 100 Mln								
	Retail	50 or less	Capital - up to JPY 50 Mln								
	Services	100 or less	Capital - up to JPY 50 Mln								
South Korea KODIT		– Any firm. However, 60% or more of the total amount of guarantees shall be for SMEs which are classified under the SME Framework Act and its Implementation Decree.[41] – Guarantees for listed enterprises are only allowed for loans made with special funds.			Guarantees are restricted to loans to gambling and similar games, luxurious leisure, entertainment and real-estate related industry.	/		/	Bond, collateralized loan obligation, tax payment, credit transaction between enterprises, etc.	Advisory services, Credit insurance, Business consult	Increase sales, employment, and firm survival rate (Oh, Lee, Choi and Heshmati (2006))
South Korea KOTEC	Technology-oriented, innovative, green-tech, start-ups, and culture	1,000 or less	Total Asset – up toKRW 100 Bln			/	/	/	Bond, venture investment, P-CBOs, etc.	Angel investment, Advisory services, Business	Increase sales, productivity, and firm survival rate (Kang, J W and Heshmati, A (2008), Roper. S. (2009))

[40] With assistance of Kawin Tiraborisut and Nutchaya Nuntasithidumrong

[41] Korea's promotion of small and medium enterprises (No date) *Criteria of Korean SMEs* [Online]. Available: http://www.smba.go.kr/eng/smes/scope.do?mc=usr0001146 [Access on 7 September 2014].

Country	Eligible criteria in screening borrowers					Specific guarantee programs				Other services	Additionality
	Industry	Employee	Asset size / Capital size	Sale / Revenue	Remarks	Start-up	Tech-oriented	Specific industry	Others		
	content production									consult	
South Korea RCGF		All business enterprises (mainly Small and Micro enterprises)				/		NA			
Chile FOGAPE				Small – up to CLF 35,000 Exporter – up to CLF 167 Mln		NA	NA	NA			40% increase in credit volume, 14% increase in probability of getting a loan, 6% increase in businesses' turnover (Larraín and Quiroz (2006))
Taiwan SMEG	Manufacturing	200 or less	Capital –NTD 80Mln		An enterprise must operate more than 6 months.	/	/	/	Micro/Women Start-up Loans, Student Loans, etc.		
	Non-manufacturing	50 or less		Up to NTD 100 Mln							
Netherland BMKB		250 or less	Total Asset – EUR43Mln	Up to EUR 50 Mln		/	/				
Canada CSBFP				Up to USD 5Mln	Farm business and charitable or religious institution are not eligible.	/					75% of guarantee users would not have been able to get a loan without the guarantee (Ridding, Madill and Haines (2007))
UK EFG				Up to GBP 25 Mln	– Guarantee includes new-term loans, Refinancing an existing loan, Converting an overdraft into a term loan, Invoice finance guarantee, OD. – Coal, forestry, fisheries, transport and	/					Increase SMEs credit access by 68% (KPMG, 2011)

Country	Eligible criteria in screening borrowers					Specific guarantee programs				Other services	Additionality
	Industry	Employee	Asset size / Capital size	Sale / Revenue	Remarks	Start-up	Tech-oriented	Specific industry	Others		
					agriculture are not eligible.						
Thailand TCG			Net Fixed Asset –THB 200 Mln. (excluding land)			/					

Table A.3.2: Design of credit guarantee schemes in selected countries

Country/ Scheme	Structure		Procedure				
	Type	Funding structure	Risk mng.	Coverage ratio	Guarantee limit	Annual fee	Subrogation
Japan CGC (Non-profit public corp.)	Individual	– Municipalities 52% – FIs 36% – Enterprises 12%	CGC	– 80% for all clients – 100% for safety-net guarantees, start-up and micro-enterprise		Depend on firms' financial positions and coverage ratio – 0.45% - 1.9% for risk sharing guarantee – 0.5% - 2.2% for full guarantee	Principal and interest after 60-day cooling-off period
South Korea KODIT (Non-profit public corp.)	Hybrid	– Government (determined year by year) – FIs (0.225% of loans[42]) – Enterprises	KODIT	Depend on credit rating and guarantee period – 50% - 85% for guarantee period up to 10 years – 50% - 80% for guarantee period more than 10 years	Depend on KODIT's credit ratings – KRW 3 - 7 billion – KRW 1.5 billion for an enterprise with weak credit condition	Depend on KODIT's credit ratings – 0.5% - 3.0% – 0.5% - 3.5% for large enterprises	Principal, interest and others expense after 3-month cooling-off period
South Korea KOTEC	Individual	– Government (determined	KOTEC		Depend on types of guarantee and enterprise	Depend on KOTEC's credit ratings, guarantee	

[42] The contribution rate also depends on the amount of a bank' payments under guarantees over contributions.

Country/ Scheme	Structure		Procedure				
	Type	Funding structure	Risk mng.	Coverage ratio	Guarantee limit	Annual fee	Subrogation
(Non-profit public corp)		year by year) – FIs (0.135% of loans) – Enterprises			– KRW 10 billion	amount and guarantee period – 0.5% - 3.0%	
South Korea RCGF	Individual	– Government (determined year by year) – FIs (0.02% of loans) – Enterprises	RCGF	Depend on amount of loans – 100% for loan amount up to KRW 20 million – Partial guarantee for loan amount over KRW 20 million	KRW 800 million	Depend on RCGF's credit ratings, amount and term of loan, registered type of enterprise, and collateral – 0.5% - 2.0%	
Chile FOGAPE (Govt fund)	Portfolio	– Government (determined year by year) – Fee paid by borrowes	Financial institutions	Auction system – 30% - 80% (65% on average)	Depend on size of companies – < CLF5,000 for SEs – < CLF15,000 for MEs – < CLF50,000 for LEs – < CLF5,000 UF for exporters	1 – 2% higher fees are applicable to borrowers with higher default rates.	
Taiwan SMEG (Non-profit public corp)	Hybrid	– Central and local government 78% – Financial institutions 21.5% – Other fund 0.5%	SMEG for direct guarantee Financial institutions for indirect guarantee	Based on guarantee programs – 60% - 95% for the Indirect Guarantee – Up to 90% for the Direct Guarantee – 100% for Package Credit Guarantee Program	– Up to NT$ 100 million under direct and indirect credit guarantee programs – Up to annual sales for working-capital loan guarantee – Unlimited amount for package loan	Based on type of loans, applicant's credit status, operation, financial & guarantee conditions, and intangible asset – 0.5% - 1.5% for programs supported by SME Fund – 0.5% - 0.75% for programs supported by funds for special purpose	Principal, interest for period of 6 months after default and the portion of lawsuit costs after 5-month cooling-off period
Germany Bürgschaftsbank	Individual	– Financial Institution		– Up to 80% (but 65% on average)	– EUR 1 million but the ratio may differ in	– Flat annual fees 0.8%-1.0% of guarantee	Claims will be paid after

Country/ Scheme	Structure		Procedure				
	Type	**Funding structure**	**Risk mng.**	**Coverage ratio**	**Guarantee limit**	**Annual fee**	**Subrogation**
(Private liability company)		– Craftsmen and Industry Union – Trade and Bank associations			each bank	amount – processing fees 0.5-1.0% of guarantee amount (one-off)	identification of net loss. Creditor is in charge of collateral sales.
Netherland BMKB (Govt campaign)	Portfolio: Matching-fund guarantee system[43]	– Government – Financial institutions (3% of guarantee amount) – Fee paid by borrowers (one-off)	Financial institutions	– 90% for ordinary SMEs – 100% for start-up enterprises ** Coverage ratio decreases every year after receiving loans.	– EUR 1.5 million – EUR 2.0 million for startups	Based on loan amount – 2 - 3.6% (one-off)	Covered loan after subogration claim is deemed legitimate.
Canada CSBFP (Govt campaign)	Portfolio	– Government – Registration fee paid by borrowers (2% of guarantee amount) – Annual fee (1.25%)	Financial institutions	– 85%	CAD 500,000 of which no more than $350,000 can be used to finance the purchase or improvement of equipment and the purchase of leasehold improvements	Flat rate applied to all borrowers (1.25% of outstanding amount)	85% of eligible loss after legal procdures have been concluded
UK EFG (Govt campaign)	Portfolio	– Government – Fee paid by borrowers	Financial institutions	– 75% – Cover only first 20% of NPL	– GBP 1,000 – 1M	Flat rate applied to all borrowers (2% of outstanding amount)	Uncollected loan amount after a financial institution executes collaterals

[43] Matching-fund guarantee system requires guaranteed financial institutions to issue loan more than or equal to the amount of guaranteed loan. For example, when the financial institution issues a loan at EUR 100 million in which a half of the loan is guaranteed by the government while another half is backed by credits from the financial institution.

<table>
<tr><th rowspan="2">Country/
Scheme</th><th colspan="2">Structure</th><th colspan="5">Procedure</th></tr>
<tr><th>Type</th><th>Funding structure</th><th>Risk mng.</th><th>Coverage ratio</th><th>Guarantee limit</th><th>Annual fee</th><th>Subrogation</th></tr>
<tr><td>Thailand
TCG
(Govt campaign)</td><td>Portfolio[44/]</td><td>– Government 95.5%
– Private banks 3.2%
– State-run banks 1.1%
– Others 0.18%
– Fee paid by borrowers</td><td>Financial institutions</td><td>– 8.5% - 50% of the average outstanding guarantee amount of total portfolio depending on schemes. For PGS, phase 1-3 cover 15.5% of total portfolio per bank. Phase 4 and 5 cover 15% and 18%, respectively.
– TCG will reimburse 50-100% of the guarantee amount for each contract to a lending bank based on the NPG level of each bank’s guaranteed loan portfolio. For example, for normal loan program under PGS 1-3, % of reimbursement is as follows.
<table>
<tr><th>NPG</th><th>claim</th></tr>
<tr><td>NPG≤12%</td><td>100%</td></tr>
<tr><td>12%<NPG≤14%</td><td>75%</td></tr>
<tr><td>14%<NPG≤18%</td><td>50%</td></tr>
</table></td><td>THB 40 million</td><td>1.5% - 2.5% depending on schemes. The flat rate is applied to all borrowers under the same guarantee program.</td><td>Uncollected loan amount after a financial institution has filed a lawsuit</td></tr>
</table>

[44] Thailand’s portfolio guarantee scheme differs from other countries’ portfolio guarantee schemes. Instead of providing proportional cover on each individual loan contract in a guaranteed portfolio and thus capping the coverage ratio at the contract level, the TCG provides the first loss guarantee. The % of reimbursement for each individual loan contract varies from 50% to 100% based on the NPG level of each bank’s guaranteed portfolio (as stated in the coverage ratio column); for example, under PGS 1-3, TCG will reimburse 100% for each non-performing loan contracts within the first 12% NPG of the bank’s guaranteed portfolio. The coverage ratio is capped at the portfolio level, i.e., 15.5% for PGS Phase 1-3, 15% for PGS Phase 4 and 18% for PGS Phase 5, etc.

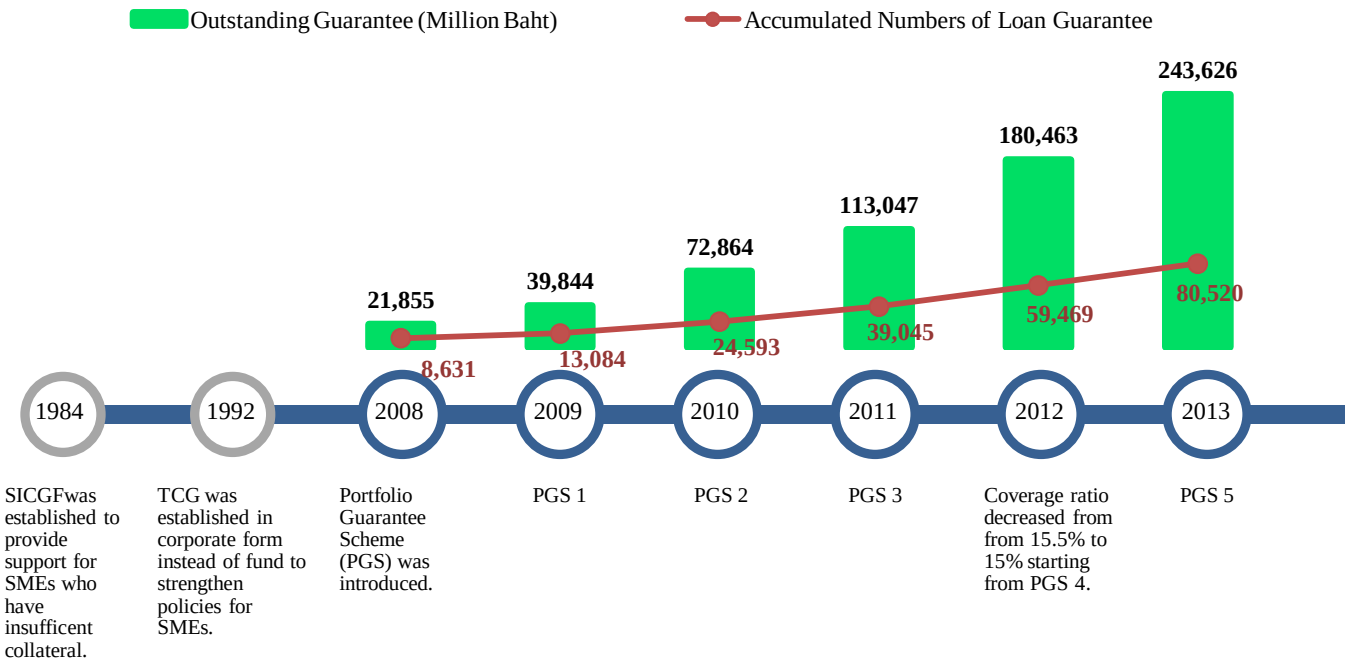
Appendix A: Thai Credit Guarantee Corporation[45]

SMEs have so far been an important component of Thai's economy. However, most of them still face barriers to acquire more funds. To ease their access to financial resources, the government initially established the Small Industry Credit Guarantee Fund (SICGF) in 1984 to facilitate SMEs lacking of collateral by providing them guarantees. Then, in 1992 after the fund proved to be successful and the Thailand government strengthened its policies to support SMEs, the Ministry of Finance established Thai Credit Guarantee Corporation (TCG) to take over the business from SICGF.

Government credit guarantee has started growing significantly since 2008 when Thailand first introduced the Portfolio Guarantee Scheme (PGS) in an effort to overcome the global financial crisis by efficiently expanding its credit guarantee system. Since 2009, the Portfolio Guarantee Scheme has been approved a phase each year and the most recent one is PGS 5 (2013-2019). Other forms of guarantee service beside PGS are very small.

Currently, TCG receives a financial support mainly from the Ministry of Finance (95.4% of the total capital). The outstanding amount of guarantee the number of SMEs participating in program has been constantly increasing over time. Figure 1 summarizes chronological development of government credit guarantee for SME in Thailand.

Figure 1: The history of government credit guarantee for SME in Thailand and size of guarantee

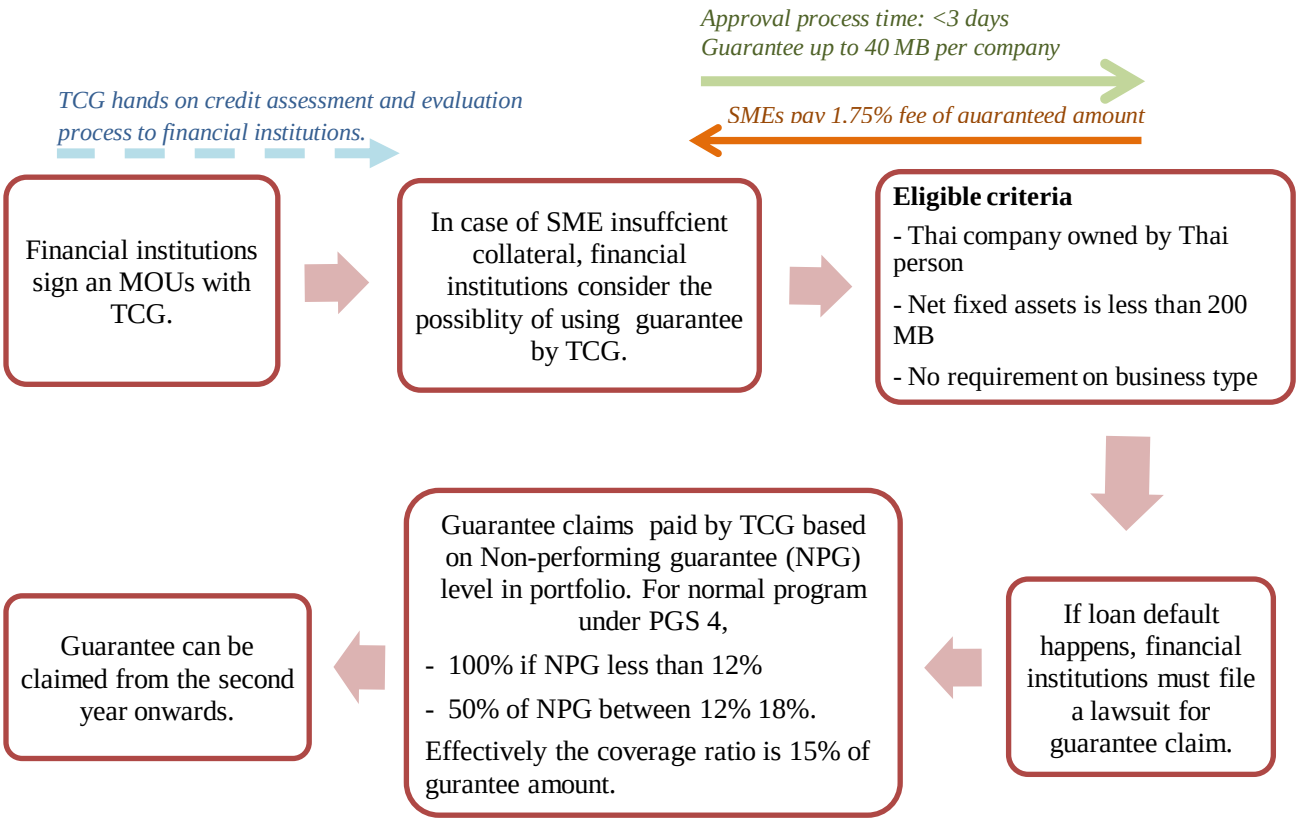


[45] Authors are grateful to Kawin Tiraborisute and Nutchaya Nuntasittidumrong for their assistance and contribution in Appendix A. Data are from Asian Development Bank. 2013. "Asia SME Finance Monitor 2013", Korea Credit Guarantee Fund (KODIT). 2013. "International Review of Credit Guarantee Schemes" and TCG website.

Portfolio Guarantee Scheme (PGS) Process

PGS is an indirect approach or portfolio model approach, where TCG does not evaluate SMEs credit risk itself but hands over the authority of examination and evaluation process to financial institutions. In addition, TCG will determine whether the handling of a certain guarantee case has been proper or not only when it is required to perform its subrogation. Figure 2 illustrates the guarantee process of the PGS.

Figure 2: TCG guarantee process in the case of PGS



TCG's Main Product: secured loan type

TCG has been operating to serve various groups of customers. Nevertheless, the majority of guarantee underlying loan is secured loan type. Table 1 shows the main features of PGS4 (2012-2016) as for an example.

Table1: "Secured loan" PGS 4 (2012-2016)

Eligible criteria for SMEs	• An individual or a company running a business in Thailand and owned by a person with Thai nationality • 200 million Baht or less of fixed assets (excluding lands) • Legal and moral business • Normal-status borrower (according to the Bank of Thailand's regulation)

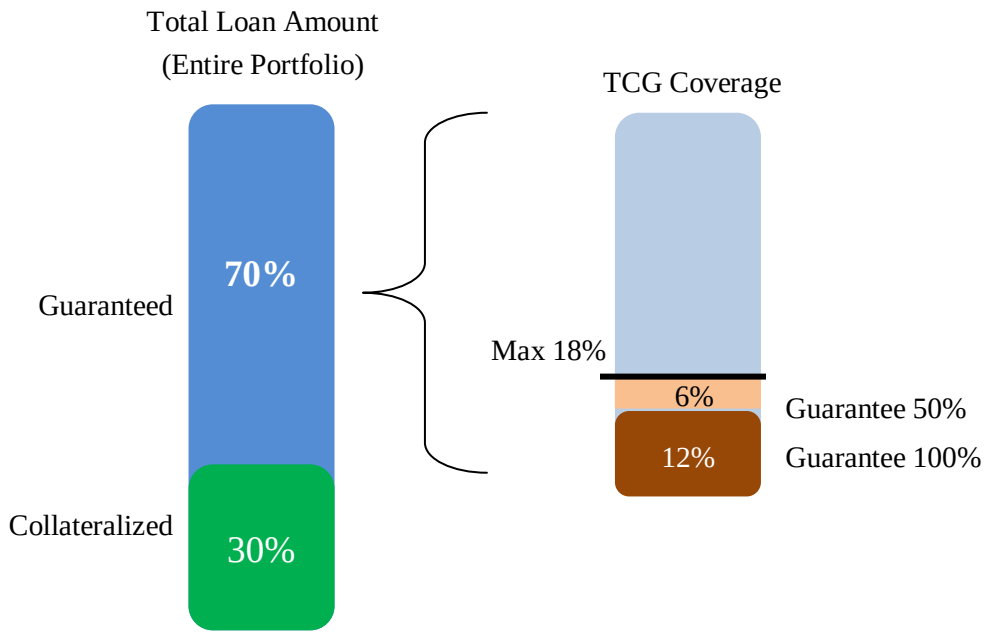
Total outstanding guarantee amount	24,000 million Baht
Guarantee limit per SMEs	≤ 40 million Baht[46]
Collateral (% of credit line)	≥ 30% of loan amount
Period	Up to 5 years
Fees*	1.75% of guaranteed amount per annum
Evaluation time	<3 business days
Effective coverage ratio of uncollateralized portfolio	15%[47]

** The government decided to exempt the first year fee in PGS5.*

TCG payment coverage

For secured loans type guarantee, the amount of loan which is not collateralized will be guaranteed by TCG. If the guaranteed amount has NPG ratio below 12%, TCG will cover all the losses. However, if the ratio is between 12% and 18%, there will be loss sharing between TCG and financial institutions and TCG will pay 50% of NPG. In effect, 15% of uncollateralized portfolio is covered by TCG. Figure 3 illustrates the TCG payment coverage.

Figure 3: TCG payment coverage



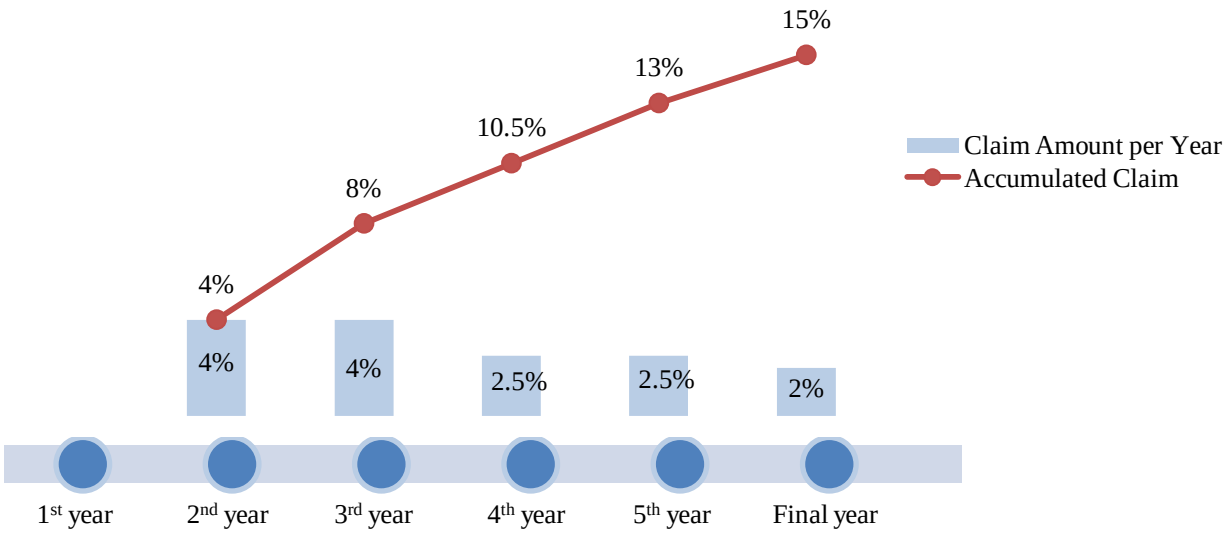
Claim payment arrangement

Only the principal can be claimed under PGS. To claim guarantees, financial institutions might file a lawsuit against defaulted SMEs loans. The claim can be made from second year onward and the claim structure is a front-end loaded claim. The maximum claim (as percent of the total loan guarantee amount) for each year is shown in Figure 4. If the amount of claim exceeds the

[46] For PGS1, the guarantee limit per SMEs is 20 million Baht or below
[47] For PGS1-PGS3, the effective coverage ratio is at 15.5%.

each year maximum, the exceeding-amount claim can be carried forward to the next year. In addition, if the total claim is less than guarantee fee, TCG will remit half of that difference to financial institutions. And once TCG pays claim to financial institutions, it assumes a right to collect the debt and collateral from defaulted SMEs at the amount equal to claim paid to lenders.

Figure 4: Maximum amount of claim as percent of total loan guarantee outstanding and accumulated claim



More specific target group PGS

In addition to certain Portfolio Guarantee Scheme, TCG also provides various supports to ease financial access of SMEs in more specific industries or targeted groups. In this section, three schemes will be shown as examples: guarantee for start-up SMEs, guarantee for micro SMEs, and guarantee for SMEs Halal Trade.

Scheme	Criteria (Net fixed asset)	Guarantee Limit	Guarantee Fee	Guarantee Period
Guarantee for New/Start-up SMEs[1]	Up to 200 MB	Up to 2 MB	1.5% of guarantee amount	Up to 7 years
Guarantee for Micro SMEs[2]	Up to 200 MB	Up to 1 MB	1.5% of guarantee amount	Up to 7 years
Guarantee for SMEs Halal Trade[3]	Up to 200 MB	Up to 40 MB	1.5% of guarantee amount	Up to 10 years

[1] Companies must be established less than 3 years and participate in management courses approved by TCG
[2] In cooperation with Government Savings Bank
[3] In cooperation with Islamic Bank of Thailand to promote SMEs operating in Halal supply chain

Table A.5.1: Estimation results for outcome equation under specification A (credit addition dummy as outcome variable)

Outcome variable: Credit addition dummy	All sectors	Manufacturing	Commerce	Construction, Real Estates, Utility	Services
	(1)	(2)	(3)	(4)	(5)
Treatment dummy (Join the PGS)	2.820***	2.685***	2.897***	1.469	3.250***
	(0.165)	(0.273)	(0.211)	(1.095)	(0.546)
Current ratio$_{t-1}$	0.342***	0.150***	0.138***	0.360***	0.605***
	(0.0183)	(0.0419)	(0.0337)	(0.0363)	(0.0600)
Return on asset $_{t-1}$	0.0110	0.00321	0.0255	0.0406	0.00798
	(0.00935)	(0.0110)	(0.0242)	(0.0524)	(0.0151)
Asset turnover ratio $_{t-1}$	0.00121*	0.00258	5.93e-05	0.00502**	-0.00530
	(0.000652)	(0.00285)	(0.000734)	(0.00248)	(0.0102)
Ln(Equity) $_{t-1}$	0.0123***	0.0117***	0.0130***	0.0129***	0.00760***
	(0.000742)	(0.00143)	(0.00134)	(0.00154)	(0.00193)
Asset growth $_{t-1}$	0.000266	-0.000397	-0.000368	0.000481	0.000436
	(0.000215)	(0.00159)	(0.000736)	(0.000335)	(0.000318)
Age $_{t-1}$	-0.00569***	-0.00862***	-0.00655***	-0.00211*	-0.000935
	(0.000541)	(0.00104)	(0.000847)	(0.00128)	(0.00185)
No of banks $_{t-1}$	0.0468***	0.0317***	0.0407***	0.0714***	0.104***
	(0.00529)	(0.0111)	(0.00769)	(0.0126)	(0.0193)
Unused credit line (million Baht) $_{t-1}$	-9.98e-06	-0.000745***	-8.19e-05	1.68e-05	2.74e-05
	(1.99e-05)	(0.000195)	(6.38e-05)	(5.61e-05)	(2.27e-05)
Over/under-collateralization ratio $_{t-1}$	0.0834***	0.0721***	0.101***	0.0630***	0.127***
	(0.00897)	(0.0159)	(0.0161)	(0.0170)	(0.0339)
Delinquency dummy $_{t-1}$	-0.344***	-0.392***	-0.380***	-0.241***	-0.345***
	(0.0266)	(0.0475)	(0.0503)	(0.0556)	(0.0742)
Bank fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Atanhrho	-0.558***	-0.471***	-0.740***	0.0706	-0.656
	(0.103)	(0.159)	(0.173)	(0.430)	(0.406)
No. of obs.	63,825	18,462	24,889	12,406	7,050

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.

Table A.5.2: Estimation results for outcome equation under specification B
(Change in credit line (million Baht) as outcome variable)

Outcome variable: Change in credit line (million Baht)	All sectors	Manufacturing	Commerce	Construction, Real Estates, Utility	Services
	(1)	(2)	(3)	(4)	(5)
Treatment dummy (Join the PGS)	4.255	0.994	-3.202	-9.621	36.36
	(8.064)	(9.104)	(9.668)	(28.84)	(32.50)
Current ratio$_{t-1}$	5.997***	0.410	6.218**	14.18***	8.794*
	(1.564)	(3.018)	(2.458)	(3.952)	(5.325)
Return on asset $_{t-1}$	-0.00837	-0.0285	0.0788	-0.00505	0.101
	(0.0546)	(0.0589)	(0.818)	(0.115)	(0.970)
Asset turnover ratio $_{t-1}$	0.0214	-0.176	0.0716	-0.0841	-1.070
	(0.0609)	(0.219)	(0.0556)	(0.276)	(0.869)
Ln(Equity) $_{t-1}$	0.0850	0.400***	0.128	0.0235	-0.0840
	(0.0591)	(0.0963)	(0.0918)	(0.154)	(0.152)
Asset growth $_{t-1}$	0.0803***	0.0255	0.0106	0.0473	0.103***
	(0.0202)	(0.105)	(0.0469)	(0.0425)	(0.0316)
Age $_{t-1}$	-0.182***	-0.183**	-0.131**	-0.0864	-0.110
	(0.0467)	(0.0745)	(0.0617)	(0.160)	(0.137)
No of banks $_{t-1}$	2.748***	6.369***	2.366***	2.563	10.37***
	(0.480)	(0.814)	(0.578)	(1.829)	(1.493)
Unused credit line (million Baht) $_{t-1}$	-0.0398***	-0.577***	-0.103***	0.00321	-0.100***
	(0.00183)	(0.00917)	(0.00436)	(0.00228)	(0.00645)
Over/under-collateralization ratio $_{t-1}$	6.019***	-2.074*	3.451***	2.008	11.51***
	(0.747)	(1.084)	(1.100)	(2.851)	(1.927)
Delinquency dummy $_{t-1}$	-7.229***	-8.195***	-2.229	-12.73**	-8.476
	(1.975)	(2.963)	(3.199)	(5.327)	(5.334)
Bank fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
atanhrho	0.0294	0.0257	0.0618**	0.0256	-0.0391
	(0.0201)	(0.0226)	(0.0287)	(0.0537)	(0.0843)
No. of obs.	63,825	18,462	24,889	12,406	7,054

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.

Table A.5.3: Estimation results for outcome equation under specification C
(Change in collateral pledged to credit line ratio as outcome variable)

Outcome variable: Change in collateral pledged to credit line ratio	All sectors (1)	Manufacturing (2)	Commerce (3)	Construction, Real Estates, Utility (4)	Services (5)
Treatment dummy (Join the PGS)	-0.106**	-0.117**	-0.108**	0.861***	-0.205**
	(0.0415)	(0.0563)	(0.0449)	(0.154)	(0.0948)
Current ratio$_{t-1}$	-0.0583***	-0.0706***	-0.0515***	-0.0257	-0.0944***
	(0.00836)	(0.0183)	(0.0122)	(0.0244)	(0.0166)
Return on asset $_{t-1}$	0.000226	0.000108	-0.00119	0.000364	-0.00291
	(0.000292)	(0.000357)	(0.00406)	(0.000712)	(0.00302)
Asset turnover ratio $_{t-1}$	-0.000508	0.000525	-0.000390	-0.000948	-0.000502
	(0.000325)	(0.00132)	(0.000276)	(0.00171)	(0.00271)
Ln(Equity) $_{t-1}$	0.000389	0.000583	1.36e-05	0.000528	0.000133
	(0.000316)	(0.000584)	(0.000456)	(0.000950)	(0.000473)
Asset growth $_{t-1}$	-3.98e-05	-0.000255	-0.000277	1.58e-06	5.03e-05
	(0.000108)	(0.000637)	(0.000233)	(0.000263)	(9.84e-05)
Age $_{t-1}$	0.000746***	0.00138***	0.00123***	-0.000559	0.00134***
	(0.000250)	(0.000452)	(0.000307)	(0.000850)	(0.000499)
No of banks $_{t-1}$	-0.0247***	-0.0309***	-0.0334***	0.00217	-0.0325***
	(0.00257)	(0.00494)	(0.00287)	(0.00924)	(0.00570)
Unused credit line (million Baht) $_{t-1}$	1.58e-05	-2.85e-05	-4.82e-06	0.000136***	-1.02e-05
	(9.80e-06)	(5.64e-05)	(2.17e-05)	(3.98e-05)	(7.11e-06)
Over/under-collateralization ratio $_{t-1}$	-0.447***	-0.469***	-0.499***	-0.387***	-0.433***
	(0.00399)	(0.00657)	(0.00546)	(0.0127)	(0.00889)
Delinquency dummy $_{t-1}$	0.000676	-0.0225	-0.00618	-0.0148	0.0676***
	(0.0106)	(0.0180)	(0.0159)	(0.0330)	(0.0166)
Bank fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
atanhrho	0.0192	0.0370	0.0247	-0.408***	0.134*
	(0.0191)	(0.0241)	(0.0256)	(0.0569)	(0.0788)
No. of obs.	63,825	18,462	24,884	12,401	7,052

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.

Table A.5.4: Estimation results for outcome equation under specification D
(Change in average interest rate as outcome variable)

Outcome variable: Change in average interest rate	All sectors	Manufacturing	Commerce	Construction, Real Estates, Utility	Services
	(1)	(2)	(3)	(4)	(5)
Treatment dummy (Join the PGS)	-0.896***	-1.070***	-0.919***	-0.885***	-0.283
	(0.111)	(0.188)	(0.191)	(0.280)	(0.468)
Current ratio$_{t-1}$	-0.0884***	-0.121***	-0.224***	0.119***	0.0639
	(0.0181)	(0.0430)	(0.0365)	(0.0304)	(0.0557)
Return on asset $_{t-1}$	0.000410	-0.00750	-0.00444	0.000636	-0.00179
	(0.000971)	(0.0120)	(0.0120)	(0.000873)	(0.00996)
Asset turnover ratio $_{t-1}$	-0.000604	-0.00205	0.000212	-0.000971	-0.0129
	(0.000735)	(0.00313)	(0.000872)	(0.00209)	(0.00902)
Ln(Equity) $_{t-1}$	-0.00240***	-0.00461***	-0.00368***	-0.00231*	0.00242
	(0.000685)	(0.00138)	(0.00136)	(0.00118)	(0.00157)
Asset growth $_{t-1}$	-2.22e-05	0.000766	-3.31e-05	9.06e-06	-0.000174
	(0.000236)	(0.00147)	(0.000688)	(0.000323)	(0.000341)
Age $_{t-1}$	0.000584	0.000696	0.00165*	0.00231**	0.000930
	(0.000541)	(0.00106)	(0.000916)	(0.00106)	(0.00166)
No of banks $_{t-1}$	-0.0478***	-0.0785***	-0.0402***	-0.0152	-0.0414**
	(0.00561)	(0.0117)	(0.00867)	(0.0115)	(0.0193)
Unused credit line (million Baht) $_{t-1}$	5.62e-06	-0.000297**	-0.000126*	9.11e-05*	-1.49e-05
	(2.13e-05)	(0.000135)	(6.91e-05)	(5.16e-05)	(2.34e-05)
Over/under-collateralization ratio $_{t-1}$	0.0106	-0.0152	0.00603	0.0274*	0.0241
	(0.00858)	(0.0153)	(0.0162)	(0.0147)	(0.0294)
Delinquency dummy $_{t-1}$	0.306***	0.407***	0.307***	0.194***	0.248***
	(0.0237)	(0.0443)	(0.0487)	(0.0422)	(0.0571)
Average Interest Rate$_{t-1}$	-0.180***	-0.205***	-0.171***	-0.168***	-0.203***
	(0.00303)	(0.00585)	(0.00487)	(0.00657)	(0.00915)
Bank fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
atanhrho	0.123***	0.169***	0.110**	0.109	0.0789
	(0.0275)	(0.0479)	(0.0461)	(0.0798)	(0.133)
No. of obs.	63,825	18,462	24,869	12,381	7,035

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.

Table A.5.5: Estimation results for outcome equation under specification E
(Asset growth as outcome variable)

Outcome variables: Asset growth	All sectors	Manufacturing	Commerce	Construction, Real Estates, Utility	Services
	(1)	(2)	(3)	(4)	(5)
Treatment dummy (Join the PGS)	0.161***	0.176	0.161	0.0111	0.393**
	(0.0617)	(0.173)	(0.127)	(0.132)	(0.153)
Current ratio$_{t-1}$	0.0846***	0.0660***	0.0265	0.0492**	0.266***
	(0.0115)	(0.0234)	(0.0219)	(0.0237)	(0.0403)
Return on asset $_{t-1}$	0.000208	-8.23e-05	0.0382***	0.000678	-0.0102
	(0.000308)	(0.000328)	(0.00831)	(0.000600)	(0.0138)
Asset turnover ratio $_{t-1}$	0.0242***	0.0424***	0.0203***	0.0484***	0.00898
	(0.00109)	(0.00253)	(0.00132)	(0.00536)	(0.00694)
Debt to asset ratio $_{t-1}$	-0.202***	-0.113***	-0.203***	-0.221***	-0.206***
	(0.0134)	(0.0217)	(0.0231)	(0.0324)	(0.0430)
Asset growth $_{t-1}$	0.00150***	0.00398***	-0.000306	0.00183**	0.00225*
	(0.000482)	(0.00154)	(0.000928)	(0.000723)	(0.00136)
Age $_{t-1}$	-0.00476***	-0.00402***	-0.00653***	-0.00290***	-0.00390***
	(0.000350)	(0.000592)	(0.000572)	(0.000832)	(0.00122)
No of banks $_{t-1}$	0.00569	-0.0114*	0.00965*	0.00858	0.00135
	(0.00359)	(0.00629)	(0.00536)	(0.00916)	(0.0149)
Unused credit line (million Baht) $_{t-1}$	1.33e-05	0.000360***	7.57e-05**	4.22e-05	-8.96e-06
	(1.40e-05)	(0.000102)	(3.79e-05)	(4.08e-05)	(1.75e-05)
Over/under-collateralization ratio $_{t-1}$	-0.00627	-0.00395	-0.0288**	0.0156	-0.000408
	(0.00533)	(0.00851)	(0.0112)	(0.0114)	(0.0128)
Delinquency dummy $_{t-1}$	-0.122***	-0.143***	-0.198***	-0.0833***	-0.0496
	(0.0140)	(0.0219)	(0.0283)	(0.0301)	(0.0390)
Bank fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
atanhrho	0.0289	-0.0126	0.00438	0.0798	0.0220
	(0.0362)	(0.138)	(0.0801)	(0.0707)	(0.0716)
No. of obs.	25,944	7,808	10,052	4,790	2,858

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.

Table A.5.6: Estimation results for outcome equation under specification F
(Become delinquent dummy as outcome variable)

Outcome variable: Become delinquent dummy	All sectors	Manufacturing	Commerce	Construction, Real Estates, Utility	Services
	(1)	(2)	(3)	(4)	(5)
Treatment dummy (Join the PGS)	1.113***	1.641*	1.133*	2.298**	0.635
	(0.407)	(0.944)	(0.685)	(1.163)	(0.856)
Current ratio$_{t-1}$	-0.0476	0.0921	-0.277***	0.280***	-0.159
	(0.0351)	(0.0791)	(0.0712)	(0.0641)	(0.117)
Return on asset $_{t-1}$	-0.000845	-5.34e-05	-0.00707	0.000988	-0.0344
	(0.00161)	(0.0175)	(0.0182)	(0.00646)	(0.0272)
Asset turnover ratio $_{t-1}$	-0.0325***	-0.0843***	-0.0148***	-0.0344*	-0.0649*
	(0.00502)	(0.0170)	(0.00526)	(0.0191)	(0.0353)
Ln(Equity) $_{t-1}$	-0.0123***	-0.0162***	-0.0146***	-0.0102***	-0.00723***
	(0.00110)	(0.00201)	(0.00223)	(0.00225)	(0.00268)
Asset growth $_{t-1}$	0.000172	-0.0309	-0.000265	0.000331	-0.00151
	(0.000346)	(0.0257)	(0.00210)	(0.000420)	(0.00375)
Age $_{t-1}$	-0.00586***	-0.00478**	-0.00387*	-0.00664***	-0.0100***
	(0.00110)	(0.00202)	(0.00198)	(0.00236)	(0.00350)
No of banks $_{t-1}$	-0.0181	-0.0410*	0.0114	-0.000605	-0.0174
	(0.0122)	(0.0237)	(0.0193)	(0.0252)	(0.0443)
Unused credit line (million Baht) $_{t-1}$	-0.000227**	-0.000588	-0.00251***	-0.000288*	-3.66e-05
	(0.000108)	(0.000413)	(0.000719)	(0.000152)	(0.000109)
Over/under-collateralization ratio $_{t-1}$	-0.0348	-0.134***	-0.0751*	0.0189	0.0191
	(0.0214)	(0.0429)	(0.0439)	(0.0277)	(0.0372)
Average Interest Rate$_{t-1}$	0.0392***	0.0133	0.0374***	0.0589***	0.0459***
	(0.00573)	(0.0107)	(0.00985)	(0.0131)	(0.0174)
Bank fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
atanhrho	-0.392***	-0.671	-0.341	-1.037	-0.204
	(0.149)	(0.420)	(0.250)	(0.705)	(0.299)
No. of obs.	57,662	17,427	22,450	10,918	5,942

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.

Table A.5.7: Estimation results by bank for outcome equation under specification F
(Become delinquent dummy as outcome variable)

Outcome variable: Become delinquent dummy	Bank A	Bank B	Bank C	Bank D	Bank E	Bank F
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment dummy (Join the PGS)	3.100***	1.412	1.075	1.479	0.699	2.918***
	(0.728)	(1.340)	(0.887)	(1.261)	(0.934)	(0.237)
Current ratio$_{t-1}$	-0.139*	-0.0769	-0.128	0.109	-0.0152	-0.632**
	(0.0795)	(0.0878)	(0.0885)	(0.119)	(0.109)	(0.276)
Return on asset $_{t-1}$	0.000959	-0.309***	-0.0673	-0.473*	-0.163	-1.453***
	(0.00406)	(0.109)	(0.0647)	(0.251)	(0.188)	(0.554)
Asset turnover ratio $_{t-1}$	-0.0129	-0.0558***	-0.0208*	-0.0507***	-0.0174	-0.232**
	(0.00853)	(0.0149)	(0.0113)	(0.0194)	(0.0137)	(0.109)
Ln(Equity) $_{t-1}$	-0.0199***	-0.0132***	-0.0134***	0.00288	-0.00677*	-0.00160
	(0.00226)	(0.00287)	(0.00262)	(0.00418)	(0.00349)	(0.0108)
Asset growth $_{t-1}$	-0.00522	-0.000746	-0.00474	-0.00307	-0.00526	-0.131
	(0.00880)	(0.00340)	(0.00894)	(0.0127)	(0.0104)	(0.120)
Age $_{t-1}$	0.00185	-0.00894***	-0.0107***	-0.00796**	-0.00715**	-0.0136
	(0.00225)	(0.00286)	(0.00289)	(0.00335)	(0.00362)	(0.00914)
No of banks $_{t-1}$	-0.0669**	-0.0663*	-0.0231	0.0343	0.0584*	-0.0351
	(0.0338)	(0.0362)	(0.0382)	(0.0297)	(0.0343)	(0.0627)
Unused credit line (million Baht) $_{t-1}$	-0.000106	-0.00776***	-7.72e-05	-0.000389	-0.00125*	-0.00269
	(0.000190)	(0.00189)	(0.000167)	(0.000460)	(0.000657)	(0.00221)
Over/under-collateralization ratio $_{t-1}$	-0.114**	-0.185***	0.122**	0.112	-0.0717	-0.0437
	(0.0458)	(0.0495)	(0.0571)	(0.0729)	(0.120)	(0.0283)
Average Interest Rate$_{t-1}$	-0.0158	0.0486***	0.0638***	-0.0690	0.0319**	-0.0869
	(0.0142)	(0.0104)	(0.0187)	(0.0565)	(0.0151)	(0.0585)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	
atanhrho	-1.328**	-0.316	-0.536	-0.617	-0.217	-10.64
	(0.587)	(0.459)	(0.358)	(0.522)	(0.354)	(142.8)

Notes: ***/**/* refer to 1%/5%/10% significance level. Robust standard errors are presented in parentheses.