Adverse Selection in SME Financing: When Both Bank and Innovative Entrepreneur Lose

Araz Khodabakhshian
Sharif University of Technology
khodabakhshian@gsme.sharif.edu

Mohsen Khosravi
Sharif University of Technology
Khosravi.mn@gmail.com

Ali. N. Mashayekhi
Professor at Graduate school of
Management and Economics,
Sharif University of Technology
Mashayekhi@sharif.edu

Abstract

SMEs are gaining increasing importance in the global economy. Compared to large enterprises, they suffer many more obstacles, a major group of which are financial obstacles. In the Iranian context these obstacles are even more pronounced for innovative SMEs. According to the Global Competitiveness Report published by the world economic forum, in Iran, it is too difficult to get a loan without adequate collateral and by only a good business plan. In such a setting, firms who have an innovative entrepreneurial idea will suffer the most. In this paper, using a system dynamics model it is demonstrated that despite the fact that banks are using tight measures to reduce their risk, the situation for both bank and SME worsens over time. This leads into larger amounts of Bad-debts for banks and reduced "ease of access to loans" for SMEs. A number of policies which may improve the situation and lead into mutual prosperity for bank and SME have been proposed.

Keywords

SME, Bank, Collateral, Risk, productivity, Bad-debt, Adverse selection, ease of access to loans

1-Introduction

Small and medium enterprises in most economies account for a large share of enterprises and a large share of overall employment in the private sector. (Beck 2007) similar to any other enterprise SME's need appropriate financing for their activities. Activities ranging from starting a new venture to expanding an already existing one into a larger enterprise or maintaining the working capital needed for the enterprise. In order to meet most of these needs, SMEs depend on financial institutes. In each country based on the development of the financial system there may be various potential sources of financing. In the case of Iran the major reliable sources of financing are the commercial banks.

Commercial banks try to balance two main mechanisms; deposit taking and loan granting, in order to survive and be profitable. Therefore when it comes to lending they start to be cautious not to accept any risks, so they filter the the potential borrowers in order to choose the ones which seem to have the least perceived risk by the bank. The real practice however has revealed that the interaction of the bank and SME is not optimal at all, and in many cases the decision procedure utilized by the bank results in the loss for both SME and bank. First because banks have chosen collateral as a guarantee for loan repayment, and are emphasizing on this measure on the expense of business plan quality. Second because an inefficient decision procedure leaves a lot of land for corruption, and corruption itself worsens the overall lending environment. This Is where the system dynamics came to help in order to model this difficulty by using a holistic view which covers two realms of Bank and SME and models it over time.

As a result the problem could be more easily understood and explained and many policy implications could be derived.

2-Studies regarding SMEs and their financing

2.1-SME definition

As the name implies, small and medium enterprises are generally defined by their size. The standard for defining SME varies by country, or more specifically, by market size. Countries with large economies use cut off points of less than 500 workers to describe SMEs. In developing countries, where market size and average firm size are both much smaller, cut off points of less than 100 workers or 250 workers are often used. (Biggs 2002)

In the Iranian context there are several definitions for SMEs, however here we use Islamic Republic of Iran's Ministry of industry and mining industrial development strategic plan's terms. Firms with less than 50 employees are considered small businesses while those with 50-150 employees are medium sized enterprises and firms with more than 150 employees are considered large enterprises.(Industrial Development strategic plan 2006)

2.2-Why are SMEs important in Iran?

There have been three main benefits indicated in the literature for the SMEs. First they are more labor intensive therefore they can create more job opportunities and reduce poverty. Second, they are considerable sources of innovative activity and can foster entrepreneurship and export competitiveness, thus they can contribute to the future industrial expansion. Third, they can increase competition and add more flexibility and dynamism to industrial and economic

environment and improve economic performance (Biggs 2002). However most of these claims didn't prove to always be empirically true.

SMEs are a heterogeneous group – ranging from small workshops making furniture, metal parts and clothing to medium-sized manufactures of machinery and service providers, such as restaurants, consulting and computer software firms. Some are traditional, "livelihood" enterprises that are satisfied to remain small; others are "growth-oriented" and innovative."(Biggs 2002)

The Focus in this research is on "growth-oriented" and "innovative firms" which have high potentials for growth. As Biggs points out SMEs are more capable of exploiting their university-based and corporate associations in order to generate marketable innovations (Biggs 2002). The Iranian demographic picture shows a large population of young university graduates who should get a job and contribute to the economy of the country. Most of them have innovative, entrepreneurial ideas. In case these ideas have enough room to become a business they can contribute hugely to the economy and technological innovation of the country. Biggs shows that SMEs also appear to provide more than their share of opportunities to young, inexperienced workers and to nascent entrepreneurs (Biggs 2002). Our focus here is not merely on the young, inexperienced firms, but on any small and medium sized business which is formed around the axis of an innovative idea to do business and create added value.

The majority of manufacturing enterprises in Iran are in the SME sector, of which approximately 75% are small businesses. More than 63% of total manpower in the industrial sector is employed by SMEs, and the share of SMEs in value-added amounts to approximately 30%. (Strategy document to enhance the contribution of an efficient and competitive small and medium-sized enterprise sector. 2003)

According to UNIDO's 2003 strategic document, the industrial SME sector has tremendous scope for growth in Iran, and by that token has a great potential for generating new jobs. (Strategy document to enhance the contribution of an efficient and competitive small and medium-sized enterprise sector. 2003)

2.3-SME financing and its obstacles

Cross-country evidence shows that small and medium enterprises are more constrained in their operation and growth than large enterprises, and access to financial services features importantly among the constraints. (Ayyagari, Demirgüç-Kunt, and Maksimovic 2008) (Beck 2007) Constraints such as high interest rates, the adverse impact of having to deal with bank bureaucracies, collateral requirements, lack of access to operations finance, appear to affect firm growth significantly.(Beck, Demirgüç-Kunt, and Maksimovic 2005)

Figure 1 shows that small firms not only report higher financing obstacles, they are also more adversely affected by these obstacles. (Beck, Demirgüç-Kunt, and Maksimovic 2005) The extent to which these factors constrain a firm's growth depends very much on its size, and firm growth is more affected by reported constraints in countries with underdeveloped financial and legal systems and higher corruption (Beck, Demirgüç-Kunt, and Maksimovic 2005)

Effect of various financial obstacles on growth of Large/Medium/small size firms
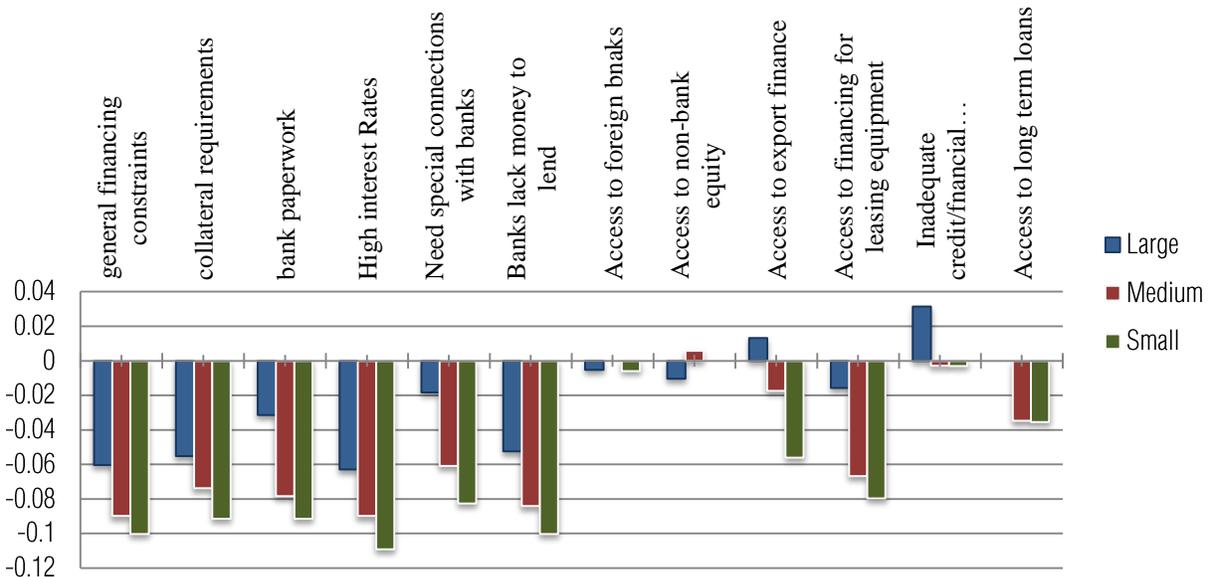
Figure 1-Effect of various financial obstacles on growth of large/medium/small firms

The potential of small firms to grow into medium and large enterprises and to contribute to the economy, and the fact that institutional and market failures create an uneven playing field between firms of different sizes, (Beck 2007) justifies the need for policy reforms and infrastructure improvement in order to create a more even playing field between firms of different sizes.

2.4-Current state of SME financing in Iran

Starting a business in Iran is a cumbersome activity. A large number of licensed businesses are not operational at present because of a lack of access to finance and the very lengthy bureaucratic procedures and arbitrary measures applied by banks to potential borrowers. (Strategy document to enhance the contribution of an efficient and competitive small and medium-sized enterprise sector. 2003)

Even though Industrial SMEs have access to several additional sources of finance, such as family and relatives, moneylenders, the Islamic Development Bank, foreign financial agencies, large enterprises (e.g. Through sub-contracting agreements) and own savings, currently, the main sources of venture capital for SMEs at affordable rates are bank funds. Nevertheless, none of these sources, however, are of much help to SMEs.

Another report that backs the claim that current financing schemes in Iran are not desirable for SMEs is the Global Competitiveness Report (GCR), which is a report published by the World Economic Forum on an annual basis. One of the indexes measured by this report is named "ease of access to loans"

The question addressed in order to assess this index is:

How easy is it to obtain a bank loan in your country with only a good business plan and no collateral?

Figure 2 below demonstrates the IRI's relative stance according to this aspect of competitiveness in recent 3 reports (where IRI was included in the GCR). As it is clear from figure below, more than 95 percent of the nations being investigated have relatively better access to loans, by providing a sound business plan.

Ease of Access to loans

■ 2010-2011   ■ 2011-2012   ■ 2012-2013

Version of "The Global Competitivness Report"
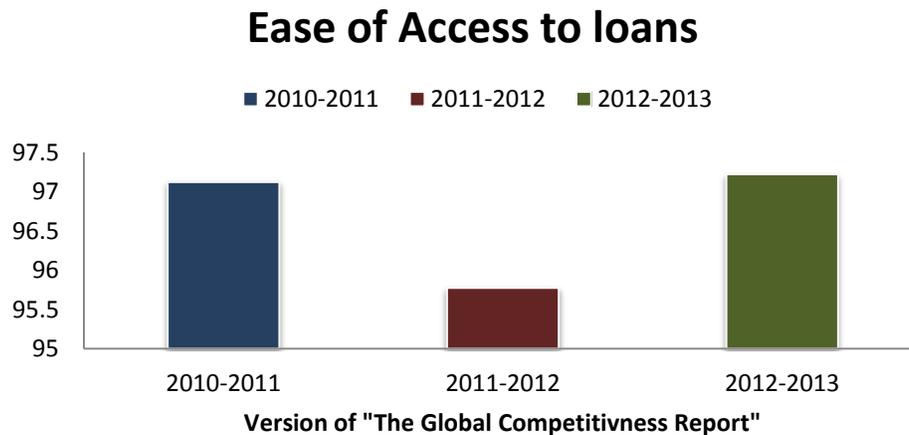
Figure 2- Islamic Republic of Iran's relative stance in ease of access to loans

The "ease of access to loans" is one of the many different components, each measuring a different aspect of competitiveness, used through a weighted average in order to calculate the Global Competitiveness Index (GCI), which is then used to rank the world countries accordingly. These components are grouped into 12 pillars of economic competitiveness[1]. (Schwab 2012)

The "ease of access to loans" measure is one of the aspects used while assessing the eighth pillar of global competitiveness which is financial market development. The role of a sound and well-functioning financial sector for economic activities is central and crucial. It channels resources to those entrepreneurial or investment projects with the highest expected rate of return rather than to the politically connected. (Schwab 2012) In developing countries there are a large number of public enterprises making heavy losses, which are allowed to survive at the expense of the rest of the economy. Their losses are financed to a great extent at the expense of their suppliers, banks and taxpayers. (Pejic-Bach 2003)

3-Complexities and the modeling question

The GCR along with other documents shows that bank loan requirements of collaterals, specially real estate collaterals in Iran pose a huge and serious problem for entrepreneurship development. SMEs which mostly have good business plans, particularly lack adequate

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[1] Competitiveness is defined as the set of institutions, policies, and factors that determine the level of productivity of a country. The level of productivity, in turn, sets the sustainable level of prosperity that can be earned by an economy. (Schwab 2012)

collateral. (Levitsky 1997)Since smaller firms are not able to make fixed asset mortgages, they do not qualify for loans. (Strategy document to enhance the contribution of an efficient and competitive small and medium-sized enterprise sector. 2003)

However, there is no doubt that the fear of loss and the under-collateralization of SME credit is rightly perceived as an important element in bank decisions not to lend to SMEs. (Levitsky 1997) Many analysts tend to present the risk factor as the main deterrent to banks' lending to SMEs. However, in most of the transition countries, the legal system is inefficient and such measures despite the strict requirements of collateral would lead to an illiquid economy with a weak small-business sector.(Pejic-Bach 2003)
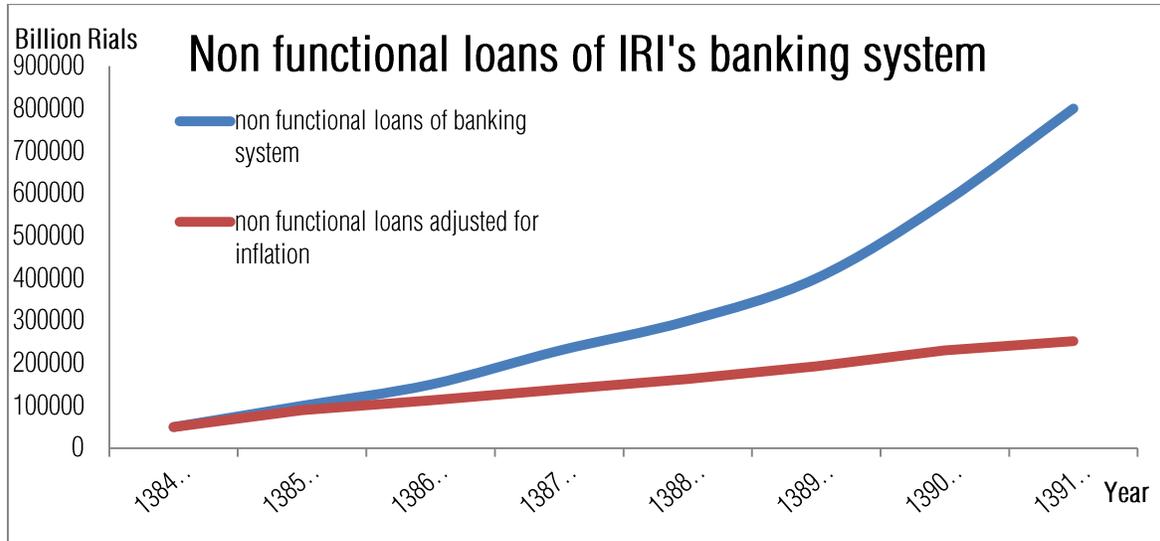
Figure 3 – Non functional loans of IRI's banking system
Source(http://www.donya-e-eqtesad.com/Default_view.asp?@=352270)

Figure3 illustrates an exponential increase in the non-performing bank loans in the banking system of IRI. However all these loans do not belong to the SME sector, they are a good indication of the general behavior of bad-debts in the banking system of Iran. The question here is: why Despite all the heavy guarantees required for bank loans and reluctance of banks to lend to SMEs (which are considered not profitable enough) Iranian banks still face such a huge risk?

However many other troubling indicators may be required to address the current modeling problem, these indicators were not available for the purpose research due to two main reasons. First, no official statistical time-series data about SMEs on the national level has ever been collected in Iran. Second, many banks are reluctant to disclose their local data about SME lending, due to information confidentiality. Despite this limitation the researchers could formalize the modeling problem mostly from indirect indicators and qualitative information provided by bank officials and economic experts during oral interviews. The validity of which has been verified by most of the people being interviewed.

4- Modeling

4.1-Conceptualization

Using the concept of "ease of access to loans" from Global competitiveness report, the mutual relationship between bank and SME is conceptualized by defining a variable named "ease of access to loans". This variable determines the feasibility of bank loans for an innovative SME which is assumed to have a good business plan. The factors affecting "ease of access to loans", are the "demanded bribe per unit of loan" and "demanded collateral per unit of loan". These two pose additional charge on innovative SME and "ease of access to loans" determines the cost per each unit of loan paid by the borrower.Conducting direct observations and many interviews with experts of banking led into the conclusion that in the Iranian context, these two conditions narrow down the pool of bank customers mostly to those few SMEs who have access to collateral and can afford the additional costs of corruption and special relations with bank officials. Others, as a result of self-exclusion may even not request for a loan. A perception of "ease of access to loans" can shape the entrepreneurial behavior of the society. If "ease of access to loans" is too low, it can be expected to have fewer new ventures, more bankrupted enterprises and less rate of firm maturity in the economy.

Here, bank interest rate is not considered as a factor for determining the "ease of access to loans" .The reason is that in the present Iranian context due to high inflation rate, the interest rate offered by the banks is far less than any other source of financing and even less than the inflation rate, Therefore the opportunity cost of using a bank loan is much less than any other source of financing.

4.2-The dynamic Hypothesis

When an innovative SME in Iran needs funding, whether to start a new venture or to enhance the current performance of the enterprise, it may ask financial institutions to contribute in its financing. The most established financial institutes in Iran are banks.

Iranian economy suffers large inflation rate, and bank interest rates are relatively very low, therefore there is always more than enough demand for bank loans. Banks cannot fulfill all the loan demands they receive so they should use a mechanism to prioritize them. Iranian banks apply the same conditions to large as well as small industries in a similar manner and do not provide a preferential policy towards SMEs. (Strategy document to enhance the contribution of an efficient and competitive small and medium-sized enterprise sector. 2003). Innovative startups have to compete with many other firms, whether large or small, private or state owned who are among loan demanders.

Maybe the first principle for banks is a minimum risk lending. Banks want to reduce their risk. That's why they ask for collaterals. Bank risk is the default risk of the loans. A commonly used measure of bank risk is the ratio of non-performing loans to total amount of loans. The more risk a bank faces the more emphasis it may put on collateral.

Empirical evidence and expert views emphasize that the more pronounced the role of collateral in the process of lending, the less important a good quality business plan becomes. A good quality business plan is attributed with higher productivity thus higher chances of loan repayment, then reduced importance of a business plan in the long run results in a more risky pool of bank customers. Riskier customers are assumed to have larger chances of default, so a drastic increase in the rate of bad debt creation after an increase in collateral importance is

expected. This will cause banks to become more risk averse and further increase their requirements of collateral per unit of loan.
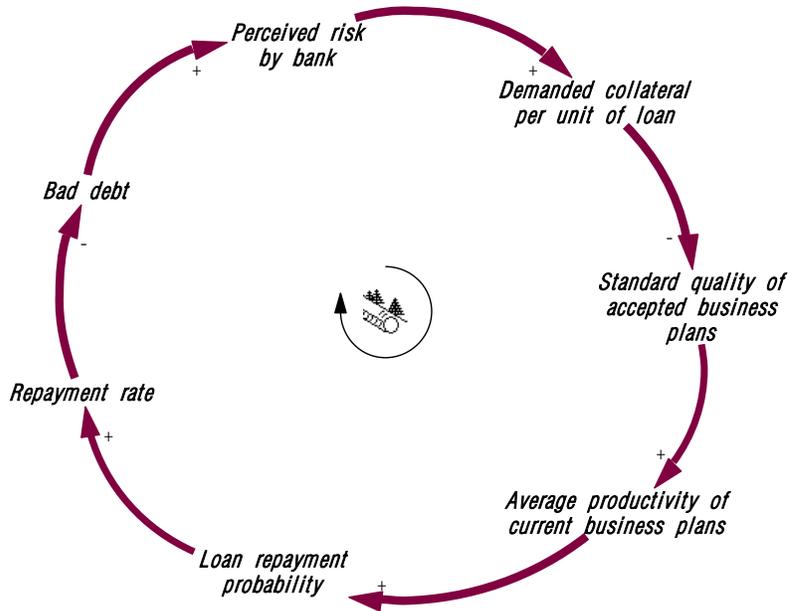
Figure 4

Reinforcing mechanism for increasing the importance of collateral

Currently banks don't rely much on the business plan soundness, nor on the credit history of the borrower as an indication of her potential productivity and solvency. Instead they check her ability to provide collateral or guarantee at the moment of borrowing. This is a very vivid example of static thinking in the banking policies exploited in Iran. Bankers are less aware of dynamic thinking in order to use a customer's previous credit behavior as an indicator of her future behavior; meanwhile they are not paying enough attention to her present business plan as an indicator of her future bank repayment probability. Here the innovative high growth SMEs are considered those who have valuable technical capabilities of producing added value and economic growthbut usually lack of guarantees since they are typically composed of young innovators who did not have enough time to collect financial guarantees for their ideas.

If the customers' business plan is not checked thoroughly for potential productivity at the time of allocating funds, there is no assessment of their ability to repay loans and the possibility of loans getting non-performing increases. This phenomenon is usually termed as "adverse selection". We believe that lending in the Iranian banking system suffers high levels of "adverse selection" and as it will be illustrated later this adverse selection is the main source of high amounts of bad debts in the Iranian banking system. Unproductive projects financed by banks are like black-holes which lock in bank resources and don't let them have circulation and value creation.

This phenomenon could be attributed to two systemic archetypes. First here collateral is a "Fix that fails", the uninteted results of increased collateral importance, in the long run worsens the situation. The other archetype is "shifting the burden", banks instead of doing heavy

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investment for building the capacity for business plan assessment and further follow-ups, as a "fundamental solution", mostly opt for the "symptomatic solution" of requesting heavy collaterals.

Without having a strong legal and juridical infrastructure, bank guarantees and particularly real state collaterals cannot significantly reduce bank risk. First because there is not enough legal enforcement for the collaterals to be functional, then as a result the collaterals cannot easily be sold. This is the case for Iranian financial systems.

This fact over time forms the perception of borrowers about the collateral instrumentality. They will soon find out that regardless of the amount of their bad debt there are few chances of their collateral being seized by the bank.

"Legal enforcement on collateral" may increase as a result of the increased "demanded collateral per unit of loan". Though this happens with great delay and not proportional to the increased collateral importance. But eventually this has two results. First the bank customers become more cautious about their loans and demonstrate less reluctant behavior in repaying their debts. Second better legal enforcement gives the bank the opportunity of selling the collaterals of non-performing loans, which returns some of bank resources. To sum up, legal enforcements tend to increase the cost of non-performing loans for the borrower, therefore reduce the risk of the bank.
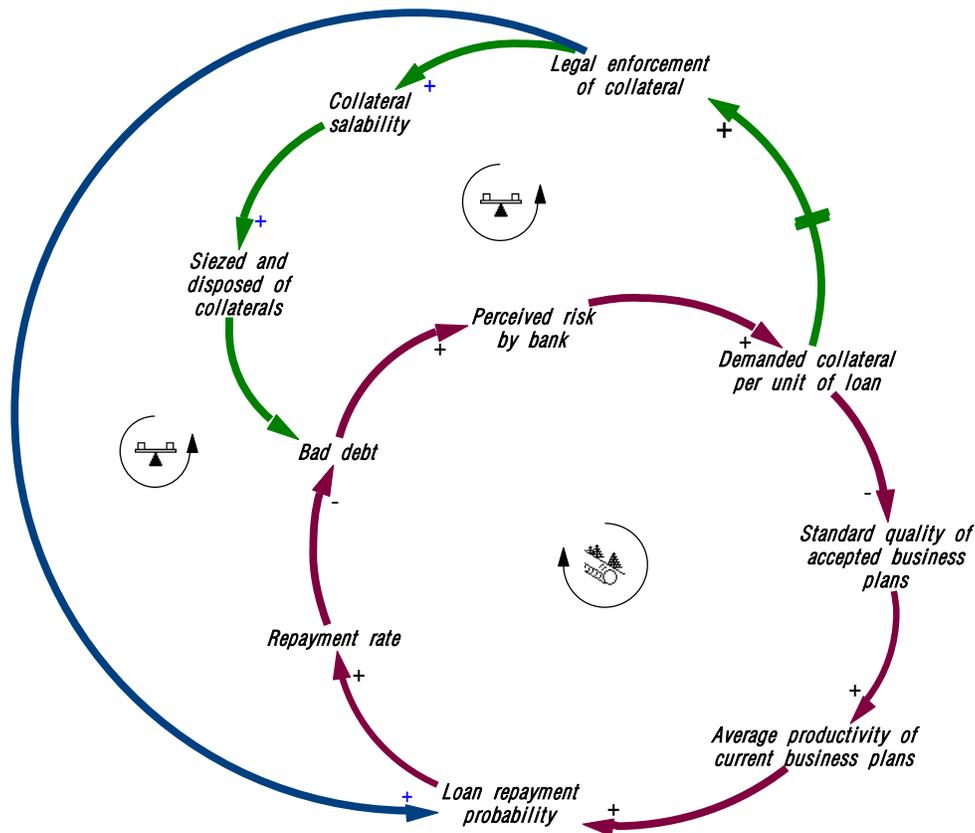
Figure 5 Two balancing loops which tend to balance the bank risk through lagal enforcements

As the competition on demand side gets though the loan demanders start to compete over available resources through non official means. The most significant and influencing of these means are bribes. Because of relatively low interest rate, bank loans are very attractive for customers. Thus, they are ready to pay an overhead amount in the form of bribes in order to get the loan. This behavior soon forms a bribing culture which may soon turn into a default pattern of loan allocation procedure. One may not get a loan unless she is able to pay the expected "gift"-s to the bank officials .
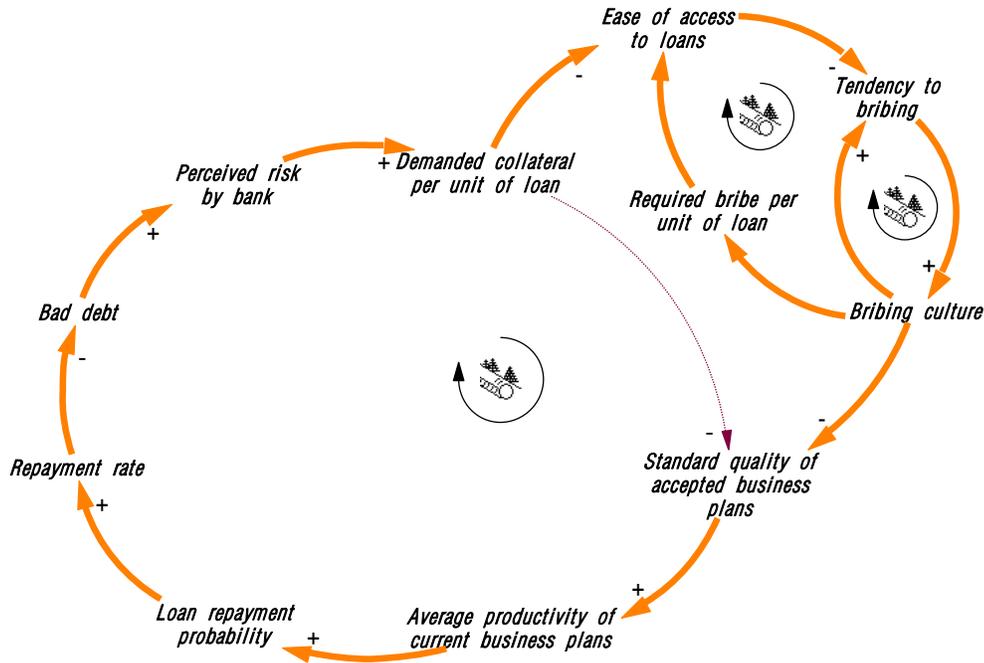
Figure 6 Effect of bribing on "ease of access to loans"

Here bribing culture is conceptualized as a stock which indicates the percent of bribable bank officials. The tendency to bribing is the annual increase rate of this ratio which is influenced by two factors. First the more prevalent the bribing the more people are encouraged to receive bribes, since it may seem to be a socially accepted behavior. Second, the less the ease of access to loans, the more the tendency to bribe the officials in order to get the loan easily.

Bribing culture poses additional burden since it increases the total cost of financing for the SMEs and also requires them to build long time mutual relations with some bank officials. The second consequence of bribing and corruption is the reduced emphasis on a good business plan. The agency problem of corrupted bank officials may lead them to choose a risky borrower with a weak business plan.
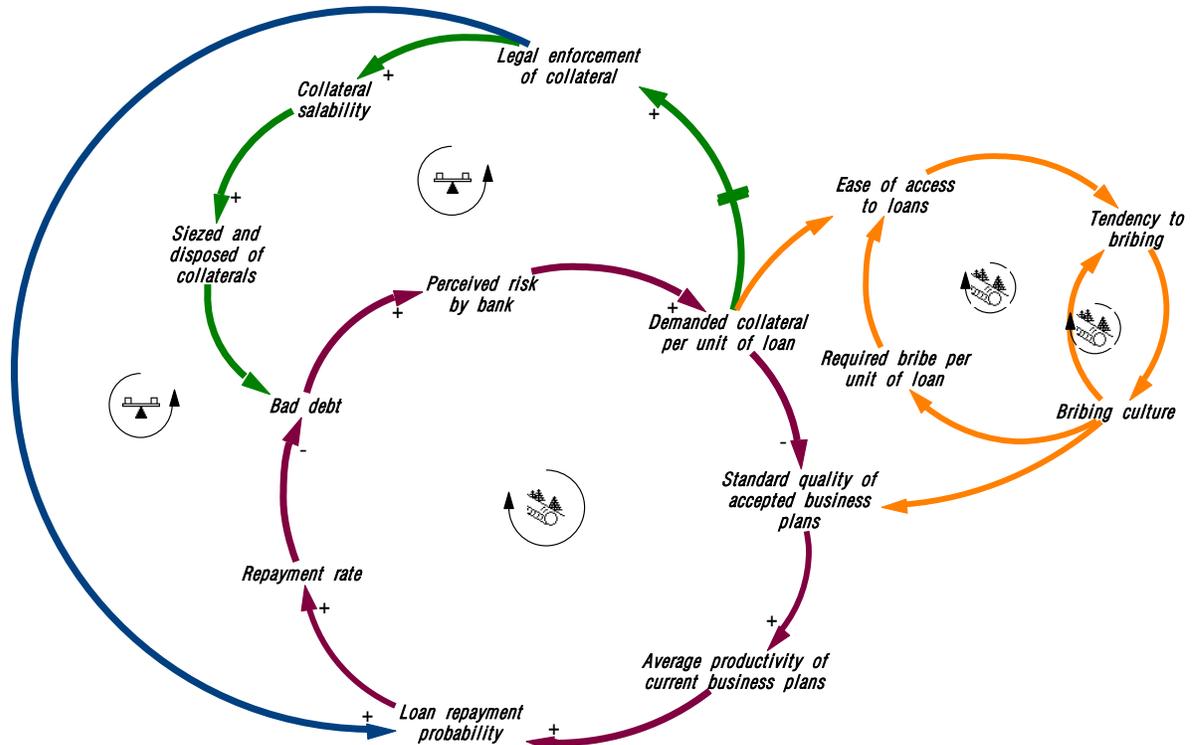
Figure 7 Causal Loop Diagram of the Dynamic Hypothesis

5-Simulation

5.1-Stock-flow model developed for the purpose of simulation

The stock-flow model developed for this phenomenon is illustrated in **Figure 8**.

The dynamic hypothesis explained in the previous section is depicted in this model, however some additional details are also implemented in order to operationalize the model.

On the top left side of this model the dynamics governing the number of SMEs are demonstrated using two stocks; number of SMEs, and number of large enterprises grown from SMEs. Every year a number of new firms enter the pool of current SMEs and some of them exit the economy due to bankruptcy. Moreover some SMEs who can sustain for long enough, grow into large enterprises. These rates are mainly correlated with "ease of access to loans" and "average profitability of SMEs", as drivers of firm creation and growth.

On the bottom left side of the model the demand for loans from SME sector is linked to bank resources, through bank lending rate. Banks are considered to have some financial resources that will be allocated to qualified loan requests, but if there are not enough economic activity on the SME side, then these bank resources will be underutilized, so they will be used in another sector such as state owned large firms. Loan demands will be fulfilled as long as there are sufficient bank resources. Average repayment time for a loan is considered to be one year. The amount of loans that are not repaid within one year move into "Bad-debt" stock. Some of them may be repaid with a larger delay and most of them may remain as non-performing loans for long periods of time. If there is enough legal enforcement to seize the collaterals and if the collaterals are easily salable then banks can counteract their losses by selling some of collaterals in hand. The "repayment rate" of loans has a crucial role here. This rate itself is dependent on

two factors. First the legal enforcement on collaterals which pushes borrowers to repay their loans, second the "average productivity of current business plans" which demonstrates the productivity of the current pool of bank financed projects. If banks finance more productive projects there is more probability of repayment by borrowers.

What determines the average productivity of projects financed by bank, is the level of scrutiny used while opting for projects.

The third sector of the model shows the dynamics of bank decision procedures in allocating loans. The more pronounced the role of Collateral the less important a good business plan becomes. Furthermore, a prevalent bribing culture, gradually nullifies the importance of a good business plan.

Bribing culture and "ease of access to loans" together form a viscous cycle. Where decreased levels of ease of access to loans leads to more "tendency to bribing" which in turn fosters "bribing culture" and reduces "ease of access to loans".
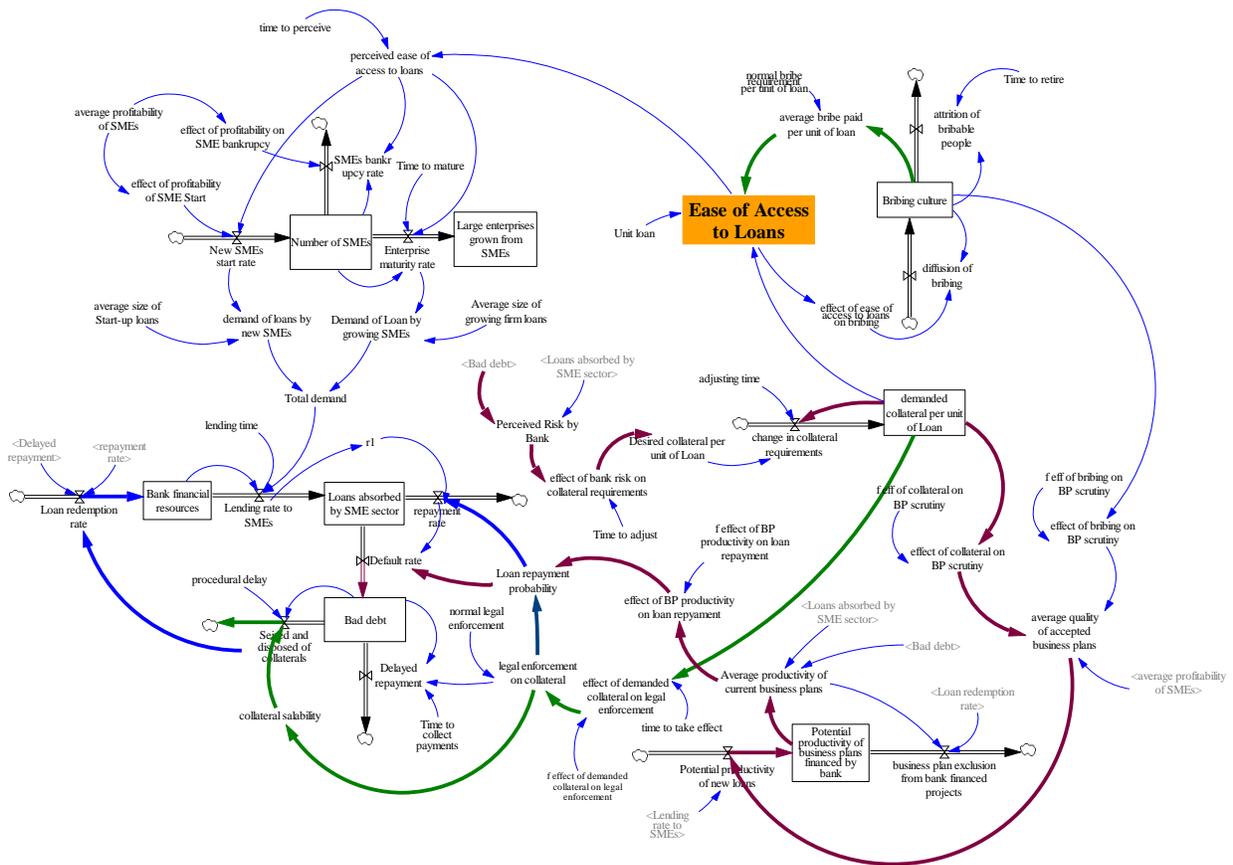
Figure 8- Stock Flow model

5.2-Simulation results

After simulating the sock-flow model, the following results were obtained.

Ease of access to loans
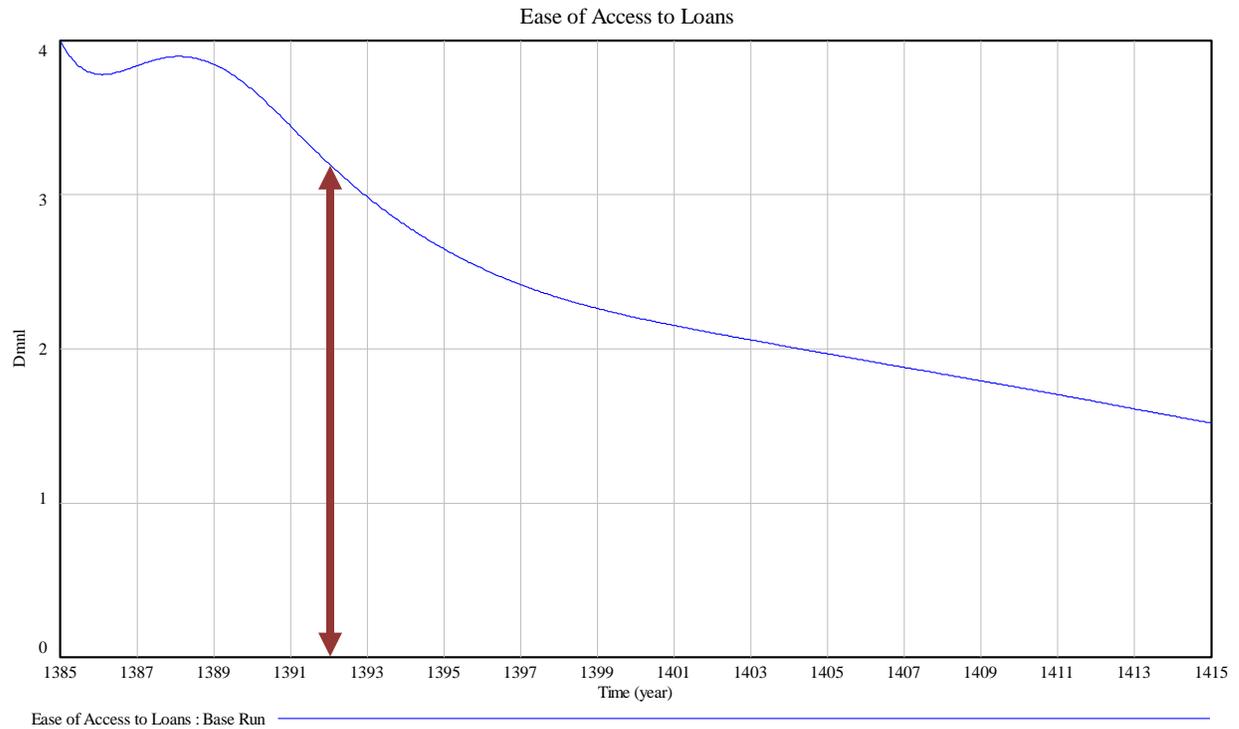
Figure 9-ease of access to loans[2]

The model shows that ease of access to loans will constantly decline over time if current policies used in SME lending persist. In order to further explain this behavior, one should look into two main factors which govern the behavior of this variable; "average amount of bribe paid per unit of loan" of loan and "demanded collateral per unit of loan".

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[2] Timescale used here is based on Solar Hijri Calendar which is the official calendar of Iran.

Average amount of bribe paid per unit of loan

average amount of bribe paid per unit of loan
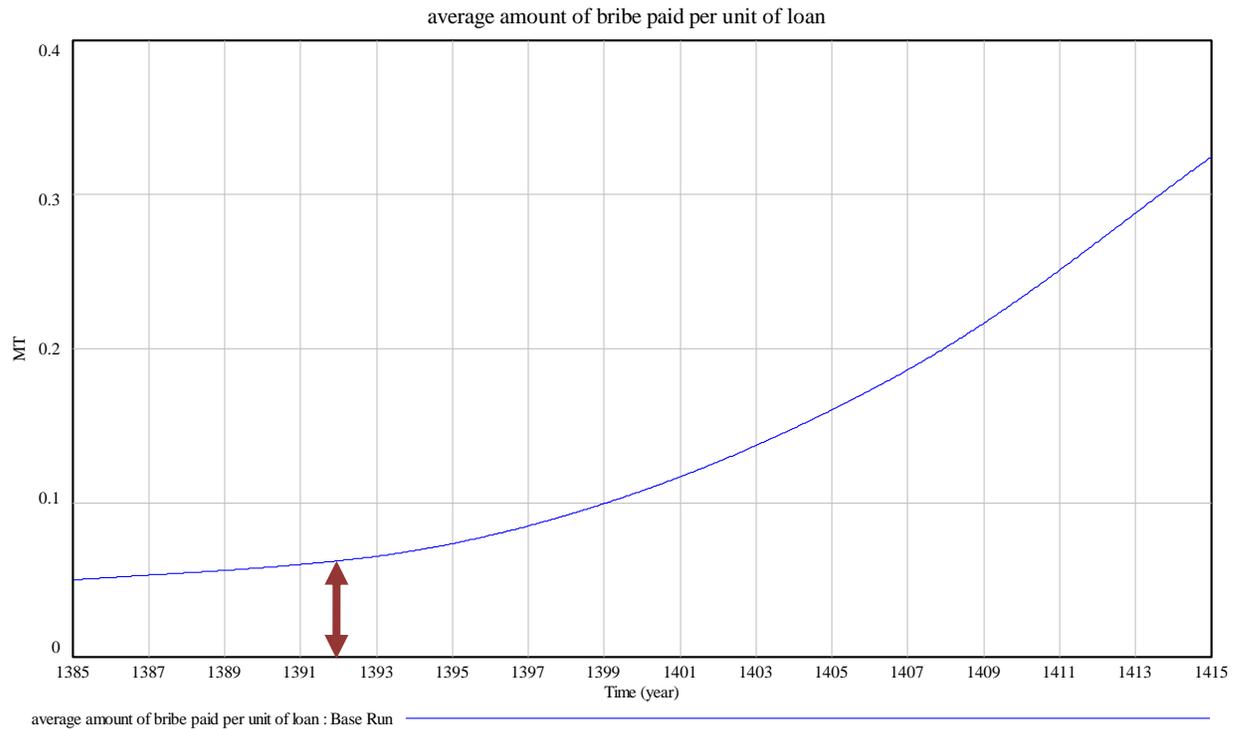
Figure 10-average amount of bribe paid per unit of loan

This variable shows a rising behavior. Which means the bribing cost for each unit of loan will increase over time. Bribing culture is formed as a result of difficulties in accessing the loans, but bribing culture itself can reduce the "ease of access to loans". Here the "bribing culture" is modeled as a stock. A stock takes some time to be filled and emptied. Therefore when bribing culture gradually becomes prevalent, it may take long to eliminate it. Moreover an established corruption culture can be an initiating factor for larger and more prevalent bribing behaviors. However, since this variable is conceptualized as the ratio of bribable to total number of officials, the amount of the variable cannot exceed one.

Demanded collateral per unit of loan

Banks increase the required collateral per unit of loan when they face higher risks of lending. Lending risk by definition is the ratio of Bad-debts to total money lent. Demanded collateral per unit of loan increases for some time and finally comes to a balance. This indicates increasing lending risk perceived by bankers. The diagram has a good fit with real world data, since nowadays minimum demanded collaterals on average is 130% of the amount of the approved loan (Year 1392).

demanded collateral per unit of Loan

demanded collateral per unit of Loan : Base Run
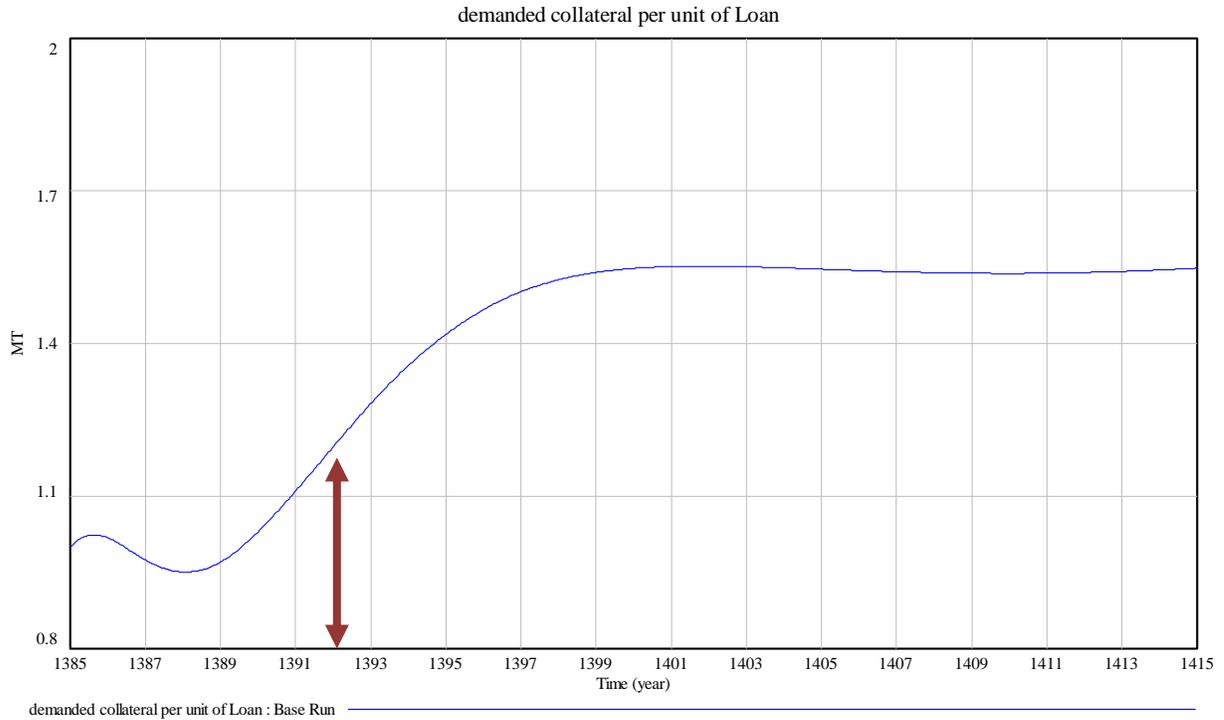
Figure 11- demanded collateral per unit of loan

Average quality of accepted business plans

average quality of accepted business plans

average quality of accepted business plans : Base Run

Figure 12-Average quality of accepted business plans

This variable shows the average profitability of business plans accepted by the bank. Profitability here is considered as the annual return on investment for each business plan funded by bank; it is expressed by the ratio of ROI per year. Increased importance of collaterals and prevalent bribing culture are supposed to reduce the standard of accepted business plans. This variable implies the importance of a good business plan in bank decision making for allocating loans, as it is already evidently shown in the **Figure 12**, in the next 20 years banks will have to implement a feedback mechanism for controlling the quality of business plans accepted. This mechanism is not working yet and there are no empirical evidence supporting its existence if such a mechanism is not activated in the bank decision making, very poor and unqualified business plans will have the chance to use bank resources.

Average productivity of current business plans
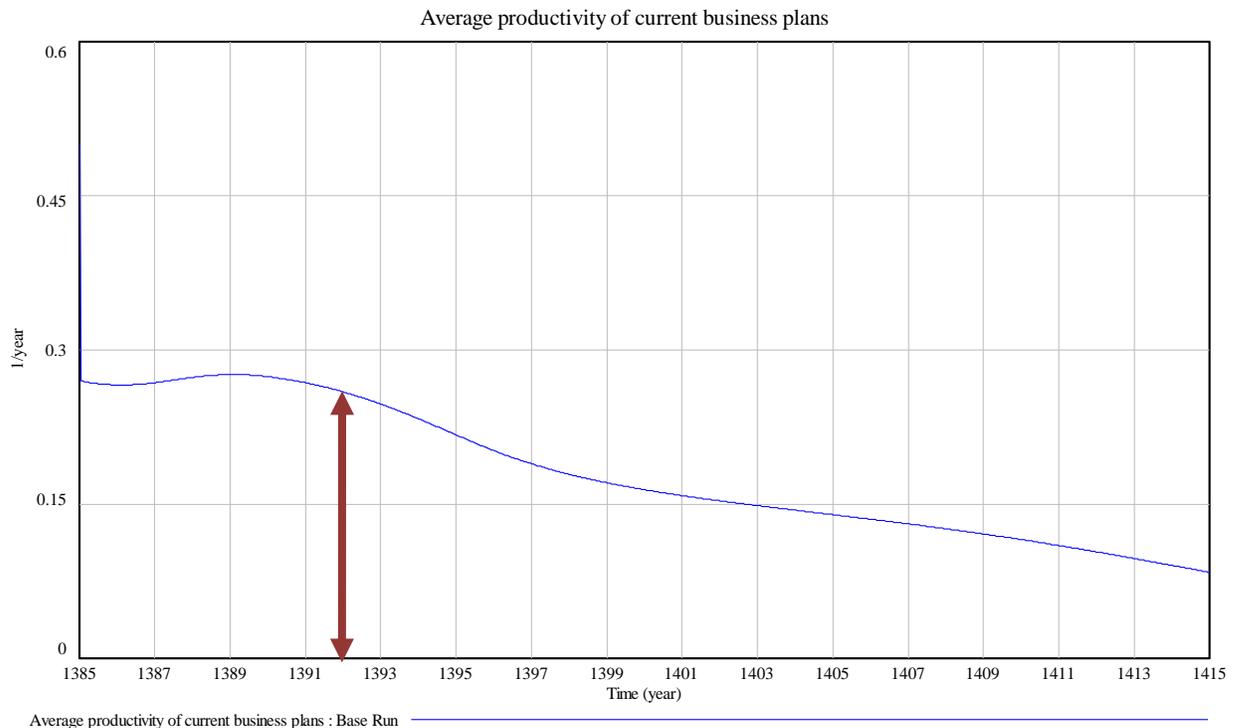
Figure 13-Average productivity of current business plans

The average productivity of current business plans is a direct function of business plan quality criteria used at the time of lending. This variable determines the SME ability to repay its debts. It is not surprising that along with "Average quality of accepted business plans"; "Average productivity of current business plans" is also declining.

Total number of SMEs and new SME creation rate
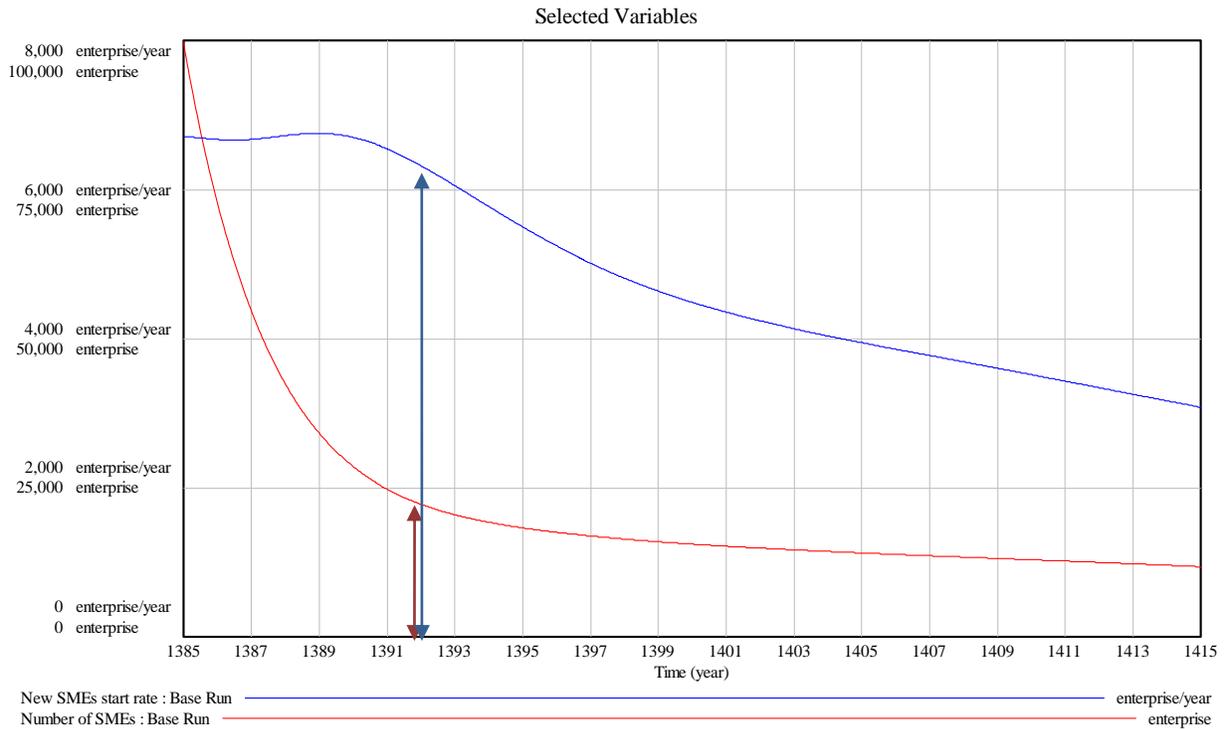
Figure 14- total number of SMEs and new SME creation rate

This figure shows an undesirable phenomenon from economical point of view. Despite the high initial number of SMEs, their total number decreases over time. Furthermore the number of new SME initiation per year is also declining. The reason behind this behavior lies in the structure which relates "ease of access to loans" to the tendency and ability of entrepreneurs to start new ventures and keep the existing ones.

Bank financial resources and bad debt

Figure 15 illustrates how bank's financial resources are allocated to "SME loans", "Bad-debts" and "Bank financial resources" which are underutilized bank resources This variable exhibits an interesting behavior ; after some time of lending to SMEs, most of bank resources remain underutilized (remain in the first stock), because there is not enough demand from SME side.. Only a small portion of bank resources is absorbed by SMEs as loans or bad-debts, the rest may be used for financing other sectors such as state owned corporations and large enterprises This phenomenon is mostly a result of "ease of access to loans", with lower perceived "ease of access to loans" many growth oriented SMEs may do self-exclusion and not even apply for a loan Therefore less innovative firms will have better chances to receive loans.

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GRAPH_1

100 M	MT	
20 M	MT	
20 M	MT	
90 M	MT	
15 M	MT	
15 M	MT	
80 M	MT	
10 M	MT	
10 M	MT	
70 M	MT	
5 M	MT	
5 M	MT	
60 M	MT	
0	MT	
0	MT	

Time (year)

Bank financial resources : Base Run ————————————————————————— MT
Loans absorbed by SME sector : Base Run ————————————————————— MT
Bad debt : Base Run ————————————————————————————————— MT
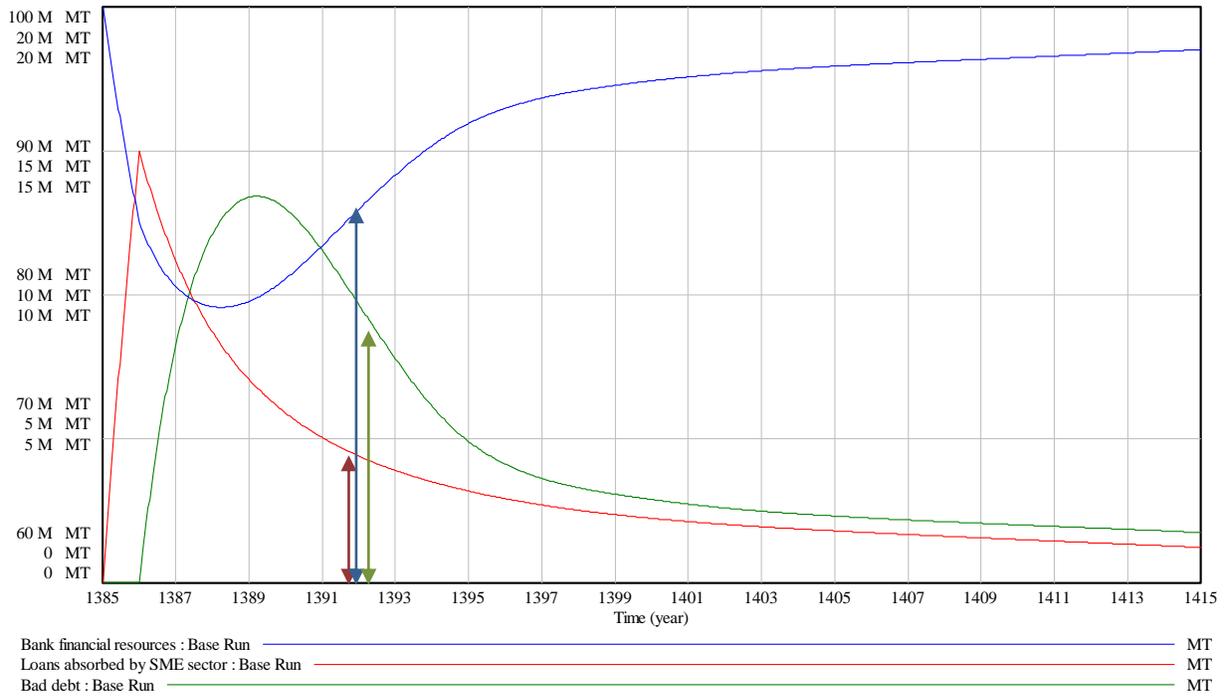
Figure 15-Bank financial resources and bad debt

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6- Policy Analysis

The policies suggested here do not aim at improving the borrowing conditions for the SMEs at the expense of banks' losses; instead they try to propose an even playing field for all firms, whether small, medium or large, in which both bank and firm will benefit. And on the long run the innovative competitiveness of the whole nation will be protected.

Policy 1: Increase the importance of business plan quality

The quality of a business plan for a new project can be a good indicator of its future productiveness. Hence In this model business plan quality is closely related to loan repayment probability. In the first run the standard business plan quality is dynamically set according to collateral requirements and bribing prevalence. Whereas in the second run a feedback mechanism for balancing the importance of business plans quality according to bank risks is set. As it is already indicated in previous section, this crucial mechanism for bank decision making is not in practice nowadays, and if it is not exploited by bank officials in the future the pool of bank-financed businesses will have a low quality as depicted in **Figure 16**. However by implementing the first policy, SMEs will experience much higher levels of "ease of access to loans". This will have its own positive consequences explained earlier.
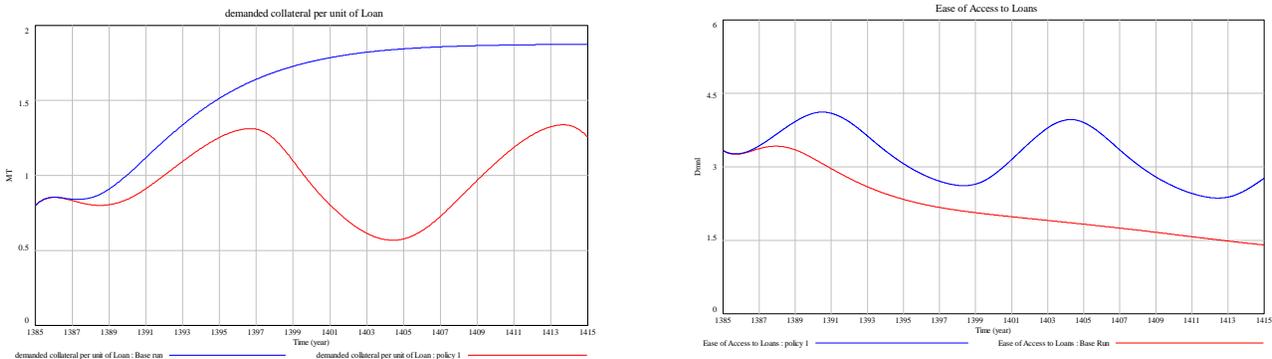
Figure 16-policy 1

Policy 2: Venture capitals

Derived from the previous policy suggestion, it seems that the lack of Venture Capitals in Iranian financial markets causes many financial obstacles that Iranian innovative firms face. Venture capitals are excellent solutions for financing new ventures which are based on innovative entrepreneurial ideas. Since there are no official VCs widely practiced in Iran, such new ventures have to ask commercial banks to fund their business. The policy implication derived from this model is the importance of business plan analysis at the time of loan approval. Since commercial banks don't have enough capability and expertise to do in detail analysis of business plans and doing so will cost them so high. We propose a change in Iranian financial markets, which will bring more dynamism and innovation through the introduction of Venture capitals. VCs can build long term capability of business plan assessment and evaluation. Through some dedicated capacity to start-ups evaluation a follow-up they can increase the possibility of new ventures success.

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Policy 3: Increase the legal enforcement for bank collaterals

In our model we considered the legal constraints of the Iranian legal system; this is done through the variable named "legal enforcement of collateral". In reality this enforcement is not sufficient and that's the reason for dysfunctionality of bank collaterals. As a test for policy implication we increased the effect of legal enforcement in the model, the result is the second curve in **Figure 17**.

It is clear that more strict legal enforcement on the long run will increase the "ease of access to loans" for SMEs. A policy implication is the reinforcement of legal procedures and institutions in order to protect the financial assets of banks. Interestingly, such a policy will have positive effects for borrowers as well.
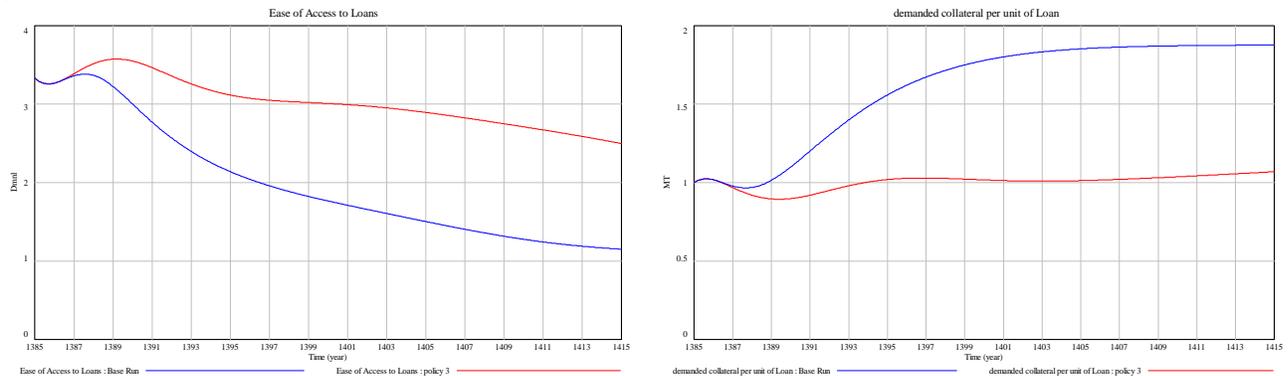
Figure 17-policy 3

Conclusion

A problem of SME financing has been addressed and modeled in this paper. The addressed firms are innovative SMEs who have good business plans and high chances of growth. Using the literature and also empirical data, with the help of system dynamics modeling we explained that an adverse selection is taking place in banking decisions for SME financing. Banks opt for more risky borrowers, only because they are able to provide collaterals and they pay bribes to bank officials. As a result most innovative SMEs are left out. In the long run riskier pool of customers, especially in a country with weak legal infrastructure like Iran, results in huge losses for the banks. Moreover the limitation posed by financing obstacles of SME section, reduces nation's overall competitiveness. Three policies are suggested based on this research. a) Increase the importance of business plan quality, b) Venture capitals, and c) Increase the legal enforcement for bank collaterals. To sum up, in order to alleviate current undesirable behaviors, business plan assessment capability should be built up in Iranian financial system, moreover legal infrastructures should be fostered.

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Appendix: Model equations

(01) adjusting time=5
  Units: year

(02) attrition of bribable people=Bribing culture/Time to retire
  Units: 1/year

(03) average amount of bribe paid per unit of loan=Bribing culture*(normal bribe requirement per unit of loan*100)
  Units: MT
  the *100 multiplier is for converting the ratio into percent

(04) Average productivity of current business plans=Potential productivity of business plans financed by bank/(Loans absorbed by SME sector+Bad debt)
  Units: 1/year

(05) average profitability of SMEs=0.3
  Units: 1/year
  percent of net profit to investment per year

(06) average quality of accepted business plans=average profitability of SMEs*effect of bribing on BP scrutiny*effect of collateral on BP scrutiny
  Units: 1/year
  expected profitability per unit of Loan

(07) Average size of growing firm loans=500
  Units: MT/enterprise

(08) "average size of Start-up loans"=100
  Units: MT/enterprise

(09) Bad debt= INTEG (Default rate-Delayed repayment-Seized and disposed of collaterals,1)
  Units: MT

(10) Bank collaterals in hand= INTEG (Collect Collateral-Redeem collateral,0)
  Units: MT

(11) Bank financial resources= INTEG (Loan redemption rate-Lending rate to SMEs,1e+008)
  Units: MT

(12) Bribing culture= INTEG (diffusion of bribing-attrition of bribable people, 0.1)
  Units: Dmnl
  Percent of bribable bank officers.

(13) business plan exclusion from bank financed projects=Loan redemption rate*Average productivity of current business plans
  Units: MT/year/year

(14) change in collateral requirements=(Desired collateral per unit of Loan-demanded collateral per unit of Loan)/adjusting time
  Units: MT/year
  IF THEN ELSE(demanded collateral per unit of Loan>effect of
        bank risk on collateral requirements , 0 , effect of bank risk
        on collateral requirements-demanded collateral per unit of Loan)

(15) collateral salability=legal enforcement on collateral
  Units: Dmnl

(16) Collect Collateral=Lending rate to SMEs
  Units: MT/year

(17)   Default rate=repayment rate*(1-Loan repayment probability)/Loan repayment probability
         Units: MT/year
(18)   Delayed repayment=Bad debt*legal enforcement on collateral/Time to collect payments
         Units: MT/year
(19)   Demand of Loan by growing SMEs=Enterprise maturity rate*Average size of growing
firm loans
         Units: MT/year
(20)   demand of loans by new SMEs=New SMEs start rate*"average size of Start-up loans"
         Units: MT/year
(21)   demanded collateral per unit of Loan= INTEG (change in collateral requirements, 1)
         Units: MT
(22)   Desired collateral per unit of Loan=effect of bank risk on collateral requirements
         Units: MT
(23)   diffusion of bribing= Bribing culture*(1-Bribing culture)*effect of ease of access to
loans on bribing
         Units: 1/year
(24)   Ease of Access to Loans=Unit loan/(average amount of bribe paid per unit of
loan+0.25*demanded collateral per unit of Loan)
         Units: Dmnl
         cost incured by borrowers per unit of loan. Risk free bank interest rate in Iran is 25
percent , therefor we consider if someone pays collater loses the interest rate for the collateral for
the duration of borrowing
(25)   effect of bank risk on collateral requirements = WITH LOOKUP (DELAY1(Perceived
Risk by Bank, Time to adjust),
             ([(0,0)-(1,2)],(0,0.2),(0.137615,0.324561),(0.278287,0.596491),(0.400612
    ,0.991228),(0.495413,1.34211),(0.617737,1.67544),(0.743119,1.86842),(0.847095
    ,1.94737),(1,2),(10,30)))
         Units: MT

(26)   effect of BP productivity on loan repyament=f effect of BP productivity on loan
repayment(Average productivity of current business plans)
         Units: Dmnl
(27)   effect of bribing on BP scrutiny=f eff of bribing on BP scrutiny(Bribing culture)
         Units: Dmnl
(28)   effect of collateral on BP scrutiny=f eff of collateral on BP scrutiny(demanded collateral
per unit of Loan)
         Units: Dmnl
(29)   effect of demanded collateral on legal enforcement=f effect of demanded collateral on
legal enforcement(demanded collateral per unit of Loan)
         Units: Dmnl
(30)   effect of ease of access to loans on bribing = WITH LOOKUP (Ease of Access to Loans,
             ([(0,0)-
(10,2)],(0,2),(0.134557,1.52632),(0.281346,1.19298),(0.513761,0.859649
    ),(0.764526,0.508772),(1.07034,0.324561),(1.7737,0.166667),(2.69113,0.0877193
    ),(3.66972,0.0614035),(4.70948,0.0438596),(5.84098,0.0350877),(6.85015,0.0175439
    ),(10,0)))

Units: 1/year
(31) effect of profitability of SME Start = WITH LOOKUP (average profitability of SMEs,
    ([(0,0)-(1,20000)],(0,0),(0.192661,1140.35),(0.35474,2456.14),(0.522936,
4210.53),(0.691131,6578.95),(0.83792,9210.53),(0.93578,11754.4),(1,15000)
    ))
Units: enterprise/year
(32) effect of profitability on SME bankrupcy = WITH LOOKUP (average profitability of
SMEs,
    ([(0,0)-(0.6,1)],(0.0605505,0.991228),(0.1,0.75),(0.166972,0.447368),(0.3
,0.2),(0.4,0.15),(0.6,0.1)))
Units: 1/year
(33) Enterprise maturity rate=Number of SMEs*perceived ease of access to loans/Time to
mature
Units: enterprise/year
(34) f eff of bribing on BP scrutiny([(0,0)-(100,10)],(0,1),(0.2,0.8),(1,0))
Units: Dmnl
(35) f eff of collateral on BP
scrutiny([(0,0)(8,8)],(0.125,8),(0.25,4),(0.366972,2.98246),(0.5,2),(0.66055,1.47368
    ),(1,1),(1.44343,0.666667),(2,0.5),(2.88685,0.350877),(4,0.25),(8,0.125))
Units: Dmnl
(36) f effect of BP productivity on loan repayment(
    [(0,0)-(1,1)],(0,0),(0.174312,0.0701754),(0.29052,0.192982),(0.351682,0.5
),(0.434251,0.798246),(0.574924,0.899123),(0.785933,0.951754),(1,1))
Units: Dmnl
(37) f effect of demanded collateral on legal enforcement(
    [(0,0)-(3,2)],(0,0),(0.357798,0.236842),(0.577982,0.45614),(0.889908,0.850877
),(1.11009,1.18421),(1.22936,1.35965),(1.37615,1.63158),(1.56881,1.83333),
(1.76147,1.92982),(2,2),(2.17431,2),(2.31193,2),(2.41284,2),(2.52294,2),(2.66055
,2),(2.75229,2),(2.84404,2),(3,2))
Units: Dmnl
(38) FINAL TIME = 2036
Units: year
The final time for the simulation.
(39) INITIAL TIME = 2006
Units: year
The initial time for the simulation.
(40) Large enterprises grown from SMEs= INTEG (Enterprise maturity rate,1)
Units: enterprise
(41) legal enforcement on collateral=effect of demanded collateral on legal
enforcement*normal legal enforcement
Units: Dmnl
(42) Lending rate to SMEs=MIN(Total demand, Bank financial resources/lending time)
Units: MT/year
(43) lending time= 1
Units: year

(44)   Loan redemption rate=Delayed repayment+repayment rate+Seized and disposed of collaterals
        Units: MT/year
(45)   Loan repayment probability= effect of BP productivity on loan repyament*legal enforcement on collateral
        Units: Dmnl
(46)   Loans absorbed by SME sector= INTEG (Lending rate to SMEs-Default rate-repayment rate,1)
        Units: MT
(47)   New SMEs start rate= effect of profitability of SME Start*perceived ease of access to loans
        Units: enterprise/year
(48)   normal bribe requirement per unit of loan=0.005
        Units: MT
(49)   normal legal enforcement=   1
        Units: Dmnl
(50)   Number of SMEs= INTEG (New SMEs start rate-SMEs bankrupcy rate-Enterprise maturity rate,   100000)
        Units: enterprise
(51)   perceived ease of access to loans=SMOOTH(Ease of Access to Loans, time to perceive)
        Units: Dmnl
(52)   Perceived Risk by Bank=(Bad debt/(Bad debt+Loans absorbed by SME sector))
        Units: Dmnl
(53)   Potential productivity of business plans financed by bank
                = INTEG (Potential productivity of new loans-business plan exclusion from bank financed projects,1)
        Units: MT/year
(54)   Potential productivity of new loans=Lending rate to SMEs*average quality of accepted business plans
        Units: MT/year/year
(55)   procedural delay=12
        Units: year
(56)   r1=DELAY FIXED(Lending rate to SMEs, 1 , 0)
        Units: MT/year
(57)   Redeem collateral=Loan redemption rate
        Units: MT/year
(58)   repayment rate=r1*Loan repayment probability
        Units: MT/year
(59)   SAVEPER = TIME STEP
        Units: year [0,?]
        The frequency with which output is stored.
(60)   Seized and disposed of collaterals=Bad debt*collateral salability/ procedural delay
        Units: MT/year
(61)   SMEs bankrupcy rate=Number of SMEs*effect of profitability on SME bankrupcy/perceived ease of access to loans
        Units: enterprise/year

(62)   TIME STEP = 0.03125
        Units: year [0,?]
        The time step for the simulation.
(63)   Time to adjust=3
        Units: year
(64)   Time to collect payments=10
        Units: year
(65)   Time to mature=10
        Units: year
(66)   time to perceive=3
        Units: year
(67)   Time to retire=30
        Units: year
(68)   Total demand=Demand of Loan by growing SMEs+demand of loans by new SMEs
        Units: MT/year
(69)   Unit loan=1
        Units: MT