Credit monitoring and development: The impact of financial integration

Lin Guo[1]
Université de Paris I Panthéon Sorbonne

March 31, 2010

[1] *CES-EUREQua, Maison des Sciences Economiques, 106-112, boulevard de l'Hôpital, 75647 PARIS Cedex 13, France. Tel. +33 1 44 07 81 96. Email: lin.guo@univ-paris1.fr.*

Abstract

This paper considers the development issue in a growth model in an open economy to explain the distinct growth paths in different countries in finanical integration. Instead of imposing exogenous and fixed financial development parameters, this paper draws financial development indicators from the model and allow for their evolution. The model outlines a transmission channel linking financial openness and real economic growth through the financial development. We find that when the financial openness makes the financial development evolve, its evolution changes the growth performance in the financial openness. The initial financial development level, the initial wealth, as well as the timing of the openness all account for the growth pattern in a financially open environment.

We explore these issues by incorporating a costly state verification (CSV) problem in an overlapping generation model and we consider the model both in autarky and in a small open economy. We find two different aspects of the financial development which behave quite differently. The financial development based on these two indicators is non-monotone and its impacts on growth exhibit threshold effects. In an open economy, on one hand, the equalizing force of capital return allocates capital to the countries with higher overall capital productivity; on the other hand, the credit constraint deters capitals by pooling capital in the countries with better financial conditions. The unequal and non-monotone financial development adjusts the strength of above competing forces, and gives up to multiple regimes of equilibrium. The financial development determines the dynamic properties of each regime and its evolution makes the transition of regime happen. Results of the model are consistent with the stylized facts and are compatible with different growth paths across the world.

Keyword: monitoring cost, financial development, financial globalization, multiple equilibrium, transition effect on growth, emerging countries

JEL classification:F4,G2,O4

Contents

1 Introduction

1.1 The research question

The growth path in the financially open economy differs a lot across countries, with different initial wealth, legislative institutions or financial development level. Some emerging countries achieved high growth after their financial integration to the world financial market, however, soon after they experienced severe financial and economic crisis in late 90s. Developed countries didn't seem experience the same. The crisis in emerging markets in late 90s reveal specific challenges raised by their financial integration to the world market. Whether and how the financial openness can be beneficial to the growth performance is an subject of many debates among economists and policymakers. Kose, Prasad, Rogoff, and Wei (2009), summarizing the debates, argues that the financial globalization seems to have different impacts in each country and that some prerequisite conditions must be satisfied for beneficial impacts to occur. The financial development level is highly relevant and is a threshold condition suggested by their empirical works. Many theoretical works also highlight the unequal outcomes of the financial openness in different countries in the presence of the financial imperfection. When the financial market is imperfect, the financial openness can be unfavorable for poor countries, while it is favorable for the rich ones. These empirical and theoretical works suggest that, for the beneficial impacts of the financial integration to occur, we need to reduce the financial imperfection and improve the financial development. It would be desirable to understand better the reduction of the financial imperfection and the financial development in financial opennss.

Mishkin (2006) enumerates various direct and indirect channels through which financial globalization could have positive impacts on financial development, for exemple the entry of foreign financial institutions, the increase of competition and the diffusion of technology. Kose, Prasad, Rogoff, and Wei (2009) points out that in theory financial globalization should catalyze domestic financial market development. Such indirect benefit may be very important, however it is not yet considered in a model with financial imperfection in financial openness. It is worthwhile to study the growth and the financial development when the financial integration can reduce the financial imperfection.

There may be one reason that such study is not yet pervasive. We often take it for grant that any problem caused by the financial development in financial openness will finally disappear because the financial development can be improved during the process of the financial globalization. Despite of various growth paths in financial openness, the perspective to achieve the most favorable path seems straight forward: more involved in the financial integration and eventually acquire necessary financial development. However, we may ignore that problems may arise just on the way to the solution. Instead of developed countries or very poorly developed countries, crisis hit emerging countries suddenly, right on their way of improvements in economic and financial fundamentals and soon after their financial integration to the world financial market. The growth and the development suffer from these crisis when these countries were improving the efficiency of their opened financial sector. We would like to model the financial imperfection and find out its impact on the financial development and the growth. Especially, we considier the evolution of the financial imperfection and try to study the process of the financial development and growth.

In this paper, we consider an overlapping generation (OLG) model both in autarky and and in a small open economy. Contrary to the standard OLG model, where the financial market is perfect and the savings automatically converted into physical capital, here the savings of current period become the next period's capital via a capital investment technology, which requires credit. We incorporate realistic frictions with respect to the lender's monitoring activity, via a costly state verification (CSV) problem. We can study the impact of this financial imperfection on the economic performance, and compare it with that in a framework without the financial imperfection. We draw from the model two financial development indicators, which are determined by the monitoring cost. We allow the monitoring cost to evolve and analyse the evolution of the financial development. We find that multiple equilibria exist in the open economy, while there is a unique steady state in autarky. Furthermore, the evolution of the financial development makes the transition of the growth dynamic happen. In fact, when the financial openness changes the monitoring costs, the financial development evolves, and the evolution of the financial development changes the growth performance in the financial openness. The initial financial development level, the initial wealth, as well as the timing of the openness can all account for the growth pattern in the financially open environment. The mechanism outlined above represents a transmission channel, linking financial openness and real economic growth through the financial development. The model shows that countries with intermediate financial imperfection and development level are more likely to experience the potent effects of financial openness through such a channel.

Among our results, three specific findings stand out. First, there is a threshold of capital intensity. The initially high capital intensity alone ensures the convergence to an equilibrium of higher capital intensity, despite of the fact that the financial development and the timing of openness account too. Second, there is a threshold effect of development. When the financial development level becomes high enough, the dynamic converges to an equilibrium with high capital intensity, despite of the initial wealth or the timing of openness. The third is that, even though the financial development will eventually help to attain a high equilibrium, the growth paths vary a lot across countries with different initial conditions. For countries at intermediate development level, the possible transition of regime may make the dynamics of growth complicated and volatile; while such transition is unlikely for developed countries.

1.2 The literature review

The first strand of litterature is dynamic general equilibrium models with the financial imperfection. In such models, the financial imperfection is often considered as a credit constraint. Mastuyama (2004) investigates the effects of financial market globalization on the inequality of nations in a model of world economy with different initial wealth levels for each country. He shows that the world economy is endogenously divided into the rich and poor countries when the credit constraints exist. After opening, the credit constraints are binding in the poor countries but not in the rich ones. These models suggest that if a country is poor, the financial integration can bring about unfavorable consequences. A further question to be explored beyond these papers is that how poor country can avoid unfavorable consequences in the financial integration. It's surely worthwhile to explore the development issues, however, this paper considers the credit constraint as given and the financial development issue cannot be properly addressed. This approach is adopted by many other works as Aghion, Bacchetta & Banerjee (2004), Bernanke, Gertler & Gilchrist (1999) , Mendoza, Quadrini & Rios-Rull (2007) . The credit constraint approach creates a link between macroeconomic fundamentals and financial frictions. However its capability is limited when we come to the development issues.

First of all, it measures only one possible financial friction. By imposing a credit constraint as the only financial friction indicator, this approach takes this invariant exogenous parameter as the only possible measure of the financial development. If the financial development may result in a relaxation of the credit constraint, we are not sure of the contrary: a relaxation of credit constraint alone imporve financial efficiency ? The financial imperfection may not be an appropriate proxy the financial development. It would be desirable to generate more comprehensive financial development indicators.

Secondly, this approache leads to some contradictions. In a model with the credit constraint, unbalanced consequences of the financial openness rely on the unbalanced structure the world economy. We can naturally think of a world structure of credit constraint with developed countries less or not at all constrained and other countries more constrained. Claims are pervasive such that the financial globalization can stimulate financial development, although the magnitude and relevance of possible channels are still under discussion. If we consider such possibility that the financial development evolves for some reasons during the financial integration, it is natural to expect a reduced difference in the credit constraints across countries, and eventually the structure of credit constraint will become flat in the world. The only implication we can draw from the credit constraint approach on the development issue is that unbalanced consequences must disappear with the financial globalization. In other words, the financial globalization is itself both the cause and the solution. The unequal consequences just come from the omission of one counterweighting channel and are supposed to disappear gradually when necessary elements are taken into account. However, it contradicts our observations: instead of very poorly developed countries, crisis hit emerging countries suddenly, right on their way of improvements in economic and financial fundamentals and soon after their financial integration to the world financial market. We conjecture that the financial development is not monotonic and the threshold effects exist.

Another strand of litterature is related to financial contract dealing with the financial imperfection of the informational asymmetry. The financial development concerns how efficiently the financial intermediation can overcome financial frictions, as the informational asymmetry. By comparing the outcome of a framework with and without financial frictions, we observe different economic performences. We can measure these differences and make them as indicators of the financial development. We consider the informational asymmetry as the financial imperfection in the model and introduce the credit monitoring. This method is adopted by Townsend(1979), Gale & Hellwig(1985), Williamson(1986, 1987) and Boyd & Smith (1997, 1998). Boyd & Smith (1998) considers a two country overlapping generation model with international capital markets in the presence of the CSV problem. They claim that the financial integration precludes identical economies from converging to the same steady state if initial wealth differs across countries. They assume the same monitoring cost across the two countries in order to solve the model in equilibrium under restricted conditions. Compared with Boyd &

Smith (1998), this paper tries to make improvements in two aspects.

First, it addresses the development issue. By observing the performance of the economy with CVS problem, we find two financial development indicators: effective capital productivity and borrowing constraint. This finding replies to the contradictory implication from the credit constraint approach, as mentioned above. We allow these indicators to vary, and their evolution behaves quite differently. The borrowing constraint behaves simular as in previous literatures, that is, the financial development leads to a relaxation of borrowing constraint, and vice versa. However, previous literature has omitted the effective capital productivity, whose evolution is non-monotone. The threshold effect exists and the joint impact of the two financial development indicators generates multiple equilibria.

Second, this paper studies the conditions of each possible equilibrium, while Boyd & Smith (1998) only shows the possibility of multiple equilibria. We find that the existence of each possible equilibrium depends on financial development. This finding confirms the important role of the financial development in the determination of growth path. Considering differences in financial development level, countries across the world don't converge to the same equilibrium in the financial open environment.

These improvements make it possible to link the growth dynamic to the financial development. For possible values of the monitoring cost, we can determine the exact financial development indicators and the corresponding regimes of equilibria. Such linkage is useful to study the outcomes of the financial integration which is not only an event but also a process. During the financial integration, the impact of a gradual motion of the monitoring cost[1] can be analysed by this model.

1.3 The structure of the paper

The paper is organized as follows. Section 2 presents a model in autarky and we consider it in a small open economy in Section 3. It is an overlapping generation model, which incorporates a costly state verification (CSV) problem in converting current capital into the next period. We assume that the capital convertion technology (which is called the capital investment technology below) is funded with both internal and external funds. There is informational asymmetry: only the borrower knows about the real return of the debt; lenders issue loans and can only monitor borrowers by incurring a monitoring cost. The CSV problem has

[1] The financial integration can affect the monitoring cost in multiple ways. Evidences suggest that in average the decline of the monitoring cost is significant eventhough the magnitude is under disscution. See Stulz (1999) for a comprehensive discussion of globalization and capital cost.

two impacts on the economy: First, the monitoring cost expended to overcome the informational asymmetry will affect the overall output of the capital; Second, the monitoring cost prevents lenders from retrieving the total amount of loans. Knowing this, the lender restricts the borrowing and makes it contingent on the value of collateral. There exists thus a borrowing limit. We make these two parameters as indicators of financial development drawn from the model, which both reflect the financial efficiency of a country. Therefore, the shift of the monitoring cost can change on the one hand the overall return of the capital, and on the other hand the borrowing limit. We allow for the financial development to evolve and we pay particular attention to the impacts of their evolution on growth. We show in this paper that their impacts are unequal. The financial development based on these two indicators are non-monotone and its impacts on growth exhibit threshold effects.

We compare their impacts in autarky to those in open economy in Section 4. From these comparisons, we assess the particular role of the financial development in open economy, which raise unequal challenges for emerging counties. In an open economy, on the one hand, the equalizing force of capital return tends to allocate capital resources to the country with higher overall output of the capital; on the other hand, capital tends to be pooled in those countries with less severe borrowing limit problem. The monitoring cost differs across country and may evolve by adjusting the strength of above competing forces, and lead to multiple regimes of equilibrium. The financial development determines thus the dynamic properties and the difference in the financial development makes the growth paths differ across countries. The transition across different regimes of the growth dynamic can happen with the evolution of the monitoring cost. We investigate possible incidences and the associated conditions, which are compatible to stylized facts in emerging and advanced countries. Finally, we conclude in Section 5.

2 The Model in Autarky

2.1 Basic framework

2.1.1 Agents, preference and technologies

We consider a two-period lived, overlapping generations model with discrete time indexed by t.

Each generation is composed of a continuum of agents in each country with unit mass. Each agent is endowed with one unit of labor when young, which is supplied inelastically to the final goods sector, and retires when old. Thus, $L_t = 1$.

In addition, agents other than the initial old have no endowment of capital or the final good at any date. All agents value only old age consumption and are risk neutral. The wealth held by the young agents at the end of period t is equal to their wage income, $w(k_t)$. They allocate their wealth, $w(k_t)$, in order to finance their consumption in period $t+1$.

There is a single final good produced from two input factors: labor denoted by L, which is supplied by the young generation, and physical capital, denoted by K, supplied by the old generation. The final good produced in period t may be consumed in period t or may be invested in the production of physical capital, which becomes available in period $t+1$.[2] The technology of the final good sector is given by a constant returns to scale production function $Y_t = F(K_t, L_t)$. Let $f(k_t) = F(k_t, 1)$ denote the intensive production function of the final good sector, where $k_t = K_t/L_t$ is the capital-labor ratio. It is assumed that $f(k_t)$ is increasing in k_t, strictly concave, with $f(0) = 0$, and that the standard Inada conditions hold. Capital is used in the production process in each period, and then depreciates completely. Factor markets are competitive. Thus, the rental rate of capital, ρ_t, and the real wage, $w(k_t)$, are both equal to their marginal products: $\rho_t = f'(k_t)$ and $w(k_t) = f(k_t) - k_t f'(k_t)$. $w(k_t)$ is assumed to satisfy $w'(k_t) > 0$ and $w''(k_t) < 0$ for $k_t > 0$.

There is a stochastic linear technology which converts the time t final good into time $t+1$ capital. This capital investment technology requires q units of the final good and yields z_t units of capital at date $t+1$ for every unit of final good invested in the technology at date t. z_t is an *iid* random variable which is realized at the beginning of $t+1$. It is drawn from the distribution G, which is assumed to have a differentiable density function g with support $[0, \overline{z}]$. The expected value of z_t is denoted by $\widehat{z}$. It is assumed that $q > w(k_t)$, so that it's necessary to borrow $b_t = q - w(k_t)$ in order to start the project.[3]

2.1.2 Credit market and contract

We assume that the young agents in each country can become one type in two possible "identities": a borrower or a lender. Borrowers have the access to the

[2] In a standard *OLG* model, the saving of period t automatically becomes the physical capital in period $t+1$, since the financial market is considered perfect. Here, we consider the role of the financial imperfection. The saving cannot directly becomes physical capital in the next period. We assume a capital investment technology which allows to convert the saving in current period into the physical capital in the next period. The capital investment technology requires external funds supplied by the credit market that we specify in the following.

[3] q is normalized to 1 later on. We focus on the case where $w(z) < 1$. We prove later that it holds in equilibrium with reasonable specifications.

captial investment technology for converting the time t final good into time $t+1$ capital. Lenders have no access to such a technology. So a borrower is able to invest in the capital investment technology, while a lender just lends and receives interests on their lendings. The identity of each agent is unknown when they were born but each agent have the same probability to become a lender or a borrower.[4] We denote the fraction of borrower in each generation by δ_t. Since it can easily happen that there is unfulfilled demand for credit, we don't restrict δ_t to be small. Suppose that in each country $\delta_t q > w(k_t)$. δ_t will be determined in equilibrium under credit rationing.[5]

The return of the capital investment project is private information to its owner: the borrower. A standard costly state verification (CSV) problem exits. The realized z_t on any capital investment project can be costlessly observed only by the owner. The lender can only ascertain the value of z_t by incurring a cost of γ units of capital.[6]

There is a credit market to transfer funds between borrowers and lenders. Borrowers and lenders are thought of entering into contractual relationships by establishing a take-or-leave-it contract annonced by the borrower. Following Williamson (1986, 1987), it is assumed that borrowers announce the contract terms, which can then be either accepted or rejected by any lender. When a borrower's contract announcement is accepted, the borrower obtains q units of the final good and undertakes his project. Contracts offered by the borrowers will be evaluated by the lenders in terms of the expected return. The lenders' expected returns thus play the role of prices in the credit market. We denote it by r_{t+1}. It is in fact the "market expected return" and is to be determined endogenously later in the model.[7]

The loan contract consists of the following set of objects. First, there is a subset $A_t \subseteq [0, \bar{z_t}]$ for which verification of the state occurs at t. The verification of the

[4] We can think that the identity is determined in a mixed strategy equilibrium, arising from the credit rationing. A part of agents who would like to be a borrower are denied of credit. However, the probability of each agent to be the borrower is equal when they are born. Therefore, in the mixed strategy equilibrium each agent accepts to be what he becomes.

[5] When the demand for credit is thought of as small, the investment is solely determined by demand. We are interested in the case with credit rationing. because this paper focus on the efficiency of resource allocation. It is no more a concern if the available resource is excessive. For this reason, the model is considered under credit rationing in the following.

[6] We will eventually allow the variation of γ. We don't use time index for instance because it doesn't depend on capital. However, we assume later that it may vary across time.

[7] We can imagine that banks intermediate funds between borrowers and lenders by allocating and monitoring credits. The market expected return can be interpreted as the saving interest rate. However, these banks would be transparant in the analysis.

state doesn't occur for $B_t = [0, \bar{z_t}] \backslash A_t$. If $z_t \in A_t$, the payment from the borrower to the lender can meaningfully be made contingent on the project return. In this case we denote the promised (state contingent) payment (per unit borrowed) by $R_t(z_t)$. If $z_t \in B_t$ the loan repayment cannot meaningfully be made contingent on the project return. Therefore the only incentive compatible loan contract is the one with an uncontingent repayment of x_t (per unit borrowed) at t when $z_t \in B_t$ .These loan contract terms A_t, B_t, R_t and x_t are to be endogenously determined in the model.

2.1.3 Timeline and events

At the time t, the production of the final good Y_t takes place with the labor supply of the young L_t and the capital supply of the old K_t. The old receives his capital return and consume. The young receives his wages and allocates to finance his consumption when old. The allocation of his wages of time t involves in the production of the capital in time $t+1$. At the end of time t, a young agent becomes either a lender or a borrower. The loan contract is established. Lending and borrowing happens. The physical capital production takes place for converting wealth of young at the end of time t into capital in time $t+1$.

2.2 Decisions of the agents

2.2.1 The Borrower

Let π^E_{t+1} denote the expected payoff of a borrower at time $t+1$. A borrower is willing to start a capital investment project only when his expected payoff π^E_{t+1} is no less than $r_{t+1}w(k_t)$. The incentive constraint of a borrower can be expressed as

$$\pi^E_{t+1} \geq r_{t+1}w(k_t) \tag{1}$$

The expected payoff of a borrower is defined as

$$\pi^E_{t+1} = q\widehat{z}_t\rho(k_{t+1}) - b_t \int_{A_t} R_t(z_t)g(z_t)dz_t - b_t x_t \int_{B_t} g(z_t)dz_t \tag{2}$$

which is the expected gross return of the project, net the expected repayment of the loan. Since the agent concerns only the consumption when old. All payoffs are value in good value. The good value of the capital is $\rho(k_{t+1})$. The above equation says that the consumption of a borrower when he is old is the good value of the expected project return $q\widehat{z}\rho(k_{t+1})$ net the repayment of debt. If the project is verified, the repayment is $b_t R_t(z_t)$; if the project is not verified, the repayment is $b_t x_t$.

Since it is the borrower who announces the loan contract, the borrower chooses the loan contract terms in order to maximize his expected payoff. The announced loan contract solves the problem (3) associated with conditions (4), (5) and (6).

$$\max \pi_{t+1}^E \tag{3}$$

$$0 \leq R_t(z_t) \leq \frac{z_t q \rho(k_{t+1})}{b_t} \tag{4}$$

$$0 \leq x_t \leq \inf_{z_t \in B_t} \frac{z_t q \rho(k_{t+1})}{b_t} \tag{5}$$

$$R_t(z_t) \leq x_t, \text{ for all } z_t \in A_t \ . \tag{6}$$

The conditions (4) and (5) say that the borrower cannot pay more than the goods value of his capital which is $z_t q \rho(k_{t+1})$ is state z_t. The condition (6) insures that the borrower must have an incentive to truthfully reveal his return when a monitoring happens.

The solution to this problem is for borrowers to offer "a standard loan contract". In particular, the borrower repays the fixed interest rate x_t when it is feasible. Otherwise he defaults on his loan. The lender verifies the state, and retains all of the proceeds from his project. More formally we have the following proposition to summarize the optimal loan contract.

Proposition 1 *The optimal loan contract must satisfy*

$$R_t(z_t) = \frac{z_t q \rho(k_{t+1})}{b_t} \tag{7}$$

$$A_t = [0, \frac{x_t b_t}{q \rho(k_{t+1})}) \tag{8}$$

Proof. See Appendix[8] ■

It remains to describe the contingent interest rate charged on the loans, x_t. It is determined by maximizing the payoff of the lender as described below.

[8]The proof of this proposition is similar to the ones found in Gale and Hellwig (1985) and Williamson (1986, 1987).

2.2.2 The Lender

Let π^B_{t+1} denote the expected return per unit lent of a lender at time $t+1$. One lender is only willing to accept a loan contract if it yields them an expected return rate no less than r_{t+1}. Therefore, the incentive constraint of a lender can be expressed as

$$\pi^B_{t+1} b_t \geq r_{t+1} b_t \tag{9}$$

The expected payoff of a lender is defined as

$$\pi^B_{t+1} b_t = \int_{A_t} [R_t(z_t)b_t - \rho(k_{t+1})\gamma] g(z_t) dz_t + b_t x_t \int_{B_t} g(z_t) dz_t \tag{10}$$

The first term says that when the verification takes place, the lender retains all the realizations of the project and for doing so the lender pays a monitoring cost. The second term says that the lender receives the repayment of the loan and there is no necessary of verification. By using the terms of the optimal loan contract (7) and (8), the lender's expected repayment per unit lent π^B_{t+1} can be rewritten as a function of the contractually specified gross interest rate, x_t, the degree of external finance, b_t, and the relative price of capital, ρ_t.[9]

$$\pi^B_{t+1}[x_t; \frac{b_t}{\rho(k_{t+1})}] \equiv x_t - \frac{\rho(k_{t+1})\gamma}{b_t} G(\frac{x_t b_t}{q\rho(k_{t+1})}) - \frac{q\rho(k_{t+1})}{b_t} \int_0^{\frac{x_t b_t}{q\rho(k_{t+1})}} G(z_t) dz_t \tag{11}$$

Because of the credit rationning, the lender will fix the interest rate x at the maximizing level. [10] The unique interest rate that maximizes the expected return is defined implicitly by $\frac{\partial \pi[x_t(b_t/\rho(k_{t+1})); b_t/\rho(k_{t+1})]}{\partial x_t(b_t/\rho(k_{t+1}))} = 0$, which implies

$$1 - \frac{\gamma}{q} g(\frac{\widehat{x}_t b_t}{q\rho(k_{t+1})}) - G(\frac{\widehat{x}_t b_t}{q\rho(k_{t+1})}) = 0$$

Note that $\frac{\widehat{x}_t b_t}{q\rho(k_{t+1})}$ defines in fact the fraction of verified projects. Call that

$$\eta \equiv \frac{\widehat{x}_t b_t}{q\rho(k_{t+1})} \tag{12}$$

where η satisfies

$$1 - (\gamma/q) g(\eta) - G(\eta) = 0 \tag{13}$$

[9] See Appendix *II*

[10] With an appropriate specification, the function π^B_{t+1} can be proved concave with a maximum point $\widehat{x}_t(b_t/\rho(k_{t+1}))$. The appropriate primitive assumption is that $g(z) + \frac{\gamma}{q} g'(z) \geq 0$ for all $z \in [0, \bar{z}]$, which is always verified in this framework.

Note that $G(\eta)$ is simply the auditing probability when the interest rate is bid up to the level which maximizes the lender's expected return. The assumption that monitoring costs capital implies that η only depends on monitoring costs and the distribution of project return.

2.3 Indicators of financial development

The choice of agents endogenously determines their payoffs as a function of monitoring cost and aggregate capital stock. In a framework without any financial imperfections, the utility of agent solely depends on capital stock. In current model, the financial imperfection will be reflected in the payoff of agent. We now rewrite the expected payoff of lender and borrower, in order to make them directly comparable with that without financial imperfections.

By using conditions (7),(9),(8),(11), and (12) we can rewrite the expected payoff of a borrower (2) as

$$\begin{aligned} \pi^E_{t+1} &= \widehat{z}\rho(k_{t+1}) - \rho(k_{t+1})\gamma G(\eta) - r_{t+1}b_t \\ &\equiv \phi\rho(k_{t+1}) - r_{t+1}(1 - w(k_t)) \end{aligned} \tag{14}$$

where

$$\phi \equiv \widehat{z} - \gamma G(\eta) \tag{15}$$

.[11] ϕ is in fact the expected amount of capital produced, per unit invested and net of monitoring cost.

By replacing (15) into (1), the incentive constraint of a borrower to start a project now becomes

$$\phi\rho(k_{t+1}) \geq r_{t+1} \tag{16}$$

In fact, an agent is willing to start a project only when the net present discounted value of the project, $\frac{\phi\rho(k_{t+1})}{r_{t+1}} - 1$ is non-negative. One is willing to borrow and to start the project when (16) holds. We call it the profitability constraint. In the case of a perfect financial market, this constraint will simply be $\rho(k_{t+1}) \geq r_{t+1}$. The additional ϕ comes from the monitoring cost which reduces the net capital production.

We rewrite the expected payoff of a lender (10), by using conditions (7),(8) and

[11] See Appendix *III*.

(12).[12]

$$\pi_{t+1}^B b_t = [\eta - \int_0^\eta G(z_t)dz_t - \gamma G(\eta)]\rho(k_{t+1}) \equiv \lambda\phi\rho(k_{t+1}) \tag{17}$$

where

$$\lambda \equiv \frac{\eta - \int_0^\eta G(z_t)dz_t - \gamma G(\eta)}{\widehat{z} - \gamma G(\eta)} \tag{18}$$

. By replacing the rewritten expression of π_{t+1}^B (17) into (9), the incentive constraint of a lender becomes

$$\lambda\phi\rho(k_{t+1}) \geq r_{t+1}(1 - w(k_t)) \tag{19}$$

.

This condition resembles a lot to the collateral constraint in Matsuyama (2004, 2007). Due to financial imperfections, agents, for some reasons, can only pledge to a fraction of the overall return of project as collateral for repayment. Here, $\phi\rho(k_{t+1})$ is in fact the overall return of capital and λ corresponds to the fraction served as collateral. We deduce the explicit function of λ from the model while it is assumed as an exogenous parameter in Matsuyama (2004, 2007). More specifically, the borrower would not be able to credibly commit to repay more than $\lambda\phi\rho(k_{t+1})$, with $0 < \lambda < 1$. Knowing this, the lender would lend only up to $\lambda\phi\rho(k_{t+1})$. Thus, the agent can start the project only if (19) holds. We call it the collateral constraint.

Both ϕ and λ comes from financial imperfections. They refelect the efficiency of the credit market and serve as indicators of the financial development in this framework. We will examine variation of these two indicators and their impacts on equilibrium later. We will discuss then the intuition of these two indicators.

We now determine the general equilibrium in autarky and define the dynamics of capital.

2.4 The autarkic general equilibrium

Definition 2 *(Equilibrium in financial autarky) Given the monitoring cost γ, and the distribution function G, the general equilibrium in autarky is characterized by a loan interest rate $\widehat{x}$, a market expected return r , and an share δ of borrower, which satisfy*

(i) $\widehat{x}$ solves $\max \pi^E(x)$ subject to $\pi^B(x) \geq r$ and $\pi'^B(x) = 0$

[12] See Appendix *III*.

(ii) r *solves* $\pi^B(\widehat{x}) = r$

(iii) δ_t *clears the domestic credit market*

Without international lending and borrowing, the domestic investment (by the young) must be equal to domestic lending (by the young) in equilibrium. Each agent disposes the $w(k_t)$ at the end of period t. Let $\delta_t \in (0,1)$ denote the fraction of borrower. The equality between demand and supply of funds requires that

$$\delta_t(1 - w(k_t)) = (1 - \delta_t)w(k_t)$$

which gives $\delta_t = w(k_t)$. It implies that a fraction of $w(k_t)$ agents finally become borrowers so that the aggregate investment is $w(k_t)$.

$$I_t = w(k_t)$$

For investments to occur in this economy, there must be at the same time the lenders and borrowers. Recall that only when (1) holds will a borrower start his project, and that only when (9) holds will a lender finance the investment. In other words, borrowing and lending happen only when the profitability constraint (16) and the collateral constraint (19) hold at the same time. Note that which of the two constraints is binding depends entirely on k_t. In fact, the collateral constraint is binding if $k_t < \widetilde{k}(\lambda)$; the profitability constraint is binding if $k_t > \widetilde{k}(\lambda)$. Thus, the investment is borrowing constrained only for the lower value of domestic wealth. We summarize these two constraints in one investment condition

$$\phi \geq \widetilde{\phi}_t \equiv \begin{cases} \frac{r_{t+1}}{f'(k_{t+1})} \cdot \frac{1-w(k_t)}{\lambda} \text{ if } k_t < \widetilde{k}(\lambda) & \text{or } \frac{1-w(k_t)}{\lambda} > 1 \\ \frac{r_{t+1}}{f'(k_{t+1})} \text{if } k_t \geq \widetilde{k}(\lambda) & \text{or } \frac{1-w(k_t)}{\lambda} < 1 \end{cases} \tag{20}$$

$\widetilde{\phi}_t$ may be interpreted as the project productivity required in order for the project to be undertaken in period t. $\widetilde{k}(\lambda)$ is defined implicitly by $w[\widetilde{k}(\lambda)] = 1 - \lambda$ with $K(1) = 0$ and $K(+0) = R^+$, where R^+ is given by $w(R^+) = 1$. The critical value of k_t, $\widetilde{k}(\lambda)$, is decreasing in λ. Thus, the higher λ is, the less important the collateral constraint becomes, and when $\lambda = 1$, the collateral constraint is never binding. In fact, when monitoring cost is zero, there must be $\lambda = 1$.

According to (20), the investment equals to one if $\phi > \widetilde{\phi}_t$, and zero if $\phi < \widetilde{\phi}_t$. When $\phi = \widetilde{\phi}_t$, the investment may take any value between zero and one. Thus, in equilibrium, there must be $\phi = \widetilde{\phi}_t$.

The capital motion is totally determined by domestic investment I_t. Since capital investment returns are *iid*, and since there is continumum of borrowers, by the law of large numbers, there is no aggregate uncertainty in this economy. The expected aggregate capital return is $\widehat{z}$. Thus the time $t+1$ per capita capital stock is simply $\widehat{z}I_t = \widehat{z}w(k_t)$ less capital expended on monitoring at $t+1$. The latter is obviously $\gamma\delta_t G(\eta) = \gamma w(k_t)G(\eta)$. Therefore, the time $t+1$ capital-labor ratio in final goods production obeys

$$\begin{aligned} k_{t+1} &= \widehat{z}w(k_t) - \gamma w(k_t)G(\eta) \\ &\equiv \phi w(k_t) \end{aligned} \tag{21}$$

The equation (21) gives the steady state $k^* = \widetilde{k}^*(\phi)$ for a given γ.[13] Usual assumption on $w(k_t)$ ensures that there exists a unique steady state. The dynamic in autarky is illustrated in Figure 1.

[13]Note that, if $k_t^i < \phi_t^i$, $k_{t+1} = \phi_t^i w(k_t) < \phi_t^i w(\phi_t^i) < \phi_t^i$. Therefore, $k_0 < \phi_t^i$ implies $k_t^i < \phi_t^i$ and $w(k_t^i) < 1$ for all $t > 0$, as has been assumed.

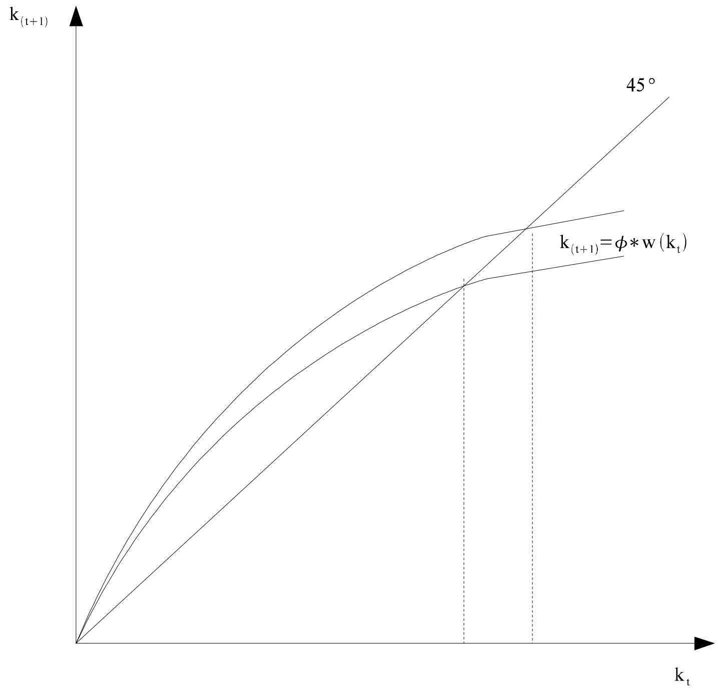


Figure 1. Dynamic in autarky

3 The Model in a Small Open Economy

We now consider the financial globalization in a small open economy. The agents are allowed to trade intertemporally the final good with the rest of the world at exogenously given price. The only final good is a capital good so that the trade in this good is, in other words, international lending and borrowing, and the intertemporal price of the good is the interest rate, which is exogenously given in the international financial market and assumed to be invariant over time: $r_{t+1} = r^w$.

The monitoring activity is considered locally. It occurs at the monitoring cost in the country where the project takes place. Thus, even though the financial openness brings about reallocation of funds across countries, the decision procedure of the agents doesn't change. The program of a borrower remains the same as in autarky except for that agents in all countries take the exogenous international interest rate r^w as given. r^w will replace the domestic interest rate r_{t+1} in equation (1). The incentive constraint of a borrower now becomes $\pi^E_{t+1} \geq r^w w(k_t)$ and the profitability constraint (16) becomes $\phi\rho(k_{t+1}) \geq r^w$. As in autarky, lenders fix the contingent loan interest rate by maximizing their payoffs. The international mobility of funds must equalize the maximized utility across countries and make it equal to the given interest rate r^w of the international financial market. The incentive constraint of a lender (9) now becomes $\pi^B_{t+1} \geq r^w$ and the collateral constraint (19) becomes $\lambda\phi\rho(k_{t+1}) \geq r^w[1 - w(k_t)]$.

For effective borrowing and lending to happen, both the profitability constraint and the collateral constraint must hold at the same time. In equilibrium, as in (20), the collateral constraint is binding if $k_t < \widetilde{k}(\lambda)$, and the profitability constraint is binding if $k_t > \widetilde{k}(\lambda)$.

$$\begin{array}{c} \lambda\phi\rho(k_{t+1}) = r^w[1 - w(k_t)] \text{ if } k_t < \widetilde{k}(\lambda) \\ \phi\rho(k_{t+1}) = r^w \text{ if } k_t \geq \widetilde{k}(\lambda) \end{array} \tag{22}$$

We can now determine the general equilibrium in the small open economy and define the dynamics of capital.

3.1 The general equilibrium in open economy

Definition 3 *(Equilibrium in Financial Openness) Given the monitoring cost γ, the initial distribution G, and the international interest rate r^w, the general equilibrium in financial openness is characterized by a loan interest rate $\widehat{x}$ which solves* $\max \pi^E(x)$ *subject to* $\pi^B(x) \geq r^w$ *and* $\pi'^B(x) = 0$. *In addition* $\pi^B(\widehat{x}) = r^w$.

The investment condition (22) describe the relationship between k_{t+1} and k_t. It determines the dynamic of capital accumulation in the small open economy.

$$f'(k_{t+1}) = \begin{cases} \frac{r^w}{\phi} \cdot \frac{1-w(k_t)}{\lambda} \text{ if } k_t < \widetilde{k}(\lambda) \\ \frac{r^w}{\phi} \text{ if } k_t \geq \widetilde{k}(\lambda) \end{cases}$$

or

$$k_{t+1} = \Psi(k_t) = \begin{cases} \Phi[\frac{r^w}{\phi} \cdot \frac{1-w(k_t)}{\lambda}] \text{ if } k_t < \widetilde{k}(\lambda) \\ \Phi(\frac{r^w}{\phi}) \text{ if } k_t \geq \widetilde{k}(\lambda) \end{cases} \quad \text{where } \Phi = f'^{-1} \tag{23}$$

This equation governs the dynamics of the small open economy. Unlike the autarky case, domestic investment is no longer equal to domestic saving. Instead, investment is determined entirely by the profitability and collateral constraints. If the credit market were perfect ($\lambda = 1$ and $\widetilde{k}(\lambda) = 0$), the economy would immediately jump to $\Phi(\frac{r}{\phi})$, from any initial condition. In the presence of the imperfection, this occurs only when the economy is at the higher level of development ($k_t \geq \widetilde{k}(\lambda)$), where the profitability of the project is the only binding constraint. At the lower level of development ($k_t < \widetilde{k}(\lambda)$), the collateral constraint is binding, which creates a gap between the investment return ϕ and the interest rate r^w. In this range, the map is increasing in k_t. This is because a high domestic investment increases the wage income of domestic young agents, enabling them to accumulate more wealth, which alleviates the collateral constraint and stimulates domestic investment. This effect is essentially the same as the credit multiplier effect identified by Bernanke and Gertler (1989) and others. In this range, the map is also increasing in $\frac{\lambda\phi}{r}$. In particular, a reduction in $\lambda\phi$ reduces k_{t+1}. In a small open economy, the interest rate is fixed by the international financial market. Therefore, greater imperfection has the effect of reducing domestic investment (and channeling more of the domestic saving into investment abroad).

The steady states of the small open economy are given by the fixed points of the map satisfying $k_{t+1} = \Psi(k_t)$. The following proposition summarizes some properties of the set of fixed points and associated conditions.

Proposition 4 *Let $\lambda_c \in (0,1)$ be defined by $f[K(\lambda_c)] = 1$. Then:*

a) If $\phi f'[\widetilde{k}(\lambda)] < r^w$, there exists a unique steady state, k_L. It is stable and satisfies $k_L < \widetilde{k}(\lambda)$.

b) If $\phi f'[\widetilde{k}(\lambda)] > r^w$, $f(\frac{\lambda\phi}{r^w}) < 1$, and $\lambda < \lambda_c$, there exist three steady states,k_L, k_M, and k_H, which satisfy $k_L < k_M < \widetilde{k}(\lambda) < k_H$. k_L and k_H are stable and k_M is unstable.

c) *If* $\phi f'[\widetilde{k}(\lambda)] > r^w$*, and either* $f(\frac{\lambda\phi}{r^w}) > 1$ *or* $\lambda > \lambda_c$*, there exists a unique steady state,* k_H*. It is stable and satisfies* $\widetilde{k}(\lambda) < k_H$*.*

For the proof see the Appendix VII[14].

The proposition is illustrated by Figure 2. Figure 2(a),(b),(c) demonstrate

[14] It follows Mastuyama (2004). Here, the difference from Mastuyama (2004) is that we don't consider λ and ϕ as exogenous. To the contrary, we deduce them from the model and allow them to evolve. We will examin the impacts of their evolution on growth path.

respectively dynamics described in Proposition 2(a),(b),(c).

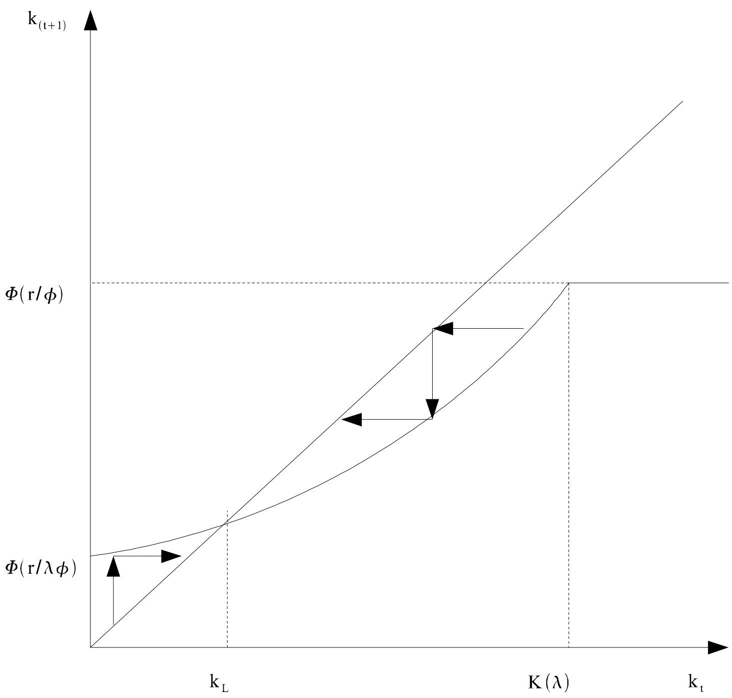


Figure 2(a). unique steady state low k_L

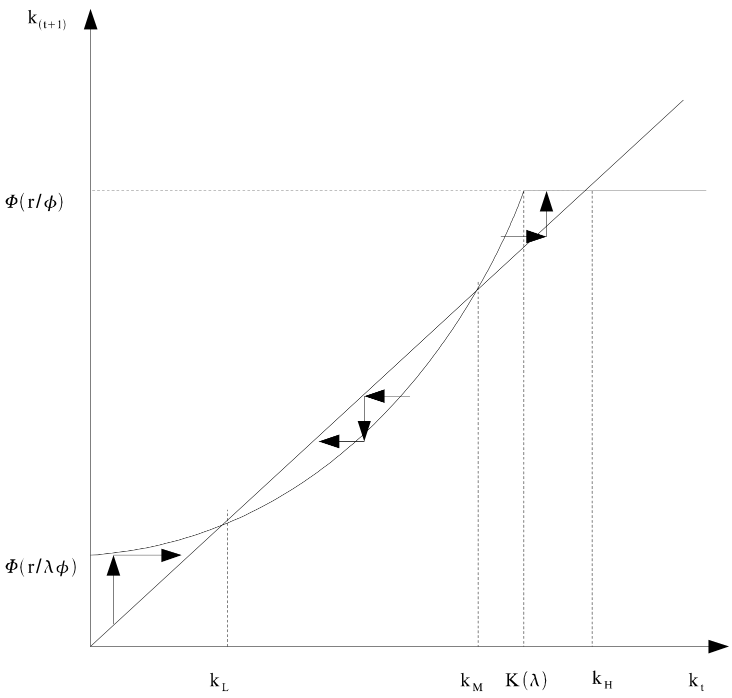


Figure 2(b). 3 steady states k_L k_M k_H

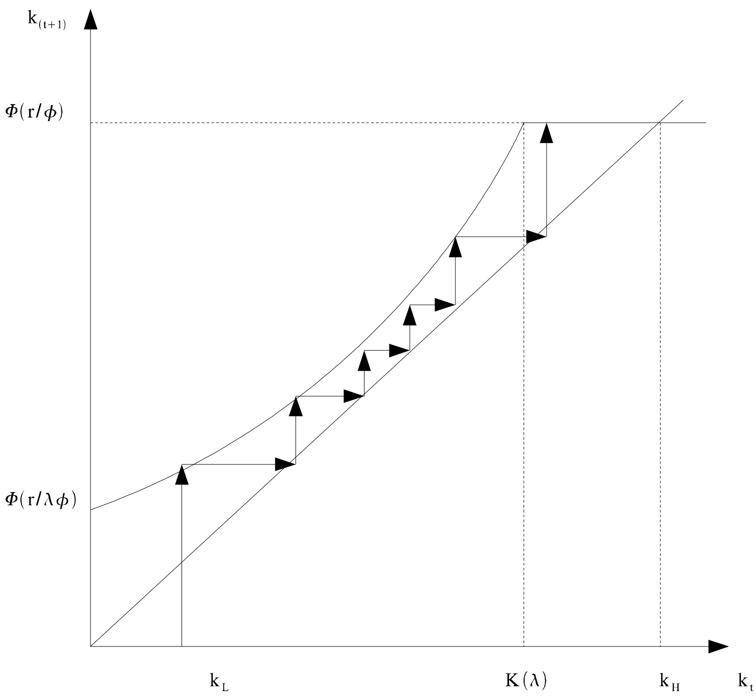


Figure 2(c). unique steady state high k_H

Definition 5 *For* $\lambda \geq 0$ *and* $\phi \geq 0$*,* A *is defined as the space defined by* $\phi f'[\widetilde{k}(\lambda)] <$

r^w, *B as the space defined by* $\phi f'[\widetilde{k}(\lambda)] > r^w$, $f(\frac{\lambda\phi}{r^w}) < 1$, *and* $\lambda < \lambda_c$,*and C as the space defined by* $\phi f'[\widetilde{k}(\lambda)] > r^w$, *and either* $f(\frac{\lambda\phi}{r^w}) > 1$ *or* $\lambda > \lambda_c$.

The conditions for Proposition 2(a), 2(b), and 2(c) are satisfied, respectively in the set A, B, and C as illustrated in Figure 3 (we call them regime A, B and C). The outer limit of regime A is given by $\phi f'[\widetilde{k}(\lambda)] = r^w$, and the border between regimes B and C are given by $f(\frac{\lambda\phi}{r^w}) = 1$. These two downward-sloping curves meet tangentially at $\lambda = \lambda_c$.

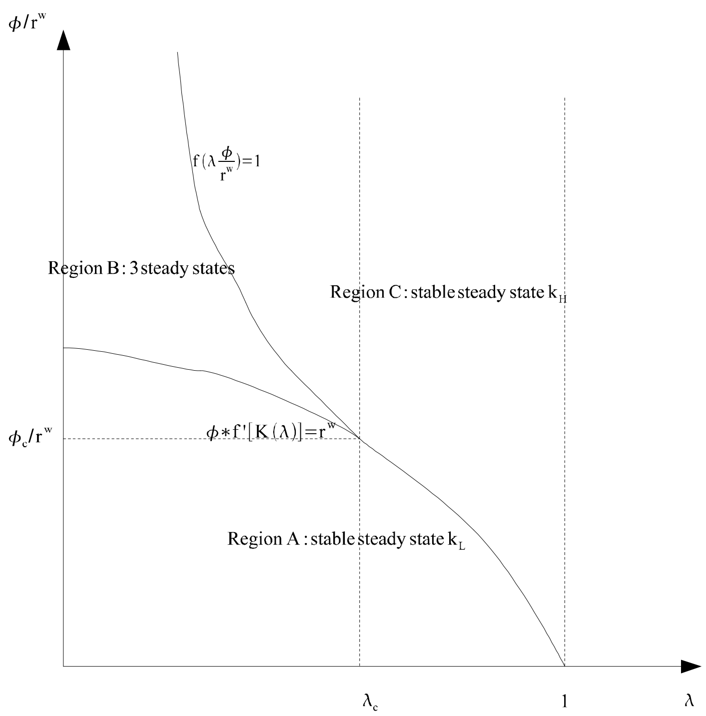


Figure 3 Conditions of 3 regimes of equilibrium

3.2 Dynamics in open economy

The dynamics of the economy differ a lot in autarky and open economy. The model in open economy exhibits 3 regimes and multiple equilibria. The financial development indicators determine in which regime the dynamic is located. The initial capital stock determines towards which equilibrium the economy will converge. Different scenarios are presented below.

If the financial development level makes the dynamic locate in Regime A, the dynamic of this economy is illustrated in Figure 2(a). The dynamic converges to a unique steady state with low capital intensity.

In Regime B, an integration of this economy to the international financial market creates multiple steady states, as shown in Figure 2(b). Around k_M, investment is borrowing constrained, and the equilibrium is unstable. If the integration occurs slightly below k_M, the economy experiences vicious circles of low-wealth/low-investment, and will gravitate toward the lower stable steady state, k_L, in which the collateral constraint is binding. On the other hand, if the integration takes place slightly above k_M, the economy experiences virtuous circles of high-wealth/high-investment, and eventually converges to the higher stable steady state, k_H, in which the collateral constraint is no longer binding. This case suggests that the timing of the integration has a significant long-run impact on capital accumulation.

In Regime C, the economy will eventually converge to the unique steady state k_H, in which the collateral constraint is not binding. This process may take a long time, however, because the economy must go through the "narrow corridor" between the map and the 45° line, as illustrated in Figure 2(c). More generally, as a comparison between the shapes of the two maps, $k_{t+1} = \phi w(k_t)$ in Figure 1 and $k_{t+1} = \Psi(k_t)$ in Figure 2, suggests the integration would slow down the growth process of middle-income economies.

We show in the next section that how the financial globalization can affect the monitoring cost and change the financial development indicator. The evolution of the financial development can eventually make the transitions between different regimes happen. We will then discuss the transition effect of financial development in open economy.

4 Impacts of Financial Development

4.1 The impact of financial development in autarky

We will study the impacts of ϕ and λ on k^* in autarky.

$k^* = \widetilde{k}^*(\phi)$ is increasing in ϕ. When ϕ increases, the curve $k_{t+1} = \phi w(k_t)$ moves upward in $\left(k_t, k_{t+1}\right)$ plan and k^* increases. This implies, in autarky, a country with a more efficient financial market has a higher steady state.

Notably, the dynamic of k in autarky, is entirely independent of λ or r; the borrowing limit has no impact on capital formation in the autarky case. This is because domestic investment is determined entirely by domestic saving. Any effect of the borrowing limit is completely absorbed by the interest rate movements. The equilibrium interest rate in autarky is given by

$$r_{t+1} = \begin{cases} \lambda\phi\frac{f'(k_{t+1})}{1-w(k_t)} \text{ if } k_t < \widetilde{k}(\lambda) \\ \phi f'(k_{t+1})\text{if } k_t \geq \widetilde{k}(\lambda) \end{cases}$$

r_{t+1} is lower at the low level of development since $\frac{1-w(k_t)}{\lambda} > 1$ and $\lambda \in (0,1)$. The financial imperfection apparently decreases the r_{t+1}.Note that a greater imperfection in the credit market (a smaller λ) manifests itself in the reduction of the interest rate.

4.2 Financial openness, financial development, and the transition effect on growth

In this section, we will show that financial globalization has a non-monotonic effect on the financial development indicators drawn from this model, which can lead to transitions of the economic growth dynamic. The initial development level and the timing of openness both account for different outcomes of the financial globalization.

4.2.1 Financial openness and its impacts on financial development

The financial openness is a process in which emerging countries make their economic and financial conditions more similar to those of developed countries, whose economic and financial fundamentals serve as references of a well functioning economy. By adopting international economic and financial transaction rules, emerging countries open their financial markets and allow for international lending and borrowing. The financial openness increases competition in lending sector and facilitates international financial transactions. The access to foreign financial markets, the increased competition in lending sector and the diffusion of technology make the monitoring costs decrease during the financial openness process. If the developed economy is already more efficient in monitoring activities than emerging countries, the financial openness will at least induce significant reduction on monitoring costs in emerging countries to make the cost close to that of developed countries. Eventually, the financial openness will be able to decrease the monitoring costs for all countries.

There are multiple ways that the financial openness possibly affects the financial development. However, interactions between financial openness and financial development are not yet rigorously considered by any growth model in open economy. One of the reasons is that we are not sure in which direction the financial openness will affect the financial development. For example, Mastuyama (2004) assumes that openness has no effect on the degree of credit market imperfection because it is not obvious in which direction openness might affect the operation of credit markets. On one hand, one might argue that the lower the cost of international financial transactions, the easier it would be for borrowers to take the money and run, and the harder it would be for lenders to catch those who default on their debt. If so, openness has the effect of reducing the efficiency of credit markets. On the other hand, one might also argue that the openness and the competition provide a greater incentive for an individual country to improve its corporate governance. If so, openness may have the effect of enhancing the efficiency of credit markets.

Instead of imposing an arbitrary guess concerning how financial openness eventually affects the financial development, we deduce it from the model. The financial imperfections are reflected in the optimal financial contract. In previous sections, we deduce two indicators, ϕ and λ, to measure the financial development. By allowing for the variation of monitoring costs in credit market, the financial development evolves. We now examine movements of ϕ and λ when monitoring costs evolve in open economy.

Proposition 6 $\frac{\partial \eta}{\partial \gamma} < 0$. *Assume that* z_t *is uniformly distributed on interval* $[0, \overline{z}]$. *Then* $\frac{\partial \lambda \phi}{\partial \gamma} < 0$ *and* $\frac{\partial \lambda}{\partial \gamma} < 0$. *When* $\lambda \in (\frac{1}{\overline{z}^2}, \frac{1}{2})$, $\frac{\partial \phi}{\partial \gamma} < 0$; *When* $\lambda \in (\frac{1}{2}, 1)$, $\frac{\partial \phi}{\partial \gamma} > 0$.

Proof. See Appendix VI. ■

We rewrite (13) and express γ as a function of η. Apparently, η is determined by γ and the distribution function. We prove easily that $\frac{\partial \eta}{\partial \gamma} < 0$. When the monitoring cost γ decreases, more projects will be verified. The changes in average expenditure on monitoring are ambiguous and depend evidently on the specification of the distribution function.

We apply a specific distribution function to simulate the mouvements of $(\frac{\phi}{r^w}, \lambda)$. Suppose that z_t is uniformly distributed on interval $[0, \overline{z}]$. $g(\eta)$ is thus constant and $G(\eta)$ is monotonically increasing in η. According to the expression of ϕ and λ, (15) and (18), they are both endogenously determined by γ.

The performance of indicators differs when the monitoring cost decreases. The decrease of the monitoring cost has a monotonic effect on λ but non-monotonic effect on ϕ. λ improves with the falling monitoring cost. When γ is as high as $\overline{z}$,

λ approaches its minimum $\frac{1}{z^2}$; when γ is as low as 0, λ approaches 1. The effect on ϕ is different: ϕ first decreases then increases with γ. The average expenditure on monitoring is the lowest either when the monitoring cost is extremely high or low.

The variation of two indicators with reduction of monitoring cost can be interpretated as follows:

ϕ captures the overall cost of the financial friction. The overall cost of the financial friction is not monotonic in the monitoring cost. In fact, the reduction of the monitoring cost has two opposite effects: the cost effect and the quantity effect. Decreases of the monitoring cost may be offset by increases in the frequency of monitoring activities. If the monitoring cost is extremely high initially, the quantity effect will dominate and the expected expenditure on monitoring indeed increases. Only when the monitoring cost goes beyond a threshold, will the further reduction in the monitoring cost increase the indicator ϕ.

λ captures the ability of a borrower to ascertain the capital return of a productive project. In a perfect market framework, zero profit condition holds for both lender and borrower. Returns of productive factors should be totally redistributed to the contributors of factors. Without market imperfections, there is no reason that the borrower retains a part of production return. Here the borrower's profit is non zero once the monitoring is costly. It is because the lender pledges the collateral with a cost. When the cost is lower, more collateral could be pledged so that the lender retains a greater share of overall return of capital. Here the lender and the borrower share the overall return of capital. The share of the lender is λ and that of the borrower is $1 - \lambda$. Therefore, the lower the γ is, the more capital investment project return can be pledged to serve as the collateral. When the cost approaches zero, the lender's share in the overall capital return approaches to 1, which is exactely the case without financial imperfections.

The reduction of monitoring cost modifies the financial development in two dimensions according to this model. One is on the scale of the overall capital return and the other on the distribution of the overall return between lenders and borrowers. The reduction of monitoring cost won't necessarily increase the overall return of capital due to its two opposite effects on the cost and the frequency of monitoring activities. The overall return can be improved only when some threshold conditions are attained. However, the reduction of monitoring cost necessarily loosens the collateral constraint. Knowing that a greater part of capital return can be retrieved, the lender releases the borrowing limit. The economy becomes less credit constrained with the falling monitoring cost in open economy.

4.2.2 Transition effect of financial development after opening

Lemma 7 *Let $\mathcal{L}$ denote the set defined by $\lambda\phi = \eta - \int_0^\eta G(z_t)dz_t - \gamma G(\eta)$. $\mathcal{L}$ exhibits a U shape curve in $(\frac{\phi}{r^w}, \lambda)$ plan.*

Proof. See Appendix VI. ■

With the reduction of γ during the process of the financial openness, the corresponding pair of $(\frac{\phi}{r^w}, \lambda)$ exhibits U shape curve in the plan $(\frac{\phi}{r^w}, \lambda)$. If for all possible values of γ, the U shape curve remains in only one region, the property of equilibrium is invariant. If the U shape curve goes through different regions, it leads to transition of regime and the property of equilibrium varies with the financial development. How the financial development affects the property of equilibrium depends on which regions will this curve go through. We now give conditions of 3 regimes, which are defined by value of γ.

Proposition 8 *(Transition effect: necessary condition) $\mathcal{L} \cap B$ is not empty when γ is large enough; $\mathcal{L} \cap A$ is not empty when γ is intermediate; $\mathcal{L} \cap C$ is not empty when γ is small.*
Proof. *See Appendix $VIII$.* ■

The implication of this proposition is that the monitoring cost determines which regime will the dynamic be located in. When the monitoring cost is very large, the dynamic is located in the regime where there is a unique steady state with low captial intensity. A slight decrease in the monitoring cost in this case will enhance the level of steady state but the equilibrium remains stable and converges to the unique steady state. A further decrease in monitoring cost may shift the dynamic into another regime where 3 steady states exist. Towards which steady state the dynamic converges, it is conditional on the initial capital stock in open economy. If the country opens when its capital per capita is high enough, the dynamic converges to a stable steady state with a high capital intensity; otherwise, it converges to a stable low one. A further slight decrease in monitoring cost doesn't change the existence of the two stable steady states, nor the level of the high steady state, however the low steady state enhances and it requires less initial wealth to converge to the high steady state. Finally, a significant reduction in monitoring cost can bring the dynamic into the regime where there is a unique high steady state, which is the same as the high steady state in last case.

Depending on the monitoring cost varies from extremely large to negligible, the position of the dynamic can be represented by the curve $\mathcal{L}$ in $(\frac{\phi}{r^w}, \lambda)$ plan divided into 3 regimes A , B and C as defined before.

Proposition 9 *(Transition effect: sufficient condition)The* U *shape curve* $\mathcal{L}$ *can thus exhibit* 3 *patterns in* $(\frac{\phi}{r^w}, \lambda)$*: it goes*

a) from Region B*, through Region* A *to Region* C *as illustrated in Figure* 4 *a).*

b) or from Region B*, enters first Region* C *then goes into Region* A *and reenter Region* C *in the end, as illustrated in Figure* 4 *b).*

c) or directly from Region B *to Region* C *as illustrated in Figure* 4 *c).*

Proof. See Appendix $VIII$.

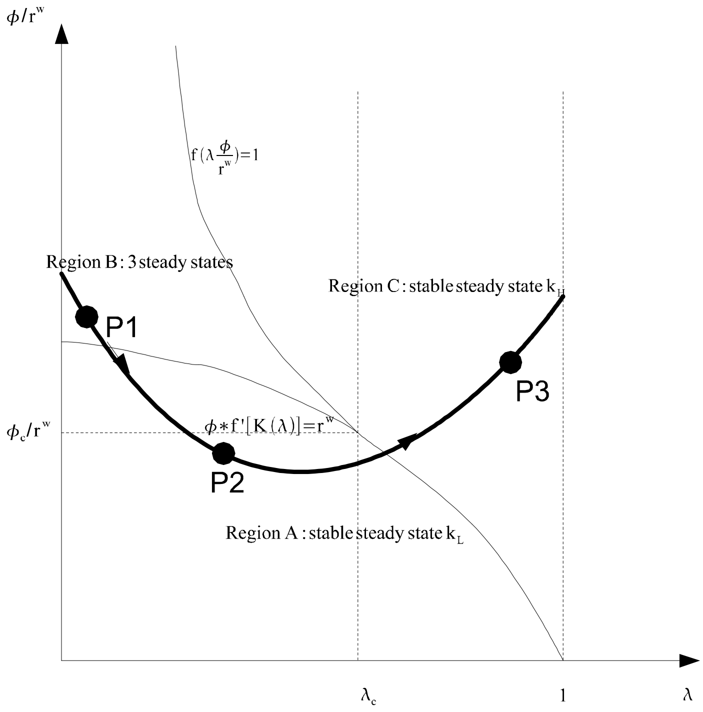


Figure 4. a). Path B-A-C

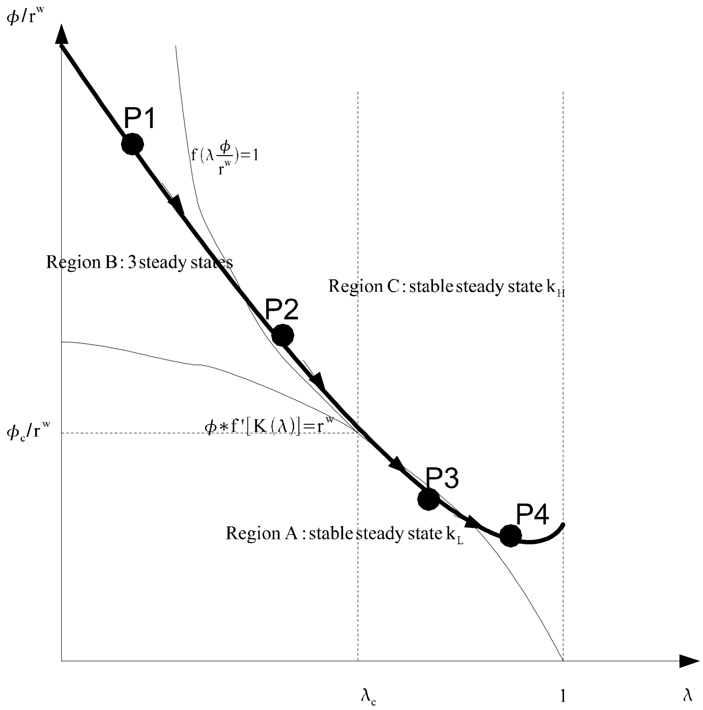


Figure 4. b). Path B-C-A-C

■

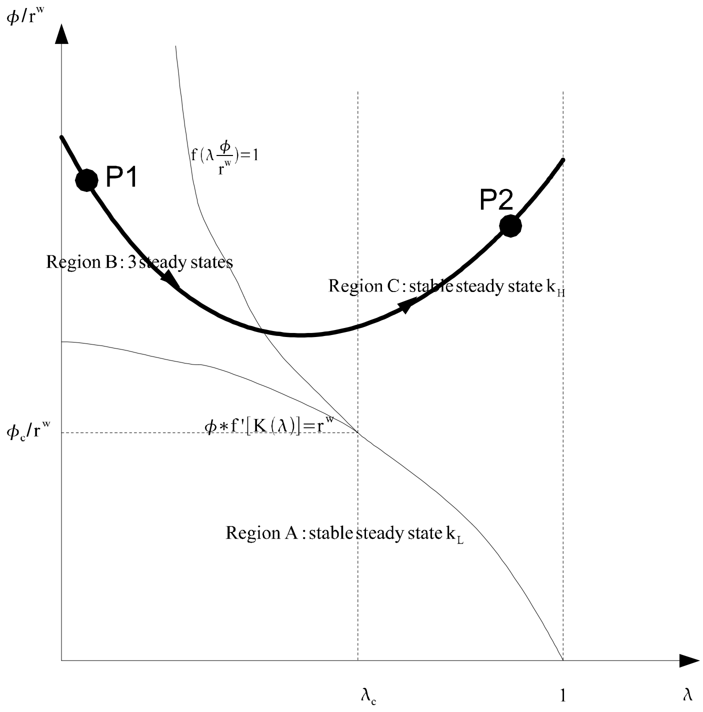


Figure 4. c). Path B-C

This proposition accounts for the threshold effects and the possibility of multiple outcomes of financial openness. There are several implications, among which three are notable.

First, when the monitoring activity is very costly, both the timing of openness and the initial wealth account for the outcomes of financial openness. A country has to be rich enough before opening if its monitoring is too costly, otherwise it will be trapped in a low equilibrium. There is a threshold of wealth. The huge wealth of a country alone insures the convergence to a high equilibrium despite the high monitoring cost. As illustrated in Figure 4, when the monitoring cost is very high, the dynamic must be that in regime B. We have discussed in previous section that in regime B, three steady states exist and the threshold effect of wealth is present. If the country opens above a threshold of rwealth, its economy converges to a high equilibrium; otherwise, it converges to a low one.

However, when the monitoring cost is intermediate or low enough, neither the initial wealth nor the timing of openness can modify the outcome of financial openness. There is a threshold effect of development. The equilibrium will be trapped only because the financial development is not high enough. Despite the timing and the wealth, the financial development alone is always a key to attain the high equilibrium. As illustrated in Figure 4, when the monitoring cost is not too high, the dynamic is in regime A or C, where a unique steady state exists. Only when the monitoring cost is high enough will the dynamics be in regime C, where there is a unique high equilibrium. When the monitoring cost is very low, the dynamic must be in regime C in any case.

The third point is that, even though the financial development will eventually help to attain a high equilibrium, the growth path may vary a lot. The initial level and the process of the financial development both account for the path of the growth. As discussed in the previous section, the transition of regime will make the dynamics of growth complicated. The possible transition patterns shown in Figure 4 $a)b)c)$ can lead to many possibilities of transition path. Take the case in Figure 4 $b)$ as an example, the dynamic is initially in regime B and it shifts first into a high equilibrium regime C and then into a low equilibrium Regime A before finally going back and staying in the high equilibrium regime C. In this example, the economy exhibits economic "take off", then "collapse" and finally "recovery", which are compatible with the growth stories experienced by some emerging countries during the emerging crisis of 90s.

The above examples are more resemble to the case of an emerging country, in which we consider a reduction in their monitoring cost. However, the model can be consistent with the experience of developed countries too. In developed countries, the monitoring cost is considered to be low enough. If the monitoring cost continues to decrease during the financial openness, the dynamic and the equilibrium won't be modified. That's why developed economies don't seem to experience abrupt changes soon after recent financial globalization waves in 90s. Eventually, we can also consider the case where the monitoring activity deteriorates in a developed country. During the recent financial crisis originated in USA in 2007, we can think that the excessive complexity of financial derivatives makes the monitoring even costly than it should be. The monitoring cost has been increasing for some time and its effects have been accumulated over time before they finally broke up now. In fact, when the monitoring cost is initially low enough and makes the dynamic the economy to be situated in a high equilibrium regime as in Figure 2c). A slight increase in the monitoring cost, whenever it doesn't induce the transition of regime, the equilibrium remain the same in regime C. That's why the indeed deterioration in monitoring activity hasn't declared immediately. Only when the monitoring cost continues to increase and brought about the transition of regime, will the accumulated effect reveals.

5 Conclusion

Empirical works show that the outcome of the financial openness differs a lot for different countries. Some emerging countries experience rapid economic "take-off" but also recessions soon after, while none developed countries have experienced the same during the recent wave of financial openness. Many previous works on emerging country crisis and financial openness explain such phenomena as adjustments to an abrupt shock, either adjustment in the coordination of anticipation or adjustment in the asset portfolio. However, the structural growth mechanism should not be ignored, besides the presence of negative shocks or temporary incidences which may have induced the economic and financial turbulences in some countries, especially some emerging ones. The volatile growth path can be structural and is a part of the growth path, even if these countries were "luckier" and unfavorable shocks didn't hit, an instable growth performance are still not exonerative for emerging countries.

This model is useful to explain divergent outcomes of the financial openness, arguing that there are fundamental factors which make the differences significant. This model confirms that the financial openness and the associated financial development account for multiple growth paths in open economy. It has transition effects and moves the dynamic of the economy from one regime to another. The transition modifies not only the long-run steady state, but also make the growth dynamics very complicated, so that volatile growth path happens just on the way of the financial development during the process of the financial integration. The model indicates the transition of the growth dynamic in a country brought by its financial development, which is in line with their financial integration to the world. Endowed with distinct initial conditions, the transition process behaves dissimilarly in different countries. The main message of this model is that the financial development plays an essential role in such transition. The financial openness makes the financial development evolve, and the evolution of the financial development in turn makes the economic transition happen in open economy. Financial development will eventually enhance long-tun equilibrium level, however, during the transition process, the dynamic of an economy can be volatile.

This model argues that dynamic transition is an intrinsic factor of the growth path in the financial openness when the financial development is considered. It is the case not only for emerging countries but also for advanced countries. However, their challenges differ because of different initial conditions. The model draw attentions on the role of the financial development when considering the desirability and the future direction of the financial openness.

6 Appendices

6.1 Appendix I: Credit rationing.

We measure the utility gap between borrower and lender $\Delta_t \equiv \frac{\phi\rho(k_{t+1})-r_{t+1}(1-w(k_t))}{\lambda\phi\rho(k_{t+1})} = \frac{1}{\lambda} - \frac{r_{t+1}}{\phi\rho(k_{t+1})} \cdot \frac{1-w(k_t)}{\lambda}$. $\Delta = \frac{1}{\lambda} - 1$ if $k_t < \widetilde{k}(\lambda)$ and $\Delta \geq \frac{1}{\lambda} - 1$ if $k_t \geq \widetilde{k}(\lambda)$. In both case, $\Delta_t > 1$ when $\lambda \in (0, 1)$. This implies that agents strictly prefer borrowing to lending. We verify that the equilibrium allocation necessarily involves credit rationing, where the fraction $1 - w(k_t)$ of young agents are denied credit.

6.2 Appendix II: π^B_{t+1} as a function of x, b and ρ

$$\begin{aligned}
\pi^B_{t+1} &= \int_{A_t} [R_t(z_t) - \rho(k_{t+1})\gamma/b_t] g(z_t) dz_t + x_t \int_{B_t} g(z_t) dz_t \\
&= \int_0^{\frac{x_t b_t}{q\rho(k_{t+1})}} (\frac{z_t q\rho(k_{t+1})}{b_t}) g(z_t) dz_t - \int_0^{\frac{x_t b_t}{q\rho(k_{t+1})}} (\frac{\rho(k_{t+1})\gamma}{b_t}) g(z_t) dz_t + x_t \int_{\frac{x_t b_t}{q\rho(k_{t+1})}}^{\bar{z_t}} g(z_t) dz_t \\
&= \int_0^{\frac{x_t b_t}{q\rho(k_{t+1})}} (\frac{q\rho(k_{t+1})}{b_t}) z_t g(z_t) dz_t - (\frac{\rho(k_{t+1})\gamma}{b_t}) G(\frac{x_t b_t}{q\rho(k_{t+1})}) + x_t[1 - G(\frac{x_t b_t}{q\rho(k_{t+1})})] \\
&= (\frac{q\rho(k_{t+1})}{b_t}) \int_0^{\frac{x_t b_t}{q\rho(k_{t+1})}} [z_t G(z_t) - \int G(z_t) dz_t] - (\frac{\rho(k_{t+1})\gamma}{b_t}) G(\frac{x_t b_t}{q\rho(k_{t+1})}) + x_t - x_t G(\frac{x_t b_t}{q\rho(k_{t+1})}) \\
&= (\frac{q\rho(k_{t+1})}{b_t})(\frac{x_t b_t}{q\rho(k_{t+1})}) G(\frac{x_t b_t}{q\rho(k_{t+1})}) - (\frac{q\rho(k_{t+1})}{b_t}) \int_0^{\frac{x_t b_t}{q\rho(k_{t+1})}} G(z_t) dz_t - (\frac{\rho(k_{t+1})\gamma}{b_t}) G(\frac{x_t b_t}{q\rho(k_{t+1})}) \\
&= x_t - (\frac{q\rho(k_{t+1})}{b_t}) \int_0^{\frac{x_t b_t}{q\rho(k_{t+1})}} G(z_t) dz_t - (\frac{\rho(k_{t+1})\gamma}{b_t}) G(\frac{x_t b_t}{q\rho(k_{t+1})}) \\
&= [\frac{x_t b_t}{q\rho(k_{t+1})} - \int_0^{\frac{x_t b_t}{q\rho(k_{t+1})}} G(z_t) dz_t - (\frac{\gamma}{q}) G(\frac{x_t b_t}{q\rho(k_{t+1})})](\frac{q\rho(k_{t+1})}{b_t}) \\
&= [\eta - \int_0^{\eta} G(z_t) dz_t - (\frac{\gamma}{q}) G(\eta)](\frac{q\rho(k_{t+1})}{b_t})
\end{aligned}$$

q is normalized to 1. So that

$$\pi^B_{t+1} b_t = [\eta - \int_0^{\eta} G(z_t) dz_t - \gamma G(\eta)] \rho(k_{t+1})$$

6.3 Appendix III: π^E_{t+1} as a function of γ and k.

According to Appendix II, we know the simplified forms of following terms

$$\begin{aligned}
\int_{A_t} R_t(z_t) g(z_t) dz_t &= \int_0^{\frac{x_t b_t}{q\rho(k_{t+1})}} (\frac{q\rho(k_{t+1})}{b_t}) z_t g(z_t) dz_t \\
&= (\frac{q\rho(k_{t+1})}{b_t}) \int_0^{\frac{x_t b_t}{q\rho(k_{t+1})}} [z_t G(z_t) - \int G(z_t) dz_t] \\
&= [\eta G(\eta) - \int_0^{\eta} G(z_t) dz_t](\frac{q\rho(k_{t+1})}{b_t})
\end{aligned}$$

$$\int_{A_t} \frac{\rho(k_{t+1})\gamma}{b_t} g(z_t)dz_t = (\frac{\gamma}{q})G(\eta)(\frac{q\rho(k_{t+1})}{b_t})$$

$$x_t \int_{B_t} g(z_t)dz_t = [\eta - \eta G(\frac{x_t b_t}{q\rho(k_{t+1})})](\frac{q\rho(k_{t+1})}{b_t})$$

From the above conditions, we have

$$\begin{aligned} b_t \int_{A_t} R_t(z_t)g(z_t)dz_t + b_t x_t \int_{B_t} g(z_t)dz_t &= \pi_t^B b_t + \int_{A_t} \rho_t \gamma g(z_t)dz_t \\ &= \rho[\eta - \gamma G(\eta) - \int_0^\eta G(z_t)dz_t] + \gamma G(\eta)\rho \\ &= \rho[\eta - \int_0^\eta G(z_t)dz_t] \end{aligned}$$

So that we can rewrite π_{t+1}^E as

$$\begin{aligned} \pi_{t+1}^E &= \widehat{z}\rho(k_{t+1}) - b_t \int_{A_t} R_t(z_t)g(z_t)dz_t - b_t x_t \int_{B_t} g(z_t)dz_t \\ &= \widehat{z}\rho - \rho[\eta - \int_0^\eta G(z_t)dz_t] \\ &= [\widehat{z} - \eta + \int_0^\eta G(z_t)dz_t]\rho \end{aligned} \quad (24)$$

Also, from the condition of zero profit of lender,

$$\begin{aligned} \pi_{t+1}^B b_t &= \int_{A_t} R_t(z_t) b_t g(z_t)dz_t - \int_{A_t} \rho(k_{t+1})\gamma g(z_t)dz_t + b_t x_t \int_{B_t} g(z_t)dz_t \\ &= r_{t+1} b_t \end{aligned}$$

, we have

$$b_t \int_{A_t} R_t(z_t)g(z_t)dz_t + b_t x_t \int_{B_t} g(z_t)dz_t = r_{t+1}b_t + \gamma G(\eta)\rho(k_{t+1})$$

So that we can rewrite π_{t+1}^E in another way

$$\begin{aligned} \pi_{t+1}^E &= \widehat{z}\rho(k_{t+1}) - b_t \int_{A_t} R_t(z_t)g(z_t)dz_t - b_t x_t \int_{B_t} g(z_t)dz_t \\ &= \widehat{z}\rho(k_{t+1}) - r_{t+1}b_t - \gamma G(\eta)\rho(k_{t+1}) \end{aligned} \quad (25)$$

6.4 Appendix IV: Proof of $\phi \geq 0$ and $\lambda \in (0,1)$.

We know that

$$1-\lambda=\frac{\widehat{z}-\eta+\int_0^\eta G(z_t)dz_t}{\widehat{z}-\gamma G(\eta)}$$

, so that

$$\left(1-\lambda\right)\phi=\widehat{z}-\eta+\int_0^\eta G(z_t)dz_t \tag{26}$$

By combining (24) and (26), we have

$$\pi_{t+1}^E=\left(1-\lambda\right)\phi\rho(k_{t+1}) \tag{27}$$

Recall that

$$\pi_{t+1}^B b=\lambda\phi\rho(k_{t+1}) \tag{28}$$

, apparently the overall return are shared by two parts: the lender take the fraction λ and the borrower take the fraction $1-\lambda$.

From (25), the non-negativity of π_{t+1}^E insures $[\widehat{z}-\gamma G(\eta)]\rho \geq r_t b_t$, or $\phi \geq 0$. From (27), the non-negativity of π_{t+1}^E and $\phi \geq 0$ insure that $1-\lambda > 0$. From (28), the non-negativity of π_{t+1}^B and $\phi \geq 0$ insure that $\lambda > 0$. Therefore $\lambda \in (0,1)$.

6.5 Appendix V: Impacts of γ on ϕ and λ : without specification on G

ϕ and λ are both function of γ. In order to know the impacts of γ on ϕ and λ, we solve the first derivative of ϕ and λ with respect to γ. We rewrite $1-(\gamma/q)g(\eta)-G(\eta)=0$ and express γ as a function of η.

$$\gamma=\frac{1-G(\eta)}{g(\eta)}$$

Derive γ with respect to η

$$\frac{\partial\gamma}{\partial\eta}=-1-\frac{1-G(\eta)}{g^2(\eta)}<0$$

the inverse gives

$$\frac{\partial\eta}{\partial\gamma}=-\frac{g^2(\eta)}{g^2(\eta)+[1-G(\eta)]}<0$$

$\phi \equiv \widehat{z}-\gamma G(\eta)$ is a function of γ and η, where η is an implicit function of γ. Derive ϕ with respect to γ. We find

$$\frac{\partial\phi}{\partial\gamma} = -G(\eta) - \gamma g(\eta)\frac{\partial\eta}{\partial\gamma}$$

$\frac{\partial\lambda}{\partial\gamma}$ is less straight forward but $\frac{\partial\lambda\phi}{\partial\gamma}$ is easier. We use it to deduce $\frac{\partial\lambda}{\partial\gamma}$.

$$\lambda\phi = \eta - \int_0^\eta G(z_t)dz_t - \gamma G(\eta)$$

$$\frac{\partial\lambda\phi}{\partial\gamma} = [1 - G(\eta)]\frac{\partial\eta}{\partial\gamma} - G(\eta) - \gamma g(\eta)\frac{\partial\eta}{\partial\gamma}$$

From $\frac{\partial\lambda\phi}{\partial\gamma} = \lambda\frac{\partial\phi}{\partial\gamma} + \phi\frac{\partial\lambda}{\partial\gamma}$, we can deduce $\frac{\partial\lambda}{\partial\gamma} = \frac{\frac{\partial\lambda\phi}{\partial\gamma} - \lambda\frac{\partial\phi}{\partial\gamma}}{\phi}$.

$$\frac{\partial\lambda}{\partial\gamma} = \frac{[1 - G(\eta)]\frac{\partial\eta}{\partial\gamma} + \frac{\partial\phi}{\partial\gamma}(1 - \lambda)}{\widehat{z} - \gamma G(\eta)}$$

For sure that a decrease in monitoring cots increases the number of projects verified. To what extend the number of projects verified apparently depends on property of distribution function G. Therefore the specification of distribution function is necessary to simulate the impacts of γ on λ and ϕ.

6.6 Appendix VI: U shape in $\left(\frac{\phi}{r^w}, \lambda\right)$ with equal distribution

We apply a specific distribution function to simulate the motion of the pair of $(\frac{\phi}{r^w}, \lambda)$. Suppose that z_t is equally distributed on interval $[0, \overline{z}]$. $g(\eta)$ is a constant and $G(\eta)$ is monotonically increasing in η. According to expression of ϕ and λ, (15) and (18), they are both endogenously determined by γ.

$$\begin{aligned}
\eta &= \overline{z} - \gamma \\
\phi &= \frac{(\overline{z} - \gamma)^2 + \gamma^2}{2\overline{z}} \\
\lambda\phi &= \frac{(\overline{z} - \gamma)^2}{2\overline{z}} \\
\lambda &= \frac{(\overline{z} - \gamma)^2}{(\overline{z} - \gamma)^2 + \gamma^2}
\end{aligned}$$

So that $\gamma \in (0, \overline{z})$, $\lambda \in (\frac{1}{\overline{z}^2}, 1)$ and $\phi \in (\frac{\overline{z}}{4}, \frac{\overline{z}}{2})$.

$$\frac{\partial \phi}{\partial \gamma} = \frac{2\gamma}{\overline{z}} - 1$$

When $\gamma \in (0, \frac{\overline{z}}{2})$, $\frac{\partial \phi}{\partial \gamma} < 0$; When $\gamma \in (\frac{\overline{z}}{2}, 1)$, $\frac{\partial \phi}{\partial \gamma} > 0$.

$$\frac{\partial \lambda \phi}{\partial \gamma} = \frac{\gamma}{\overline{z}} - 1 < 0$$

$$\frac{\partial \lambda}{\partial \gamma} = \frac{-2(\overline{z} - \gamma)\overline{z}\gamma}{(\overline{z} - \gamma)^2 + \gamma^2} < 0$$

λ is monotonically decreasing with γ.

$$\phi = \frac{\overline{z}}{2\left[1 + 2\lambda^{\frac{1}{2}}(1-\lambda)^{\frac{1}{2}}\right]}$$

When $\lambda \in (\frac{1}{\overline{z}^2}, \frac{1}{2})$, $\frac{\partial \phi}{\partial \gamma} < 0$; When $\lambda \in (\frac{1}{2}, 1)$, $\frac{\partial \phi}{\partial \gamma} > 0$. The pair $\left(\frac{\phi}{r^w}, \lambda\right)$ exhibits a U shape curve. We give several value examples of different indicators.

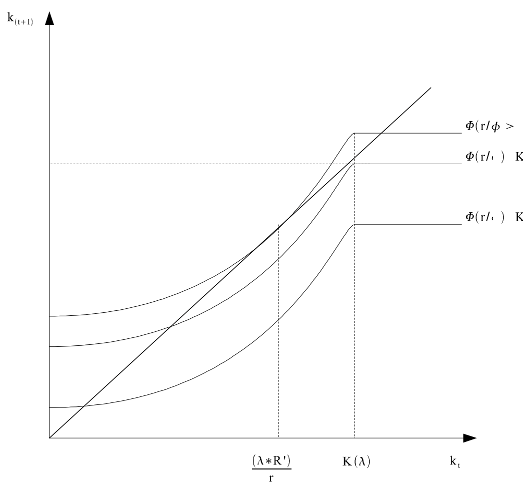
$$\begin{vmatrix} \eta & \overline{z} & \frac{\overline{z}}{2} & 0 \\ \gamma & 0 & \frac{\overline{z}}{2} & \overline{z} \\ \lambda & \frac{1}{\overline{z}^2} & \frac{1}{2} & 1 \\ \phi & \frac{\overline{z}}{2} & \frac{\overline{z}}{4} & \frac{\overline{z}}{2} \end{vmatrix}$$

6.7 Appendix VII: Proof of Proposition 4.

By following Mastuyama (2004), the proof consists of four steps.

Step 1. Since $f(\widetilde{k}(\lambda))$ is strictly decreasing and continuous in λ and $f(K(1)) = f(0) = 0 < 1 = W(R+) < f(R+) = f(K(0)), \lambda_c \in (0,1)$ is well defined and $f(\widetilde{k}(\lambda)) > (<)1$ if and only if $\lambda < (>)\lambda_c$.

Step 2. Consider the non-generic case of $Rf(\widetilde{k}(\lambda)) = r^w$. Then, $\widetilde{k}(\lambda) = \Phi(r^w/R)$ and hence $\widetilde{k}(\lambda)$ is a fixed point of the map, Ψ. Because $f(\widetilde{k}(\lambda)) - 1 = \widetilde{k}(\lambda)f(\widetilde{k}(\lambda)) + W(\widetilde{k}(\lambda)) - 1 = \widetilde{k}(\lambda)r^w/R - \lambda = \lambda[lmk \uparrow \widetilde{k}(\lambda)\Psi(k) - 1]$, the left derivative of the map at $\widetilde{k}(\lambda)$ is greater (less) than one if and only if $f(\widetilde{k}(\lambda)) > (<)1$ or $\lambda < (>)\lambda_c$. These properties are illustrated in Figure $A.1$ for $\lambda < \lambda_c$ and Figure $A.2$ for $\lambda \geq \lambda_c$. Note that, from the Lemma, Ψ has another intersection, $0 < kL < \widetilde{k}(\lambda)$, in Figure $A.1$, and has no other intersection in Figure $A.2$.



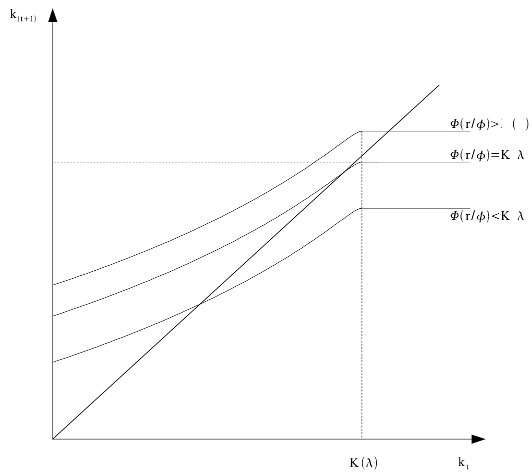


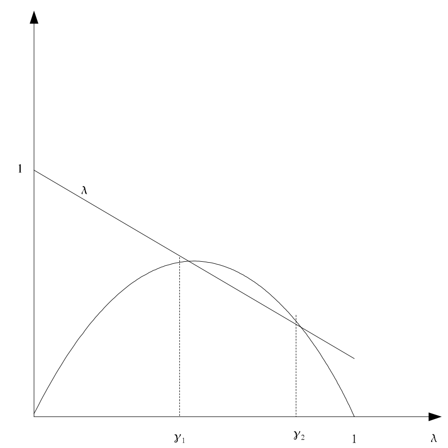
Figure A.1 Figure A.2

Step 3. Consider the case where $Rf(\widetilde{k}(\lambda)) < r^w$. This case can be studied by reducing R, starting from the case, $Rf(\widetilde{k}(\lambda)) = r^w$, while fixing λ and r^w. This change is captured by a downward shift of the map, Ψ, in Figures A.1 and A.2. Clearly, with any downward shift, Ψ has the unique stable fixed point, which satisfies $kL < \widetilde{k}(\lambda)$. This proves Proposition $2(a)$.

Step 4. Consider the case where $Rf(\widetilde{k}(\lambda)) > r^w$, which can be studied by increasing R, starting from the case,$Rf(\widetilde{k}(\lambda)) = r^w$, while fixing λ and r^w. This change is captured by an upward shift of the map Ψ in Figures A.1 and A.2. In Figure A.2, i.e., if $f(\widetilde{k}(\lambda)) \leq 1$, Ψ has the stable unique fixed point, $kH = \Phi(r^w/R) > \widetilde{k}(\lambda)$, after any upward shift. In Figure A.1, $.e.$, if $f(\widetilde{k}(\lambda)) > 1$, there is a critical value of R, R' , such that, if $r^w/f(\widetilde{k}(\lambda)) < R < R'$, there are three fixed points, $kL < kM < \widetilde{k}(\lambda) < kH$, and, if $R > R'$, there is the unique fixed point, $kH = \Phi(r^w/R) > \widetilde{k}(\lambda)$. In the borderline case, $R = R'$, Ψ is tangent to the $45°$ line below $\widetilde{k}(\lambda)$. From part (c) of the Lemma, the value of k at the tangency is equal to $\lambda R'/r^w$, and hence $\Psi(\lambda R'/r^w) = \lambda R'/r^w$, which can be rewritten as $(\lambda R'/r^w)f(\lambda R'/r^w) = 1 - W(\lambda R'/r^w)$, or $f(\lambda R'/r^w) = 1$. Thus, $f(\lambda R/r^w) < 1$ implies the three fixed points and $f(\lambda R/r^w) > 1$ implies the unique steady state, $kH = \Phi(r^w/R) > \widetilde{k}(\lambda)$. This proves Proposition 2(b) and 2(c).

6.8 Appendix VIII: Proof of proposition 10.

a) $\phi f'[\widetilde{k}(\lambda)] < r^w$ implies that $\widetilde{k}(\lambda) > f'^{-1}(\frac{r^w}{\phi})$ or $w(k_t)(1-\lambda) > f'^{-1}(\frac{r^w}{\phi})$, so that $\lambda < 1 - w\left[f'^{-1}(\frac{r^w}{\phi})\right]$. $1 - w\left[f'^{-1}(\frac{r^w}{\phi})\right]$ is a decreasing function of ϕ, and it first increases then decreases with γ; while λ is decreasing in γ. If $\lambda < 1 - w\left[f'^{-1}(\frac{r^w}{\phi})\right]$ is valid, γ must be comprised between two values. Let γ_1 and γ_2 denote solutions, if exist, to $\lambda = 1 - w\left[f'^{-1}(\frac{r^w}{\phi})\right]$. As illustrated in the following picture, $\phi f'[\widetilde{k}(\lambda)] < r^w$ requires $\gamma \in (\gamma_1, \gamma_2)$.



b) $\phi f'[\widetilde{k}(\lambda)] > r^w$ requires that γ is either small enough or big enough, .e $\gamma \in (0, \gamma_1)$ or $\gamma \in (\gamma_2, \overline{z})$. $f(\frac{\lambda\phi}{r^w}) < 1$ implies $\lambda\phi < r^w f^{-1}(1)$. Since $\lambda\phi$ is decreasing in γ, $\lambda\phi < r^w f^{-1}(1)$ implies that γ must be big enough. Denote that γ_3 solves implicitly $\frac{(\overline{z}-\gamma)^2}{2\overline{z}} = r^w f^{-1}(1)$. It requires that $\gamma \in (\gamma_3, \overline{z})$. $\lambda < \lambda_c$ implies $\widetilde{k}(\lambda) > K(\lambda_c) = f^{-1}(1)$. Since $K(\cdot)$ is an increasing function of γ, $\widetilde{k}(\lambda) > f^{-1}(1)$ implies that γ must be big enough. Let γ_4 denote the γ which solves implicitly $\lambda = w\left[f^{-1}(1)\right]$. It requires that $\gamma \in (\gamma_4, \overline{z})$. Put three conditions together, γ should be big enough. When $\min(\gamma_2, \gamma_3, \gamma_4) > \gamma_1$, $\gamma > \max(\gamma_2, \gamma_3, \gamma_4)$.

c) To the contrary to (b), γ should be small enough. When $\max(\gamma_3, \gamma_4) > \gamma_1, \gamma < \gamma_1$; When $\max(\gamma_3, \gamma_4) < \gamma_1$ $\gamma < \max(\gamma_3, \gamma_4)$.

To sum up: conditions of γ to be in Region A, B and C are as follows:

Proposition 10

a) *γ is intermediate for $\mathcal{L}$ to be in Region A and $\gamma \in (\gamma_1, \gamma_2)$.*

b) *γ is large enough for $\mathcal{L}$ to be in Region B. It satisfies $\gamma \in (0, \gamma_1)$ or $\gamma \in (\gamma_2, \overline{z})$, and $\gamma \in (\gamma_3, \overline{z})$, and $\gamma \in (\gamma_4, \overline{z})$.*

c) *γ is small enough for $\mathcal{L}$ to be in Region C. It satisfies $\gamma \in (0, \gamma_1)$ or $\gamma \in (\gamma_2, \overline{z})$, and $\gamma \in (0, \gamma_3)$, or $\gamma \in (0, \gamma_4)$.*

6.9 Appendix IX: Proof of proposition 11.

Using $f(k_t) = Ak_t^\alpha$, we can deduce $w(k_t) = (1-\alpha)Ak_t^\alpha$, $f^{-1}(\cdot) = (\frac{\cdot}{A})^{\frac{1}{\alpha}}$, $f'(k_t) = \alpha A k_t^{\alpha-1}$ and $f'^{-1}(\cdot) = \left(\frac{\alpha A}{\cdot}\right)^{\frac{1}{1-\alpha}}$. Furthermore, we can deduce $1 - w\left[f'^{-1}(\cdot)\right] = 1 - (1-\alpha)A\left(\frac{\alpha A}{\cdot}\right)^{\frac{\alpha}{1-\alpha}}$ and $w\left[f^{-1}(1)\right] = 1-\alpha$.

γ_1, γ_2 solves

$$\frac{(\overline{z}-\gamma)^2}{(\overline{z}-\gamma)^2+\gamma^2} = 1-(1-\alpha)A\left(\frac{\alpha A}{\frac{(\overline{z}-\gamma)^2+\gamma^2}{2\overline{z}}}\right)^{\frac{\alpha}{1-\alpha}}$$

γ_3 solves

$$\frac{(\overline{z}-\gamma)^2}{2\overline{z}} = r^w(\frac{1}{A})^{\frac{1}{\alpha}}$$

γ_4 solves

$$\frac{(\overline{z}-\gamma)^2}{(\overline{z}-\gamma)^2+\gamma^2}=1-\alpha$$

and $\gamma_1, \gamma_2, \gamma_3, \gamma_4 \in (0, \overline{z})$.

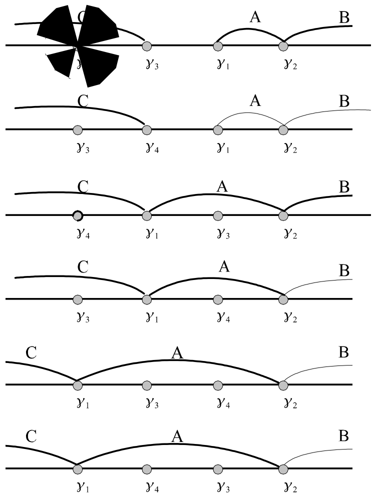


Figure B. 1 Transition B-A-C

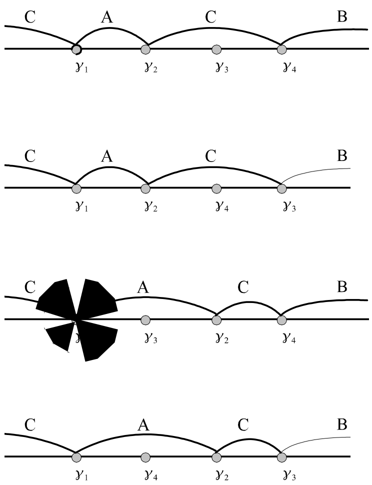


Figure B. 2 Transition B-C-A-C

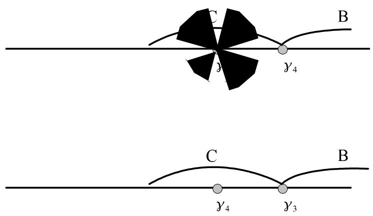


Figure B. 2 Transition B-C

7 References

Aghion, P., Bacchetta, P., Banerjee, A.: Financial development and the instability of open economies, Journal of Monetary Economics, Elsevier, vol. 51(6), pages 1077-1106, September (2004).

Bencivenga, V.R., Smith, B.D.: Financial intermediation and endogenous growth. Review of Economic Studies 58, 195–209 (1991)

Bencivenga, V.R., Smith, B.D.: Some consequences of credit rationing in an endogenous growth model. Journal of Economic Dynamics and Control 17, 97–122 (1993)

Bernanke, B.S., Gertler, M.: Agency costs, net worth, and business fluctuations. American Economic Review 79, 14–31 (1989)

Bernanke, B.S., Gertler, M., Gilchrist, S.: The financial accelerator in a quantitative business cycle framework, Handbook of Macroeconomics, in: J. B. Taylor

& M. Woodford (ed.), Handbook of Macroeconomics, edition 1, volume 1, chapter 21, pages 1341-1393 Elsevier. (1999)

Boyd, J., Smith, B.D.: Capital market imperfections, international credit markets, and nonconvergence. Journal of Economic Theory 73, 335–364 (1997)

Boyd, J., Smith, B.D.: Capital market imperfections in a monetary growth model. Economic Theory 11, 241–273 (1998)

Gale, D., Hellwig, M.: Incentive-compatible loan contracts. Review of Economic Studies 52, 647–663 (1985)

Greenwood, J., Jovanovic, B.: Financial development, growth, and the distribution of income. Journal of Political Economy 98, 1076–1107 (1990)

Greenwood, J., Smith, B.D.: Financial markets in development and the development of financial markets. Journal of Economic Dynamics and Control 21, 145–181 (1997)

Guzman, Mark G. , lender structure, capital accumulation and growth: a simple macroeconomic model, Working Papers 99-07, Federal Reserve Bank of Dallas. (1999)

Kose, M.A, Prasad, E, Rogoff, K, Wei,S.J : Financial Globalization: A Reappraisal, IMF Staff Papers, Palgrave Macmillan Journals, vol. 56(1), pages 8-62, April (2009).

Mendoza, E.G., Quadrini, V., Ríos-Rull, J.V.: On the Welfare Implications of Financial Globalization without Financial Development, NBER Working Papers 13412, National Bureau of Economic Research, Inc.(2007)

Mendoza, E.G., Quadrini, V., Ríos-Rull, J.V.: Financial Integration, Financial Deepness and Global Imbalances, NBER Working Papers 12909, National Bureau of Economic Research, Inc.(2007)

Mishkin, Frederic S.: The Next Great Globalization: How Disadvantaged Nations Can Harness Their Financial Systems to Get Rich, forthcoming (Princeton, New Jersey: Princeton University Press).(2006)

King, R.G., Levine, R.: Finance and growth: Schumpeter might be right. Quarterly Journal of Economics 108, 717–737 (1993b)

Levine, R.: Financial development and economic growth: views and agenda. Journal of Economic Literature, American Economic Association, vol. 35(2), pages 688-726, June. (1997)

Stulz, R.M: Golbalization, Corporate Finance, And The Cost Of Capital. Journal of Applied Corporate Finance, vol. 12(3), pages 8 - 25, Fall (1999)

Townsend, R.M.: Optimal contracts and competitive markets with costly state verification. Journal of Economic Theory 21, 265–293 (1979)

credit rationing. Journal of Monetary Economics 18, 159–179 (1986)
Williamson, S.D.: Costly monitoring, loan contracts, and equilibrium credit rationing. Quarterly Journal of Economics 102, 135–145 (1987)