Financial Crises in an Economy with High Savings*

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Abstract

In this paper we first develop a theoretical model to study the linkage between the high savings and the financial crisis in an open economy where flow of capital cross border is allowed. There are three sectors of interest in the model: the industrial, the agricultural and the banking sectors. People work either in the industrial or the agricultural sectors. Savings out of labor incomes and agricultural rents are free to be saved either in foreign banks or domestic banks, which are free to borrow foreign capital at the world interest rate. The industrial sector needs labor inputs as well as financial services (investments) which are only available from the domestic banks. Therefore, return of investments that are financed from the domestic savings as well as foreign capital has to, at least, reach the world interest rate in order to keep both the industrial and the banking sectors active. The deterioration of the return due to small changes in the economic environment would lead to outflows of both the domestic savings as well as the foreign capital. This would result in a deep recession, in terms of reduction of the industrial production, associated with banking crises. In the empirical tests, we find that a higher savings is associated with a higher probability of banking crisis when real GDP growth is low.

1 Introduction

The banking sector as the financial intermediation plays an important role to the economic development. As generally agreed, the banking sector can provide liquidity and payment services as well as managing risk, asset transformation, monitoring and information processing. As augured by Hellwig 1991, the banking sector exerts a fundamental influence on capital allocation, risk sharing and economic growth. Therefore, on the other hand,

*Preliminary version for discussion. Comments welcome.

the failure of banking sector would have big impact on the real economy. In other words, financial/banking crises affect the real economy in an important way.

The size of financial intermediation is generally determined by the side of total savings in the economy. The capital inflow/outflow would help to balance the difference between the savings and the investment which is generally though the financial intermediations. Becsi, Wang, and Wynne (1999) proposes a dynamic general equilibrium framework. The savings as well as the consumption are optimally determined by the household. Their model provides a useful explanation how the saving changes according to the change of time preference, investment uncertainty, and banking cost as well as the consequences of such changes on the economy. What they found is that small changes in the financial system may cause the economy to shift between low and high-income equilibrium (multiple equilibria).

However, recent Asian financial crisis and the ten-year recession in Japan have posed a question that how an economy could be suddenly fallen into the recession without losing its resource. Lin and Norbäck (2000) constructs a closed economic model that treats the rate of savings as exogenous variable. This is based the fact that many no-economic factors could actually govern the savings behavior. The paper introduces the portfolio choice of the savings: either saving into the bank or keep the cash. The later choice would be taken by the households when the return of the investment is negative. The paper can identify, by the simulations, the bipolar impacts of the high savings: it could result in high growth, but at the same time, also lead the economy to be more vulnerable to small changes in the economic environment.

In this paper we extend the model in Lin and Norbäck (2000) to an open one where flow of capital cross border is allowed. As the result, we can identify the negative role of the high savings analytically. Our economy consists of three sectors, banking sector, downstream industry, and agricultural sector. People work either in the industrial or the agricultural sectors. Savings out of labor incomes and agricultural rents are free to be saved either in foreign banks or domestic banks, which are free to borrow foreign capital at the world interest rate. The industrial sector needs labor inputs as well as financial services (investments) which are only available from the domestic banks. As the result from the model, the return of investments that are financed from the domestic savings as well as foreign capital has to, at least, reach the world interest rate, which is assumed to be exogenous in our model, in order to keep both the industrial and the banking sectors active. The deterioration of the return due to small changes in the economic environment would lead to outflows of both the domestic savings as well as the foreign capital. If the outflow could not be happened due to what ever the reason, the investors would choose the cash as the way to avoid losing the value of savings. If we assume that the savings would leave the banking sector simultaneously, the bank-run would occur. This would further result in a deep recession, in terms of reduction of the industrial production, associated with the banking crises.

In the empirical studies, there are three seminal studies on banking crisis with different definitions of banking crisis, a different degree of coverage of data, and a different focus of research interest. Kaminsky and Reinhart (1999) explore banking crisis as by-product of currency crisis and restrict their sample to 20 countries with fixed exchange rates and currency crisis over the period 1970-1995 and focus on the predictability of the timing of

either type of crisis. Eichengreen and Rose (1997) studies internal and external factors of banking crisis in developing countries using a macroeconomic and financial dataset on 105 countries from 1975 until 1992. And finally, Demirguec-Kunt and Detragiache (1998) explore domestic financial, macroeconomic, and institutional factors of banking crisis for 65 developing and developed countries over the period 1980-1994. The latter two studies use a probit or logit analysis. While Kaminsky and Reinhart (1999) date the beginning of a banking crisis as a bank run, or as the press announcement of a merger, closure, nationalization, or government bail-out of one or more banking institutions, Eichengreen and Rose (1997) restrict a banking crisis to the failure or suspension of a bank which leads to the exhaustion of much or all bank capital[1], and Demirguec-Kunt and Detragiache (1998) date a banking crisis, whenever (1) the ratio of non-performing assets to total assets in the banking system was larger than 10 percent, or (2) the cost of the rescue operation was at least 2 percent of GDP, or (3) there resulted large scale privatization, or (4) there were extensive bank runs or the government reacted on the crisis by deposit freezes, extended bank holidays, or generalized deposit guarantees.

The studies highlight different explanations of banking crisis. Kaminsky and Reinhart (1999) find that banking crisis occurs after financial liberalization accompanied by a recession which follows after a prolonged boom with large capital inflows, an overvalued currency, and a credit boom. Eichengreen and Rose (1999) stress the role of a rise of Northern[2] interest rates. Demirguec-Kunt and Detragiache (1998) claim domestic factors such as low economic growth, high inflation, high real domestic deposit rates, weak law-enforcement, and the presence of a deposit insurance scheme as culprits of banking crisis.

There seems thus evidence both for the (domestic and foreign) interest rate effect and the GDP growth effect on banking crisis that is predicted by our theoretical model. However, the savings rate in its role as financial multiplicator has not been explored yet. Therefore, we add the savings rate as additional explicatory variable to the previous studies. We find that a higher savings is associated with a higher probability of banking crisis when real GDP growth is low.

The paper is organized as the following. The model and analytical exercise are carried out in Section II, where, we zoom up the negative aspect of the high savings. How the price shock could easily lead the economy with high saving to the banking crisis/the deep recession is discussed in this section. In section III, we carry out our empirical tests. Finally, conclusive remarks are give in Section IV.

2 The model

We start with a quick overview of the basic structure before proceeding into details. We focus on an a small open economy in which there are three sectors of interest: There is a industrial sector and an agricultural sector producing tradable goods. Savings out of labor income and agricultural rents flow into a banking sector, which are lent to the

[1]There banking crisis data are actually taken from Caprio and Klingebiel (1996).

[2]The Northern interest rate is an average of the short term rates of the US, Japan, Germany, UK, France, and Switzerland.

industry sector for investments into capital. While the economy is open in flows of goods and savings, we shall assume that banking services are non-tradable.[3]

2.1 Households

Assume that every period, two generations, young and old, co-exist in the economy. For simplicity, they are in the same size, L. Furthermore, only the young works and owns the land. Thus, households only have income as young.[4] By saving into banks, consumers can transfer incomes earned as young to be used for consumption as old. Consumer preferences are represented as:

$$U(C_1, C_2) = u(C_1) + \beta u(C_2), \qquad u(C_t) = \frac{C_t^{1-\frac{1}{\gamma}} - 1}{1 - \frac{1}{\gamma}}, \qquad C_t = Y_t^{\alpha} A_t^{1-\alpha} \tag{1}$$

where β is the subjective time-preference factor, γ is the inter-temporal elasticity of substitution, α is the share of income spent on industrial goods and $t = \{1, 2\}$ indicate periods as young and old, respectively.

The inter-temporal budget constraint takes the form:

$$\mathcal{P}_1 C_1 + \frac{\mathcal{P}_2 C_2}{1 + R} = I_1 \tag{2}$$

where I_1 indicates the consumers income as young , R is the return to savings and $\mathcal{P}_1$ and $\mathcal{P}_2$ denote price indexes for consumption of agricultural industry goods when the consumer is young and old.

Maximizing (1) subject to (2), yields the savings rate:

$$s = \frac{\left((1+R)\frac{\mathcal{P}_1}{\mathcal{P}_2}\right)^{\gamma-1}\beta^{\gamma}}{1 + \left((1+R)\frac{\mathcal{P}_1}{\mathcal{P}_2}\right)^{\gamma-1}\beta^{\gamma}} \tag{3}$$

Hence, a share $1 - s$ of income earned as young is spent on consumption as young, whereas as share s is saved for use as old. In each period, a share α is spent on industrial goods, whereas the remainder $1 - \alpha$ is spent on agricultural goods.

For expositional reasons, we shall solve the model for the special case of $\gamma = 1$ (i.e $\log u(C_t)$), where s simplifies to the fixed savings rate $s = \frac{\beta^{\gamma}}{1+\beta^{\gamma}}$. In this case, the substitution and the income effect of change in the return to savings R cancels. This will greatly simplify calculations, but assuming $\gamma \neq 1$, so that savings are affected by the by the return to savings, does not qualitatively change the results. Finally, when examining the effects of changes in exogenous parameters we shall assume that these are permanent. Hence, we can drop time indexing.

[3] Hence, banks must be located in the economy. Banks could then be either domestic- or foreign owned.

[4] Furthermore, suppose that there is no inter-generation transfer. Then, to consume as old consumers needs to rely on the savings made as young.

2.2 The industrial- and the agricultural sectors

Production of industry goods requires capital and labor. Capital investments in the industry sector are financed by savings by consumers channelled through the bank sector. New growth theory has shown how financial intermediaries improve economic efficiency by overcoming various market frictions, facilitating a smoother transfer of wealth and information between households and firms[5]. Many of these frictions arise from various scale economies. For example, financial intermediaries give savers access to large investment projects via pooling of funds, many individual savers may benefit from information gathering by the intermediaries. Pooling may also reduce the problem of illiquid investment which will result in more investment in long-term projects. Ultimately, by providing such services intermediaries improves the allocation of savings into investments into various types of capital in the industrial sector.

We incorporate the effect of financial intermediation as follows: Let the production function for industrial goods be:

$$Y = X^a L_Y^{1-a}, \tag{4}$$

where Y denotes industrial production, X denotes banking services, L_Y labor-usage and where a is the cost-share of X.

In the production function (4), investment into capital is not modelled explicitly. Rather, we use of a "reduced form", which indirectly captures how investments out of savings into capital is enhanced by a "deeper" financial system. Formally, banking services used by the industrial sector are then aggregated into a bundle of services X, defined as:

$$X = \left(\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}, \tag{5}$$

where x is the amount used of a single variety whereas n is the number of available varieties of services. $\sigma \in (1, \infty)$ is the elasticity of substitution between *any* two varieties, implying that varieties of financial services are symmetric, but imperfect substitutes among themselves[6]. Note that symmetric use of banking services in (5) yields is $X = n^{\frac{\sigma}{\sigma-1}} x$, which is an increasing convex function in the number of banks n. Hence, increased efficiency is gained in the industry sector when a larger range of banks are present, as savings are more efficiently transferred from consumers to investments into capital in the industry sector.

Using (5), we may derive the minimum-cost for one unit of the bundle of banking services X, P, as:

$$P \equiv \min_{\{x(\omega)\}} \left[\int_0^n x(\omega) p d\omega \mid X = 1 \right] \equiv \left(n p^{1-\sigma} \right)^{\frac{1}{1-\sigma}}, \tag{6}$$

[5]For an excellent article on this subject, see Becisi and Wang (1997).

[6]$\sigma > 1$ is assumed since the elasticity of substitution is one in the production function (1). Essentially, this means that final good producers find it easier to substitute between any two intermediate inputs, than between any intemediate input and the primary factors capital and labor. Restricting the substitution elasticity to be smaller than infinity, simply means that intermediate inputs are differentiated goods.

where p is the price for the single variety x. Again, because varieties of services are imperfect substitutes, the addition of new banks enhance the efficiency in industrial production, as illustrated by the fact that P is decreasing in n.

From (4), we notice that $Y(\cdot)$ exhibits the constant returns to scale (CRS). Hence, profit maximization implies that price equals marginal cost determines industry supply Y:

$$q = \frac{1}{\lambda} w^{1-a} P^a, \tag{7}$$

where the right hand side in (7) is the marginal cost and $\lambda = (1-a)^{1-a} a^a$.

We let the agricultural sector represent the "rest of the economy". Production of agricultural goods uses a constant returns technology with two distinct inputs: labor, L_A and sector-specific land T.

$$A = L_A^d T^{1-d}, \tag{8}$$

where d is the share of labor input L_A. Agriculture goods are also tradeable in the world market. For simplicity, their price are normalized to 1 and the supply of land T is fix and also normalized to 1.

2.3 The Banking sector

As have been argued above, there may be scale economies involved into financial intermediation. Hence, banking will naturally be subject to imperfect competition. We shall assume that the market interaction is monopolistic competition. Each bank then produces a single variety. From (6), it can be shown that the demand is:

$$x = P^{\sigma-1} p^{-\sigma} aqY \tag{9}$$

In this demand function, an individual firm in the industrial sector takes the price index P and the total industrial expenditure on differentiated services, aqY, as given.

To simplify, we shall assume no labor is used in banking and that each unit of banking service requires a unit of savings and a fixed cost F in terms of savings[7]. The fixed cost F is an entry cost for investment into propriety information, imported equipment etc. The profits of producing each variety can be written as:

$$\pi = px - (1+R)(x+F), \tag{10}$$

where R denote the return to savings. Assuming free entry and exit, and using the demand function (9), the zero-profit condition results in the following conditions:

$$p = \frac{\sigma}{\sigma - 1}(1+R), \tag{11}$$

$$px = (1+R)(x+F). \tag{12}$$

[7]Labor usage can be included but leads to more complicated expressions.

where it can be noted that the price elasticity $EL_p x$ has been approximated with the substitution elasticity σ. As is commonly known, these two equations determine a unique supply of services from each bank:

$$x = (\sigma - 1) F. \tag{13}$$

Equating (9) and (13), so that demand equals supply for an individual variety, we can then use (11) and (6) to derive the number of banks consistent with a given demand for bank services aqY from the industry sector, n^D.

$$n^D = \frac{aqY}{\sigma F (1 + R)}. \tag{14}$$

2.3.1 The return to savings and the number of banks

Summing up, two generations, young and old, co-exist in the economy in each period. Furthermore, only the young earn income, so that individuals know that consumption at old age has to rely on savings made at young age. Equilibrium in the market for savings can then be written as follows:

$$n (F + x) = s \left((1 - a) qY + \left(\frac{d}{w} \right)^{\frac{d}{1-d}} \right) \tag{15}$$

where the LHS in (15), $n (F + x)$, shows total demand for deposits, whereas the RHS in (15) shows the total domestic supply of savings, which is proportional to income. This income consists of two terms: total labor income in industrial production $(1 - a)qY$ and total land rents and labor income in agricultural production $\left(\frac{d}{w}\right)^{\frac{d}{1-d}}$. We can then use (15) and (13) to calculate the number of banks consistent with given supply of savings, n^S:

$$n^S = \frac{s \left((1 - a) qY + \left(\frac{d}{w} \right)^{\frac{d}{1-d}} \right)}{\sigma F}, \tag{16}$$

The return to savings, R, can then be calculated as the return which equates n^D and n^S. This is the return which clears the market for savings in the sense of matching the number of banks corresponding to the demand for savings in the industry sector n^D, to the number of banks n^S corresponding to the supply of savings on the consumer side . Using (16) and (14) and writing out the gross return $1 + R$, we have:

$$1 + R = \frac{aqY}{s \left((1 - a) qY + \left(\frac{d}{w} \right)^{\frac{d}{1-d}} \right)}. \tag{17}$$

Note that the gross return $1 + R$ relies on the balance between the savings supply from labor incomes and land rents, $s \left((1 - a) qY + \left(\frac{d}{w} \right)^{\frac{d}{1-d}} \right)$, and the demand of financial services from the industry sector, aqY.

2.4 Solving the model

The model can now be solved by determining w and Y. This can be accomplished in the following way.

2.4.1 The *RR*-curve

Because of our assumption of a small open economy, the combination of wage and industrial output in equilibrium, must be consistent with a return which is at least as high as the world interest rate $R \geq R^*$. This ensures that the young generation channel their savings into the bank sector, rather than saving abroad. Thus, from (17), equilibrium wages and industrial output must also satisfy the *return condition,* which we will denote RR:

$$\frac{1}{s}\frac{aqY}{(1-a)qY + \left(\frac{d}{w}\right)^{\frac{d}{1-d}}} \geq 1 + R^* \tag{18}$$

In Figure 1, the $RR-curve$ shows combinations wages and industrial output where (18) holds with equality, that is, the demand for savings exactly matches the domestic supply of savings at a return equal to the world market interest rate, $R = R^*$. The RR-locus is negatively sloped, which can be explained as follows. When industrial output increases, the demand for savings increases, since industry firms demand more bank services. This demand effect is captured by the term aqY in (18). However, an increasing industrial production also increases industrial employment, which generates an increased supply of savings out of wage income. This supply effect is captured by the term $s(1-a)qY$ in (18). Note that to have a well-defined return to savings R, the demand effect must be larger than the savings effect, that is:[8]

$$s \leq \tilde{s} = \frac{a}{1-a} \tag{19}$$

When (19) holds, an increasing industrial output generates an excess demand for savings. To keep the return at $R = R^*$, the wage must decrease which, in turn, increases agricultural rents. The latter effect is captured by the term $\left(\frac{d}{w}\right)^{\frac{d}{1-d}}$. Hence, wages w an industrial output Y must be negatively correlated to preserve the return R^* along the $RR-curve$.

Finally, we may note that the shadowed area represents combinations of wages w and industry output Y which yield returns of deposits in the banking sector less than the opportunity cost, $R < R^*$, and, subsequently, in this region the young generation save abroad. The region to the north of the RR-locus, on the other hand, represents combinations of wages w and industry output Y generate a return of depositing savings in the banking sector larger than the world market interest rate, $R > R^*$.

[8] That is, to have unique wage w defined as function of industrial output Y at the return $R = R^*$, (19) must hold.

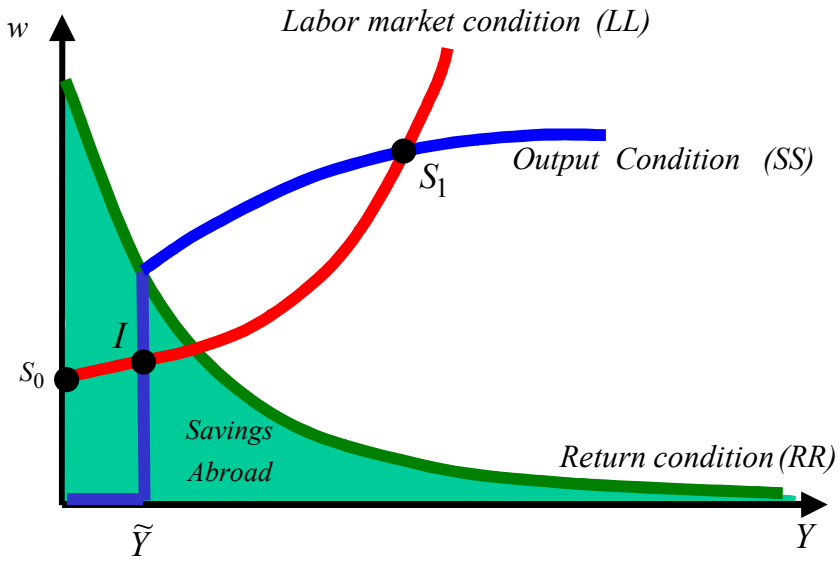

Figure 1:

2.4.2 The *SS*-curve

Second, we can express the unit cost for the bundle of banking services, P, in terms of w and Y by substituting $1 + R^*$ into (11) and (14). Using (6), (7) can be written:

$$\begin{cases} q = \frac{1}{\lambda} w^{1-a} \left(\left(\frac{aqY}{\sigma F(1+R^*)} \right)^{\frac{1}{1-\sigma}} \left(\frac{\sigma}{\sigma - 1} (1 + R^*) \right) \right)^a, & Y \geq \tilde{Y} \\ w = 0, & Y < \tilde{Y} \end{cases} \tag{20}$$

which we will be referred to as the $SS-$locus which is also drawn in fig 1. This condition simply says that price must equal marginal cost in the industrial sector. The $SS-$locus has three segments:

The first, horizontal part, where $w = 0$, shows combinations of wages and industrial output for which $Y < \tilde{Y}$, where $\tilde{Y}$ is the minimum level of industrial production associated with an active banking sector. Note that whenever $Y < \tilde{Y}$, industrial output is too low to generate a return to savings in the bank sector equal to the world market interest rate and $R < R^*$. Consumers then choose to save abroad and the banking sector cannot channel savings to the industrial sector. At a zero number of banks, $n = 0$, the price index P goes to infinity (c.f equation (6)), and from (7), w must be set to zero. This explains the horizontal part of the SS-curve.

On the other hand, whenever industrial production reaches the critical level $Y = \tilde{Y}$, so that the return to savings reaches the world market interest rate, $R = R^*$, consumers place their savings into domestic banking. The SS-curve jumps then vertically to the increasing, concave part starting from the intersection of the $RR - curve$ at which, per definition, $R = R^*$.

Whenever industrial output Y increases beyond $\tilde{Y}$, the demand for financial services rises, which enables more banks to enter (c.f equation (14)). Since the demand effect on savings is larger than the supply effect of from an increase in industrial production, an

excess demand on savings is generated. This tends to push the return to saving R above the world market interest rate R^*, which attracts foreign savings. The inflow of foreign savings then ensures that the domestic return to savings is kept at the world market interest rate. In turn, as more banks enter, the price of the composite banking service P (c.f. equation (6)) is reduced which lowers the cost of an additional unit of industrial production (c.f equation (7)). Then, as the cost of an additional unit of the aggregate financial service input X, decreases when Y increases, the wage level w has to be increased to preserve equality between price and marginal cost in industrial production. This explains the upward-sloping part of the SS-curve.

Finally, for comparative statics exercises in the next section, we can explicitly calculate the critical level of industrial output needed to have an active banking sector $\tilde{Y}$. Combining (20) and (18), we have:

$$\tilde{Y} = \left[\left(\frac{s(1+R^*)}{a - s(1-a)(1+R^*)} \right)^{\frac{1-d}{d}} q^{-A} (1+R^*)^B \Lambda \right]^{\frac{1}{C}} \tag{21}$$

where A, B, C and Λ are positive constants of the exogenous parameters in the model.[9]

2.4.3 The *LL*-curve

The second equation comes from the labor market. We assume that the size of the labor force of the young generation is L and assume full employment. Thus:

$$(\frac{d}{w})^{\frac{1}{1-d}} + (1-a)\frac{qY}{w} = L, \tag{22}$$

where L_A and L_Y have been specified from the optimal decisions on agriculture production (8) and industry production (4). This condition is defined as the *labor market condition* which we will denote LL. The LL-locus is upward-sloping in Figure 1 indicating that as industrial expansion draws labor from the agricultural sector, wages increase due an increasing land/labor ratio.

2.4.4 Multiple equilibria

The intersections of the SS-curve and the LL-curve in figure 1 determine equilibrium wages and industrial output, w and Y. As can be seen, there are three equilibria, indicated as S_0, I and S_1. Note that S_0 and S_1 are stable, whereas I is unstable. This is so because whenever $w_{SS} > w_{LL}$ industrial output increases, since the price of industrial goods exceeds marginal cost at the wage level consistent with full employment, whereas industrial outputs decreases whenever $w_{SS} < w_{LL}$, as marginal cost exceeds price of industrial goods at the wage level consistent with full employment.[10]

[9] By calculation: $A = \frac{1-d}{d}$, $B = \frac{a\sigma}{(\sigma-1)(1-a)}$, $C = \frac{a}{(\sigma-1)(1-a)} + \frac{1-d}{d}$, $\Lambda = \Phi^{\frac{1}{1-d}} d$, where $\Phi = \frac{1}{\lambda}\left(\frac{a}{\sigma F}\right)^{\frac{a}{\sigma-1}} \left(\frac{\sigma}{\sigma-1}\right)^a$.

[10] We are then assuming that the agglomeration forces in the economy are not extreme so that there is a single intersection between the LL curve and the SS curve when $Y \geq \tilde{Y}$. For a short discussion see the appendix.

Moreover, note that S_0 is characterized by a collapse of the financial and industrial sector. The economy produces only agricultural goods. At zero industrial output, the return to savings is also zero, which implies that no savings takes place in to the bank sector. With all domestic savings abroad, banks cannot operate, industrial firms cannot invest, and the economy remains in an equilibrium with no industrial output. On the other hand, there is also another stable equilibrium S_1 where industrial output is sufficiently high to provide a return to saving equal to the world market interest rate, $R = R^*$. Domestic (and foreign) consumers then deposit savings into domestic banks and industrial output and wages in S_0 are by far higher than in S_0 where only agricultural goods are produced. This illustrates how a "deeper" financial system, where many varieties of banking services of are present, improves economic efficiency as savings are more efficiently transferred from savers to investments in the industrial sector.

2.5 Comparative statics

We can now perform some comparative statics. Table 1 below describes the effects of an increases in the savings rate s, the world market interest rate R^* and the world market price of industrial goods q on the critical level of industrial output $\tilde{Y}$, and equilibrium industrial output Y and the wage level w in equilibrium S_1 in figure 1.

Table 1: Comparative statics results in model

Change in the	Effect on endogenus variables:		
exogenous variable:	$\tilde{Y}$	Y	w
$s:$	$+$	.	.
$R^*:$	$+$	$-$	$-$
$q:$	$-$	$+$	$+$

2.6 Vulnerability connected to high savings rates

From table 1 we can read off the impact a high savings rate, s? Given that the economy is initially in the equilibrium S_1, equilibrium wages and industrial output are unaffected: From (22) and (20), the LL- and SS-curves are unaffected by an increased savings rate, which is illustrated in figure 2.

However, note that figure 2 reveals that a high savings rate enlarges shadowed area.[11]

[11]the *RR-curve* is shifted upwards. The vertical shift of the *RR-curve* occurs because because a higher saving rate increases the supply of savings while leaving the demand unaffected. To equalize supply and demand of savings, the wage must increase. At a increased wage, total income is reduced as land rents decrease, which, in turn, generetes the needed reduction in savings.

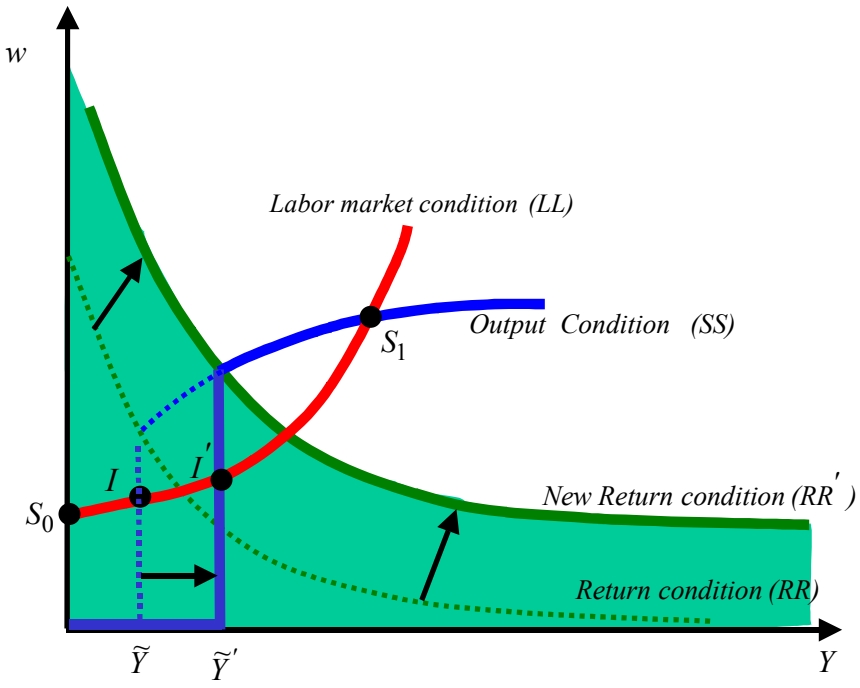

Figure 2:

From table 1 and (21), we can see that the reason is that the critical level of output $\tilde{Y}$ increases. Intuitively, a higher saving rate s increases the supply of savings while leaving the demand unaffected. Therefore, the minimum level of industrial output $\tilde{Y}$ must increase to $\tilde{Y}'$, where the demand for savings matches the domestic supply at a return equal to the world market interest rate, $R = R^*$ at the higher savings rate. As a result, the vertical part of the $SS - curve$ shifts outwards and the instable equilibrium I shifts outwards to I'. Since, S_1 is closer to a I' than I, a banking crisis is more likely to occur.

Proposition 1 *A high saving rate will increase the risk for a deep recession.*

2.7 External shock and financial crises

The above result suggests that the economy can be more vulnerable to changes in economic environment at a higher savings rate. In order to show this, we investigate a decline of the world market price of industrial goods q and an increase in the world market interest rate R^*.

2.7.1 The effects of a reduced world market price of industrial goods

The effects of a negative q shock is shown are described in table 1 and illustrated in figure 3.

Again, suppose that the economy is initially in the equilibrium S_1 as illustrated by figure 2. From table 1, we can note that if the price in the world market q decreases the

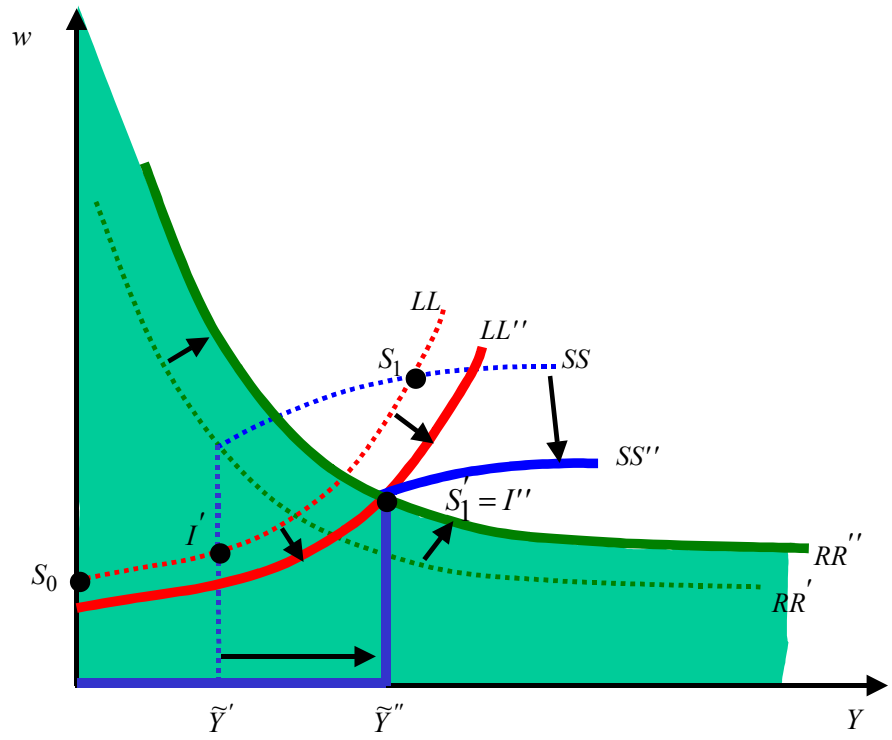

Figure 3:

critical level of industrial output $\tilde{Y}$ increases (c.f equation (21). Since the demand effect on savings is stronger than the supply effect on savings, a reduced output price on industrial goods q generates an excess supply for savings. To keep supply equal to demand at the R^*, industrial output must increase. Hence, the unstable equilibrium $I^{'}$ shifts further to the right from $\tilde{Y}^{'}$ to $\tilde{Y}^{''}$.

Turning to the LL-locus, this curve shifts down. A reduction in q reduces production and, hence, the demand for labor in the industry sector. Labor flows to agriculture which leads to a fall of the marginal product of labor. Thus, the wage must fall. Finally, the SS-locus also shifts down when q is reduced. Lower prices for industry goods must be compensated by a lower marginal cost, which is accomplished by a reduction in the wage w. Hence, the equilibrium S_1 shifts down to the left in figure 3.[12]

In fact, if q is reduces sufficiently much, the equilibrium $S_1^{'}$ and $I^{''}$ will coincide. If the price of industrial goods falls even more, the increase in the critical level of output $\tilde{Y}$ and the decrease of industrial output in $S_1^{'}$ will cause a separation of the LL-locus and the SS-locus as the wage consistent with full-employment, w_{LL}, is higher than the wage consistent with profit maximization in the industry sector, w_{SS}. Industrial production then contracts and the return to saving into the bank sector falls below the world market return. As banks are left without savings, industrial production ceases, and the economy is left in S_0 without industrial production.

[12]In the appendix, we show that both industrial output Y and wages w will be reduced as S_1 shifts to th south-west in figure 2.

2.7.2 The effects of an increase world market interest rate R^*

The effects of increased world market interest rate R^* is similar to the effects of a decreased world market price of industrial goods q, described in the section above. From (21), we can see that the critical level of output $\tilde{Y}$ increases, since a higher level of industrial activity is needed to keep the domestic return to savings at the level of the world market. While leaving the $LL - curve$ unaffected, an increase in R^* shifts down the $SS - curve$ as a higher investment costs through an increasing interest rate increases the marginal cost in industrial production, which need to be compensated with lower wage costs. Hence, the SS-curve shifts down and industrial output is reduced towards the (increasing) critical level of industrial output, and the economy is closer to a collapse.

To summarize:

Proposition 2 *High saving rates combined with external shocks may explain why recessions may become very deep.*

3 Empirical test of the model

The model predicts that a crisis in the banking sector will occur if there is an internal shock like a drop of GDP or a rise in the rate of return of the best alternative investment possibility of savers. Or there may be an external shock like a terms of trade deterioration or a rise in foreign interest rates.

We decided to base our empirical study on the data of Demirguec-Kunt and Detragiache (1998)[13], since banking crisis is defined more as a macroeconomic rather than a microeconomic phenomenon which is requested by our theoretical model. Moreover, it contains both developed and underdeveloped countries. Our theoretical model would not distinguish rich from poor economies either. The Eichengreen and Rose (1997) data contain more underdeveloped countries, but less explanatory variables, and the Kaminsky and Reinhart (1999) data are unsuitable for our purposes, because they focus on fixed exchange rate regimes, while our theoretical model is not bound to fixed exchange rate regimes.

As in Eichengreen and Rose (1997) and in Demirguec-Kunt and Detragiache (1998), we run a probit/logit analysis on the banking crisis and a set of independent variables. Again as in the two previous studies, we exclude all observations from the sample, while a banking crisis is ongoing to avoid endogeneity problems. We exclude also observations with negative savings rates, since our theoretical model requires positive savings into the banking sector. The independent variables include the savings rate, the real GDP growth rate, the growth rate of domestic credit, the real and nominal deposit rate, the inflation rate, a measure of exchange rate overvaluation, a measure of law enforcement, and a dummy for deposit insurance. These are the variables used in the previous studies.

We present the results of Logit estimates in table 2.

[13] A data description is given in the data appendix. In particular, the country names are given, and the independent variables are defined. Also the data-sources for the independent variables are provided in the same appendix.

Table 2: Logit-Estimation Results

Dependent Variable: Banking Crisis	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CONS	-3.28*** (.45)	-3.47*** (0.52)	-3.46*** (0.59)	-4.19*** (0.70)	-5.33*** (1.14)	-6.69*** (1.75)	-4.75*** (2.15)
SAVINGS	0.01 (.02)	0.02 (0.02)	0.01 (0.03)	0.03 (0.03)	0.06 (0.04)	0.11* (0.06)	0.05 (0.05)
GDPGROW	-0.1** (.02)	-0.13*** (.05)	-0.11* (0.06)	-0.12** (0.0.06)	-0.21*** (0.08)	-0.36*** (0.1)	-0.38*** (0.11)
CREDGROW	-	0.00** (0.00)	0.00** (0.00)	0.00* (0.00)	0.00** (0.00)	0.00** (0.00)	0.00*** (0.00)
REALINT	-	-	-0.000 (0.002)	-	-	-	-
DEPOSINT	-	-	-	0.06** (0.03)	0.082*** (0.03)	0.09*** (0.03)	0.12** (0.05)
INFLRATE	-	-	-	-3.46* (2.03)	-4.49* (2.42)	-4.21* (2.32)	-10.87** (4.9)
DIFREXCH	-	-	-	-	-0.01*** (0.00)	-0.02** (0.01)	-0.02*** (0.01)
DEPINSUR	-	-	-	-	-	0.52 (0.84)	-
LAWORDER	-	-	-	-	-	-	0.08 (0.3)
Pseudo R2	0.02	0.08	0.07	0.12	0.19	0.23	0.24
p(LR Chi2)	0.05**	0.00***	0.01***	0.00***	0.00***	0.00***	0.00***
Log-Likelihood	-122.27	-99.34	-84.96	-80.57	-46.78	-40.81	-38.64
observations	817	690	617	617	406	363	304

Remarks: *** 1% Significance Level; ** 5% Significance Level; * 10% Significance Level; Similar results are obtained with probit, random probit, conditional logit estimations; Similar standard errors are obtained if White-correction is used; Among the list of insignificant variables is: Ratio of liquid assets to total assets of banking system; Ratio of Foreign exchange reserves and M2; current account surplus/deficit as percentage of GDP; Government debt as percentage of GDP; Ratio of Exports and Imports to GDP (Openness); the spread of deposit and loan interest rates; the ratio of short term debt in the current account to total foreign assets;
All observations with negative savings rates and all observations with a banking crisis in the previous year are excluded;
Data Sources: Demirguec-Kunt and Detragiache (1998), World Bank Development Indicators, Talley and Mas (1990), International Country Risk Guide

Clearly, low domestic real GDP growth and large credit growth increase the probability of banking crisis significantly and robustly over many different specifications. The effect of domestic real GDP growth on banking crisis supports thus our theoretical model. Similar effects are found in Eichengreen and Rose (1997) and in Demirguec-Kunt and Detragiache (1998).

A higher savings rate is associated with a higher probability of banking crisis as predicted in the theoretical model, but it is not significant.

The real deposit rate itself is not significant. However, a high nominal deposit rate and a low inflation rate taken separately are both significant and robust explanatory variables of banking crisis. Moreover, an overvalued currency rises the probability of banking crisis.

There may be two effects stemming from the inflation rate. First, a higher inflation rate may reduce the real deposit rate given a nominal deposit rate. Second, a low inflation rate may indicate the result of a period of financial liberalization which has been found by Kaminsky and Reinhart (1999) as main cause of banking crisis in particular in the 80ies. In the same vein, an overvalued currency may result from such a financial liberalization which in turn is associated with a banking crisis.[14]

Table 3: WLS-Logit Estimation Results

Dependent Variable: Banking Crisis	(8)	(9)	(10)	(11)	(12)	(13)	(14)
CONS	-4.20*** (.07)	-8.52*** (1.31)	-9.56*** (1.56)	-11.96*** (1.91)	-24.84*** (5.38)	-12.35*** (2.35)	-5.32*** (2.63)
SAVINGS	0.10*** (.03)	0.24*** (0.05)	0.28*** (0.05)	0.35*** (0.06)	0.75*** (0.16)	0.36*** (0.07)	0.40*** (0.08)
GDPGROW	-0.37** (.07)	-0.71*** (.12)	-0.87*** (0.14)	-0.12** (0.0.06)	-1.84*** (0.32)	-1.05*** (0.18)	-1.50*** (0.24)
CREDGROW	-	0.00** (0.00)	0.00** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)
REALINT	-	-	-0.01 (0.02)	-	-	-	-
DEPOSINT	-	-	-	0.18*** (0.06)	0.37*** (0.11)	0.19*** (0.07)	0.32*** (0.12)
INFLRATE	-	-	-	-15.33*** (5.21)	-22.67*** (7.67)	-16.35*** (5.92)	-40.00** (13.01)
DIFREXCH	-	-	-	-	-0.03 (0.03)	-	-
DEPINSUR	-	-	-	-	-	0.04 (1.22)	-
LAWORDER	-	-	-	-	-	-	1.49*** (0.43)
Pseudo R2	0.09	0.28	0.30	0.34	0.57	0.35	0.49
p(LR Chi2)	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
Log-Likelihood	-188.95	-102.18	-92.77	-87.09	-35.74	-70.74	-54.10
observations	806	681	608	608	406	500	419

Remarks: *** 1% Significance Level; ** 5% Significance Level; * 10% Significance Level;
The weight variable is GDP;
There are 11 observations less for GDP than for GDP growth in the World Bank Development Indicator Database;
All observations with negative savings rates and all observations with a banking crisis in the previous year are excluded;
Data Sources: Demirguec-Kunt and Detragiache (1998), World Bank Development Indicators, Talley and Mas (1990), International Country Risk Guide

Although a formal deposit insurance and bad law enforcement increase the probability of banking crisis, those effects are not significant. A wide range of other control variables such as (1) the ratio of liquid to total assets in the banking system, (2) the ratio of foreign exchange reserves and M2, (3) the current account surplus/deficit in percentage of GDP, (4) government debt as percentage of GDP, (5) the trade openness of a country, (6) the

[14]See Diaz-Alejandro (1985) for an excellent theoretical and anecdotical underpinning of the relation of financial liberalization and banking crisis in Chile.

spread of deposit and loan rates, (7) and the ratio of short term debt as percentage of foreign assets in the current accounts all turn out not to be significant, too.

We further explore the significance of the savings rate using a different econometric technique, i.e. weighted least squares (WLS) as in Eichengreen and Rose (1997) who find WLS to be their preferred statistical specification.[15] The results are displayed in table 3. In general, fit is much better as compared to simple Logit estimates. In particular, we find now that the savings rate is significant, while all other significant explanatory variables of simple logit estimations retain their signs. Also law enforcement becomes significant, while exchange rate overvaluation looses its significance. We also tried probit, random probit, and fixed effect logit estimations without any qualitative change in results compared to simple logit estimates.[16] In general, the size of coefficients varies quite a bit across specifications which is mainly due to the largely varying sample sizes, since many variables are only available for a small subset of all the countries used in this study.

Summing up, we found that 2 out of three effects predicted by our theoretical model can be retrieved in our empirical analysis with correct signs, significance and robustness, while one effect - the one on the savings rate - has the correct sign and is strongly significant in the statistically preferred WLS estimations, but not in simple Logit estimations.

4 Conclusions

From both the theoretical and the empirical exercises in this paper, we may demonstrate the negative aspect of the savings as well as its contribution to the financial crisis and recessions. The intuition is quite simple. The fast growth would absorb the high savings without any problem. However, once the savings are more than the companies/banking sector can profitably invest, the public would than like to withdraw the savings from the banking sector by either investing abroad or keeping the savings in cash. It creates the structure savings surplus which might deteriorate the banking sector's performance that would have the consequence on the real economy. This seems what is happening in Japan nowadays (Sachs, Financial Times, April 19, 2001). The appreciation of Yen and deflation can be captured by the q-shock in our paper. As Japan met resistance of further current account surplus in 1990s by the policymakers abroad, Japanese people tends to save in the government-run post-bank which has no direct contribution to raising private investment.

We show that a higher savings could lead to high level of output (growth) as well as high wage. The later one might lead the economy more vulnerable to changes on economic environment. The Asian financial crisis provide the examples of such changes in the reality. First of all, high savings/high investment result in the high growth in past thirty years, some of the countries have caught up with the living standard of advanced country. Secondly, since before the crisis, the Asian countries normally adopted the fixed exchange rate to the U.S. dollar which has been appreciated. As a result, the currencies in the Asian countries have been appreciated accordingly. Thirdly, the new competitors, such as China, emerge on the market for these economies' exports. The price for those export goods fell. These shock could be translated into a negative shock in q-shock in our paper. Hence, our result

[15] We use GDP as wheight variable.

[16] We do not include those estimates to save space, but they are available from the authors upon request.

can capture, at least, part of the explanation of the Asian financial crisis.

What we have been discussed in this paper is that the dark side of the growth which is driven by the resources. An implication of the model is that the way to avoid such crises is the long-term micro-economic reforms which would raise the economy's long-term growth potential.

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Appendix

A Equation (6)

How the expression

$$\begin{aligned} P &\equiv \min_{\{x(\omega)\}} \left[\int_0^n x(\omega) p d\omega \mid X = 1 \right] \\ &\equiv \left(n p^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \end{aligned} \tag{A1}$$

which shows the minimum cost for one unit of the aggregate financial services, is driven?

The full cost-minimization problem is

$$\begin{aligned} P &\equiv \min_{\{x(\omega)\}} \left[\int_0^n x(\omega) p d\omega \mid X = 1 \right] \\ \text{st} &: \quad X = \left(\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}} = 1 \end{aligned} \tag{A2}$$

The Lagrange function becomes:

$$L = \int_0^n x(\omega) p d\omega - \lambda [(\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega)^{\frac{\sigma}{\sigma-1}} - 1] \tag{A3}$$

Take the first-order-condition:

$$p = \lambda \frac{\sigma}{\sigma-1} \frac{\sigma-1}{\sigma} [(\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega)^{\frac{\sigma}{\sigma-1}}]^{\frac{\sigma}{\sigma-1}-1} x^{\frac{\sigma-1}{\sigma}-1} \tag{A4}$$

Simplifying this expression and using the fact $X = (\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega)^{\frac{\sigma}{\sigma-1}} = 1$, we have:

$$p = \frac{\lambda x^{\frac{\sigma-1}{\sigma}-1}}{\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega} \tag{A5}$$

Multiply x on both sides,

$$px = \frac{\lambda x^{\frac{\sigma-1}{\sigma}}}{\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega} \tag{A6}$$

Integrating this expression over variable ω :

$$\int_0^n p(\omega) x(\omega) d\omega = \frac{\lambda \int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega}{\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega} \tag{A7}$$

Therefore,

$$P = \lambda \tag{A8}$$

Thus,

$$\begin{aligned} px &= \frac{Px^{\frac{\sigma-1}{\sigma}}}{\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega} \\ &= Px^{\frac{\sigma-1}{\sigma}} \end{aligned} \tag{A9}$$

where we have used the fact

$$\begin{array}{c} X = (\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega)^{\frac{\sigma}{\sigma-1}} = 1 \\ \Rightarrow \\ \int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega = 1 \end{array} . \tag{A10}$$

From (A9) we have

$$x = P^{\sigma} p^{-\sigma} \tag{A11}$$

By considering the assumption that varieties are imperfect but symmetric substitutes, we can insert the demand for individual varieties x (A11) into (A2) to get:

$$\begin{aligned} P &\equiv \int_0^n x(\omega) p(\omega) d\omega \\ &= npx \\ &= npP^{\sigma} p^{-\sigma} \\ &= nP^{\sigma} p^{1-\sigma} \end{aligned}$$

Simply solving the last line, we have the equation (6) in the text,

$$P = (np^{1-\sigma})^{\frac{1}{1-\sigma}}$$

B Equation (9)

Equation (A11) shows the demand for a single variety x when firms use one unit of the aggregate input good $X = 1$. Then how much X is then actually used by the firms?

Since the production function $Y = X^a L^{1-a}$ is constant returns to scale, we have

$$a = \frac{PX}{qY}. \tag{B1}$$

Solving X in (B1), we have that $X = aqY/P$. Considering the fact that $X = 1$ and combining (A11), we have

$$\begin{aligned} x &= P^{\sigma} p^{-\sigma} \frac{aqY}{P} \\ &= P^{\sigma-1} p^{-\sigma} aqY \end{aligned} \tag{B2}$$

C Derivation of agricultural rent

We just solve for the maximization for perfectly competitive firm with a decreasing returns technology (DRS since land is fixed). The simplifications are a little messy, but the problem is straightforward.

Say that agricultural goods are produced with the following Cobb-Douglas technology using labor L_A and land T.

$$A = L_A^d T^{d-1} \tag{C1}$$

Assume that land is in fixed supply $\bar{T} = 1$ and that the price of agricultural goods $q_A = 1$.

The representative "farm" then solves the following maximization problem. Hence, the rent π_A is defined:

$$\pi_A = \underset{L_A}{Max} q_A L_A^d T^{d-1} - wL_A = \underset{LA}{Max} L_A^d - wL_A \tag{C2}$$

The first-order condition:

$$dL_A^{d-1} = w \tag{C3}$$

Solving for the demand for labor:

$$L_A = \left(\frac{d}{w}\right)^{\frac{1}{1-d}} \tag{C4}$$

Then production is $A = L_A^d$, or:

$$A = \left(\frac{d}{w}\right)^{\frac{d}{1-d}} \tag{C5}$$

So the rent is $\pi_A = A - wL_A$, or:

$$\begin{aligned} \pi_A &= \left(\frac{d}{w}\right)^{\frac{d}{1-d}} - w\left(\frac{d}{w}\right)^{\frac{1}{1-d}} \\ &= \left(d^{\frac{d}{1-d}} - d^{\frac{1}{1-d}}\right) w^{-\frac{d}{1-d}} \\ &= d^{\frac{1}{1-d}}\left(\frac{1-d}{d}\right) w^{-\frac{d}{1-d}} \\ &= d^{\frac{d}{1-d}}(1-d) w^{-\frac{d}{1-d}} \end{aligned} \tag{C6}$$

D Data appendix

The sample covers the following countries over the time period 1980-1994:

Austria, Australia, Burundi, Belgium Bahrain, Canada, Chile, Congo, Colombia, Cyprus, Denmark, ecuador, Egypt, El Salvador, Finland, France, Germany, Greece, Guatemala,

Guyana, Honduras, Indonesia, India, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Malaysia, Mali, Mexico, Netherlands, Nepal, New Zealand, Niger, Nigeria, Norway, Papua New Guinea, Paraguay, Peru, Philippines, Portugal, Senegal, Seychelles, Singapore, South Africa, Sri Lanca, Sweden, Swaziland, Switzerland, Syria, Tanzania, Thailand, Togo, Turkey, Uganda, United Kingdom, United States, Uruguay, Venezuela, Zaire, and Zambia.

The data on Banking Crisis are from Demirguec_Kunt and Detragiache (1998) of the IMF. The variable banking crisis takes the value one if (1) ratio of non-performing assets to total assets in banking system was larger than 10 percent, or (2) the cost of the rescue operation was at least 2 percent of GDP, or (3) there resulted large scale privatization, or (4) there were extensive bank runs or the government reacted on the crisis by deposit freezes, extended bank holidays, or generalized deposit guarantees. The length of a banking crisis may be in between one annual observation and 14 (US S&L crisis). There are a total of 31 distinct episodes of banking crisis in the sample of which 23 were in developing countries and 8 in developed countries.

Table D: Independent variables, definitions, and sources

Variable:	Definition	Source
SAVINGS	Savings rate	World Bank Development Indicators
GDPGROW	growth rate of GDP	World Bank Development Indicators
CREDGROW	growth rate of real domestic credit	World Bank Development Indicators
REALINT	DEPOSINT-INFLRATE	World Bank Development Indicators
DEPOSINT	deposit interest rate	World Bank Development Indicators
INFLRATE	consumer price index	World Bank Development Indicators
DIFREXCH	deviation of the dollar real exchange rate from its sample period average	World Bank Development Indicators
DEPINSUR	Dummy for formal deposit-insurance scheme	Talley and Mas (1990)
LAWORDER	Index of the quality of law enforcement	International Country Risk Guide