External Shocks, High Savings, and Financial Crises A Model with Application to the Asian Crisis*

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Abstract

High saving is a driving factor for the rapid growth in Asia in the past thirty years. Thus, without considering the impact of high saving, it seems hard to have an entire image of the Asian …nancial crisis and understanding why those economies were the victims of their own success. In this paper we develop a theoretical model to study the bipolar impacts of high saving: 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 such as falling world market prices of vital export goods. The labor market policy, the exchange rate policy, and the interest rate policy are also discussed in the paper.

1 Introduction

Before the Asian …nancial crisis, the East Asia economies: Korea, Hong Kong, Indonesia, Malaysia, Taiwan, and Thailand had been widely admired for their economic achievements: fast growth, low in‡ation, macroeconomic stability and strong …scal positions, high saving rates, open economies, and thriving export sectors. These economies did not have the problems such as large …scal de…cits, heavy public debt burdens, and rapid monetary expansion, which might lead to the crisis, as pointed out by, among the others, Bijan B. Aghevli (1999). This has left many people wondering why the Asian …nancial crisis happened and what has been caused the crisis?

The common views on the causality of the Asian crisis, so far, are focused on issues of the trade and the imbalance structure of foreign capital. The …nancial liberalization directly contributed to the buildup in foreign capital ‡ows, since much of the domestic credit expansion was …nanced by domestic banks and other …nancial institutions borrowing o¤shore. Over in‡ow of the short-term capital leads the economies more vulnerable to the …nancial shocks, since some long-term projects have to be …nanced by the short-term capital. The sudden withdrawal of such short-term capital due to whatever the reason can result in liquidity problem and therefore largely damage the real economy. Steven Radelet and Je¤rey Sachs (1998) notices that the ratio of the short-term debts to foreign banks (with maturity of one year or less) to available foreign exchange reserves were high in these Asian economies that were hit badly by the crisis. Giancarlo Corsetti, Paolo Pesenti, and Nouriel Roubini (1999) argues that increases in the current account de…cit, due to the slow down of the growth (as observed in Thailand in 1996), the overheating of economy, which lead to increase of interest rate (in Indonesia), or the marked drop of exports (in Malaysia) may lead to the …nancial crisis.

Some other studies, however, have been looked at the banking sector. They argue that fundamental problem is due to the banking sector. As pointed out by Mishkin (1999), Radelet and Sachs (1999) and

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Paul Krugman (1998), weak .nancial system, asymmetric information, and moral hazard problem in the banking sector lead to the over investments that further result in the .nancial crisis. The advantage of this viewpoint is that it can actually link the economic boom and the deep recession due to the .nancial crisis.

Furthermore, Zhang Gang (1999) attempts to identify more general structure (non-.nancial) problems in these economies, such as the lack of human capital and the mismanagement of industry policy by the governments. These industry policies could actually lead to the boom of economy. However, such growth may not be steady, since the booming economy could result in the labor shortage that further drive up the wage level. The comparative advantage may be deteriorated due to the increase of labor cost and the fail to transfer productions towards high value-added one. This could further lead to the sudden leave of the foreign investment. This could hurt the economy if it relies on the foreign investment. The key point in his paper is that the accumulation of human capital (capability of innovation) is much slower than that of the physical capital. The imbalance of two accumulations could lead to the painful adjustment process, the deep recession. Such a view has called the rethinking of the standard growth theory.

Nevertheless, we hardly agree that all potential factors, which could both lead economy to the booming and the crisis, have been listed. As a matter of fact, we recognize that the high rate of savings in East Asian economies has been ignored by the existing study[1]. Although many studies argue against the view that the East Asian economies were resource-driven growth, as concluded from Kim and Lau (1984), Krugman (1994), and Young (1985),[2] it can hardly deny that the high savings provided the primary resources for the growth in these economies. What is the interaction between the such high growth driven by the high savings and .nancial crisis? In this paper we provide a theoretic answer based on our empirically-motivated model. The key feature of this paper is that high saving has a bipolar impacts: it generates high growth, but at the same time, it leads economy to be more vulnerable to changes in the economic environment. This gives an alternative view why these economies were the victims of their own success. Moreover, it shows how a resource-driven economy could be suddenly fallen into the recession without losing its resource.

It might be surprising to link the saving and the .nancial crisis. However, the intuition is fairly easy: as the mechanism presented in Zhang's study, the high savings result the high investments and the high growth in terms of high wage and output. If the economy is not using its resources to upgrading the economy to produce more high value-added productions, it could be too cost to support the existing industry. Therefore, small changes in the economic environment can send the economy into the deep recession, especially when the labor market is not ‡exible enough. The changes in the economic environment discussed here are characterized in terms of economic shocks: reduce of the world price of exports and rise of the interest rate.

Our economy consist of three sectors, banking sector, downstream industry, and agricultural sector. The key assumption is that the economy is closed in terms of capital ‡ow across the border, but open in terms of tradable .nal outputs. Why do we rely on such model? This is due to the underlying structure problems that we would like to identify, such as eroding comparative advantage and in‡exible labor-market-structure, may di¤er from the problems associated with foreign capital in‡ow. Moreover, domestic .nancial resources are actually the dominating resource of growths. A closed model, which could be complement to the existing studies, would most likely capture such problems by isolating the issue of the foreign capital.[3]

The paper is organized as following. The stylized facts about the East Asia economies and the Asian .nancial crisis are listed in Section II. Our empirically-motivated model is developed in Section III. How a world market price shock could easily lead the economy with high saving to the .nancial crisis/ the deep recession is discussed in Section IV. Impacts of other external factors, such as increases in the interest rate and the .xed exchange rate regime, are also studied in this section. In the next section, we relax the assumption of the full employment. The study of short-run wage rigidity is carried out in this section. Finally, conclusive remarks are given in Section VI.

[1] Becsi, Wang, and Wynne (1999) looks at the multiplicity of equilibria due to dynamic interactions between saving decisions and bank's monopolistic competition. However, we recognize that there are many no-economic factors that govern the saving behavior in the East Asia. We will further discuss their paper in the later part of this paper.

[2] The details see the review in Singh and Trieu (1996).

[3] Mishkin (1999) points out "although capital ‡ows did contribute to the crisis, they are a symptom rather than an underlying cause of the crisis, suggesting exchange controls are unlikely to be a useful strategy to avoid future crises."

2 Stylized facts about the crises in Asia

to be written

Figure 1. "Stylized facts of Asian economies" is about here.

3 The basic model and major assumptions

We start with a quick overview of the basic structure before proceeding into details. The model is displayed in the Figure 2. We focus on an economy in which there are three sectors of interest. People in this economy works either in the downstream industry, Y, that combines banking services and labor inputs into the world market tradable .nal good, which can be used in consumption and investment, or in the agricultural sector where the world market tradable agricultural goods are produced with labor and sector-speci.c land. Savings out of labor income and agricultural rents are assumed to be ‡owed into the banking sector, X, that provides the di¤erentiated banking services to the industry sector. We assume that the .nancial ‡ows over borders is restricted, so that neither banking services nor savings can ‡ow over the border. This is to highlight domestic components of the Asian crisis.[4]

Figure 2. "The structure of the model" is about here

3.1 Productions of industry and agriculture goods

The industry goods is produced by the .rms in the industry sector. Where the industry .rms are perfectly competitive. We follow the literature and represent it by using a representative .rm[5]. Production of industry goods requires two distinct inputs: banking services, X, and labor, L_Y:

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

where a is the input share of X. According to the de.nition of the production function, we notice that $Y(\cdot)$ exhibits the constant returns to scale, CRS.

How much the .rm uses X and L_Y to produce Y can be determined by the maximization of the pro.t $\Pi = qY - PX - wL_Y$, where the .rms treat the world-market price for .nal goods, q, the wage level, w, and the price of X, P, are as given. The .rst order conditions show that

$$X = \frac{aqY}{P}, \tag{2}$$

and

$$L_Y = \frac{(1-a)\,qY}{w}. \tag{3}$$

From (2), (3), and (1), we know that w and P have to satisfy the following relationship, so-called the *output condition*, OC, to the exogenous q:

$$q = \frac{1}{\lambda} w^{1-a} P^a, \tag{4}$$

[4] Becsi et al., (1999) propose the roughly same structure of model. In their dynamic framework, the saving as well as the consumption are optimally determined by 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 .nancial system may cause the economy to shift between low and high-income equilibrium (multiple equilibria). In contrast to their dynamic general equilibrium model, we do not introduce the intertemporal consumption-saving decisions facing by the household here. In other words, we only have the one-period setting. The saving rate is taken as exogenous. This is due to we are interested in the issue that the economy with either high or low savings responses to the economic shock di¤erently. One-period setting would su¢ ciently serve our objective.

[5] See for example Uddén-Jondal (1993) and Oswald (1982).

where the constant λ denotes $(1-a)^{1-a}a^a$. Since we are interested in how w and Y would be a¤ected by q, we need to specify P in (4). The determination of P would rely on the balance in the banking sector. We leave it to the next section to discuss.

Here, we …rst specify the labor inputs in more detail. As we mentioned before, we assume that the full labor force L in the economy is employed either in agriculture or industry, namely, $L = L_A + L_Y$. We further assume both labor forces would receive the some wage w. This requires the same marginal productions in agriculture and in industry. The marginal production of industry goods is given by (3). In order to specify the marginal production in agriculture, we need to de…ne the production function for the agricultural goods: the production requires two distinct inputs: labor, L_A and sector-speci…c land T. The production function is represented by the Cobb-Douglas one:

$$A = L_A^d T^{1-d}, \tag{5}$$

where d is the share of labor input L_A. The agriculture goods are also tradeable in the world market at the price of 1, with the simplicity. Furthermore, the supply of land T is …xed and simpli…ed to 1. Hence, the marginal cost for the labor can expressed as:

$$w = d(L_A)^{d-1}. \tag{6}$$

By considering the fact of (3), we have our …rst condition which characterizes the equilibrium:

$$w = d(L - (1-a)\frac{qY}{w})^{d-1}. \tag{7}$$

This condition is de…ned as the labor market condition (LMC). It is upward-sloping curve in the wY-space (see Figure 3)[6] indicating that as industrial expansion draws labor from the agricultural sector, wage increases due to the increases in the ratio of land/ labor.

Figure 3. "The equilibrium and the deep recession" is about here

3.2 Banking sector

The total income subjecting to consumptions and investments is the labor income wL and the rent generated in the land in the agriculture, $L\theta w^{\frac{d}{1-d}}$. The consumers, including the labor force and the land-owners, would only use part of their income to consume and save the rest part of income into the banking sector. Note that even though the …nal industrial and agricultural goods are the only choice for the consumption, the decision on the demands on the goods would have no e¤ect on the productions. This is because, the supply of such goods are in…nite in terms of open trade.

How does the …rm then use banking services? Banks provide the industry …rms the capital with services such as banking, accounting, leasing, and risk analysis etc. The banks intermediate savings from labor and land-owners to the industry …rms. Because of costly intermediations, we rule out the self-…nancing for in the latter …rms. We do not explicitly model investment in the industry sector, even though the use of banking services can be thought of as investments. We assume that the banking services are di¤erentiated, namely the bank can supply slightly di¤erent services. Such services could increase the e¢ ciency of using the savings. To capture this property, banking services are treated as an aggregated input good X, de…ned as:

$$X = \left(\int_0^n x(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}, \tag{8}$$

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 banking services are symmetric but imperfect substitutes among themselves[7]. In turn, this gives rise to a

[6] Simulation values: $R = 0.5\%$, $a = 0.25$, $b = 0.75$, $s = 10\%$, $d = 0.5$, $L = 5$, $q = 2$, $\sigma = 7$, and $F = 0.5$.

[7] $\sigma > 1$ is assumed since the elasticity of substitution is one in the production function (1). Essentially, this means that …nal good producers …nd 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 in…nity, simply means that intermediate inputs are di¤erentiated goods.

property in (8), often referred to as "love of variety", originating from the works of Dixit-Stieglitz (1977) and Ethier (1982). To see this, note that symmetric use of inputs in (8) yields is $n^{\frac{\sigma}{\sigma-1}}x$, which is an increasing convex function in the number of banks n, suggesting that increased e¢ ciency is gained in industry ..rms when a larger range of varieties become available. Using (8), we may derive the minimum-cost for one unit of the banking service input bundle X, P, as:

$$\begin{aligned} P &\equiv \min_{\{x(\omega)\}} \left[\int_0^n x(\omega) p d\omega \mid X = 1 \right] \\ &\equiv \left(n p^{1-\sigma} \right)^{\frac{1}{1-\sigma}}, \end{aligned} \tag{9}$$

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 e¢ ciency in industrial production, as illustrated by the fact that P is decreasing in n. As indicated in (9), in order to specify P, we have to be clear with n and p. Furthermore, from (9), we know that the demand for the banking services of single variety is:

$$x = P^{\sigma-1} p^{-\sigma} a q Y. \tag{10}$$

Now we turn to the banking sector to investigate how the banks work. We assume that the monopolistic competition is the market form in the banking sector. We shall also assume one bank only produces one single variety at the ..xed cost F in terms of savings. This ..xed cost F could be interpreted as cost for the human capital, for instance. We further assume that F will be fully consumed.

The pro..ts of producing each variety can be written as:

$$\pi = px - (1+R)(x+F), \tag{11}$$

where R denote the return to investor. Assuming free entry and exit, and using the demand function (10), the zero-pro..t condition result in following conditions:

$$p = \frac{\sigma}{\sigma-1}(1+R), \tag{12}$$

$$px = (1+R)(x+F). \tag{13}$$

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

$$x = (\sigma - 1) F. \tag{14}$$

The number of banks, n, will depend on the total demand from the industry sector. We can solve it by ..rst equating (10) and (14) so that demand equals supply for an individual variety, and then use (12) and (9) to derive n^D:

$$n^D = \frac{aqY}{\sigma F (1+R)}. \tag{15}$$

The number of banks, n, will also depend on the supply of savings. We shall assume that labor and land-owners save a ..xed share out of their income, s. This savings rate shall play a crucial role in our analysis below. Keep in mind, we are interested in the e¤ects of di¤erent rate of savings on the economy. Hence, without loss generality, we simplify the model into the one-period setting. Hence, we do not specify the optimal savings/ consumption decision facing the household, and the savings rate is taken as exogenous.[8] As a result, we can write:

$$n^S : \begin{cases} n^S (F+x) = s\left(n^S (F+x) R + wL + L\theta w^{-\frac{d}{1-a}} \right) & \text{if } R \geq R^*, \\ n^S = 0 & \text{if } R < R^*, \end{cases} \tag{16}$$

[8] An endogenous savings rate will still depend on the time prefernces parameter, which you need to exogenously set higher for Asain people. Then you still neeed to know why Asian people behave in this way.

where $\theta = d^{\frac{d}{1-d}}(1-d)/L$. The LHS of the first expression in (16) shows the required savings as indicated by the capital requirement of having active banks. The RHS of (16) shows the supply of savings, which is proportional to income. This income consists of three terms: the return to investing in banking sector $n^S(F+x)R$, the labor income wL and the land rents $L\theta w^{\frac{d}{1-d}}$.[9] But, from the second expression in (16), we may also note that there is a minimum requirement on the return to investment $R^* \geq 0$, below which no investor would place money into banking sector. We could think of R^* as the opportunity cost. This could be some safe interest rate in government bonds or some other alternative to save into the upstream sector. For simplicity, we assume that R^* is the short-term money market rate, which is exogenously determined and a policy instrument used by the government.

For a given return to investment $R \geq R^*$, we can use (16) to calculate the number of banks consistent with given supply of savings, n^S:

$$n^S = \frac{swL\left(1+\theta w^{\frac{1}{d-1}}\right)}{\sigma F(1-sR)}, \tag{17}$$

where the fact of (14) has been used.

Then, the return to investment R, is defined as the return where n^D and n^S are equal. That is, it is the return to investment that clears the market for savings, Using (17) and (15) and writing out the gross return $1+R$, we have:

$$1+R = \frac{1+s}{s}\frac{aqY}{aqY + wL(1+\theta w^{\frac{1}{d-1}})}. \tag{18}$$

As indicated in (18), the gross return $1+R$ relies on, among the others, the balance between the saving supply from the labor and rent incomes, $wL(1+\theta w^{\frac{1}{d-1}})$, and the demand of banking services from the industry sector, aqY.

Using (18) and (15), the number of banks can be determined as function of industry output Y and the wage rate w:

$$n = \frac{s}{1+s}\frac{aqY + wL\left(1+\theta w^{\frac{1}{d-1}}\right)}{\sigma F}. \tag{19}$$

3.3 Equilibrium of the model

The model can now be solved by determining w and Y. To accomplish this, we need two equations in w and Y. Note that we have one such condition through the labor market equilibrium, LMC (7).

The second condition is the OC (4). Now we can specify the unit cost for X, P, in terms of w and Y by using the pricing rules p (12) and n in (19). As the result, the OC can be rewritten as:

$$\left(\lambda q w^{-b}\right)^{\frac{1}{a}} = aqY\left(aqY + wL\left(1+\theta w^{\frac{1}{d-1}}\right)\right)^{\frac{\sigma}{1-\sigma}} A\left(\frac{s}{1+s}\right)^{\frac{\sigma}{1-\sigma}}, \tag{20}$$

where $A = \frac{\sigma}{(\sigma-1)}(\sigma F)^{\frac{1}{1-\sigma}}$. The LHS of (20) simply shows the marginal revenue of an additional unit X, whereas the RHS of (20) shows the marginal cost. The OC-locus is negatively sloped in the Yw-space. This can be explained in the following way:

When industrial output Y increases, the demand for banking services rise, which enables more banks to enter (c.f equation (19)). In turn, this tends to lower the price of the composite banking service P (c.f. equation (9)). This is the variety effect. But as expanding industry production increases the return to savings R (c.f equation (18)). Therefore, an expanding industrial production Y also drives up the price of individual banking services p (c.f equation (12), which will tend to increase P (c.f. equation (9))). This is the price effect.

[9] Since the setting is the one-period framework, the saving stock is unimportant. As the matter of fact, when the saving stock is taken into account, there is new term, total saving sS, in the RHS. Since S is a constant, it only makes up the variables. Since we are interested in the comparative static studies, ignoring S would have no consequence for the study.

It can be shown that the strength of the vertical linkages between the industry and banking sectors are not extreme, so that the price e¤ect dominates the variety e¤ect. In this type of model, this will be the case if the share of banking services in the production of industrial goods a is not too large and the substitution elasticity between two varieties σ is not too small. Then, as the cost of an additional unit of the aggregate banking service input X, increases when Y increase, the wage level w has to be reduced to increase the …rms willingness to pay to preserve optimal usage of banking services X as represented by (20).[10] Hence the OC is negatively sloped in the Yw-space.

(20) and (7) determine w and Y. Due to the negatively sloped OC and the positively sloped LMC, the economy has a unique equilibrium which is indicated by the point E^* in …gure 3.[11] The combination of wages and industrial output in the equilibrium, however, must be consistent with a su¢ ciently high return $R \geq R^*$ that would insure investors to put money into the banking sector. Therefore, from (18), w and Y have to satisfy the return condition (RC):

$$\frac{1+s}{s}\frac{aqY}{aqY + wL\left(1+\theta w^{\frac{1}{d-1}}\right)} \geq 1 + R^*. \tag{21}$$

In Figure 3, the shadowed area represents combinations of wages w and industry output Y which yield returns of investments into banking sector less than the opportunity cost, $R < R^*$, and, subsequently, in this area labor and land owners will not invest money into banking sector. For a given level of output Y and, therefore, a given expenditure on banking services aqY, the demand for savings in the banking sector is too low to meet a supply of savings expanded through high wages, at a return above the opportunity cost. This means that no banks can be operated, which terminates industrial production as the price P turns to in…nity. The economy produces only agricultural good and wage is $w = d(L)^{d-1}$. Finally, note that the RC is positively sloped in …gure 3. To keep the return to saving at $R = R^*$ when Y increases, the wage w has to increase to keep the demand for savings equal to the supply of savings.

To conclude: to have industrial production active, the equilibrium E^* in …gure 3 must be located outside the shadowed area. We are now ready to perform some experiment which we could shed some lights on understanding of the recent Asian …nancial crisis.

4 High savings and …nancial crisis

4.1 Vulnerability of resource-driven growth to the deep recession

As we also noted in section II, the Asia economies have high rate of savings. What is the impact then of a high s in our model? First, note that the LMC (7) is una¤ected by an increased savings rate. Turning to the OC, calculations shows that this curve would be shifted to the right, as it is indicated in …gure 4.[12] The intuition is that when savings increase, more banks are able to enter. This in turn lowers the unit cost of the banking services composite. Therefore, for a given Y, the wage is allowed to increase in order to restore the equilibrium for banking services.

Hence, when labor and land-owners save more out of their income, both industrial output Y and wages w must increase. Assume that the industrial …rms merely increase the quantity of current productions rather than up-grading them in terms of increasing quality. In our model, up-grading the economy means di¤erent type of Y will be produced. So an economy that fails to be up-graded illustrates what Krugman (1994) has termed the resource-driven growth.

Figure 4. “The vulnerability of resource-driven growth to the deep recession” is about here.

[10] There is also a third e¤ect from wages: if wages fall, aggregate savings tend to decrease which weakens the …rst e¤ect, but ampli…es the second e¤ect.

[11] Note, however, that the OC is convex in Y. This is because the agglomeration forces become stronger at higher industrial production. If we allow for stronger vertical linkages the OC could get a U-shape indicating the possibility of multiple equilibria, as it will be shown in the section V. Our results in the paper would carry over the such a setting, although we would have to abandon analytical solutions.

[12] Saving rate has been increased to 27% for the simulations.

There is, however, a risk associated with a high rate of savings. Note that ..gure 4 also reveals that a high rate of savings enlarges shadowed area (by comparing ..gure 3 and ..gure 4), the equilibrium E' is much closer to the shadowed area than E^* in ..gure 3. This is due to the shifts down of the RC. A higher rate of savings increases the supply of savings and, therefore in order to equalize supply and demand of savings, the wage must be decreased to restore $R = R^*$. We can summarize:

P rop osition 1 A high rate of savings will increase industrial output and wages, but it may also increase the risk for a deep recession.

4.2 External shock and ..nancial crises

As have been shown, the higher rate of savings could lead to higher both wage and output. At the same time, the economy would be more closed to the deep recession. In other words, the economy would be more vulnerable to changes in economic environment. In order to show this, we investigate a decline of the world market price of industrial goods. Some observations could be use to motivate this exercise: First of all, the real appreciation of Asian currencies. Fixed exchange rate regime has been adopted in East Asian economies and the currencies have been pigged to US dollar. The appreciation of the US dollar implies an increase in the real price level in these economies. Equally, this could be described by lower the world price level. Second, the major industry countries experienced very low in‡ation rate. This could also be interpreted as no big increases in the world price. At the same time, the world market price for some products, such as semiconductor (for which South Korean has specialized in), dropped a lot. Last, new competitors emerge on the market for these economies' exports. As an example, China took up production of many of the typical export goods in the other Asian economies.[13]

In our model, all these observations can be translated into q shock, that is, a decreasing of q. Assume that domestic ..rm takes the price q as given. Then what are the e¤ects of a negative q shock? The result[14] is shown in ..gure 5.

Figure 5. "The consequence of the q shock under the full employment assumption" is about here

If we use E, the equilibrium prior the q shock, in ..gure 5 as our point of departure, we will notice that both industrial output Y and wage w are decreased in responding to a lower price per-unit of industry goods. The economy moves from E to E'.[15] In order to ..nd out the underlying story, we have to be clear about the movements of three conditions. The RC-locus shifts to the right when the price in the world market q decreases. At a given wage w and therefore at a given supply of savings, a negative price shock reduces the demand for savings. To keep supply equal to demand at the alternative return R^*, industrial output Y must increase. The LMC-locus also shifts to the right. At a given wage w, output Y must increase to keep downstream employment constant when q decreases.[16] Finally, the OC-locus shifts to the left when q is reduced. Lower prices for industry goods must reduce the value of using an additional aggregate input good X, that is, the price P must be lowered. As a result, the industrial output Y has to be deceased.

In summary, OC-locus moves to the left and LMC-locus to the right. We can shown (in Appendix E) both output Y and wage w would be reduced. Note also that since the RC-locus shifts outwards, the area with insu¢ cient return to investment in banks expands. In fact, if q reduces further, the equilibrium E' could fall into the shadowed area, where the economy falls into deep recession as labor and land-owners terminates savings into banks, which in turn results in a collapsing industry production.

We then have the concluding proposition:

[13] Some studies evidently argue against that Chinese competition is the primary cause of the Asian crisis (Fernald, Pesenti, and Loungani, 1999, and Liu, Noland, Robinson, and Wang, 1998). However, in our viewpoint, China is still the main competitor to the East Asian economies. First of all, it can not be denied that China has a similar trade structure, but very low labor cost. Second, Chinese currency has been devaluated a lot. No matter that the process might started before 1994 o¢ cial devaluation, it would take time to reallocate the capabilities to the production to gain the share of export. Therefore it is hard to accept no e¤ect of devaluation of Chinese currency. Third, more than half of the Chinese export is due to foreign direct investments that are from Hong Kong, Taiwan, Singapore, South Korean, and Thailand. Even though, the share of export from these economies has not be reduced, but substantial part is actually produced in China.

[14] q reduces to 1.75 in our simulations as demonstrated in Figure 5.

[15] The calculation shows that output must decrease whereas the outcome of wages are harder to determine.

[16] Alternatively, for a given output Y, a reduction in q reduces production and, hence, the demand for labor in the industry sector. Labor ‡ows to agriculture which leads to a fall in the marginal production. Thus, the wage must fall.

Proposition 2 The high rate of savings in the Asian countries may explain why the recession, following smaller external shocks, becames so deep.

So far, we have discussed the relation between the crisis and the saving behaves. Although, the saving behaves in Asian economies could give a reasonable explanation of heavily fluctuating growth, the causality of the Asian financial crisis is hardly to be due to a signal factor. We here discuss some other factors, which relevant to the issue of the economic policy: higher interest rate policy, exchange rate regime, and labor market structure.

4.3 High interest rate

As it has been shown in section II, many Asia countries tried to cool off their booming economies with increasing their interest rates. What is the effect of this policy in our model? We can model this effect by studying the impact of the opportunity cost R^*. When government policy or other factors increase R^*, the equilibrium E is not affected since R^* does not affect the LMC (7) or the OC (20). As long as the savings keep flow into banking sector, namely return is kept sufficiently high, $R > R^*$, industry output and wages are unaffected.

However, increasing R^* enlarges the shadowed area at which banking sector is left without savings and industrial output shrinks to zero. The intuition is the same as before: for a given level of expenditure on banking services aqY, the demand for savings in the banks is too low to meet a supply of savings expanded through high wages at the higher opportunity cost. Therefore, for a given Y, the wage w has to decrease to restore $R = R^*$ at the RC-locus. Hence, a higher opportunity cost enables the shadowed area to expand and to move closer to the equilibrium E and the dark cloud of recessions is more present. In our case here, the new equilibrium E' in figure 6[17] is pulled into the shadowed area. Because of these agglomeration economies (sending P to the infinite), in equilibrium industrial output will be zero as banking sector is absent. This scenario is extreme, but it illustrates what we think may have been structural problems in the East Asia economies and how external shocks, while amplified through the financial system, could have very large effects.

Figure 6. "High interest rate and q shock could send the economy into deep recession" is about here

We can summarize that

Proposition 3 A high interest policy may increase the risk of the deep recession.

Proof. See appendix E. ■

We have now argued that two features in the Asian countries - high interest rates and extremely high savings rates - may work towards making these economies vulnerable.

4.4 Fixed exchange rate regime

The fixed exchange rate regime has been adopted by the region before the crisis. Some economies have been forced to let their currencies to freely float during the crisis. The determination of exchange rate is a very complicated issue and hardly to be studied in our framework. Nevertheless, we still could have some discussions on this issue.

Basically, the fixed exchange rate regime provides a fixed linkage between the world market price and domestic one. In other words, the domestic firms have to produce at the world market price q. When q drops, firms have to cut both output and wage as shown in the previous sections. On the other hand, under the free floating regime, if the determination of exchange rate, e, is more or less according to the trade consideration, e could move in the opposite direction of changing of q. As a result, domestic price, $\widetilde{q}$, which the domestic firms are facing, could have a smaller change or no change at all in responding to the q shock. This is because

$$\widetilde{q} = e \cdot q. \tag{22}$$

[17] The interest rate increases to 5% in the simulation that produces the Figure 6.

If this is a true, the movements of all curves in figure 5 would be small. In other words, the economy would be less effected by the q shock.

Furthermore, if the fixed exchange rate is not fully credible, i.e., when the currency is under the attack by whatever a reason, the monetary authority might have to increase the interest rate to a very high level in order to defense the currency. As we have just been discussed in previous sector (proposition 3), this would be another driven force leading economies to the crisis.

Since the determination of exchange rate is a complicated issue, we hardly conclude which regime is more desirable for the economy. However, one thing seems clear: the fixed exchange rate regime might lead the Asian economies more vulnerable to the q shock.[18]

5 Unemployment and financial crisis

So far, the economy remains full employment with adjustments taking place in the agricultural sector, when the changes in economic environment occur. In response to a shock, the wage goes down and so does the total savings and industry output. However, in the reality, the agricultural sector could not absorb the unemployment arising in the industry. The real recession is normally associated with large occurrence of the unemployment. Here, we shall investigate how our economy would respond the shocks if we allow the occurrence of unemployment.

For a given wage w, from (7), we know that the employment in the agriculture is

$$L_A = (\frac{d}{w})^{\frac{1}{1-d}}.$$

So the total employment can be calculated by simply adding industry employment:

$$L_Y + L_A = (1-a)\frac{qY}{w} + (\frac{d}{w})^{\frac{1}{1-d}}. \tag{23}$$

Then it might be the case that when the economic environment changes, total employment $L_A + L_Y$ might be smaller L:

$$(1-a)\frac{qY}{w} + (\frac{d}{w})^{\frac{1}{1-d}} < L. \tag{24}$$

We define this as the *Labor Force Constraint* (LFC). Figure 7 describes the situation of an economy that allows unemployment after the q shock occurred. The LFC-locus divides the figure into two parts. The left-hand area is the possible production area. While the combination of w and Y that locates in the right-hand area would violate the LFC. Note also that the LFC-locus is up-sloping in wY-space, indicating that a higher w is required to increase output, since additional labor must be pulled out of the agriculture sector.

Figure 7. "The wage rigidity and the multiple equilibria" is about here

If some people cannot find work neither in agriculture nor in industry, these unemployed people would not have any income. Then the total income subjected to saving becomes

$$\begin{aligned} & w(L_Y + L_A) + d^{\frac{d}{1-d}}(1-d)w^{-\frac{d}{1-d}} \\ = \; & (1-a)qY + d^{\frac{d}{1-d}} w^{-\frac{d}{1-d}}, \end{aligned} \tag{25}$$

where the first term in the first line of (25) is the labor income and the second term is the rent generated in the agriculture sector. Note that the total income, $w(L_Y + L_A)$, now is not only the function of w but also the function of Y. Therefore, the total labor income, so the supply of savings would be more sensitive to the industrial output Y, by comparison of that with full employment, wL.

[18] More discussion about exchange rate regime can be found in Mishkin (1999).

We can restate the RC as

$$\frac{1+s}{s}\frac{aqY}{aqY+(1-a)qY+d^{\frac{d}{1-d}}w^{-\frac{d}{1-d}}}=1+R\geq 1+R^{*}, \tag{26}$$

which we de..ne as the short-run return condition (SRRC). Note that, the $SRRC$ has fundamentally changed. First of all, $SRRC$ becomes negative sloped. This indicates, for instance on the $SRRC$-locus, in order to produce the same return R^{*}, increased Y has to be compensated by the low of w. Note that the labor income becomes more sensitive to the industrial output Y here. Increases in Y, therefore, increase not only the demand of savings, aqY, but also the supply of savings via the labor income generated by the industry, $(1-a)qY$. As a result, w has to be decreased in order to maintain the same return R^{*}. Secondly, unlike the RC under the full employment assumption, the supply of saving would be signi..cantly reduced by increases in unemployment at a given wage. The reduction of supply would drive up the return R, as indicated in (26). Thus, taking the equilibrium prior the q shock E as our departure point, RC-locus would jump to far left and becomes $SRRC$-locus. Therefore, as shown in the Figure 7, the shadowed area is much smaller by comparing that under the full employment assumption in Figure 5.

For the same reason, the short-run output condition (SROC) can be rewritten as

$$\left(\lambda qw^{-b}\right)^{\frac{1}{a}}=aqY\left(aqY+(1-a)qY+d^{\frac{d}{1-d}}w^{-\frac{d}{1-d}}\right)^{\frac{\sigma}{1-\sigma}}A\left(\frac{s}{1+s}\right)^{\frac{\sigma}{1-\sigma}}. \tag{27}$$

In the Yw-space, SROC -locus has been shifted downwards and su¢ ciently leftward, as indicated in Figure 7. Importantly, the structure of $SROC$ is very di¤erent from that of OC : it still negatively sloped in the far left, but becomes considerably ‡at and positively sloped in the rest of area. In other words, the $SROC$-locus have the U-shape. The intuition seems to be as the following: If we compare P shown in (20) under both full- and un-employment, we may note that the total supply of savings $swL(1+\theta w^{\frac{1}{d-1}})$ has been replaced by a smaller value $s[(1-a)qY+d^{\frac{d}{1-d}}w^{-\frac{d}{1-d}}]$, which is the function of output Y. On the one hand, the variety e¤ect due to increases in Y on P tends to be stronger in (27). When Y is larger enough, the variety e¤ect could over come the price e¤ect. As a result, increases in Y would lead to decreases of an additional unit of the aggregate banking service input X, P. Furthermore, it can be shown that increases in w always increase P. Hence, w have to be decreased (via equation (4)). On the other hand, when Y is small, the $price$ e¤ect still dominates $variety$ e¤ect as what we have shown under the full employment assumption. Therefore, w would have to reduced associated with the increases in Y.

By allowing the unemployment, we now have to abandon the assumption that the wage can be freely adjusted. Instead, we assume the wage is downwards rigid in the short-run when the economic environment changes. More speci..cally, the wage will remain at the level in the equilibrium prior to the q shock. As a result, LMC reduces the short-run labor market condition (SRLMC),

$$w=\overline{w}, \tag{28}$$

where $\overline{w}$ is a constant. Note that, in our Yw-space, $SRLMC$-locus, therefore, is a horizontal line.

The new equilibrium is characterized by (27), (26), and (28). First of all, as indicated in our simulation result, the economy with the wage rigidity would be more easily get into the recession.[19] So we conclude:

Proposition 4 An in‡exible labor market may increase the risk of the deep recession.

This result implies that although reductions of Y and w are not avoidable, the economy could still be outside of the deep recession area if w could be freely adjusted, as the equilibrium E' shown in the ..gure 5. The economy with the wage rigidity is more likely to be in the deep recession under the same q shock, as the equilibrium E^{w} shown in the ..gure 7. This result can be used to explain why Asian economies su¤ered di¤erently. Korea, a country with very strong workers' union, was badly hurt by the crisis than Taiwan and Hong Kong, which have more ‡exible structure of labor market.

[19] It can be shown if saving rate is low, the economy could stay outside of shadowed area. (This simulation result is not shown here.)

Singapore, which was hurt less than her neighborhoods, on the other hand, has very strong government's intervention on the labor market. The government ordered to low the wage level during the crisis. This can be re‡ected by downward shifting of the $SRLMC$-locus. Lower wage means regain of the comparative advantage by lower the labor costs. The best situation is that $SRLMC$-locus could shift down to position of $SRLMC'$, where the $SRLMC'$-locus crosses the intersection of LFC-locus and $SROC$-locus as the equilibrium E^g shown in Figure 7. As a result, the economy could not only stay out of the deep recession, but also could avoid the large reduction of output Y and maintain the full employment. Note that the reduction of Y is not avoidable, since decreases of wage in responding to the q shock would lead to increase of employment in agriculture sector.[20]

Notice that the equilibrium E^g is consistent to the equilibrium $E^{'}$ in ..gure 5. However, this does not suggest this kind of un-market adjustments are desirable. Simply because, this kind of adjustment is very hard to be carried out and associated with a risk. If the wage adjustment process is beyond the control, the economy could be in the bad state. As noticed, the wage in our model is real one. Therefore, many factors could actually lead to the reduction of the wage. If such reductions are just the consequences of economic chaos, the equilibrium would more likely end up in the deep recession. The U-shape of the $SROC$-locus makes such situation possible. As indicated in Figure 7, the economy is characterized by the multi-equilibrium where one equilibrium, E^b, could be in the shadowed area. This result may help us to understand what happened in Indonesia.

6 Conclusions

In this paper, we identify the high saving as the factor that is able to pose two opposite contributions to an economy leading to both rapid growth and vulnerability to the deep recession. The high saving could sever to explain why rapid growth is vulnerable to the crisis. The mechanism is that the booming economy leads to labor shortage and increase of the labor-cost. This would decrease the return of the investment. A small change on the world price then would have a large e¤ect both on the real and banking sectors. The economy with a ‡exible labor market, which allows reduction of the wage when the q shock occurs, can badly be hurt, but might stay out of the deep recession. Free ‡oating exchange rate regime could also absorb the e¤ect of the q shock.

An important issue, which we could not discuss here, is that the economy has to be upgraded in terms of moving to produce the high value-added productions by the innovations. The human capital, thus, plays a very important role in this process. By doing this, the economy could maintain its competitive advantage. In terms of our model, an upgraded economy means the ..nal good would not meet any competitions. Namely, there would be no q shock. During the ..rst and second oil shocks, the Japanese economy provided a good example.

The human capital issue here poses an important research topic in the growth theory. That is due to the di¤erent speed for the accumulation of the human capital and physical capital. The rapid growth due to the fast expansion of physical capital could lead the economy to the position of dis-equilibrium, which has not been well studied. This imbalance of the development could lead the economy vulnerable to changes in economic environment.

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[20] We could give another reason why Singapore could avoid the deep recession, since there is no agriculture sector. The agriculture sector serves to determine the wage level in our model. If the wage can be determined exogenously, for instance, by the government, the horizontal wage equation and FSC or $SRFSC$ could determine the equilibrium.

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Appendix

A Equation (9)

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 banking 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,

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

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 (9) in the text,

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

B Equation (10)

Equation (A11) shows the demand for a single variety x when ..rms use one unit of the aggregate input good $X = 1$. Then how much X is then actually used by the ..rms? The answer can be obtained by combination of (2) and (A11):

$$\begin{aligned} x &= P^{\sigma}p^{-\sigma}\frac{aqY}{P} \\ &= P^{\sigma-1}p^{-\sigma}aqY \end{aligned} \tag{B1}$$

C Derivation of agricultural rent

We just solve for the maximization for perfectly competitive ..rm with a decreasing returns technology (DRS since land is ..xed). The simpli..cations 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 ..xed 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 de..ned:

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

The ..rst-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:

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

Here we have used the fact of $1 - \frac{1}{1-d} = -\frac{d}{1-d}$.

D Figure 3

To derive the slopes discussed in ..gure 3, we will ..rst take logs of (21), (7) and (20) and then di¤erentiate in 1 and Y to derive the elasticities $El_Y w = \frac{dw}{dY}\frac{Y}{w}$. Let us start with the return condition (RC) or equation (21). Log di¤erentiating , we get:

$$[El_Y w]_{RC} = \frac{aqY + wL(1 + \theta w^{\frac{1}{d-1}})}{1 - \frac{d}{1-d}\theta w^{\frac{1}{d-1}}} > 0 \tag{D1}$$

where $1 - \frac{d}{1-d}\theta w^{\frac{1}{d-1}} > 0$ will be assumed. This condition can be written $wL > d^{\frac{2-d}{1-d}} w^{\frac{d}{d-1}}$, and should be ful..lled as long as the labor force L is su¢ ciently large and the cost-share of labor in agriculture d is not extremely large.

For the labor market condition, LMC, we have:

$$[El_Y w]_{LMC} = \frac{(1-d)(1-a)}{\frac{wL}{qY} - d(1-a)} > 0 \tag{D2}$$

where $wL/qY - d(1-a)$ is positive, since $wL/qY = (1-a)$ and $d < 1$.

Finally, computing the elasticity for the output condition, OC, we have

$$[El_Y w]_{OC} = -\frac{\Phi}{\Lambda} < 0 \tag{D3}$$

where

$$\begin{aligned} \Phi &= 1 - \frac{\sigma}{\sigma - 1}\frac{wL}{aqY + wL(1 + \theta w^{\frac{1}{d-1}})}(1 - \frac{d}{1-d}\theta w^{\frac{1}{d-1}}) > 0 \\ \Lambda &= 1 - \frac{\sigma}{\sigma - 1}\frac{aqY}{aqY + wL(1 + \theta w^{\frac{1}{d-1}})} > 0 \end{aligned} \tag{D4}$$

The positive signs are due to $\sigma/(\sigma - 1) \in (0, 1)$, $wL \in (0, 1)$, $aqY/[aqY + wL(1 + \theta w^{\frac{1}{d-1}})] \in (0, 1)$, and $(1 - \frac{d}{1-d}\theta w^{\frac{1}{d-1}}) \in (0, 1)$.

E Comparative statics study

What are the e¤ects of increases in s, q, and R^*? We start from RC :

$$\begin{aligned} [El_s Y]_{RC} &= \frac{aqY + wL(1 + \theta w^{\frac{1}{d-1}})}{1 + s} > 0 \\ [El_q Y]_{RC} &= -1 < 0 \\ [El_{R^*} Y]_{RC} &= \frac{R^*}{1 + R^*}\frac{aqY + wL(1 + \theta w^{\frac{1}{d-1}})}{wL(1 + \theta w^{\frac{1}{d-1}})} > 0 \end{aligned} \tag{E1}$$

The LMC :

$$\begin{aligned} [El_s Y]_{LMC} &= 0 \\ [El_q Y]_{LMC} &= -1 < 0 \\ [El_{R^*} Y]_{LMC} &= 0 \end{aligned} \tag{E2}$$

The OC

$$\begin{aligned} [El_s Y]_{OC} &= \frac{\frac{\sigma}{\sigma-1}\frac{1}{1+s}\left(aqY + wL(1+\theta w^{\frac{1}{d-1}})\right)}{wL(1+\theta w^{\frac{1}{d-1}}) - \frac{1}{\sigma-1}aqY} > 0 \\ [El_q Y]_{OC} &= \frac{\frac{1-a}{a}\left(aqY + wL(1+\theta w^{\frac{1}{d-1}})\right) + \frac{\sigma}{\sigma-1}aqY}{wL(1+\theta w^{\frac{1}{d-1}}) - \frac{1}{\sigma-1}aqY} > 0 \\ [El_{R^*} Y]_{OC} &= 0 \end{aligned} \tag{E3}$$

Here we require σ is not that small. Furthermore, if a is not too close to 1 we can shown that

$$\frac{\frac{1}{a}}{1 - \frac{\sigma}{\sigma-1}\frac{aqY}{aqY + wL(1+\theta w^{\frac{1}{d-1}})}} - 1 < 1$$

Therefore, output Y in the equilibrium would be decreased as q shock occurs.

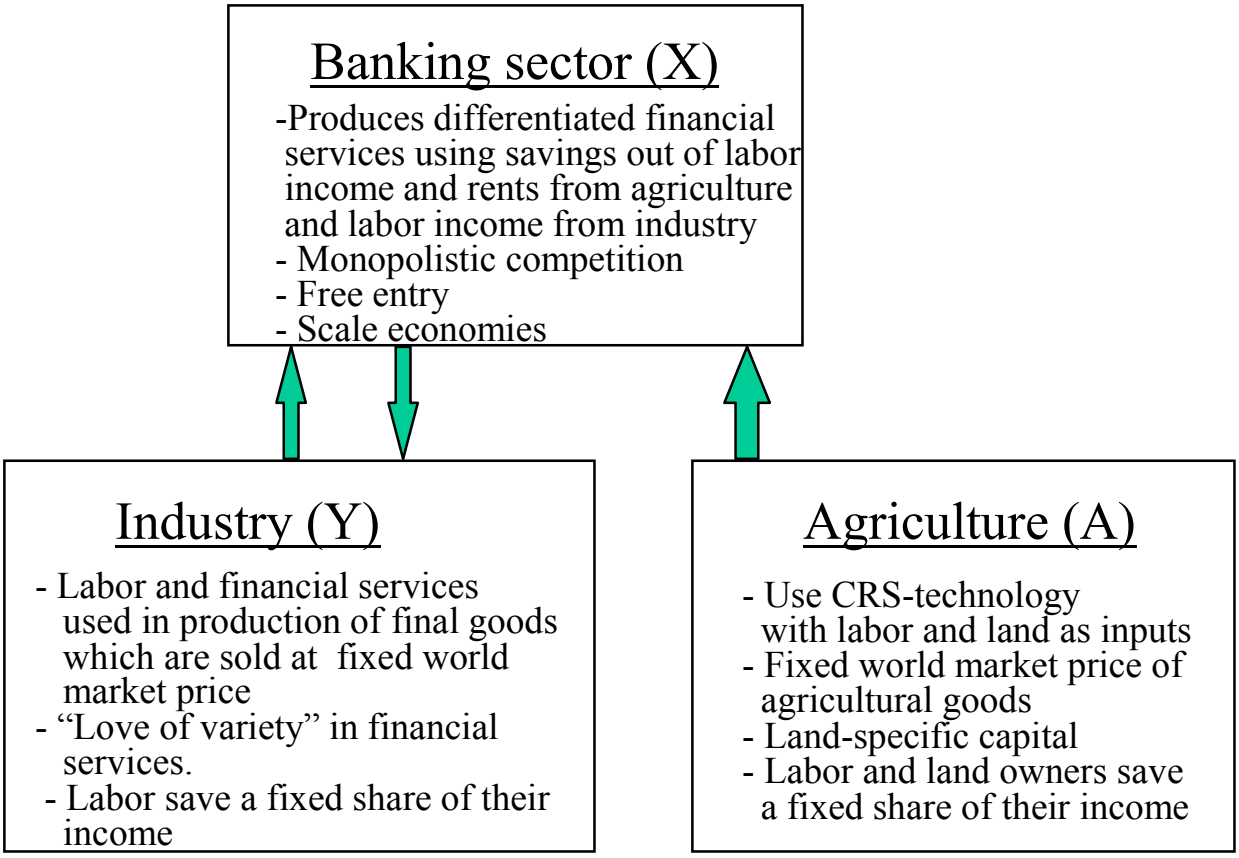

Figure 2
The structure of the model

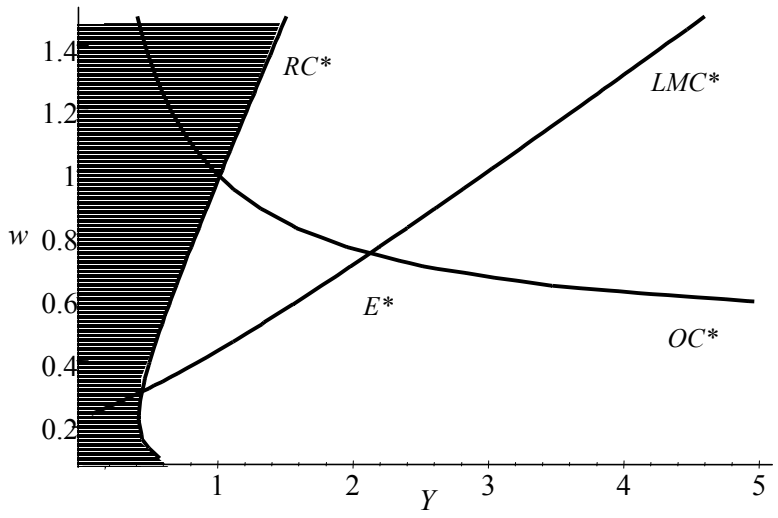

Figure 3
The equilibrium and the deep recession

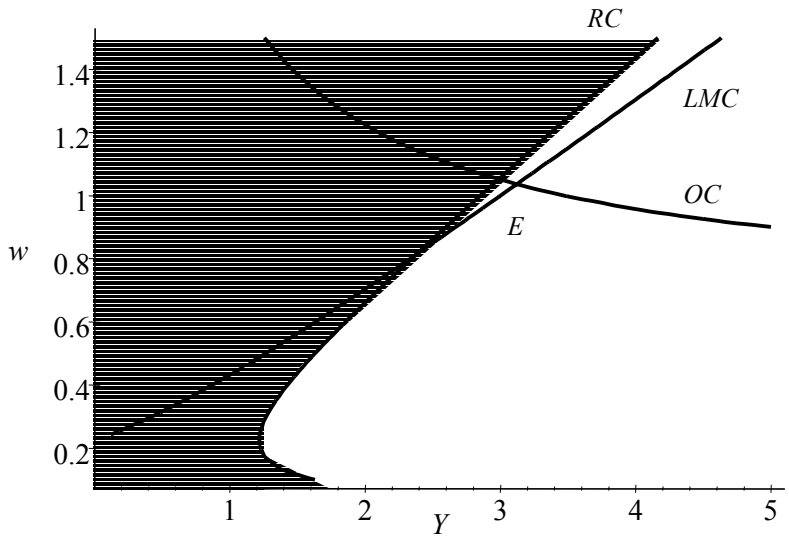

Figure 4
The vulnerability of resource-driven growth to the deep recession

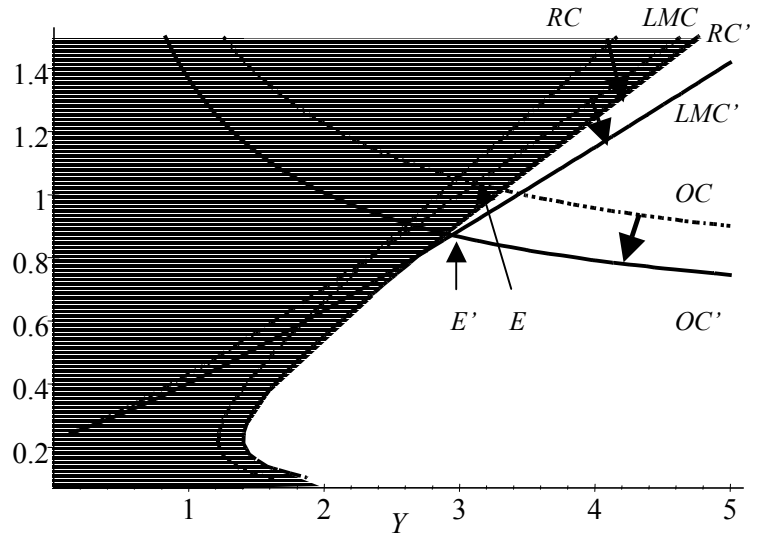

Figure 5
The consequence of the *q* shock under the full employment assumption

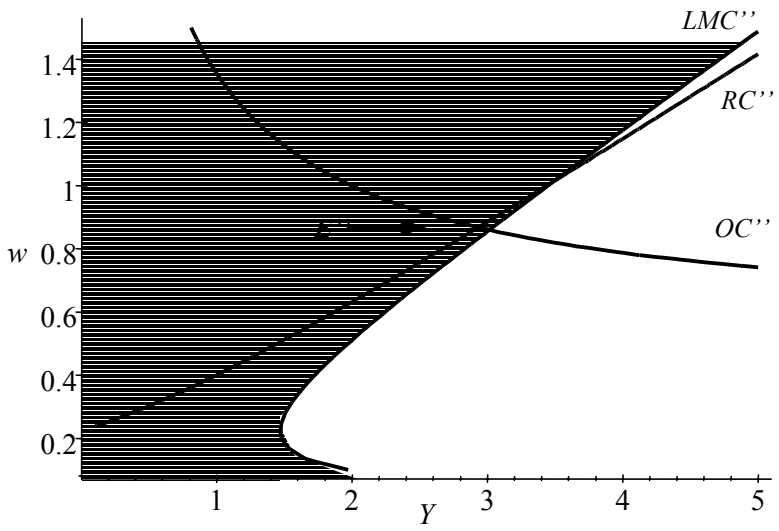

Figure 6
High interest rate and q shock could send the economy into deep recession

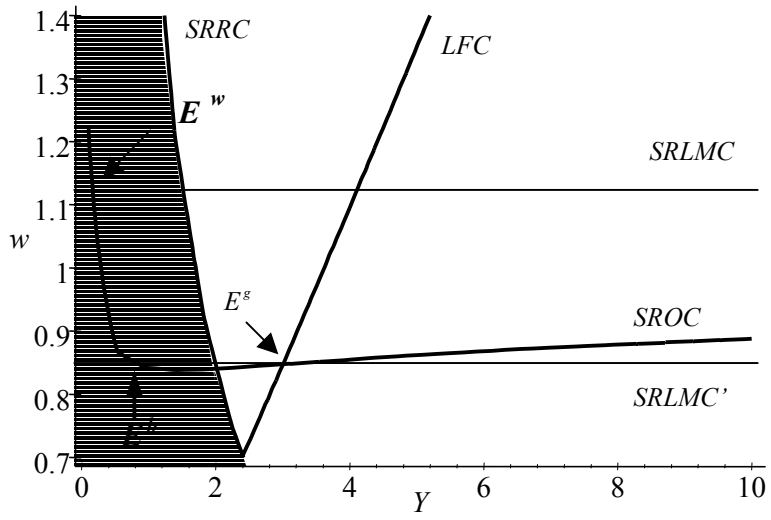

Figure 7
The wage rigidity and the multiple equilibria