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Credit distortion and financial crisis

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Abstract

A simple and consistent theory based on credit distortion is developed to understand the origin of financial crises in the emerging markets. We prove that without the guarantee of various government agencies on the credit risk of foreign loans, the interest rate on foreign loans would be the same as the domestic loans, which would eliminate the incentive to borrow foreign loans on a great scale. We demonstrate that the common phenomena prelude the crisis, such as heavy foreign borrowing and overinvestment in real estate, are rational choices when a particular currency is overvalued and cheap credit is available.

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1. Introduction

There is a large amount of literature on financial crisis. But there does not seem to exist a simple and coherent theory to provide a practical understanding and prediction of financial crises. For example, before the Asian crisis, many had maintained that Asia would not repeat the debt crisis of the Latin American type because of the high domestic saving rates in most Asian countries. When the Thai government depreciated the baht 20% on July 2, 1997, after 10 years of increasing current account deficit and total depletion of its currency reserve, it was hailed as the beginning of the recovery, and Thailand stock market rebounded 25% in the next 3 days. This showed that little was understood about the nature of the problem at that time.

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Even long after the crisis, there exists serious logical inconsistency in explaining the causes of the crisis. Many blame cronyism, not enough openness, and poor regulation as the culprits of the crisis. At the same time, many argue that China has escaped the financial crisis because its financial system is insulated from the outside world; that is, China's system is less open than that of other countries. Besides, most would agree that cronyism in China is much worse than in other countries that were badly hurt by the crisis. Yet, few have questioned the logical inconsistency of the explanations.

In the process of understanding the Asian and financial crises in other emerging markets, we need to solve the following puzzles. First, why did so many international banks, which were sophisticated in risk control and credit evaluation, lent aggressively to those undercapitalized regional banks with little transparency on their balance sheet? Second, why had Asian countries accumulated so much foreign debt when the domestic saving rates were very high? Third, why did real estate booms continue after the economy slowed down substantially and vacancy rate built up? Fourth, why were most loans short term while the financed projects, such as real estate projects, were long term? Fifth, why did the real exchange rates of these weak currencies appreciate steadily before the depreciation?

Extensive literature has emerged since the Asian crisis. See [Corsetti, Pesenti, and Roubini \(1999\)](#) for a detailed account of the various problems that led to the Asian crisis and for extensive references. When analyzing the causes of the Asian crisis, we need to ask ourselves a simple question, “Did all the problems exist several years ago, when the whole region was experiencing a spectacular boom?” A problem confounding this discussion is the lack of an analytical framework in which we can derive the logical relations between different phenomena. Using a consistent and quantitative approach, we demonstrate that the common phenomena precluding the crisis, such as heavy foreign borrowing and overinvestment in real estate, are rational choices when a particular currency is overvalued and cheap credit is available. We show that under the current global financial systems, which systematically bail out big international lenders, any small overvaluation of a particular currency, coupled with the rigid policies on wages and asset prices, will gradually widen the interest rate differential between domestic and foreign loans. The widened interest rate differential will translate into heavy foreign borrowing, regardless of how high the domestic saving rates are. Without the reform from this fundamental base, any financial liberalization in a particular country will magnify this weakness and trigger another financial crisis, as we have already seen in Latin America, Asia, and emerging Europe.

The rest of the paper is organized as follows. Section 2 presents the main results. Section 3 analyzes how the dynamics of institutions will keep the overvaluation of assets for a long time before the eventual depreciation. Section 4 concludes.

2. Main results

Currencies in many developing countries were, more or less, pegged to the U.S. dollar, explicitly or implicitly. During the pegging period, a currency may become under- or overvalued because of a change in economic condition, either in the United States, the

pegging country, or a major trading partner, such as Japan. When a pegging currency is undervalued, the natural inflation pressure of wages and asset prices will restore the equilibrium soon. However, if a currency is overvalued, it is politically difficult to adjust wages and asset prices downward. Hence, currency overvaluation usually lasts longer and has a more profound influence on a country's economic and financial structure.

For simplicity, we assume there are only two currencies, a domestic currency and a foreign currency. When the domestic currency is overvalued, suppose the probability of the domestic currency depreciation in 1 year is p and the expected amount of depreciation is d . In a risk-neutral world, the relation between domestic risk-free interest rate, r_D , and foreign risk-free interest rate, r_F , is determined by

$$1 + r_F = (1 + r_D)(1 - p) + (1 + r_D)(1 - d)p = (1 + r_D)(1 - d)p \quad (1)$$

Hence, the domestic interest is higher than the foreign interest rate. See Fig. 1 for the interest rate differential between the Thai baht and the U.S. dollar when Thai baht was pegged to U.S. dollar.

In a free and open economy, the default risk of a foreign loan caused by possible currency depreciation and the resulting financial distress will raise the interest premium of the foreign loans. Specifically, we have the following.

Proposition 1. *Suppose that a loan is collateralized by an asset that is of equal value at the time of lending and that the asset's value in domestic currency grows at risk-free domestic interest rate. The lender is risk neutral. Then, the foreign loan rate is equal to the risk-free domestic interest rate.*

See Appendix A for the Proof of Proposition 1.

Because most lenders are risk averse and because asset value usually drops sharply during financial distress (Bernanke & Gertler, 1989), triggered by the currency depreciation, the effective foreign lending rate will be higher than the domestic interest rate. Hence, there is no incentive to borrow dollar-denominated loans, and this kind of foreign-debt-induced crisis will not occur in a free and open economy. In practice, most foreign loans are channeled through domestic banks. But loans are ultimately backed by assets and, thus, the above proposition applies.

However, from past experiences, such as the IMF-led bail out in the Mexico crisis in 1994, foreign lenders are confident that the local governments in these developing countries and some international organizations will guarantee the payment in case the borrowing institutions are in financial difficulty. Hence, little default premium is charged for foreign loans, and the effective lending rate of foreign loans is much lower than that of the domestic loans. The guarantee on international loans explains why so many international banks, which were sophisticated in risk control and credit evaluation, lent aggressively to those undercapitalized regional banks with little transparency on their balance sheet.

In the early stage of the development of an emerging economy, information about the economy and credit worthiness of a project is scarce. To promote foreign investment, local governments often provide loan guarantee for project financing or

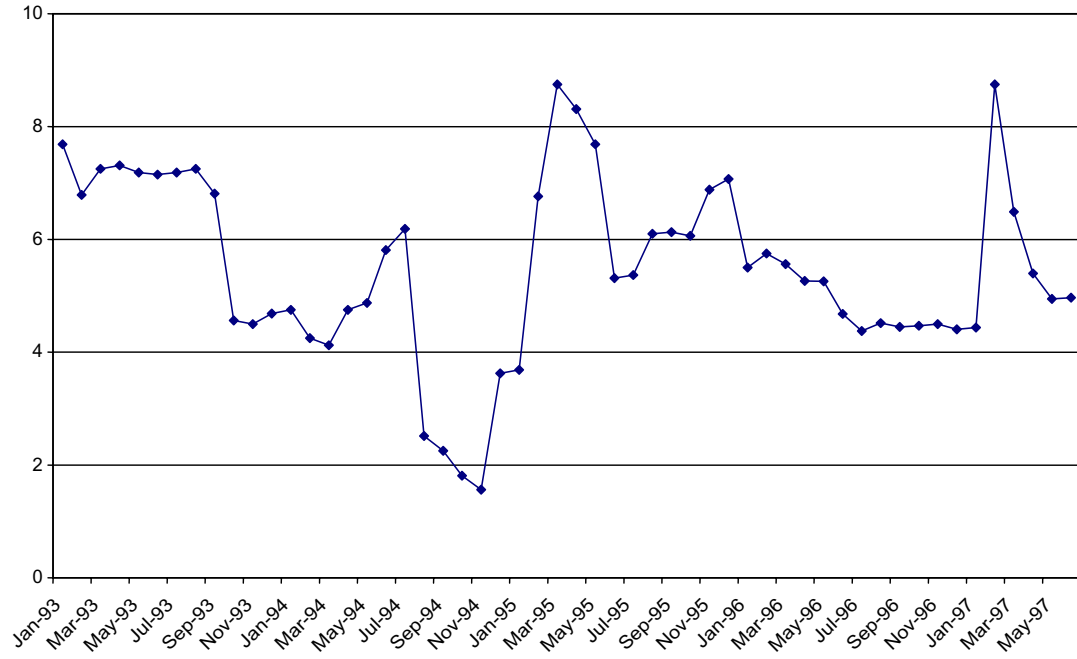


Fig. 1. The Thai baht interest rate premium over USD interest rate. This is the interest rate differential of 3-month Thai baht interbank rate and 3-month USD interbank rate since the beginning of 1993 to June 1997. We can see that the interest rate differential is always positive, indicating the depreciation pressure.

company borrowing. This type of guarantee works well if the loans are small scale, when the research cost is very high, and abuse of the guarantee will not give big payoff. However, when the loan sizes become larger and larger, both lenders and borrowers have an incentive to exploit the guarantee system. For the lenders, they can have a big loan with very little credit risk. For the borrowers, they can divert the loans to their personal interest for potential huge profit. From Jensen and Meckling (1976), the limited liability of equity owners put the monitoring task to the debt owners, which are mostly banks specializing in credit risk assessment. However, the loan guarantee removes the incentive of credit risk assessment by the debt owners and set the total amount of loans ballooning.

Because IMF and local governments only guarantee foreign loan but not domestic loans, during the financial crisis of the emerging markets, many firms have kept paying interest on dollar-denominated loans and defaulted on domestic-currency-denominated loans. The high default risk of domestic loans certainly contributes to the high lending rate. We have the following:

Proposition 2. *Suppose a project is financed by foreign loans in proportion q , domestic loans in proportion $1 - q$. The loans are collateralized by an asset that is of equal value of the total loans at the time of lending. Assume that the asset's value in domestic currency grows at risk-free domestic interest rate. In case of currency depreciation, the project's owner will pay off foreign loans before starting to pay the domestic loans. The lenders are risk neutral. Then, the interest rate on domestic loans is an increasing function of q , the proportion of foreign loans.*

See Appendix A for the Proof of Proposition 1.

This proposition shows that even if the initial overvaluation and the interest rate differential are small, this interest rate differential will grow as businesses borrow more and more foreign loans, which, in turn, drives the interest rate differential wider. The wide interest rate differential explains why Asian countries accumulated so much foreign debt when the domestic saving rates were very high.

The original intention of the loan guarantee is to attract foreign investment. However, under this guarantee to foreign investors, domestic investors are at a disadvantage. Hence, domestic investors often channel their money into more equal investment environment such as the United States. The loan guarantee to foreign investment, in effect, drives away domestic investment.

The existence of interest rate differential induces an incentive to create an investment vehicle to carry out the interest rate arbitrage. For a manufacturing business, its scale is constrained by the availability of skilled workers, which takes a long time to produce. However, the scales of real estate projects are only constrained by the availability of funding, which can be very elastic. Many real estate projects can lock in prices by presales. Hence, the financing cost becomes the most important factor in profit. The domestic risk-free interest rate is the benchmark for all other risky investment. The expected return of other risky investment is higher than the risk-free interest rate to compensate for the risk. When interest rate differential between foreign and domestic lending exists, you can make a profit even with return lower than the domestic lending rate, which is relatively easy. This is why real estate booms continued after the economy slowed down substantially and

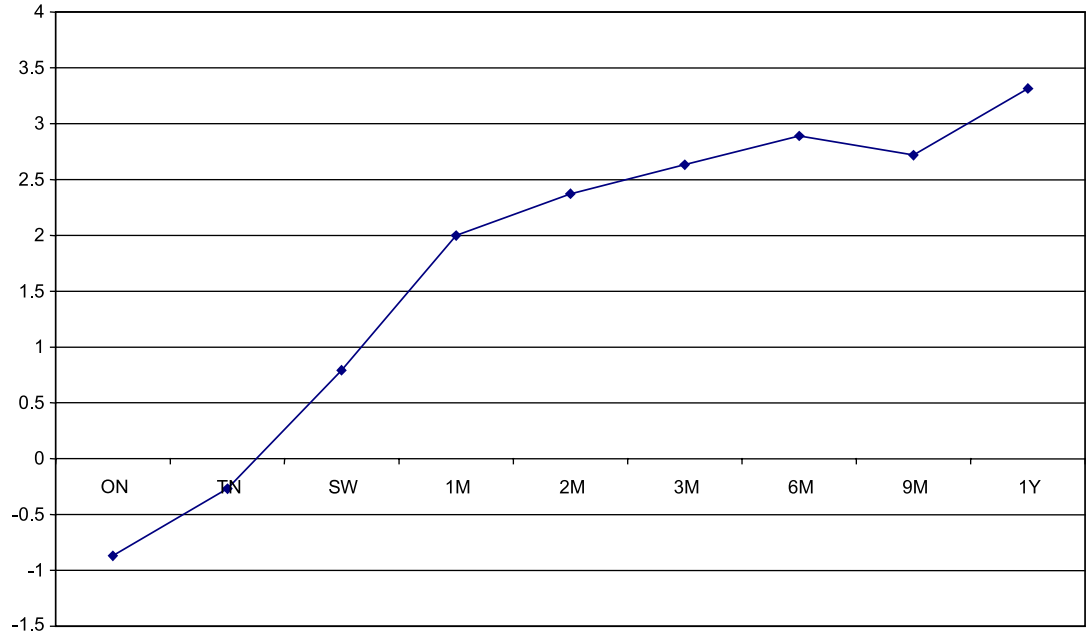


Fig. 2. HKD-USD interest rate differential after Thai baht's depreciation. The curve is the 1-year monthly average of interest rate differential between Hong Kong and U.S. dollars from overnight to 1-year rates.

vacancy rate built up. Because many real estate loans are only collateralized by the real estate projects, developers have little to lose if the currency depreciates and the projects lose money.

Although IMF provides loan guarantee, all the loans eventually have to be paid back by the borrowing companies. For a long-term loan, it may take years of negotiation and uncertainty before the principle can be paid back, sometimes partially. Hence, the lending institutions prefer short-term loans, which can be repaid soon when a financial crisis is eminent or just starts. This is why most loans were short term, while the financed projects, such as real estate projects, were long term.

As more and more investment takes place to arbitrage the interest rate differential between domestic and foreign loans, the return on this type of investment will become lower and lower. As the expected return becomes lower than the domestic lending rate, only projects on foreign loans are expected to make money, which leads to more and more projects being financed by foreign loans.

Many papers criticize that the borrowers do not hedge their foreign exchange exposure. However, if these borrowers hedge away the exchange exposure with currency forward or swap contracts, they are effectively borrowing at domestic interest rates, which defeats the very purpose to borrow foreign loans.

In a liberalized financial system, the interest rate arbitrage can push the financial leverage to infinity until the system collapses. However, in a tightly controlled financial system, such as those in China, Taiwan, and Singapore, it is not easy to do so. That is why these countries are better off in this financial crisis. It also suggests that local financial liberalization without reform in the global financial system will lead to financial crisis, which we have seen in developing countries everywhere.

A closer look at the interest rate differential will reveal more information about the region. When we compare the short-term interest rate differential between the U.S. dollar and a pegged currency, we need to use a currency that is very narrowly pegged to the U.S. dollar. Otherwise, the fluctuation of exchange rate will make the comparison of short-term rates invalid. The Hong Kong dollar meets this criterion for it is very closely pegged to the U.S. dollar. Fig. 2 is the yield curve differential between the Hong Kong and the U.S. dollars after the Thai baht depreciation. We can observe that the very short-term rates of the Hong Kong dollar are lower than that of the U.S. dollar, while the longer term Hong Kong rates are higher than those of the U.S. dollar. The higher rates of the Hong Kong dollar indicate the depreciation risk. The lower rates in very short term indicate that there is an abundant supply of Hong Kong dollars, which is very natural, given the high domestic savings in the Asian region. We would rather see capital outflow than inflow. However, foreign loans are insured against the depreciation-induced default risk, which makes the interest rate on foreign loans artificially low. Hence, we observed large-scale capital inflow into East Asia.

3. Dynamics of institutions

In this section, we analyze how the dynamics of institutions will keep the overvaluation of assets for a long time before the eventual depreciation.

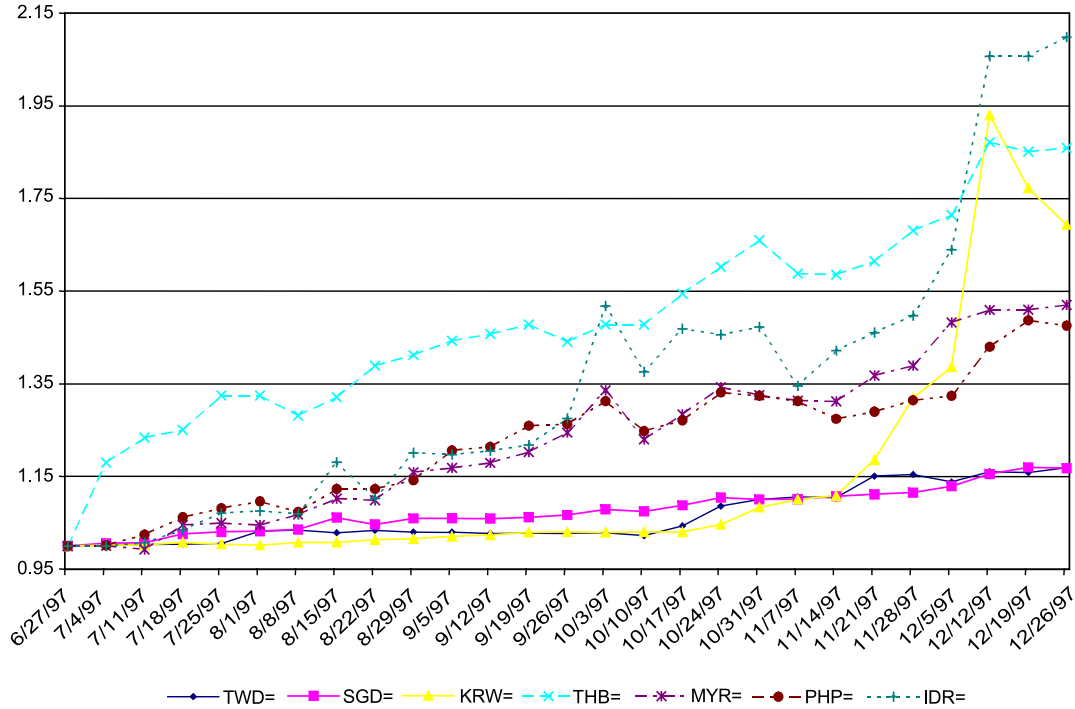


Fig. 3. Asian currencies against U.S. dollar in the second half of 1997. The exchange rates of all the currencies at the end of June 1997 are scaled to one.

If there is a potential for profit when cheap money is available, businesses will set up investment vehicles to leverage to extreme to extract maximum amount of profit. Eventually, this type of risk arbitrage will drive down the rate of return and build up immense overcapacity. When the market value of the assets becomes lower than the that of the loan liability, the business' goal becomes keeping the book value of the asset holding as high and as long as possible and not liquidating the assets at the market price. Hence, the interested parties can continue to draw dividend or salary. This is why there is a huge build up of vacancy without a drop of prices, and why many banks hold real estate assets for such a long time without cleaning them up. As the balance sheets further deteriorate, the need to prop up the book value of the assets becomes greater. Hence, these institutions need to buy a large amount of high-yield instruments to window dress the balance sheet. That is probably why so many high-yield Indonesian corporate bonds end up on the books of the Korean merchant banks. The above analysis is very similar with that of [Akerlof and Romer \(1993\)](#), whose analysis is on looting. But even for legitimate businesses, the incentive to prop up the balance sheet will attract more junk debts. The banks hope that they can “grow out of problems” and the junks bonds can “grow” into high grades bonds. However, their hunger for high book value assets at low prices rarely yield high quality assets. Our analysis shows that it usually takes a long time for the whole thing to unravel and it usually unravels violently.

On the country level, if there are few foreign debts, the depreciation will restore the competitive balance in a relatively straightforward way. However, as foreign debts build up, the decision to depreciate becomes harder and harder. That is why most pegging systems are forced to break up. When a currency faces depreciation pressure, its interest rate will increase to prevent the capital outflow. However, the insured foreign money will flow in to arbitrage the interest rate differential. As a result, the real exchange rate will appreciate instead of depreciate, thus further deteriorating the country's competitiveness. The appreciated weak currency faces a bigger drop when it eventually depreciates, which drives domestic interest rates higher and attracts more foreign money. When a currency starts to depreciate, every foreign loan borrower tries to secure U.S. dollars as early as possible. This creates a big demand for the U.S. dollar and pushes the domestic currency down further. See [Fig. 3](#) for the exchange rates in the second half of 1997 of Thailand, The Philippines, Malaysia, Indonesia, Korea, Singapore, and Taiwan.

There is little that a government can do in this environment. An overvalued currency induces an incentive to spend, which drives up inflation. When the government tries to curb inflation by raising interest rates, the inflow of foreign capital to arbitrage the interest rate differential will push the domestic exchange rate even higher, which induces more spending.

4. Conclusion

In the last several decades, the economy in various developing countries has experienced high growth at different stages. Each time, the high growth attracts a lot of global investment, which generates spectacular boom in that region. However,

because of the explicit and implicit loan guarantee by various government agencies, credit risks are not priced into the loans. This leads to over leveraging in the economy, which always causes an even more spectacular bust.

Each financial crisis causes great pain to the society, and the ensuing bail out sows the seed of another financial crisis on a bigger scale. Friedman (1998) wrote, “In reality Mexico was not bailed out. Foreign entities—banks and other financial institutions—that had made dollar loans to Mexico...were bailed out...The Mexican bailout helped fuel the East Asian crisis that erupted two years later.”

Our analysis shows that high foreign debts, real estate booms, and the appreciation of real exchange rates of the weak currencies are all caused by the interest rate arbitrage supported by the credit guarantee of the various government agencies. Without the loan guarantee, the credit risk involved in foreign loans will naturally raise foreign lending rate to the domestic rate. This essentially eliminates the incentive of over borrowing of foreign loans, which is at the heart of each financial crisis in the emerging markets.

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Appendix A

Proof of Proposition 1. In the risk-neutral world, the relation between domestic and foreign interest rate is determined by

$$1 + r_F = (1 + r_D)(1 - p) + (1 + r_D)(1 - d)p = (1 + r_D)(1 - dp) \quad (A1)$$

where p is the probability of the domestic currency depreciation in 1 year and d is the expected amount of depreciation. If a foreign loan is backed by an asset of the same value at the time of lending, then, the interest rate R_F charged for the loan should satisfy

$$1 + R_F = (1 + R_F)(1 - p) + (1 + r_D)(1 - d)p$$

which is

$$1 + R_F = \frac{1}{1 - p} [(1 + r_F) - (1 + r_D)(1 - d)p]$$

Substituting Eq. (A1) into the above equation, we have

$$\begin{aligned}
 1 + R_F &= \frac{1}{1-p} [(1-dp)(1+r_D) - (1-d)p(1+r_D)] \\
 &= \frac{1-dp - (1-d)p}{1-p} (1+r_D) = 1+r_D
 \end{aligned}$$

Hence, the foreign loan rate is equal to the domestic risk-free interest rate. □

Proof of Proposition 2. The domestic and foreign risk-free interest rates are r_D and r_F , respectively. The probability of the domestic currency depreciation in 1 year is p , and the expected amount of depreciation is d . Suppose the proportion of the foreign loans is q . After simple calculation, we find that the foreign loan interest rate R_F will satisfy

$$(1+r_F)q = (1+R_F)q(1-p) + (1+r_D)(1-d)p$$

when

$$q > \frac{1+r_D}{1+r_F}(1-d)$$

or

$$R_F = r_F$$

otherwise.

When

$$q < \frac{1+r_D}{1+r_F}(1-d)$$

the foreign loan rate is r_F and the domestic loan interest rate R_D is determined by

$$\begin{aligned}
 (1+r_D)(1-q) &= (1+R_D)(1-q)(1-p) + \left[(1+r_D) - \frac{(1+r_F)q}{1-d} \right] p \\
 &= (1+R_D)(1-q)(1-p) + \left[(1+r_D) - \frac{(1+r_D)(1-dp)q}{1-d} \right] p
 \end{aligned}$$

from Eq. (A1). After rearrangement, we have

$$1 + R_D = (1+r_D)f(q) \tag{A2}$$

where

$$\begin{aligned}
 f(q) &= \frac{(1-q)(1-d) - [(1-d) - (1-dp)q]p}{(1-q)(1-p)(1-d)} \\
 &= \frac{1-d-p+dp^2}{(1-p)(1-d)} + \frac{pd}{(1-q)(1-d)}
 \end{aligned}$$

which is an increasing function of q . From Eq. (A2), R_D is an increasing function of q . When

$$q > \frac{1 + r_D}{1 + r_F} (1 - d)$$

the domestic interest rate is

$$R_D = \frac{r_D + p}{1 - p}$$

which can be obtained by setting

$$q = \frac{1 + r_D}{1 + r_F} (1 - d)$$

in Eq. (A2). □

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