The International Spillover of the Financial Disruption:  
The Case of Korea

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and  

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Abstract. The Korean economy was hit hard by the global financial crisis. High short-term external debts resulted from excessive short-term borrowings by banks before the crisis and the subsequent large-scale capital outflows raised concerns about another currency crisis in Korea. This paper attempts to explain why external debts increased rapidly before the bankruptcy of Lehman Brothers and how financial instability in advanced countries generated an immediate and powerful spillover to Korean economy.

1. Introduction

Until the Lehman Brothers bankruptcy shook the global financial markets, Korea seemed to enjoy steady macroeconomic performance. Even when the subprime mortgage problems came to surface in mid-2007, the initial impact on the Korean economy was limited in scale and severity. Despite underlying strength of the fundamentals in the Korean economy, however, there was also vulnerability arising from the increased openness in international trade and finance. Greater openness might contribute to robust economic activities in normal times, but at the same time widen channels through which the shocks originated in advanced countries could transmit to the Korean economy.

Acknowledgments. We are grateful to Seunghwan Lee for kindly sharing the data and the fellows at KDI for valuable discussions. We also thank Soyeon Lee and Bohae Lee for excellent research assistance. All remaining errors are ours.
Together with the rest of the world, Korean economy was hit hard in mid-September 2008 following the bankruptcy of Lehman Brothers. Korea experienced large capital outflows and serious difficulties in refinancing foreign currency denominated liabilities as the financial vulnerability was eventually realized. Then, exports and industrial production plummeted thanks to contracting global demand in late 2008, leading to a pronounced deceleration of economic growth.

As in the literature on contagion, countries can be linked through two different channels of transmission, international trade channel and international financial channel. Given the export-oriented economic growth and fully opened financial markets in Korea, both channels played important roles in the transmission of external shocks to Korean economy. Nevertheless, along with the global integration of financial markets, financial channels are growing in importance in transmission of shocks between economies. The recent global financial crisis has highlighted the critical role of financial markets in the propagation of adverse shocks, both in spreading shocks from one country to another and in magnifying the effects of shocks. Kohn (2009) also notes that financial linkages might now be more important than the traditional trade linkages. Cetorelli and Goldberg (2010) provide evidence on global banks’ role in the transmission of the crisis to emerging market economies.

Indeed, the biggest concern raised by the media and investors was that Korea was at risk of external debt defaults and foreign exchange liquidity problem. This concern was based on the observation that Korea’s external position was highly leveraged despite large foreign exchange reserves. For example, the Financial Times reported that short-term external debts on a remaining maturity basis were compared with foreign exchange reserves, giving Korea one of Asia’s skinniest coverage ratios. In this respect, foreign exchange liquidity problem appeared to be the starting point of spillovers. Therefore, this paper attempts to explain why external debts increased rapidly before the bankruptcy of Lehman Brothers and how financial deleveraging in advanced countries generated an immediate and powerful spillover to Korean economy.

Van Rijckeghem and Weder (2001) emphasize the importance of financial channel in contagion among emerging market economies. Hong and Lee (2009) find that financial linkages better explain the synchronizations of contractions in domestic credits and stock prices between advanced countries and emerging market countries.
The remainder of this paper is organized as follows. Section II reviews the trends of foreign exchange shortage and external debts around the crisis period. Section III explains why the external debt increased rapidly before the crisis. Section IV documents a potential amplification effect triggered by sudden capital outflows. Section V concludes.

2. Foreign Currency Shortage During the Global Financial Crisis

2.1. Capital outflows

In the wake of Lehman Brothers’ filing for bankruptcy protection in September 2008, Korean economy experienced a sharp depreciation of Korean won and a huge increase in CDS (credit default swap) premium. Figure 1 shows that the exchange rate of Korean won against U.S. dollar rose to 1,478.5 on October 29, a 57.6% increase from the beginning of 2008. The CDS premium, which is a proxy for the cost of foreign currency funding, also skyrocketed to 699 bps on October 27.

The rises of exchange rate and CDS premium reflect that foreign currency liquidity conditions deteriorated severely following the global financial crisis. In fact, Figure 2 shows that Korea underwent reversals of capital inflows, recording a large capital account deficit of $42.6 billion in the 4th quarter of 2008. The rapid outflows of foreign capital caused a liquidity strain in the foreign exchange market, triggering a sudden rise in exchange rate.

<Figure 1> Exchange rate and CDS premium

Source: Bank of Korea, Bloomberg
Table 1 exhibits the balance of payment in Korea with sub-accounts in the capital account. It tells us which sub-account was more responsible for the foreign exchange shortage. In this paper, the foreign exchange shortage is defined by the sum of current account deficit and capital account deficit in the sense that the deficits should be financed by a decrease in reserve assets. Table 1 shows that the foreign exchange shortage increased to $14.6 billion in the 3rd quarter of 2008, but the size of current account deficit was greater than the size of capital account deficit during the period. In the 4th quarter of 2008, despite the current account surplus, the foreign currency shortage amounted to $34.8 billion, resulting in a sharp decrease in the reserve assets. In 2009, the current account continued to exhibit surplus and the capital account also moved back to surplus in the 2nd quarter.

The sub-accounts in Table 1 shows that the huge foreign currency shortage in the 4th quarter of 2008 was mostly attributed to a large deficit in other investments. The deficit of other investment amounted to $35.6 billion among the total capital account deficit of $42.6 billion. A close look at the balance of other investments, which include trade credits, loans (borrowings),

2 In Table 1, a positive number in the changes of reserve assets corresponds to a decrease in reserve assets. The sum of current account and capital account should be equal to the sum of changes in reserve assets and the errors and omissions with opposite sign.
currency and deposits, and others, reveals that large capital outflows from short-term borrowings by domestic deposit-taking institutions (including foreign bank branches) was responsible for the huge deficit during the period.

<Table 1> Foreign currency shortage and balance of payments

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Current account(A)</td>
<td>-4.866</td>
<td>-0.412</td>
<td>-8.330</td>
<td>7.831</td>
<td>8.618</td>
<td>13.097</td>
</tr>
<tr>
<td>Capital account(B)</td>
<td>1.990</td>
<td>-3.161</td>
<td>-6.286</td>
<td>-42.627</td>
<td>-1.399</td>
<td>8.682</td>
</tr>
<tr>
<td>Investments</td>
<td>2.101</td>
<td>-2.934</td>
<td>-6.069</td>
<td>-43.291</td>
<td>-2.124</td>
<td>8.387</td>
</tr>
<tr>
<td>Direct investments</td>
<td>-5.782</td>
<td>-4.140</td>
<td>-3.661</td>
<td>-2.050</td>
<td>-2.045</td>
<td>-0.172</td>
</tr>
<tr>
<td>Derivatives</td>
<td>-1.250</td>
<td>-1.241</td>
<td>-3.550</td>
<td>-8.729</td>
<td>-4.894</td>
<td>-0.615</td>
</tr>
<tr>
<td>Other Investments</td>
<td>13.533</td>
<td>-5.910</td>
<td>10.564</td>
<td>-35.572</td>
<td>1.283</td>
<td>-7.566</td>
</tr>
<tr>
<td>Other capital account</td>
<td>-0.110</td>
<td>-0.227</td>
<td>-0.218</td>
<td>0.664</td>
<td>0.725</td>
<td>0.295</td>
</tr>
<tr>
<td>Changes in reserve assets(C)</td>
<td>3.850</td>
<td>5.718</td>
<td>12.883</td>
<td>33.995</td>
<td>-9.017</td>
<td>-19.542</td>
</tr>
<tr>
<td>Errors and omissions(D)</td>
<td>-0.974</td>
<td>-2.146</td>
<td>1.733</td>
<td>0.800</td>
<td>1.798</td>
<td>-2.238</td>
</tr>
<tr>
<td>C+D</td>
<td>2.876</td>
<td>3.572</td>
<td>14.616</td>
<td>34.795</td>
<td>-7.219</td>
<td>21.780</td>
</tr>
</tbody>
</table>

Source: Bank of Korea

In contrast, the cause of the foreign exchange shortage in the 3rd quarter of 2008 was quite different. The balance of other investments recorded a surplus of $10.6 billion, suggesting that external borrowings continued until the bankruptcy of Lehman Brothers. The balance of portfolio investments, however, recorded a deficit of $9.4 billion. Thus, portfolio investments were the main cause of the foreign exchange shortage in the 3rd quarter of 2008.

Although Table 1 gives an outline of the balance of payments and thus the foreign exchange shortage, it does not provide information about the magnitude of capital outflows by foreign investors. To examine the capital flows across border, we need to look at the liability side of the capital account. Figure 3 depicts the trend of capital flows in equity securities investments, debt securities (bonds) investments, and borrowings. The data on equity investments and debt securities investments are from the liability side of portfolio investments and the data on borrowings are from a part of the liability side of other investments in the capital account. Since the data is from liability side of capital account, positive (negative) values imply capital inflows (capital outflows) by foreign investors.
Several interesting aspects emerge from Figure 3. First, capital outflows from borrowings were most evident in the 4th quarter of 2008. In particular, short-term borrowings by deposit-taking institutions experienced a huge capital outflow of $48.4 billion in the period. Although smaller than the capital outflows from borrowings, there were also sizeable capital outflows from portfolio investments during the period. The capital outflows from equity and bond investments amounted to $4.3 billion and $10.0 billion, respectively.  

Second, although all of the three investments recorded capital outflows in the 4th quarter of 2008, they showed quite different trends until the 2nd quarter of 2008. Foreign investors already started to sell domestic equities in mid-2007 when sub-prime mortgage problems in the U.S. came to surface. The capital outflows from equity investments amounted to $28.9 billion in 2008.

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3 When the crisis hits, a plunge in stock prices and a spike in foreign exchange rate occur simultaneously, doubling the losses to the foreign investors. This might limit foreign capital outflows from domestic stock markets in the 4th quarter of 2008.
the second half of 2007 and $29.3 billion in the first half of 2008, much larger than the capital outflows in the second half of 2008.\(^4\)

Unlike equity investments, however, large-scale capital inflows to domestic bond market were witnessed until the 2nd quarter of 2008. In 2007, for example, $59.1 billion was invested in domestic debt securities. Similarly, since 2006, external net borrowings also continued to exhibit positive numbers until the 3rd quarter of 2008. The capital inflows through borrowings amounted to $44.2 billion in 2006 and $42.0 billion in 2007. Even between the 1st quarter and 3rd quarter of 2008, $22.8 billion was newly borrowed. The large-scale borrowings inevitably increased the external debts and thus raised concerns about potential currency crisis.

Third, as the Korean economy began to recover and the financial markets regained stability in 2009, all of the three investment categories bounced back to exhibit capital inflows. In 2009, $25.7 billion and $23.7 billion were invested in equity securities and debt securities, respectively. External borrowings also started to increase in the 2nd quarter of 2009, amounting to $9.0 billion through the year.

2.2. External debts

At the time of outbreak of global financial crisis, despite much healthier shape of Korean economy than during 1997-98 East Asian crisis periods, the media and investors raised concerns regarding how the Korean economy would perform forward. In particular, there were concerns that Korea might face another foreign exchange crisis akin to the one it faced a decade ago. Given the drought of foreign capital, some foreign investors evaluated that Korean economy was deemed to be very risky thanks to its large external debts. For instance, the Economist reported that HSBC forecasted that Korea’s short-term debt would exceed its shrinking reserves by the end of 2009.

Indeed, as we have seen in the previous section, the rapid increases in short-term borrowing by domestic banks since 2006 resulted in large external debts and thus led the Korean

\(^4\) Foreign investors' shareholding out of total market capitalization was 30.1% in 2000. Then it increased to an unprecedented level of 42.0% in 2004. Capital outflows from equity investment, however, reduced the ratio of shareholding to 28.9% in 2008.
economy vulnerable to the global credit crunch\(^5\). The external debt was only $187.9 billion at the end of 2005, but it grew rapidly thanks to large-scale external borrowings by domestic banks (including foreign bank branches), reaching at $426.1 billion in the 3rd quarter of 2008. This level of total external debt was equivalent to 175% of GDP. Then, the total external debt-to-GDP ratio increased to 206% in the 4th quarter of 2008 before it decreased steadily since 2009.\(^6\) This high debt-to-GDP ratio is comparable to the one in the Asian crisis in 1997-98.\(^7\)

Short-term external debt, whose original maturity is less than a year, increased more rapidly from $65.9 billion at the end of 2005 to $189.6 billion in the 3rd quarter of 2008. It follows that the short-term debt to total external debt ratio marked 45% in the 3rd quarter of 2008, similar to 48% in the 1st quarter of 1997. As long as external finance is no longer available, Korea must run down its foreign exchange reserves. Therefore, international organizations and investors consider the ratio of short-term debt to foreign exchange reserves as a useful measure of financing risk that Korean economy may face. The ratio revealed why some foreign investors raised concerns about potential default of Korea on its foreign debt. Despite large foreign reserves, the ratio of short-term debt to reserves increased to 79.1% in the 3rd quarter of 2008. Moreover, as of the end of 2008, total current external debt (debt with remaining maturity of less than a year) due in 2009 was $193 billion, which comprises short-term contracts of $150 billion and long-term debt of $43 billion due in 2009. Thus, the ratio of current external debt to foreign exchange reserves became close to one. This was what the Financial Times pointed out as a sign of vulnerability that might cause another currency crisis in Korea.

In responding to the concerns about external debts, the Korean government argued that a significant portion of external debt was risk-free. The government asserted that, among the total external debt of $379 billion as of end 2008, $103 billion was non-obligatory debt, meaning that they were not subject to any repayment burden. For example, $39 billion was incurred as a result of advanced receipts (or unearned revenue) for shipbuilding contracts, which would be cleared

\(^{5}\) In this paper, domestic banks refer to domestic Korean banks and foreign bank branches operating in Korea.

\(^{6}\) In the 4th quarter of 2008, the total external debt slightly decreased but GDP declined more, resulting in an increase in external debt-to- GDP ratio.

\(^{7}\) The external debt-to-GDP ratio was 210% in the 1st quarter of 1998.
off from the books at the time of delivery of the ships. Excluding these non-obligatory debts, the net external debts of Korean economy came to $276 billion, significantly smaller than the claimed $379 billion. In addition, among the short-term external debts of $149.9 billion, $72.4 billion was owed to domestic branches of foreign banks. Therefore, that led to the point that Korean domestic banks and corporations owed only $77.5 billion, which was about a third of the foreign exchange reserves.8

<Figure 4> Total and short-term external debts

3. Backgrounds of the high external debts

3.1. Foreign currency financing and FX swaps

A domestic Korean bank can raise foreign currency funds in two ways: borrowing directly in the foreign currency money markets or borrowing domestic currency and convert the proceeds into foreign currency through an FX swap (foreign exchange swap). When a Korean bank raises U.S. dollars via an FX swap, it exchanges Korean won for dollars at the foreign exchange spot rate while contracting to exchange in the reverse direction on the maturity date at the foreign exchange forward rate. Because the counterparties of Korean banks are most likely foreign bank branches in FX swaps, they are interconnected.

8 The Korean government also argued that, taking into consideration non-obligatory debts, the actual amount of the current external debt was roughly $124 billion.
Figure 5 exhibits how foreign bank branches and Korean banks are interconnected through FX swaps. It shows the position changes of foreign bank branches (left panel) and Korean banks (right panel) in three steps. In each step, the left rectangle represents a transaction at time t and the right rectangle represents a transaction at t+s, maturity of borrowing or FX swap. A rectangle above the horizontal axis denotes capital inflows while a rectangle below the axis denotes capital outflows. Currency units of transactions are marked inside the rectangles.

The first step of left panel (top of the left panel) shows that foreign bank branches borrow in U.S. dollars (inflows) and repay the principle and interest in the future (outflows). Likewise, the first step of right panel exhibits Korean banks’ financing (for instance, deposits) and repayment in Korean won. In the second step (middle of the panels), foreign bank branches (Korean banks) convert the U.S. dollar (Korean won) into Korean won (U.S. dollar) via an FX swap for a short-term contract. Similarly, foreign bank branches and Korean banks can enter into currency swap agreement for a long-term contract. As a result, foreign bank branches (Korean banks) end up with Korean won denominated funds (U.S. dollar denominated funds) as depicted in the third step (bottom of the each panel). The third steps without the first and the second steps indicate the cases that foreign bank branches directly raise funds in Korean won and Korean

9 Combining cash flows of the first step and the second step generates the cash flows in the third step.
banks directly borrow money in U.S. dollars.

Finally, foreign bank branches invest the proceeds in Korean won-denominated domestic bonds or interest rate swaps while Korean banks use the fund for loans to importing firms, factoring for exports, etc. The previous section shows that both external borrowings and bond investments had increased substantially since 2006. The financing mechanism in Figure 5 suggests that external borrowings and bond investment can be positively correlated to the extent that foreign bank branches invest in domestic bonds.

Then, who was more responsible for the increase in external debts in banking sector, Korean banks or foreign bank branches? Table 3 presents the domestic banking sector’s external debts between 2003 and 2009. The total external debts of the banking sector rose from $51.2 billion in 2005 to $96.2 billion in 2006 and $135.4 billion in 2007. The dramatic increase in external debts mainly came from the sharp rise in borrowings by foreign bank branches. The net increase in the external debts owed to foreign bank branches was $29.8 billion in 2006 and $27.5 billion in 2007. In contrast, Korean banks raised new external capital of $15.2 billion in 2006 and $11.7 billion in 2007. In 2005, the share of Korean banks in the total external debts of banking sector was 54.9%, but the share fell to 45.1% in 2006 and 40.7% in 2007. Interestingly, although Korean banks had less external debts before Lehman Brothers bankruptcy, they experienced a larger withdrawal of funds (decrease of external debts) than foreign bank branches in 2008.

<Table 3> Banking sector’s external debts from borrowings  

<table>
<thead>
<tr>
<th>Year</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>External debts</td>
<td>46.1</td>
<td>47.0</td>
<td>51.2</td>
<td>96.2</td>
<td>135.4</td>
<td>112.6</td>
<td>120.2</td>
</tr>
<tr>
<td>Korean banks</td>
<td>25.0</td>
<td>24.6</td>
<td>28.1</td>
<td>43.3</td>
<td>55.0</td>
<td>42.5</td>
<td>44.5</td>
</tr>
<tr>
<td>(54.3)</td>
<td>(52.3)</td>
<td>(54.9)</td>
<td>(45.1)</td>
<td>(40.7)</td>
<td>(37.8)</td>
<td>(37.0)</td>
<td></td>
</tr>
<tr>
<td>Foreign bank branches</td>
<td>21.0</td>
<td>22.4</td>
<td>23.1</td>
<td>52.9</td>
<td>80.3</td>
<td>70.1</td>
<td>75.7</td>
</tr>
<tr>
<td>(45.7)</td>
<td>(47.7)</td>
<td>(45.1)</td>
<td>(54.9)</td>
<td>(59.3)</td>
<td>(62.2)</td>
<td>(63.0)</td>
<td></td>
</tr>
<tr>
<td>Changes in external debts</td>
<td>4.8</td>
<td>0.9</td>
<td>4.2</td>
<td>45.0</td>
<td>39.2</td>
<td>-22.8</td>
<td>7.6</td>
</tr>
<tr>
<td>Korean banks</td>
<td>2.0</td>
<td>-0.4</td>
<td>3.5</td>
<td>15.2</td>
<td>11.7</td>
<td>-12.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Foreign bank branches</td>
<td>2.8</td>
<td>1.4</td>
<td>0.7</td>
<td>29.8</td>
<td>27.5</td>
<td>-10.3</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses are shares.
Source: Bank of Korea
3.2. Why has external borrowing increased so rapidly?

In this subsection, we review the underlying factors that might contribute to the rapid increase in external debts through the mechanisms described above.

Hedging foreign exchange risks and banks’ foreign exchange positions

One of the most frequently suggested factors that led banks to increase external borrowings since 2006 is the increase in demand for foreign currency forward contracts by domestic exporting firms and domestic asset management firms\(^{10}\). An exporting firm, who does not wish to be exposed to exchange rate risk over a period of time, opens a forward contract with a Korean bank. Then, the Korean bank is left with an exposure to exchange rate risk in the future. Thus, the bank borrows foreign currency and exchanges it into domestic currency in the spot market to hedge the risk in its forward position. These transactions inevitably increased external debts.

The most notable exporting firms that actively entered into foreign currency forward contracts were shipbuilding firms. Because of the large size of the shipbuilding contracts and the long time interval between the orders and the delivery, the shipbuilding firms in Korea are exposed to high exchange rate risks and thus have a great incentive to hedge the risks. Indeed, the ship orders received by Korean firms, who have the largest market share in the world market, rose by 97.3% to $61.7 billion in 2006 and by 58.0% to $97.5 billion in 2007. At the same time, the amount of forward contracts by shipbuilding firms rose to $35.3 billion in 2006 and $53.3 billion in 2007.

\(^{10}\) Korea has a structural problem in the imbalance of forward contracts. Korean manufacturing exporting firms receive the revenues in U.S. dollars but pay the cost in Korean won. Thus, they are eager to hedge exchange rate risks. In contrast, crude oil importing firms, which account for the largest share of imports, do not need to fully hedge the risks. They import crude oil in U.S. dollars and also export the refined products in U.S. dollars. In addition, they can pass-through the changes in exchange rate to domestic prices.
<Table 4> Shipbuilding firms’ orders received and foreign currency forward contracts

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship orders Received (A)</td>
<td>23.9</td>
<td>31.8</td>
<td>31.3</td>
<td>61.7</td>
<td>97.5</td>
<td>71.8</td>
<td>18.3</td>
</tr>
<tr>
<td>Forward Contracts (B)</td>
<td>4.5</td>
<td>12.5</td>
<td>16.8</td>
<td>35.3</td>
<td>53.3</td>
<td>41.7</td>
<td>16.1</td>
</tr>
<tr>
<td>B/A (%)</td>
<td>18.7</td>
<td>39.3</td>
<td>53.8</td>
<td>57.1</td>
<td>54.6</td>
<td>58.0</td>
<td>87.6</td>
</tr>
</tbody>
</table>

Source: Bank of Korea

The increase in the external debts caused by the shipbuilding firms’ forward contracts, however, would be reduced at the maturity date of the forward contracts. If shipbuilding firms deliver the foreign currency to banks with the payment received from the importers at the maturity date, the banks can use the proceeds for the repayment of the external debts. This is the reason why the Korean government argued that the external debts in Korea was overly exaggerated.\(^\text{11}\)

In addition to hedging demand by shipbuilding firms, domestic asset management firms also entered into forward contracts in a large scale in 2006 and 2007 as the foreign investments by domestic residents increased. The amount of investments in foreign securities rose from only $1.5 billion in 2005 to $13.1 billion in 2006 and $27.2 billion in 2007. For a substantial part of these investments, asset management firms entered into forward contracts, contributing to an increase in external debts.

Arbitrage opportunity and domestic bond investments

As described in the previous sub-section, external borrowings by foreign bank branches and their investment in bond markets started to rise simultaneously in 2006. At that time, Korean banks either borrowed external funds directly or entered FX swaps with foreign bank branches in order to adjust foreign exchange positions. If they used FX swaps to raise foreign currencies, the foreign bank branches were left with Korean won funds. Thus, it is not surprising that, with the proceeds, the foreign bank branches began to increase investments in domestic bonds. From the

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\(^\text{11}\) Global contraction in demand in 2008 and 2009, however, could cause cancellation of orders, which lead shipbuilding firms to over-hedge.
perspective of foreign bank branches, which could access to foreign capitals with relatively low cost, FX swaps and bond investments seemed to provide a good profitable investment opportunity.

Another aspect that might explain the increase in bond investments is the existence of arbitrage opportunities. In general, an arbitrage opportunity is measured by the deviation from covered interest parity conditions (CIP), which is defined as the interest rate differential minus forward discount rate in FX swap markets.\(^\text{12}\) Alternatively, it can be expressed as a difference between domestic government bond yield and CRS rate (currency swap rate or FX swap rate) as illustrated in Figure 6.\(^\text{13}\) It could be true that the excessive demand for foreign currency forward by shipbuilding firms and asset management firms put pressures on swap rate or CRS rate to decrease. Given the domestic and foreign interest rates, the pressures could generate deviations from covered interest rate parity conditions and thus higher expected returns on bonds.

However, it is not clear that the arbitrage opportunity is enough to explain the foreign bank branches’ investments in bonds. Until the 2nd quarter of 2007, the deviation from CIP was not large. In 2006, the deviation from CIP was only 0.20% for 3 month investment and 0.28% for 1 year investment. Moreover, if we take into account transaction costs, the actual arbitrage opportunity could be minimal.

\(^\text{12}\) Specifically, the deviation from CIP is \((i-i^*) - \left((F-S)/S\right)\), where \(i\) and \(i^*\) are domestic and foreign interest rates and \(F\) and \(S\) are forward rate and spot rate.

\(^\text{13}\) The bond investments by foreign investors are heavily concentrated on Korean government bonds and Monetary Stabilization Bonds (MSBs) issued by Bank of Korea. In 2007, government bonds and MSBs accounted for 66.1% and 31.0% in the total bond investments by foreign investors.
<Figure 6> Spreads of government bond yields and CRS rate

1yr spreads of KTB yields and CRS

3yr spreads of KTB yields and CRS

5yr spreads of KTB yields and CRS

10yr spreads of KTB yields and CRS
The deviation from CIP, however, began to widen considerably from the 3rd quarter of 2007. For 3 month investment, for example, it increased to 1.41% in the 3rd quarter and 2.77% in the 4th quarter of 2007. During the period from the 3rd quarter to the 2nd quarter of 2008, the pressures on FX swap market continued as domestic banks attempt to secure US dollar funding to support domestic firms. At the same time, as argued by Baba, Packer and Nagano (2008), the non-resident foreign banks appeared to become much more cautious about lending U.S. dollars because of heightened counterparty risk and their own need to preserve funds on hand. The liquidity problem in the foreign exchange market stemmed from the unfavorable demand and supply conditions, which likely contributed to further deviations from the CIP conditions.

Despite the large arbitrage opportunity, the foreign bank branches’ investments in bond market actually decreased in mid-2007. In addition to credit crunch triggered by U.S. subprime mortgage problem, foreign bank branches appeared to face a binding constraint on Korean bond investments (Korea limit). Instead, the non-resident foreign investors increased the investments in bonds significantly, probably to exploit the widened arbitrage opportunities. In fact, their net investments in bonds amounted to $12.68 billion in the 3rd quarter and $19.87 billion in the 4th quarter of 2007, comparing to $2.13 billion in the 2nd quarter.

<Table 5> Domestic bond investments by foreign bank branches and non-resident foreign investors

<table>
<thead>
<tr>
<th></th>
<th>2006 1q</th>
<th>2006 2q</th>
<th>2006 3q</th>
<th>2006 4q</th>
<th>2007 1q</th>
<th>2007 2q</th>
<th>2007 3q</th>
<th>2007 4q</th>
<th>2008 1q</th>
<th>2008 2q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Bank Branches</td>
<td>0.83</td>
<td>9.73</td>
<td>6.02</td>
<td>1.17</td>
<td>16.79</td>
<td>-1.22</td>
<td>-2.41</td>
<td>0.68</td>
<td>3.57</td>
<td>-5.17</td>
</tr>
<tr>
<td>Non-resident Foreign investors</td>
<td>0.17</td>
<td>0.41</td>
<td>0.64</td>
<td>0.12</td>
<td>1.82</td>
<td>2.13</td>
<td>12.68</td>
<td>19.87</td>
<td>7.10</td>
<td>8.60</td>
</tr>
<tr>
<td>Total</td>
<td>1.00</td>
<td>10.14</td>
<td>6.66</td>
<td>1.29</td>
<td>18.61</td>
<td>0.91</td>
<td>10.27</td>
<td>20.55</td>
<td>10.67</td>
<td>3.43</td>
</tr>
<tr>
<td>Arbitrage Opportunity (3 month)</td>
<td>0.10</td>
<td>0.26</td>
<td>0.24</td>
<td>0.18</td>
<td>0.30</td>
<td>0.55</td>
<td>1.41</td>
<td>2.77</td>
<td>2.04</td>
<td>1.84</td>
</tr>
<tr>
<td>Arbitrage Opportunity (1 year)</td>
<td>0.16</td>
<td>0.29</td>
<td>0.34</td>
<td>0.35</td>
<td>0.31</td>
<td>0.44</td>
<td>1.10</td>
<td>1.78</td>
<td>2.07</td>
<td>1.97</td>
</tr>
</tbody>
</table>

Source: Bank of Korea

\[14\] In part, foreign bank branches also sold the bonds to headquarters because of the scheduled change in tax schemes in Korea.
Other domestic factors in banking system

Since mid-2000s, Korean banks have attempted to expand competitively. Facing sluggish bank deposits, Korean banks increased bond issuance with fixed coupon rates, and used the proceeds to expand mortgage lending with variable interest rates.\footnote{In Korea, the high ratio of banks’ loans to their deposits was another important concern because the ratio was one of the measures of the vulnerability of banking systems. In fact, the global financial crisis exposed the vulnerability of Korean banks that relied on wholesale funding, especially in a currency other than their domestic currency.} Then, to deal with the interest rate risks, Korean banks entered into interest rate swap agreement with foreign bank branches. Since all the Korean banks faced similar situations, foreign bank branches must be the counterparty of interest rate swaps. In interest rate swaps, Korean banks agreed to pay foreign bank branches cash flows equal to interest at a variable rate while the foreign bank branches agreed to pay Korean banks cash flows equal to interest at a predetermined fixed rate on a notional amount for a number of periods. Interest rate swaps allow Korean banks to manage interest rate risks and also provide foreign bank branches with another important investment vehicle. To finance funds of domestic currency for interest rate swaps, foreign bank branches borrowed money from abroad and used FX swaps. Unlike bond investments, however, foreign bank branches’ entering into interest rate swaps is closely related to lending behaviors of Korean banks.

Another important expansionary area of Korean banks is export-import finance which includes foreign currency lending to machinery and equipment importing firms as well as factoring of export exchange bills and import usance. The share of long-term borrowings by foreign bank branches was only 3.7\% at the end of the 3rd quarter of 2008. In contrast, among the total external debt from borrowing by Korean banks, 14.6\% was long-term debts. It suggests that, in part, Korean banks raised foreign currency funds to support the imports of machinery and equipments.

4. Impacts of Foreign capital outflows on the domestic financial system

An FX swap can be viewed as simple lending and borrowing transactions between financial institutions. The only difference is the currencies involved in the transactions. That is, an FX swap is effectively equivalent to a transaction when foreign bank branches lend foreign
currencies to Korean banks and at the same time borrow Korean won from Korean banks. In the crisis, foreign banks in the advanced countries hit by an adverse liquidity shock reduced its cross-border lending and also reduced funding to its foreign branches in support for the head office balance sheet. The retreat of foreign banks’ lending led to a severe dislocation from FX swap market and caused funding difficulties of Korean banks. Therefore, when liquidity conditions tightened in foreign countries, Korean banks suffered from foreign currency liquidity problem not only in the direct borrowings but also in the indirect funding through FX swaps. Figure 7 illustrated the two channels of transmitting foreign shocks to Korean banks. Indeed, as Ceterolli and Goldberg point out, international banking linkages are viewed as having spread the profound difficulties from the financial crisis that began in advanced counties to emerging economies including Korea.\textsuperscript{16}

<Figure 7> Channels of transmitting foreign liquidity shocks

Building on Upper and Worm (2004) and others, S. Lee (2010) attempts to measure financial systemic risks in Korea stemmed from FX swaps with foreign bank branches. He calibrates foreign currency loan transactions by using end uses of foreign currencies and direct

\textsuperscript{16} Many studies document that systemic risks of financial institutions tend to increase as they are more interconnected. Allen and Babus (2009) provide an excellent survey.
sources of foreign currencies\textsuperscript{17}. To elaborate, let $b_{ji}$ denote the foreign currency borrowings of bank $i$ from bank $j$, $v_{ik}$ be the foreign currency borrowings of bank $i$ from exogenous sector $k$, $u_{ki}$ be the foreign currency loans of bank $i$ to external sector $k$, and the foreign currency short (long) position of bank $i$ be $s_i > 0$($s_i < 0$). Then the balance sheet of bank $i$ implies that the total uses of foreign currency funds must be equal to the total sources of foreign currency funds:

$$
\sum_{j=1}^{N} b_{ji} + \sum_{k=1}^{M} u_{ki} + s_i = \sum_{j=1}^{N} b_{ij} + \sum_{k=1}^{M} v_{ik} = x_i,
$$

where $N$ is the number of banks in the banking system, $M$ is the number of external sectors which include non-financial firms and $x_i$ is total liabilities of bank $i$. Here, what we can observe from each bank is $\sum_{k=1}^{M} v_{ik}$, $\sum_{k=1}^{M} u_{ik}$, and $x_i$, $b_{ji}$’s are calibrated using a modified version of Schneider and Zenios (1990). Then, $b_{ji}$’s indicate the interbank foreign currency lending exposures of the Korean banks.

Then, under additional assumptions, he calculates the amount of foreign currency assets directly or indirectly liquidated by each bank when it is unable to roll over one unit of external borrowing. With these measures, he constructs the Systemic Funding Risk Indicator (SRI) and argues that it shows the extent of amplification impact of the external liquidity shock on the banking system due to the interconnectedness.

Figure 8, adapted from S. Lee, shows that SRI jumped up in 2006 when FX swap transactions increased along with the sharp rise of foreign bank branches’ external borrowings. Because, by construction, SRI should be equal to one if there is no interbank transaction of foreign currencies, the higher values of SRI since 2006 suggest increased interconnectedness in foreign currency funding. Since SRI is constructed under the assumption that the banking system is hit by unitary foreign currency liquidity shocks in each point of time, it does not tell us the actual magnitude of risks that the banking system might face. To measure more realistic foreign currency funding risks, the size of the shocks is adjusted by multiplying the level of external debts. Figure 9, also adapted from S. Lee, shows that the adjusted SRI peaks at the 2nd quarter of 2008, suggesting that very high risk prevailed just before the Lehman Brothers bankruptcy.

\textsuperscript{17} This approach is taken because it is difficult to observe official statistics of FX swap transactions among banks
<Figure 8> Systemic funding risk indicator in the Korean banking industry

<Figure 9> Adjusted SRI
5. Concluding Remarks

The extent of the international financial integration became painfully evident to Korea during the recent global crisis, with the insecurity of international financial markets spreading foreign currency funding pressure to domestic banking system. High short-term external debts resulted from excessive short-term borrowings by banks reinforced the immediate and powerful international transmission of shocks into the domestic economy and raised concerns about another currency crisis in Korea.

To reduce the vulnerability of foreign exchange market to external shocks, Korean government is preparing comprehensive measures to curb an excessive rise in the short-term external debt during normal times and their sudden outflow during periods of financial instability. Since the early 2000s, there have existed several restrictions on foreign currency liquidity in banking sector. For example, Korean banks should maintain foreign currency denominated short-term assets to be greater than 85% of foreign currency denominated short-term debts. But, this restriction on short-term foreign currency liquidity ratio was not effective during the recent crisis. Because Korean banks made short-term loans to non-financial firms in a way that the firms rolled-over the loans, the liquidity ratio could be met. However, banks could not call in loans during the crisis period. Therefore, the government recently refined the restriction in that, for example, banks should hold a certain portion of safe assets among the foreign currency denominated short-term assets.

Another important measure that the Korean government is planning to adopt is to directly regulate the total size of FX swap transaction by imposing a limit on forward position depending on bank capital. This new regulation is expected to decrease risk exposures in banking system but may have serious adverse effects on trade financing.
References


