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The role of banking portfolios in the transmission from currency crises to banking crises – potential effects of Basel II*

Abstract

This paper evaluates the potential effects of the Basel II accord on preventing the transmission from currency crises to financial crises. By analyzing the case study of South Korea, it shows how mismatches on banks' balance sheets were the primary cause for such a transmission, and models how Basel II would have affected those balance sheets. The paper shows that due to South Korea's positive credit rating in the months leading up to the crisis, the regulatory capital reserves under Basel II would have been even lower than those under Basel I, and that therefore Basel II would have had adverse effects on the development of the crisis. In the second part, the article analyses whether the behavior of rating agencies has changed since their failure to predict the Asian crisis. The paper finds no robust econometric evidence that rating agencies have started to take micro-mismatches into account when assigning sovereign ratings. Thus, given the current approach of credit rating agencies, we have reservations concerning the effectiveness of Basel II to prevent the transmission from currency crises to banking crises, both for the case of South Korea and for potential future crises.

JEL Classification: F3, F40, G15, G28

Keywords: Asian Financial Crisis, Bank Portfolios, Currency Mismatch, Maturity Mismatch, Basel II, Credit Ratings

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Zusammenfassung

Die vorliegende Arbeit untersucht die möglichen Effekte der Basel II-Bankenregulierung auf die Transmission von Währungskrisen zu Bankenkrisen. Die Analyse des Beispiels Südkorea zeigt die wichtige Rolle der Unausgeglichenheit von Bankaktiva und -passiva in bezug auf deren Fristigkeit und Währung bei diesem Transmissionsprozess und stellt dar wie Basel II auf die Bankenbilanzen gewirkt hätte. Es wird gezeigt, dass die regulatorischen Kapitalanforderungen unter Basel II, aufgrund der guten Kreditratings im Vorfeld der Krise, geringer gewesen wären als unter Basel I. Dadurch wäre die Krise verschärft worden. Im zweiten Teil der Arbeit wird analysiert, ob die Ratingagenturen ihr Verhalten seit dem Versagen bei der Prognose der Asienkrise geändert haben. Dieser Beitrag findet keine empirische Evidenz für eine Berücksichtigung der Unausgeglichenheit in den Bankenbilanzen bei der Ableitung von Ratingergebnissen für Länder. Deshalb muss die Effektivität von Basel II bei der Prävention der Transmission von Währungs- zu Bankenkrisen sowohl im Falle Südkoreas als auch bei möglichen zukünftigen Krisen angezweifelt werden.

Schlagworte: Asienkrise, Bankenbilanzen, Währungs-Mismatch, Laufzeit-Mismatch, Basel II, Kreditratings

Introduction

The severe financial market turbulences of the East Asian crisis have highlighted the dangers associated with an unregulated, globalized financial system. To prevent the future spread of currency crises throughout the domestic financial system, as was the case in South Korea in 1997, numerous alterations to the international financial architecture have been recommended. The revised "Basel Accord on Capital Adequacy" (Basel Committee, 2005) by the Bank for International Settlements (from now on the "Basel II" accord) has been proposed as one potential tool to limit financial crises in the future. In this paper we analyze the possible usefulness of the Basel II accord's regulation of bank portfolios in preventing the transmission from currency crisis to banking crises, by assessing the impact Basel II could have had on inhibiting such a transmission in the case of South Korea.

In Section I of this essay a taxonomy of currency crises is provided, with particular focus on the issues of currency mismatch and maturity mismatch that characterize third generation currency crises, and which are the main avenues of transmission of currency crises to the domestic banking system (Chang and Velasco, 1999). We then outline the events that led up to the Korean currency crisis of 1997, and describe the crisis in some detail. In Section III the set-up of the Basel II accord is explained. We show how the effectiveness of this mechanism to set regulatory capital reserves depends crucially on the correct assessment of sovereign default-risk by external credit rating agencies such as Standard & Poor's.

In Section IV we simulate the potential effects of Basel II on preventing the Korean currency crisis, and its transmission to a banking crisis. We focus on the accord's effects on capital reserves, its potential pro-cyclical effects, and its impact on the maturity structure of bank financing. We show that under the Basel II regulation, regulatory capital reserves would have been lower than under the prevalent Basel I accord. This is primarily attributed to the failure of external credit rating agencies to correctly analyze the real vulnerability of the Korean economy. Section V takes this issue further and analyses whether the performance of rating agencies is sufficiently reliable to merit the central role they are allocated in the new Basel accord. We argue that the performance of the rating agencies before the crisis on Korea throws severe doubt on whether the imposition of Basel II in 1997 could have prevented the crisis from occurring. We then analyze whether the rating agencies have changed their rating procedures to such an extent that they now take account of the indicators that signal currency and maturity mismatches. We further examine whether or not the current rating procedures of rating agencies will have increased the effectiveness of Basel II in preventing the future transmission of third-generation currency crises to banking crises. While our analysis is restricted by data limitations, we find no robust econometric evidence that rating agencies have started to take micro-mismatches into account when assigning sovereign ratings. Thus, given the current approach of credit rating agencies, we have reservations concerning the effect-tiveness of Basel II in preventing such a transmission from currency crisis to banking crisis, both for the case of South Korea and for potential future crises.

SECTION I – Theoretical Background

In November and December 1997, South Korea's currency collapsed, leading to a sharp economic decline with GDP falling by 6,9% in 1998. This came as a surprise to most market participants and official observers, given South Korea's remarkable economic success over the previous decade: Between 1995 and 1997, the world's 11th-largest economy had grown by an average of 6.8% per annum (IFS, 2006). However, retrospectively Korea's remarkable economic success disguised a number of structural, micro-economic weaknesses, primarily related to the balance sheet of the financial sector. These weaknesses can be interpreted to have been the primary driver of the transmission from the currency crisis throughout the whole economy, mainly via the banking sector. In order to explain exactly what these weaknesses were, and how they contributed to the transmission from the currency crisis to a banking crisis, we start by surveying the literature on the various models of currency crises, with a particular focus on the so-called "third-generation" crises, which most accurately describes the events in Korea.

1.1 Taxonomy of Currency Crises

The academic literature distinguishes broadly between three different models or "generations" of currency crises. Until the early 1990s the prevailing **first-generation model** explained currency crises in terms of macroeconomic mismanagement on part of the sovereign. Broadly speaking, a crisis would arise when the monetization of fiscal deficits would drive the shadow exchange rate of a currency above the level of the peg as determined by the government. Speculators, realizing that government attempts to maintain the peg would eventually lead to a decline in reserves, would move to sell their assets before the inevitable devaluation, bringing about the devaluation even earlier than would otherwise have been the case. (Krugman, 1979; Flood and Garber, 1984). This model served well to account for the currency crises in Latin America in the 1970s and 1980s.

The ERM crisis of 1992 necessitated the development of a new, **second-generation model** of currency crises. The forced exit of the British pound from the rigid European Exchange Rate Mechanism (ERM) could not be sufficiently explained by an overly expansionary fiscal or monetary policy – the UK fiscal deficit in 1992 was at 4,7% anything but excessive (Datastream, 2006). Rather, Obstfeld (1994) rationalized the new generation of currency crises as a multiple equilibria game, in which the government views adhering to the peg as a contingent commitment, constantly trading off its costs and benefits. In the dynamic model used to explain the ERM crisis, speculators have the ability to influence this trade-off, and can push a country from a positive to a negative equilibrium. In the early 1990s, the German Bundesbank had raised its interest rates significantly to combat the inflationary effects of the German re-unification. Participation in the ERM, which was practically a DM-peg, forced participating countries to also raise

interest rates to remain within the narrow exchange rate bands. This was particularly difficult for the UK, which was suffering a deep recession with the rate of unemployment in 1992 at 9.2%. While investors believed in the determination of the Major government to remain within the ERM, the trade-off was sustainable. However, once investors feared that Britain might let the pound float against the deutschmark, they moved their capital out of the UK. As a result, sustaining the peg would have required raising interest rates even higher to attract capital. This further increase in interest rates was politically infeasible, and forced the British government to abandon the peg. In the British case, investors' movements out of the pound were coordinated by the actions of George Soros. Such a self-fulfilling, multiple-equilibria model of currency crises has also been used to explain the 1995 Mexico crisis.

The Asian Crisis of 1997-8, and in particular the episode of South Korea, showed that not only macro-economic weaknesses, but also micro-economic weaknesses could be the cause of an exchange rate crisis. While these crises had some self-fulfilling aspects, the central weakness was not of macroeconomic nature, but was related to the balance sheets of the corporate sector, and in particular the banking sector. Therefore, academics have developed a **third-generation model** of currency crises, which focuses on precisely those microeconomic weaknesses that were the predominant background-cause of the Asian crisis. While there are various approaches to these third-generation crises, Krugman (1999) and Chang and Velasco (1999) stressed the important role of balance-sheet imbalances that arose from a number of mismatches in the operations of commercial banks. In particular, strong emphasis has been put on the presence of both currency mismatches and maturity mismatches.

Currency mismatches arise when assets and liabilities on the private and corporate sectors' balance sheets are denominated in different currencies. This is a particularly prevalent problem in developing and emerging market economies, because agents in these countries are generally unable to borrow large amounts in their local currency, and thus have to rely on financing themselves by borrowing in foreign currency (Lindner, 2006). This is especially problematic in a system of tightly managed exchange rates (as was the case in most the Asian economies prior to the crisis), where these mismatches are rarely hedged in the belief that the peg or quasi-peg will be sustained. These currency mismatches are an important mechanism in the transmission from currency crises to banking crises. Once a currency crisis is set in motion (whether due to macro-economic mismanagement, real shocks or due to a decline in investor confidence), the currency depreciation in the presence of a currency mismatch will lead to a deterioration of banks' balance sheets. In particular, the presence of foreign currency denominated debt will result in a negative wealth effect for local banks by increasing the domestic currency value of banks' liabilities. This can have a serious adverse effect on the banks' ability to lend, resulting in a credit crunch, and potentially in bank insolvency (Arteta and Hale, 2006).

Maturity mismatches between assets and liabilities on a balance sheet result in financial institutions, and in whole countries being vulnerable to an international version of a Diamond and Dybvig (1983) style bank-run. Most banks finance themselves short-term on the international financial markets, while lending long-term to domestic corporations (Kashyap, et al, 2002). In the case of a currency crisis given currency mismatches, with the associated deterioration of banks' balance sheets outlined above, international lenders may become unwilling to roll-over the financing of banks. This necessitates banks to prematurely call-in loans, leading to a credit crunch and worsening the crisis. If banks are unable to immediately call in sufficient number of loans to satisfy the withdrawal-demands of international investors (a task complicated by the currency mismatches outlined above), this can also increase the danger of banks becoming insolvent.

SECTION II – The Korean Currency Crisis

In the run-up to the Korean Currency crisis, macroeconomic conditions appeared very sound (Radelet and Sachs, 1998). GDP was growing in 1996 at a healthy 7%, inflation was approximately 4.9%, and foreign exchange reserves at a high, even though the current account deficit had widened significantly. The fiscal balance was in surplus, suggesting that the currency crisis could not be explained by the first-generation model outlined above. Also, second-generation models lack explanatory power: The low rate of unemployment meant that sustaining the peg in Korea, even in the face of high interest rates, was not as damaging, as, for example, the sustaining of the peg by the United Kingdom in 1992 would have been.

Table 1:
South Korean Financial Indicators

Description	1992	1993	1994	1995	1996	1997	1998
GDP AT 2000 PRICES (Trillion Won)	371.4	394.2	427.9	467.1	499.8	523.0	487.2
GDP GROWTH	5.9	6.1	8.5	9.2	7.0	4.7	-6.9
CPI (%)	6.3	4.7	6.3	4.5	4.9	4.4	7.5
UNEMPLOYMENT RATE (%)	2.4	2.8	2.4	2.0	2.0	2.6	6.8
FOREIGN EXCHANGE (Billion USD)	16.6	19.7	25.0	31.9	33.2	19.7	52.0
CURRENT ACCOUNT (Billion USD)	-4.1	0.8	-4.0	-8.7	-23.2	-8.4	40.4
FISCAL DEFICIT (-) OR SURPLUS (Trillion Won)	-1.2	1.7	1.0	1.0	0.4	-5.7	N/A

Source: IFS (2006).

2.1 Background Causes

The positive macroeconomic indicators disguised the vulnerability of the Korean economy resulting from the balance sheet of the private sector, in particular of banks. Bank credit extended to the private sector had risen from 36.6% of GDP in 1980 to 65.6% of GDP in 1997, severely increasing the leverage of the commercial sector. By the end of 1997, the thirty most important conglomerates were financed with an average debt-to-equity ratio of 519%. This can be contrasted to a gearing of 157% in the US and 193% in Japan. (Bisignano, 1999). There is also evidence of both severe currency mismatches and maturity mismatches that contributed to the vulnerability of the economy. This was particularly problematic in Korea, where the absence of properly developed capital

markets increased the reliance of domestic firms on the banking sector for finance (Chino, 2000).

The **maturity mismatch** that was prevalent in the South Korean economy on the eve of the crisis was to a large extent the result of the process of capital account liberalization pursued by the Korean government. In 1993 the government had increased the scope for short-term foreign borrowing, by liberalizing short-term lending rates, while retaining the restrictions on long-term borrowing as well as direct access to capital markets by Korean firms. Short-term external debt rose from USD 40bn in 1993 to USD 98bn at the beginning of October 1997. Of this amount of short-term debt, commercial banks could only cover 55% with short-term assets (Chopra et al, 2001). Bisignano (1999) provides similar evidence for the reliance of merchant banks (which were even less regulated than generic commercial banks) on short-term financing. Table 2 shows that by 1997 Merchant Banks had raised almost USD 12bn in short-term funds that could not be covered by short-term assets. This created serious problems of maturity mismatch, which in the case of declining investor confidence could lead to a serious roll-over problem.

Table 2:
Foreign Funds Raised and Employed by Merchant Banks (Million USD)

		1992	1993	1994	1995	1996	1997
Funds Raised	Long-Term	1,276	1,953	2,182	4,568	5,996	5,428
	Short-Term	3,258	3,583	5,083	7,091	12,627	13,684
	Total	4,534	5,526	7,265	11,659	18,623	19,113
Funds Employed	Long-Term	4,418	5,382	7,114	11,442	17,823	17,106
	Short-Term	116	144	151	217	800	2,007
	Total	4,534	5,526	7,265	11,659	18,623	19,119

Source: Bisignano (1999).

In addition, most of the short-term bank financing was in foreign currency, which created a serious **currency mismatch**. Cho and McCauley (2003) calculate that the proportion of foreign-currency debt to total debt in the South Korean economy rose from 15,6% in 1992 to 28,5% in 1997. Sharma (2004) argues that this was partly due to high domestic interest rates, which were significantly above world interest rates, encouraging banks to heavily rely on cheap foreign credit. The strong macroeconomic performance prior to the crisis, and the success of the currency-peg, led most banks to underestimate the risk of their foreign currency exposure. As a result, only a small part of the outstanding currency mismatch was hedged by market participants. Therefore, the large, unhedged foreign borrowing, combined with its short maturities, left South Korea vulnerable to a third-generation currency crisis.

This problem was intensified by a **lack of prudential monitoring** and supervision of the banking sector. Significant moral hazard was present in the financial system, resulting

from the assessment that the Korean government would not allow any of its major banks or corporations to fail. Bank of Korea economists claimed that the "popular expression 'conglomerates will never go broke' had been considered an unwritten law" (Bank of Korea, 1998). In their interviews with South Korean economists, Amess and Demetriades (2001) showed that similar implicit guarantees were assumed for the financial sector. They found that prior to the crisis 93.1% of economists believed that South Korean financial institutions enjoyed implicit guarantees from the government. However, even if the government had issued explicit guarantees to the banking sector (as partly was the case with the introduction of the 1996 Deposit Insurance Scheme), the currency mismatch on the balance sheets of the banks that were guaranteed severely reduced the usefulness of such a guarantee. In the case of a currency crisis, the central bank's own lack of foreign currency reserves limits its ability to provide banks with the type of liquidity (e.g. foreign currency) that would be necessary to avert a bank-run. Therefore, in the presence of currency mismatches, a small change in the perceived ability of the government to provide foreign currency liquidity to banks could trigger a bank-run and be an additional transmission mechanism from currency crises to banking crises.

The government also intervened in lending decisions, directing many funds towards the large *chaebol* conglomerates and preventing the development of effective risk-management systems. This practice of state-directed credit allocation has removed, or at least delayed, the need for banks to develop effective internal risk-management procedures (Sharma, 2004).

2.2 Proximate Causes

In this situation of financial vulnerability, a changing external economic environment posed real dangers for the health of the South Korean economy. Some of these factors were general macroeconomic problems, such as rising oil prices and the depreciation of the yen against the US dollar, which reduced the competitiveness of Korean firms. In 1997, first indicators of an impending crisis emerged. The fall in the world-market prices for South Korean exports such as semiconductors led to the collapse of a number of large *chaebols*. Table 3 shows the sequence of chaebols becoming insolvent and going bankrupt. The collapse of a significant number of important creditors inevitably undermined the health of the banking-sector balance sheet and rapidly eroded the capital position of banks in Korea. While non-performing loans stood at approximately 12.2 trillion won at the end of 1996, this figure rose to 21.9 trillion won in the nine months leading up to September 1997 (Bank of Korea, 1998).

As a result, in July 1997, several Korean banks were placed on a negative credit outlook by international rating agencies (Chopra et al, 2001). The devaluation of the Thai bath, and the ensuing contagion, negatively influenced international investor attitude towards Asian emerging market economies. A sharp increase in risk aversion of investors, combined with a re-assessment of the riskiness of investments in Asian emerging market

economies, led to a gradual increase in capital outflows from Korea. International banks and investment funds, unable to distinguish at first between healthy and unhealthy Asian economies began to reduce their exposure to the Korean market, despite government guarantees to ensure that Korean banks repaid their liabilities.

Table 3:
Bankruptcies of Chaebols, 1997

January 23	Bankruptcy of Hanbo Group
March 19	Bankruptcy of Sammi Group
April 21	Jinro Group filed under Corporate Bankruptcy Postponement Accord
May 28	Daenong filed under Corporate Bankruptcy Postponement Accord
July 15	Kia filed under Corporate Bankruptcy Postponement Accor
November 1	Bankruptcy of Haitai Group
November 4	Bankruptcy of Newcore Group
December 5	Bankruptcy of Hanlla Group

Source: Lee and McNulty (2003).

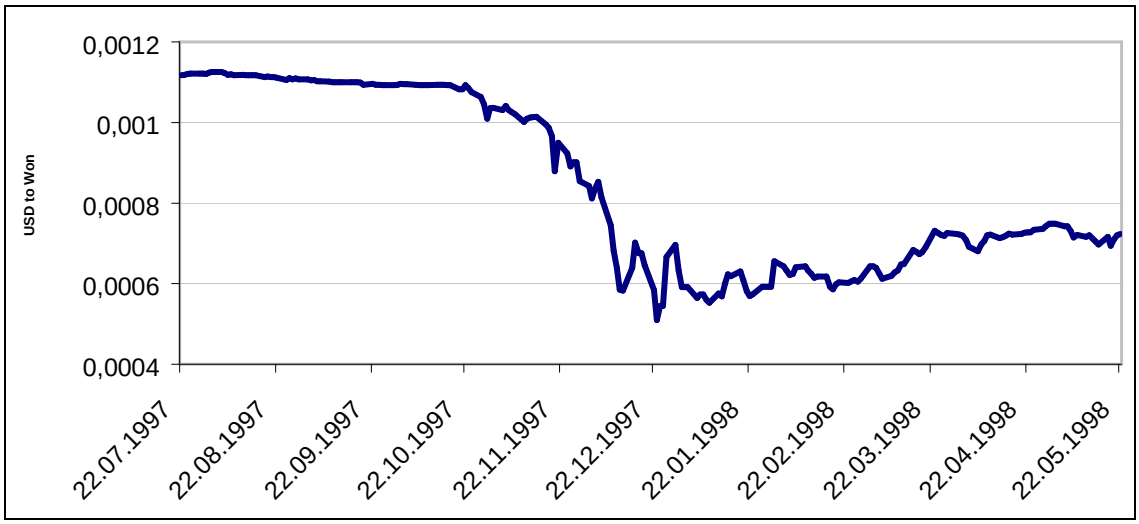
2.3 Crisis and Resolution

Problems became serious when on October 24, Standard & Poor's downgraded Korea from AA- to A+, due to the government practice of bailing out failing companies. As a result, many market participants lost faith in the Korean economy, and started to further withdraw credit lines. Between July and October 1997, the rollover rate of the seven largest South Korean banks was generally over 85%. By November, this rate had fallen to 58.8%, declining further to 32.2% in December (Bank of Korea, 1998). Diagram 1 shows clearly that beginning in late October 1997, the South Korean won depreciated heavily against the US dollar, forcing the Bank of Korea to give up its peg, and pushing the country into a currency crisis.

These developments led to a serious credit crunch, amplified as outlined above by the presence of problematic currency and maturity mismatches. Ferri and Kang (1999) analyzed individual bank data and found that banks raised lending rates and rapidly reduced their lending. The refusal of international capital markets to roll-over credit-lines to banks led to a foreign-currency shortage, as banks were trying to obtain enough foreign currency to repay their maturing short-term liabilities. Between October and November 1997, usable South Korean foreign exchange reserves fell from USD 22.3bn to USD 7.3bn, a level insufficient to cover even one month's imports (Bank of Korea, 1998). On November 21, 1997, South Korea had to turn towards the IMF for support. A multilateral

aid package of USD 58.3bn, including the largest IMF support package up to that time, was agreed on December 3, 1997, conditional on several structural and macro-economic reform projects. However, only the election of a new South Korean president on December 18, 1997 could partly restore the trust of international investors in the South Korean economy.

Diagram 1:
Korean Won / USD Exchange Rate



Source: Datastream.

SECTION III – The Basel II Accord

In the aftermath of the Asian financial crisis, the academic and professional community has made numerous suggestions on how to deal with some of the weaknesses in the international financial architecture that had been demonstrated by the Asian financial crisis. For example, it has been proposed to introduce an International Lender of Last Resort, that would aid (pre-qualified) countries with temporary solvency problems (see Sachs, 1999, and Rogoff, 1999, for an overview of these suggestions). Joshi (2003) suggests to consider the introduction of capital controls. Another proposal (which forms the topic of this essay), has been the introduction of an accord to regulate the capital reserves of banks. Basel II is the proposed accord, and allows more control over the balance sheets and lending behavior of financial institutions. Banks operate under a system of fractional reserve holding, in which the liquid assets that banks hold at any given moment in time represent only a fraction of their liabilities. This system relies on the statistical assumption that it is unlikely for all depositors to withdraw their deposits simultaneously. In the absence of regulatory requirements, banks have a strong incentive to engage in very risky lending projects without holding sufficient buffer capital, relying on the central bank as a domestic lender of last resort to provide the necessary liquidity in case of default or a bank run (Santos, 2001). This moral hazard is further increased by the limited liability status granted to most banks, which reduces the personal loss of employees in the worst-case scenario. Miller and Zhang (1999) argue that regulatory capital requirements are one way to reduce such moral hazard. The correct amount of such capital reserves should depend, among other factors, on the riskiness of the loan, that is, on the probability of its default.

In addition, properly regulated banks with sufficient regulatory capital also minimize the danger of a lack-of-confidence-induced bank run. If investors know that banks hold sufficient capital to remain solvent even in the face of corporate bankruptcies, they will limit the rate of withdrawal of capital, therefore contributing to the maintenance of solvency. Thus, in theory, regulatory capital requirements could be an effective way of helping to prevent currency crises turning into banking crises.

3.1 Overview of Basel II

In June 1999 the Basel Committee on Banking Supervision issued a proposal for a new capital adequacy framework for banks. This so-called Basel II accord was to replace previous attempts at regulating capital adequacy, in particular the Basel I accord of 1988, which had proved too simplistic.[1] The new approach substantially changes the treatment of credit risk, and compels banks to retain capital reserves to cover operational risks in

1 For example, Basel I risk-weighting for sovereign lending only distinguished between OECD countries (which were weighed at 0%) and non-OECD countries (which were weighed at 100%).

addition to market and credit risk. By aligning the capital requirements more closely with the perceived default risk of the debtor, Basel II aims to curb imprudent lending practices by providing incentives for banks to discriminate between borrowers on the basis of their repayment risk. Basel II is based on a three-pillar approach, and is timetabled to be implemented by domestic regulators around the globe by January 1, 2008 at the latest. South Korea has decided to implement the accord by the end of 2007 (Bank of Korea, 2005).

Pillar I outlines minimum regulatory capital requirements for banks. It regulates the amount of capital that banks must hold to protect their balance sheet against credit risks, operational risks and market risks. Basel II maintains the minimum capital requirement at 8% of risk-weighted assets, as set by the Basel I accord. However, it introduces a more sophisticated risk-weighting approach to determine the exact amount of regulatory capital. This approach, and the impact of external credit ratings on the amount of regulatory capital, are the primary focus of this essay. In addition, Pillar I outlines methods for credit risk mitigation that would allow a reduction in regulatory capital. This credit risk mitigation is possible by obtaining collateral or by selling credit risks in the market (for example through Credit Default Swaps).

Pillar II outlines the process for supervisory control of the financial institution's risk management process and its capital adequacy. In this way, Basel II attempts to reduce the dangers to the financial system caused by insufficient supervisory oversight or inadequate corporate governance.

Pillar III attempts to enforce a higher degree of market discipline by regulating the disclosure requirements of banks. In particular, the Basel Committee stated that "The purpose of Pillar 3 is to complement the minimum capital requirements and the supervisory review process. The Committee aims to encourage market discipline by developing a set of disclosure requirements which will allow market participants to assess key pieces of information on the scope of application, capital, risk exposures, risk assessment processes, and hence the capital adequacy of the institution." (Basel Committee, 2005).

In the following, I will focus exclusively on the alterations in the process of determining credit risk that were outlined in Pillar I.

3.2 Determining Credit Risk

The primary improvement of Basel II upon Basel I is in the process of evaluating and determining the credit risk faced by financial institutions. The increased sophistication of Basel II results from its more complex process of allocating different risk weights to different types of claims. Basel II allows banks to choose from a continuum of three approaches to determine these risk weights. This permits each financial institution to select the approach that is most appropriate to its size, complexity and nature of risk.

Table 4 shows the three different approaches at the disposal of banks. Banks can choose between the so-called standardized approach and two versions of the Internal Ratings Based (IRB) approach. The standardized approach allocates a certain risk-weight to each claim on the basis of a rating of the issuer of the claim provided by an external rating agency such as Standard & Poor's or Moody's. The method for determining capital requirements for credit risk can be summarized in a very simplistic way. The capital reserves that banks are required to hold are obtained by taking 8% of the product of the risk-weight of a particular claim and the volume of the claim.

Minimum Capital Requirement = Risk Weight x Volume of Claim x 0.08

Table 4:
Various Approaches to Measuring Credit Risk

Criteria	Standardized Approach	Internal Ratings Based (IRB) Approach	
		Foundations Approach	Advanced Approach
Rating	External	Internal	Internal
Risk Weight	Calibrated on the basis of external ratings by the Basel Committee	Function Provided by Basel Committee	Function Provided by Basel Committee
Probability of Default	Implicitly provided by the Basel Committee; tied to risk weights based on external ratings	Provided by bank based on own estimates	Provided by bank based on own estimates
Data Requirements	• Provision dates • Default events • Exposure Data • Customer segmentation • Data collateral segmentation • External Ratings Collateral Data	• Rating Data • Default events • Historical data to estimates PDs • Collateral Data	• Same as IRB foundation plus: • Historical loss data to estimate loss given default • Historical exposure data to estimate exposure of default

Source: KPMG International, 2004.

The Internal Ratings Based (IRB) approaches are less clearly specified and more complex. They allow banks to use their own risk-management processes to allocate risk-weights to different claims in their portfolio. It is very difficult to obtain the data necessary to simulate the capital requirements for banks applying their own, complex risk-management mechanisms. In addition, the Basel Committee assumes that, at least initially, the majority of banks will be using the standardized approach (BIS, 2002); only the most sophisticated international banks are expected to utilize the IRB approach.

Therefore, the rest of this paper will model the potential effects of Basel II by focusing on the standardized approach.

As detailed by Table 4, under the standardized approach, the risk-weights associated with different loans in a bank's portfolio are determined by external credit rating agencies. The risk-weights associated with certain credit ratings also depend on the type of debtor. Table 5 summarizes the various risk-weights associated with different external credit ratings for each borrower class.

For sovereign borrowers, OECD-membership will no longer be the determining criterion for risk-weights. Instead, the assessment of external credit rating agencies will determine the risk-weights of sovereign borrowers. This should improve the ability of the Basel accord to differentiate between very real disparities in sovereign risk between both members and non-members of the OECD.

For the treatment of banks as debtors there are two options: The first option assigns banks a risk-weight category that is one class below that of the sovereign of incorporation. A cap of 100% is imposed, except for banks in countries rated worse than B-, in which case a cap of 150% is introduced. Alternatively, national supervisory bodies can choose a second option, which allocates risk-weights dependent on external assessments of banks. In the case of the second option, claims on some banks (Rated A+ to BB-) with an original maturity of less than three months receive a risk weighting that is one category more favorable than the risk-weighting attached to long-run credit to those banks.

Table 5:
Basel II Risk Weightings under the Standardized Approach

Credit Assessment	AAA to AA	A+ to A-	BBB+ to BBB-	BB + B-	Below B-	Unrated
Sovereign	0%	20%	50%	100%	150%	100%
Banks – Option 1	20%	50%	100%	100%	150%	100%
Banks Option 2 – Long-Term	20%	50%	50%	100%	150%	50%
Banks Option 2 – Short-Term	20%	20%	20%	50%	150%	20%

Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BB-	Below B-	Unrated
Corporate	20%	50%	100%	150%	100%

Source: Basel Committee, November 2005.

For corporate borrowers, the Basel II accord also moves away from the “one-size-fits-all” approach of Basel I, which assigned a risk-weight of 100% to all corporate credits. Instead, as in the case of sovereign borrowers, an external assessment of credit risk determines the risk-weight attached to a corporate loan.

For all types of borrowers, the new Basel accord poses the real danger of adverse selection associated with the fact that unrated organizations will be assigned a lower risk-weighting than low-rated organizations. Therefore, organizations that expect to obtain a bad credit rating are motivated to obtain no rating at all. The Basel committee was aware of that danger, but concluded that the 100% risk-weight for unrated institutions was warranted to prevent an unnecessary increase in the borrowing costs of small- and medium-size businesses, which may have healthy balance sheets but do not want to incur the costs associated with soliciting a rating.

It has been suggested that the introduction of Basel II capital requirements could contribute in the future to the prevention of currency crises and their transmission to banking crises (Siebert, 2005). In order to evaluate such a claim, we attempt to deduce whether the Basel II accord could have helped to prevent past currency crises. In particular, we analyze the case of South Korea. There are a number of reasons to imagine that the introduction of Basel II could have helped to prevent the South Korean crisis. In particular, under the old Basel I accord, South Korea, as an OECD member, was assigned a 0% risk weight, requiring banks to hold no regulatory capital against claims on the South Korean government. Under the Basel II accord, the quantity of capital requirements depends in part on the external rating of the sovereign. A potentially higher level of regulatory reserves could have allowed banks to cover a larger proportion of the capital outflow without having to terminate domestic lending, softening the credit crunch. In an optimal case, the higher levels of capital reserves could have induced sufficient confidence in the health of the banking system to prevent the capital outflows in the first place.

SECTION IV - The potential effect of Basel II on the Korean Crisis

In this section we attempt to predict the effects that Basel II could have potentially had on the development of the Korean crisis. Specifically, we simulate the difference in regulatory capital requirements of banks had Basel II rather than Basel I been in place. We also discuss potential pro-cyclical effects that Basel II may have had, in addition to potential effects on the maturity structure of bank borrowing. We show that under the assumptions of our simulation, regulatory capital requirements would have been even lower under the proposed accord than under Basel I – this suggests that Basel II would have had little positive, and potentially even adverse effects on investor confidence. However, we also show that the capital requirements depend crucially on the sovereign credit rating of Korea. Specifically, we show that Basel II could have had a positive effect on capital reserves had the sovereign credit rating of South Korea been only marginally worse.

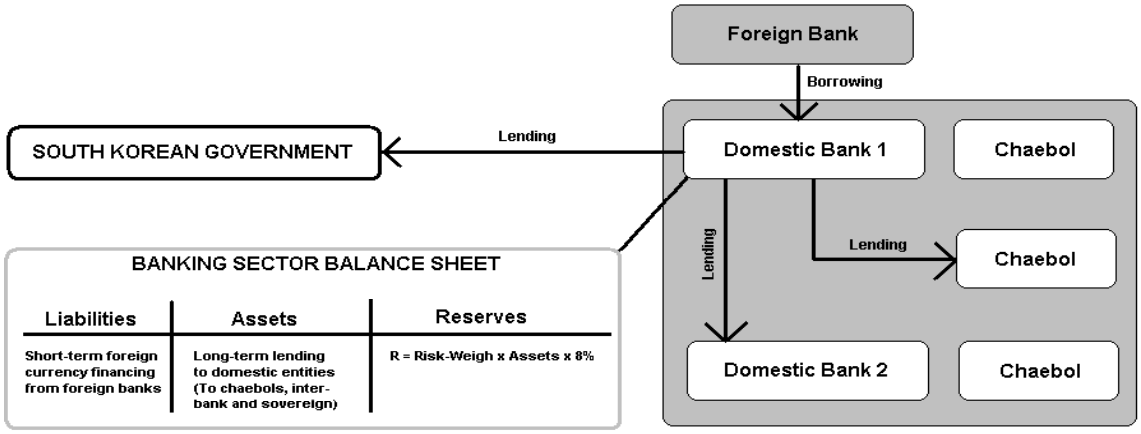
4.1 The importance of the sovereign credit rating

Sovereign credit ratings are of particular importance in determining the impact of Basel II on regulatory capital requirements. This is because even though sovereign debt may only represent a small proportion of the assets in a bank's portfolio, the risk-weights associated with other assets are closely related to the credit risk of sovereign debt. Diagram 2 shows the different positions on the balance sheet of a typical emerging-market bank.

As described above, banks generally finance themselves via short-term loans from foreign banks. Its assets are comprised of lending to its sovereign entity (in our example to the government of South Korea), lending to other domestic banks and lending to domestic corporates (in the case of South Korea, primarily the powerful chaebols). The minimum regulatory reserves specified by Basel II depend on the risk-weightings of each of these assets. However, it can be shown that the majority of these risk-weightings are closely related to the sovereign credit rating.

In Section III we showed how the risk-weighting associated with sovereign debt is a direct function of the credit rating allocated to the national government. In addition, the risk-weights associated with lending to other banks are often also related to sovereign credit ratings, via "Option 1" described in Section III. The third major component of the asset-side of banks' balance sheets, lending to the corporate sector, is also partly a function of the credit rating of the country of incorporation. Creditworthiness of large corporations in Korea often depended upon the explicit or implicit government guarantees, and a downgrade of the sovereign could thus affect the risk-weights of corporate lending. State involvement in the South Korean economy was very high, and it is generally accepted that the government provided implicit guarantees to the corporate sector. As argued above, in their interviews, Amess and Demetriades (2001) found that the overwhelming majority of South Korean economists believed that the South Korean banks enjoyed government credit guarantees.

Diagram 2:
Importance of Sovereign Credit Rating



Components of Risk-Weight

1. Risk-Weight of Sovereign Debt → Dependent on Sovereign Rating
2. Risk-Weight of Lending to Domestic Bank → Via Basel II Method 1 → Dependent on Sovereign Rating of Country of Incorporation
3. Risk-Weight of Lending to Chaebols → Dependent on Rating of Chaebols → Dependent on Sovereign Rating via "Sovereign Ceiling"

A different but related argument is used by credit rating agencies such as Standard & Poor's to justify what is sometimes termed the "sovereign ceiling". This is the idea that due to the tax-raising powers of the government it is very unlikely that a corporate borrower will be able to have a more favorable credit rating than the country of incorporation.[2] Thus, a sovereign downgrade will almost necessarily lead to a downgrade in the ratings of significant portions of the corporate sector. Therefore it becomes clear that a correct assessment of sovereign credit risk by credit rating agencies is an important aspect in the successful application of Basel II, because sovereign credit ratings play an integral part in determining the minimum regulatory capital reserves related to the majority of assets in a bank's portfolio.

2 „In the case of foreign currency debt, the sovereign has first claim on available foreign exchange, and it controls the ability of any resident to obtain funds to repay creditors. To service debt denominated in local currency, the sovereign can exercise its powers to tax, to control the domestic financial system, and even to issue local currency in potentially unlimited amounts. Given these considerations, the credit ratings of nonsovereign borrowers most often are at, or below, the ratings of the relevant sovereign".

Standard & Poor's also outlines a few exceptions to this idea: "A supportive offshore parent, substantial business and assets in another country, and structural enhancements are the primary attributes associated with a nonsovereign obligor having a rating that exceeds the rating associated with the risk of a sovereign imposing foreign exchange controls."

Standard & Poor's, September 7, 2001, Rating Methodology: Evaluating the issuer.

Standard & Poor's, September 22, 2003, Credit FAQ: Sovereign / Nonsovereign Ratings Differentials.

4.2 Simulating Regulatory Capital Requirements

In this section we proceed to simulate the regulatory capital reserve requirements for Korean banks had Basel II been implemented in 1997, and compare them with the minimum reserves as determined by the Basel I accord.

Monfort and Mulder (2000) of the IMF have previously attempted to approximate such capital requirements for the aggregate of some emerging market economies. They faced the problem that there is insufficiently detailed data available on the actual ratings or "probability of default"- estimations of lending to corporations or banks. They dealt with this problem by assuming that sovereign ratings were binding, i.e. that the ratings of all positions in a bank's portfolio were identical to the ratings of the sovereign. Given this assumption, they showed that for all emerging market economies combined, the necessary capital adequacy ratio under Basel II would have been lower than that under Basel I. However, they do not conduct this simulation for individual countries.

This result, however, depends crucially on the assumption of binding sovereign ratings. It is unlikely that all loans are as good as those of the sovereign, and given the reasonable assumption that at least some loans to domestic banks or corporations would have been internally or externally rated to be more risky than government bonds, it is likely that the actual capital requirements under Basel II would have been higher than those determined by Monfort and Mulder.

Table 6:
Trend of Shares in Bank Lending

	1997	1998	1999	2000	2001	2002	2003	2004
Corporate Loans	63.8	63.6	61.9	56.5.	48.9	45.5	45.6	43.5
Household Loans	20.0	18.3	34.3	39.0	49.1	52.9	53.0	55.0
Loans to public (and other legal) entities	16.3	18.1	3.8	4.6	2.0	1.5	1.3	1.4

Source: Kim et al (2006).

We enrich the analysis by Monfort and Mulder, by analyzing data detailing the share of sovereign and corporate lending in a bank's portfolio. Information about the composition of domestic banks' balance sheets at the time of the crisis is notoriously difficult to obtain, particularly given the lack of prudential regulation and insufficient publication requirements. Nevertheless, using data on the destination-sector of bank loans, provided by the Bank for International Settlement (Kim et al, 2006) we proceed to simulate the capital adequacy ratios.

We make the assumption that corporate loans, bank-to-bank lending and lending to the household sector were weighted one risk-category lower than those of the sovereign. We feel that given the Basel II – rules for the allocation of reserve capital to bank-lending,

and the logic of Section 4.1, that this approach is a more realistic approximation of the actual capital requirements of Korean banks under Basel II than those undertaken by Monfort and Mulder.

Additionally, in contrast to Monfort and Mulder, we do not limit the analysis to calculating the changes in capital requirement on an annual basis, but attempt to predict the required changes as a result of each Standard & Poor's rating change of the Korean sovereign rating since the beginning of 1997. To calculate the volume of outstanding loans in the exact periods of the rating, we interpolated the annual balance sheet data, assuming a linear trend.

Table 7:
Minimum Capital Requirement Simulation (Trillion Won)

	01.01.1997-24.10.1997	**24.10.1997-25.11.1997**	**25.11.1997-11.12.1997**	**11.12.1997-22.12.1997**	**22.12.1997-18.02.1998**	**19.02.1998-25.01.1999**
Rating	AA-	A+	A-	BBB-	B+	BB+
Capital Requirement Basel I	41.6	41.6	41.6	41.6	37.5	37.3
Capital Requirement Basel II	8.3	22.4	22.4	24.8	64.4	41.1
Excess Requirement Basel II	-33.3	-19.2	-19.2	-16.8	26.9	3.8

	25.01.1999-11.11.1999	**11.11.1999-13.11.2001**	**13.11.2001-24.07.2002**	**24.07.2002-31.12.2002**	**2003**	**2004**
Rating	BBB-	BBB	BBB+	A-	A-	A-
Capital Requirement Basel I	42.9	45.9	56.3	58.3	64.4	67.0
Capital Requirement Basel II	43.7	46.7	56.8	29.3	32.4	33.7
Excess Requirement Basel II	0.8	0.8	0.5	-29.0	-32.0	-33.3

Source: Kim et al (2006), Authors' calculations.

Table 7 shows the results from the simulation exercise. It can be seen that in the run-up to the crisis, the capital requirements under Basel I would have been significantly higher than those required by the proposed accord. This is particularly so, because under the old

accord lending to corporate entities (the vast majority of Korean bank lending) was weighted at 100%, while under Basel II, given the favorable rating of the guaranteeing Korean government, less capital would have had to be put aside.

An opposing effect is seen for lending to sovereign entities. Under Basel I, lending to South Korea as an OECD member required no capital reserves. Under Basel II, even given the rather favorable rating, from October 24, 1997, lending to the South Korean sovereign attracted a minimum weighting of 20%. However, the combined effect of an increase in capital reserves required for sovereign lending and a fall in capital reserves required for corporate lending leads to a clear overall fall in capital reserves in the run-up to the crisis. This allows us to conclude that the introduction of Basel II would not have helped to prevent the transmission of the currency crisis to a banking crisis in South Korea by inducing confidence that banks held sufficient levels of capital reserves.

Another interesting result of the simulation exercise is that this conclusion would have been very different had the sovereign rating of South Korean been only marginally different in the lead-up to the crisis. For example it can be shown that if the Korean rating in the period 25.11.1997 – 11.12.1997 had been one notch worse, pushing Korea into a higher risk-weight category, the required reserves under Basel II would have been at 45.6 trillion won, and thus higher than those required by Basel I. Therefore, had the rating agencies been more successful at predicting the crisis, Basel II could have helped to reduce the size of the credit crunch required. Therefore, in the following section, the behavior of the rating agencies is analyzed closely.

Given the actual behavior of the credit rating agencies, we can confidently conclude that had the proposed Basel II accord had been in place before the Korean crisis in 1997, this would not have meant that banks held a more healthy buffer-stock. This is particularly due to the favorable sovereign credit rating given to South Korea. On the contrary, our simulation suggests that given the actual Standard & Poor's ratings of South Korea, Basel I would have required higher capital reserves than Basel II well into the crisis, and that therefore under Basel II the extent of the damaging credit-crunch may have been even more dramatic.

4.3 The Pro-Cyclicality of Basel II

A number of academics (such as Griffith-Jones et al, 2004; European Central Bank, 2001) have criticized that linking capital requirements to assessments of default risk would introduce an undue degree of pro-cyclicality into the lending process, which would lead to a weakening rather than a strengthening of the international financial architecture.

Basel II makes agents' borrowing costs dependent on their external credit rating. This means that agents have easy access to credit in good times (when they have positive credit ratings) and deteriorating access to credit in bad times. In particular, once a country is

subject to a severe depreciation or currency crisis, this adversely affects its ability to repay its sovereign loans. As a result, external credit rating agencies move to downgrade the sovereign debt of such a country. For example, during the South Korean Crisis, Standard & Poor's downgraded South Korea by ten notches, from AA- to B+. Given the new Basel II accord, such a downgrade would have pro-cyclical effects. The new, lower credit ratings would force banks to reserve more capital to support the same quantity of loans. Given that in times of crises banks are unlikely to experience a capital-inflow (as was seen above, in Korea banks were faced with a capital-outflow), the higher capital reserves would require banks to cut lending even further, reinforcing the credit crunch caused by the failure to renew short-term credit lines. This credit crunch may push more firms and banks into insolvency, further stifling economic activity, and potentially provoking another rating downgrade.

Pro-cyclicality in this form was not a problem under Basel I. Even if a country faced a severe crisis, its borrowing costs would only be raised by a change in OECD status. Therefore it can be argued that in the case of currency crises, the presence of Basel II could intensify the crisis.

4.4 Effect on the Maturity of Lending Structure

An additional danger associated with the Basel II accord is related to its differential treatment of short-term and long-term lending to banks. In Table 5 one can see that short-term lending to banks in emerging market economies (where banks are rated between A+ and BB-) is allocated a lower risk-weight (and is thus cheaper) than long-term lending. This encourages short-term financing for banks. The incentive towards short-term lending to banks is less pronounced than it was for Basel I (where it existed for all non-OECD country banks, not just those rated between A+ and BB-) but unfortunately is not removed. Raffer (2006) describes this problem effectively: Naturally, for any individual loan, a shorter maturity means, ceteris paribus, a lower risk than longer maturity. However, the associated risk-weighting would lead to a maturity mismatch in the aggregate.

The decision to lower the threshold for "short-term" loans from 6 months to 3 months will move the maturity structure of bank financing even further towards the short-term end. Reisen (2002) analyses the effects of Basel II on the maturity structure of banks' balance sheets empirically, and concludes that Basel II provides significant regulatory incentives for short-term interbank lending. Given that banks generally lend long-term, this promotes the type of maturity mismatch on banks' balance sheets that has been identified above as one of the primary causes of the transmission of currency crises to banking crises. Therefore it is clear that Basel II in its current version fails to remove significant destabilizing aspects of the motivation for short-term the motivation for short-term bank financing.

SECTION V – The Performance of Rating Agencies

As was shown in Section III, the Basel II accord grants external credit rating agencies an explicit and important role in the determination of risk weights and thus of minimum standards of regulatory capital. Therefore, a good performance of credit rating agencies is a crucial component if Basel II is to be successful in preventing the transmission from currency crises to banking crises in the future. After describing the failure of rating agencies during the Asian currency crisis, we assess whether credit rating agencies have changed and improved their approach to measuring sovereign credit risk.

5.1 The Performance of Sovereign Credit Ratings

As argued by Reisen and von Maltzan (1999), both the Mexican crisis of 1994/5 and the East Asian crisis of 1997/8 showed that the credit rating agencies had failed to predict the currency crises, and the dangers of the impending default. For example, Korea's credit rating had to be reduced by S&P by ten notches in the months during and after the crisis. While some of this "rating crisis" (Jüttner and McCarthy, 2000) can be attributed to genuinely declining economic conditions in the countries following the strong depreciations, it is fair to argue that rating agencies strongly underestimated the dangers associated with potential currency crises. In the aftermath of the East Asian crisis, the credit rating process was therefore criticized by academics and multinational institutions such as the IMF (Reisen, 2002). In particular, it was argued that by ignoring liquidity and balance sheet risks, rating agencies have been guided by outdated crisis models, being able to only adequately warn of first-generation currency crises.

There is no theoretical necessity for sovereign credit ratings to systematically predict or warn of currency and banking crises. Nevertheless, in particular in emerging markets, there is a strong link between currency crises and sovereign debt default. Reinhart (2002) finds that in his representative sample, 84% of emerging market defaults were associated with currency crises. Without the international bail-out organized by the IMF and the international community, it is likely that the currency crises of South Korea, Thailand and others would also have ended in sovereign default. This assessment is shared by most external credit rating agencies, who regularly downgrade sovereign rating significantly in the aftermath of a currency crisis. Therefore it can be argued that sovereign ratings should systematically take into account the risk of currency crises when estimating default risk. Yet, evidence of recent currency crises shows that these were not anticipated in sovereign credit ratings; Reinhart (2002) provides interesting empirical evidence for this statement. It appears that rating agencies are reactive to rather than predictive of actual crises. This may limit the effectiveness of the new Basel Accord, as was seen in Section IV. As outlined above, for Basel II to aid in the prevention of the transmission from currency

crises to banking crises, sovereign credit ratings must force banks to raise capital reserves in advance of a potential crisis.

It is fair to argue that currency crises in general are difficult to predict. Nevertheless, there are various indicators for the three generations of currency crisis, and it is important to analyze whether credit rating agencies do take these indicators into account. If guided by outdated crisis models, sovereign ratings fail to provide advance warning of crises, and fail to guarantee that banks hold sufficient capital to cover the actual credit risk. In the following paragraphs we analyze which macro- and micro-economic indicators are most effective at explaining differences in sovereign credit ratings between countries, and whether these indicators are sufficient to provide early-warning indicators for all three generations of currency crisis.

5.2 The Components of Credit Ratings – Literature Review

Credit rating agencies are in general rather vague about which aspects they take into account when allocating sovereign ratings. Standard & Poor's (2004) claims that the "appraisal of each sovereign's overall creditworthiness is both quantitative and quailtative. The quantitative aspects of the analysis incorporate a number of measures of economic and financial performance and contingent liabilities, although judging the integrity of the data is a more qualitative matter. The analysis is also qualitative due to the importance of political and policy developments."

Cantor and Packer (1996) provided one of the first systematic empirical investigation into which indicators factor most strongly in the determination of sovereign ratings. Using cross-sectional data of 49 countries from September 1995, the authors use a regression analysis to establish which quantitative factors are most relevant in the determination of sovereign credit ratings of Moody's and Standard & Poor's. They found that credit ratings can be explained to over 90% by a small number of macroeconomic variables and dummies. In particular, they found that a rating is strongly related to per capita income, GDP growth, CPI inflation, the ratio of foreign debt to exports as well as dummies for economic development and previous default. Additionally, they established that fiscal balance and external balance did not factor significantly in the estimations of sovereign credit ratings.

Cantor and Packer's analysis shows that credit ratings prior to the Asian crisis focused primarily on traditional macroeconomic fundamentals. The taxonomy of currency crises in Section I shows that such a focus may aid in detecting danger signals of first- and maybe second-generation currency-crises, but fails to predict micro-structure based third-generation currency crises. In other words, as Reisen (2002) concluded, sovereign ratings leading up to the Asian crisis seem to have been driven by an outdated crisis model.

The Cantor and Packer analysis, however, proves to be unstable over time. Jüttner and McCarthy (1999) conduct a similar analysis, and show that the factors identified by Cantor and Packer deteriorate in significance for subsequent years, especially for 1998. Jüttner and McCarthy conclude that the rating behavior changes during crises, and cannot be predicted.

Monfort and Mulder (2000) use a different approach to measure the importance of various components in the rating behavior. They use a dynamic relation of the error correction type to account for the fact that credit rating agencies claim to attempt to see through cycles. Their finding of relevant indicators is similar to that of Cantor and Packer. In addition, they find that ratings exhibit a high degree of inertia. However, with the exception of the ratio of short-term debt to total debt, Monfort and Mulder also fail to test for any micro-economic balance-sheet variables that are the prime cause of third-generation currency crises, und subsequent default.

5.3 The Components of Credit Ratings – Post-Crisis

Following their failure to predict the Korean and other Asian currency crises, rating agencies admitted to having missed some important indicators of the crises, and promised to take them into account in their future rating decisions. For example, Standard & Poor's increased the number of categories in which they would assess each sovereign borrower. These categories are outlined in Table 8, and now include the crucially important aspects of currency mismatch and maturity mismatch, as well as other liquidity indicators.

This table would suggest that Standard & Poor's should have started to put more emphasis on the micro-economic structure of the domestic economy when assigning its currency ratings. To analyze whether this is actually the case, we carry out a number of econometric analyses which are described in the next section.

In a manner similar to Cantor and Packer (1996) and subsequent research, we begin by expressing the rating outcome as the dependent variable on a linear scale (from AAA = 1 to B– = 16), approximating each rating-notch by one numerical step. Table 9 details the numerical interpretation of the rating outcomes. We include GDP growth, GDP per capita, CPI inflation, general government balance and current account balance as potential explanatory factors in the panel-analysis. Unlike Cantor and Packer, who often analyzed three-year-averages of these variables, we examine annual data. In addition, we also include dummy variables for the economic development of the countries, their default history.

Table 8:
Sovereign Ratings Methodology Profile – Standard and Poor's

Political Risk - Stability and Legitimacy of Political Institutions - Orderliness of leadership succession - Popular participation in the political process - Public Security	**External Liquidity** - Impact of Fiscal and monetary policy on external accounts - Structure of the current account - Composition of Capital Flows - Reserve Adequacy
Income and Economic Structure - Prosperity, diversity, and market-orientation - Income Disparities - Availability of Credit - Competitiveness and profitability of non-financial sector - Efficiency of public sector - Labor flexibility	**Private Sector External Debt Burden** - Financial sector external debt, including deposits and structured debt, as % of Current Account receipts - Non-financial private sector external debt, as a percentage of Current Account receipts - Maturity profile, Currency Composition + interest-sensitivity - Access to concessional financing
Economic Growth Prospects - Size and composition of Savings and Investment - Rate and pattern of economic growth	**Offshore and Contingent Liabilities** - Size and Health of nonfinancial public-sector enterprises - Robustness of financial sector
General Government Debt Burden - Gross and Net debt as percentage of GDP - Share of revenue devoted to interests - Currency composition and maturity profile - Depth and Breadth of local capital markets	**Public Sector External Debt Burden** - Public sector external debt as percentage of CA receipts - Maturity profile, Currency Composition + interest-sensitivity - Access to concessional financing - Debt Service Burden
Fiscal Flexibility - General government surplus/deficit trends - Revenue-Raising flexibility and Efficiency - Expenditure Effectiveness - Pension Obligations	**Monetary Flexibility** - Price behavior in economic cycles - Money and Credit expansion - Compatibility of exchange rate regime and monetary goals - Institutional factors such as central bank independence

Source: Standard and Poor's (2004).

Table 9:
Mapping of Rating Outcome to Number

Interpretation of Rating	Standard & Poo's Notation	Numeric Transformation
Investment Grade	AAA	1
	AA+	2
	AA	3
	AA-	4
	A+	5
	A	6
	A-	7
	BBB+	8
	BBB	9
	BBB-	10
Speculative Grade	BB+	11
	BB	12
	BB-	13
	B+	14
	B	15
	B-	16

To determine whether rating agencies today put sufficient emphasis on micro-economic mismatches in the banking sector, we include three new indicators in the analysis of the panel data. Firstly we have included a **currency-mismatch indicator**, using data from the BIS (2006a). The indicator is comprised of the ratio of foreign currency assets to foreign currency liabilities of domestic banks vis-à-vis all sectors. A low ratio hints at potential balance-sheet problems in the case of a devaluation, and should thus adversely affect the sovereign credit rating.

We also include a **maturity-mismatch indicator**, using data provided by the Joint External Debt Hub coordinated by the World Bank (2006). In particular, we calculate short-term loans as percentage of total cross-boarder loans from foreign banks. A high fraction of short-term loans is an indicator of the danger of a debt roll-over crisis in the face of an economic crisis, and should negatively influence the sovereign rating of the country.

We include an additional indicator measuring the **net foreign position of banks**. This indicator represents the ratio of total cross-boarder deposits to total cross-boarder loans. A low ratio of foreign currency deposits with foreign banks to foreign currency loans from foreign banks reveals further balance sheet problems which could intensify in the case of a currency crisis.

5.4 Method and Results

While previous analyses have focused primarily on cross-sectional data, the data required to calculate the mismatch-indicators is only available for a limited number of countries (39 countries publish the data required to calculate currency-mismatch, 30 countries the data required to calculate maturity-mismatch). Therefore, focusing on the cross-section of countries at one point in time provides an insufficient number of data points for a robust analysis. Thus we decided to analyze the 29 countries with required data sets spanning the years 2002 to 2005. Analysis over a longer time-period was not an option, as the required data for the mismatch-indicators for a number of countries has not been published for a longer period. A list of the countries included in our analysis can be found in Table 10. Data for the currency mismatch indicator is not provided by Greece and Mexico for 2002, therefore the analysis includes a total of 110 observations.

Table 10:
Countries analyzed in empirical study

Austria	Belgium	Brazil	Canada
Chile	Denmark	Finland	France
Germany	Greece	Hong Kong	India
Ireland	Italy	Japan	Luxemburg
Mexico	Netherlands	Norway	Panama
Portugal	Singapore	Spain	Sweden
Switzerland	Taiwan	Turkey	United Kingdom

In order to evaluate the composition of factors influencing the rating results we consider three econometric models. In particular, we utilize two linear regression models, namely a random effects panel data analysis and a pooled panel data regression. In addition we employ a limited dependent variable model, namely a probit maximum likelihood analysis including random effects.

Preliminary correlation analysis indicates benefits from excluding the default history variable and the GDP per capita variable from the analysis because of their high correlation with other explanatory variables.

We start our analysis with the random effects model. We follow Cantor and Packer (1996) by preliminarily assuming the dependent variable to be metric and linear (as outlined in Table 9). This assumption will prove to be untenable and is relaxed later. We choose a random effects model for panel data analysis since fixed country effects do not seem to be appropriate taking into account the short time-dimension.[3] The model takes the form of:

$$rating_{it} = \alpha + \beta_1 \text{gdp\_gr}_{it} + \beta_2 \text{infl}_{it} + \beta_3 \text{govbal}_{it} + \beta_4 \text{cabal}_{it} + \beta_5 \text{currmis}_{it} + \beta_6 \text{matmis}_{it} + \beta_7 \text{netforpos}_{it} + \beta_8 \text{advecon}_{it} + u_i + \varepsilon_{it} \quad (1)$$

Here $rating_{it}$ is the rating of the respective country i in year t, gdp_gr_{it} is the growth rate of GDP, $infl_{it}$ is the CPI inflation rate, $govbal_{it}$ is the general government balance, $cabal_{it}$ is the current account balance, $currmis_{it}$ is the currency mismatch indicator, $matmis_{it}$ is the maturity mismatch indicator, $netforpos_{it}$ is the net foreign position of banks, and $advecon_{it}$ is a dummy for the economic development status of the countries. The sum of u_i and ε_{it} is treated as an error term consisting of two components: A country specific component which does not vary over time, and a remainder component which is assumed to be uncorrelated over time. We conduct two estimations, one including all variables, one just including variables with significant coefficients. The results of this analysis are reported in Table 11.

The R^2 statistic indicates that the model does explain large part of the dependent variable, the low error probability of the F-test indicates that the explanatory variables do add significant information compared to a pure random model. The negative coefficient of the government balance variable indicates that the smaller the deficit is, the lower the rating-mapping. Since lower rating-mappings are associated with a higher-quality rating (see Table 9), smaller deficits are related with better ratings. The coefficient of the currency mismatch variable is also negative, indicating that a lower indicator value, e.g. a larger mismatch, is related with a higher (worse) rating. The negative coefficient of advanced economy dummy shows that advanced economies are better rated then developing countries. Therefore, all coefficients that showed to be statistically significant also are intuitively meaningful. The significance of the currency mismatch indicators would thus suggest that rating agencies now do consider some of the microstructure of balance sheets. The results also show that the random effects model is not able to identify whether rating agencies would consider maturity mismatch or the net foreign position of banks as important determinants of their ratings.

3 The Hausman test indicates that the use of a random effects model is appropriate.

Table 11:
Linear random effects panel data model

	General model	Significant only model
Dependent variable	rating	
gdp_gr	-0.0363041	
infl	0.0188955	
govbal	-0.0618301**	-0.0920633***
cabal	-0.0026402	
curmis	-0.1560763	-0.1987555**
matmis	-0.0585616	
netforpos	-0.0583569	
advecon	-7.906987***	-7.871453***
cons	10.1113***	9.933249***
sigma_u	1.8988128	2.0522033
sigma_e	0.30856562	0.31061171
roh	0.97427171	0.97760464
No of observations	110	110
No of groups	28	28
Obs per group: min:	3	3
avg:	3.9	3.9
max:	4	4
R^2 within:	0.2493	0.1943
between:	0.7487	0.7602
overall:	0.7465	0.7572
Wald chi^2	115.02	103.95
Prob > chi^2	0.0000	0.0000

*: Significant at 10%-level, **: Significant at 5%-level, ***:Significant at 1%-level.

Source: Stata output, own calculations.

However, the small *t* of the panel and the limited number of observations suggest that one may ignore country specific effects and rather pool the observations and conduct a more robust pooled panel analysis. This is done in our the second estimation model:

$$rating_i = \alpha + \beta_1 \text{gdp\_gr}_i + \beta_2 \text{infl}_i + \beta_3 \text{govbal}_i + \beta_4 \text{cabal}_i + \beta_5 \text{currmis}_i + \beta_6 \text{matmis}_i + \beta_7 \text{netforpos}_i + \beta_8 \text{advecon}_i + \varepsilon_i \quad (2)$$

As before, we conduct two estimations, one including all variables, one just including variables with significant coefficients; we end up with the results as presented in Table 12.

The results differ significantly from those of the random effects model. We obtain similar results with regard to governments balance and the advanced economy dummy. However, all microstructure balance sheet indicators are insignificant, while the GDP growth measures as well as inflation rates become significant. The signs of all coefficients are

intuitively meaningful. These results are largely in line with those of Cantor and Packer (1996).

Table 12:
Pooled linear panel data model

	General model	Significant only model
Dependent variable	rating	
gdp_gr	0.3121171***	0.3252269***
infl	0.0679488*	0.0672877*
govbal	-0.228989***	-0.2098048***
cabal	0.0359479	
curmis	-0.1106103	
matmis	0.71395	
netforpos	0.0673267	
advecon	-6.210514***	-5.880793***
cons	5.462207***	5.667642***
No of observations	110	110
F statistic	60.26	122.44
Prob > F	0.0000	0.0000
R^2	0.8268	0.8235
Adjusted R^2	0.8131	0.8167
Root MSE	1.6513	1.635

*: Significant at 10%-level, **: Significant at 5%-level, ***:Significant at 1%-level.

Source: Stata output, own calculations.

However, the differences between the results produced by the previous two econometric approaches, in particular with regard to their detection of the relevance of the balance sheet indicators, leads us to rethink the approach of linear regression models in the case of rating evaluation. It is intuitively clear and supported by research (Majnoni and Powell, 2005) that, in fact, rating classification are ordinal but not metrically scaled in relation to default probability. In other words, it is not the case that one rating notch is associated with a fixed change in the probability of default. It is important to bear in mind that linear regression models depend on the assumption of metrically scaled data. Therefore, it is doubtful whether the linear regression models employed by Cantor and Packer (1996) and others, and utilized in our first two econometric approaches, will be able to pick up effectively the correct influences on the non-metrically scaled dependent rating variable.

To correctly handle the ordinal data of rating results we construct three groups: AAA ratings are assembled in Group 0, ratings between AA+ and A+ are banded together in Group 1, and all other ratings are included in Group 2. Group 0 includes around 50 percent of all rating observations while the remaining 50 percent are distributed almost equally between the other two groups. We estimate the influence on these groupings by employing an ordered probit model using maximum likelihood estimation. In order to

account for the panel structure of the data we also consider random country effects. The model takes the form of:

$$rat3^*_{it} = x'_{it}\,\beta + u_i + \varepsilon_{it},\ i = 1,2,...,29 \text{ and } t = 1,2,3,4$$

$$rat3_{it} = \begin{cases} 2\ if\ rat3^*_{it} > 1 \\ 1\ if\ 1 \geq rat3^*_{it} > 0 \\ 0\ else \end{cases} \qquad (3)$$

The estimation is carried out in Stata using the "reoprob extension" developed by Frechette[4] (compare also Butler and Moffitt, 1982; Green, 2000). Estimation results of the general model and the significant variables only model are reported in Table 13.

Table 13:
Ordered probit, random effects model

	General model	Significant only model
Dependent variable	rat3	
gdp_gr	-0.0656932	
infl	1.433916**	0.3968088*
govbal	-1.056137***	-0.5755665***
cabal	0.1395552	
curmis	-1.519087	
matmis	1.832538	
netforpos	1.54365	
advecon	-15.88667***	
cut1_cons		
cut2_cons	-9.280664**	5.402373
rho_cons	-0.213867	10.63025
No of observations	0.9822781***	0.9934281***
LR chi^2		
Prob > chi^2	110	110

*: Significant at 10%-level, **: Significant at 5%-level, ***:Significant at 1%-level.

Source: Stata output, own calculations.

When employing the approach that we believe is the most appropriate (i.e. using a random effects ordered probit model) all micro-structure variables turn out to be insignificant. The only significant coefficients are those of inflation and the public deficit, both showing the expected signs.

4 http://homepages.nyu.edu/~gf35/html/econ.htm.

5.5 Interpretation of results

As a conclusion from the empirical analysis we deduce that while we can show that rating agencies do seem to take certain variables into account on a fairly consistent basis, we fail to obtain robust evidence for the micro-economic mismatch variables being of any relevance for rating agencies. This throws doubt on the insistence of rating agencies that in fact they do take these micro-mismatches into account (see section 5.3). On the other hand, rating agencies do seem to consider inflation, public deficits and the development status of the economies as relevant data for their decisions – similar to the rating behavior prior to the Asian crises, these are all macro-economic indicators. The low significance of the other factors considered in this analysis may be due to the important role that qualitative analysis plays in the rating assignments. However, it is important to bear in mind the limitations of our conclusions due to the limited number of observations. Thus we emphasize the importance of carrying out similar estimations when more data about the mismatch-indicators becomes available.

SECTION VI – Conclusion

In the standardized approach of the Basel II accord, credit ratings become the fundamental determinant of the risk-weight attached to bank exposures. However, the failure of credit rating agencies to predict the Asian crisis casts doubt on the effectiveness of applying credit ratings to determine the regulatory capital requirements of financial institutions. This paper analyzed the potential effects of the Basel II accord on preventing the transmission from a currency crisis to a banking crisis in the case of the South Korean crisis of 1997/1998.

The simulations of capital requirements under Basel I and Basel II in the case of South Korea prior to the crisis show that under Basel II in the run-up to the crisis, there would have been lower rather than higher minimum capital reserves. This suggests that Basel II could not have effectively contributed to mitigating the transmission from the currency crisis to the domestic financial system. Additionally, the pro-cyclical nature of the capital reserves under Basel II and the risk-weight preference of short-term lending further undermine the ability of the new capital adequacy accord to positively influence the development of financial crises.

Empirical investigation into the factors that determine sovereign credit ratings do not generate any robust evidence that credit rating agencies have in fact altered their rating behavior in response to their failure to predict the Asian crisis. In particular, it cannot be shown that rating agencies nowadays pay attention to micro-economic balance sheet factors such as currency mismatch or maturity mismatch. While we acknowledge the limitations these findings have as result of the data restrictions outlined above, we do believe that they are consistent and significant enough to allow a tentative conclusion. This leads to argue that South Korea's significant mismatches in the months leading up to the crisis would even under the current rating system not have triggered an earlier downgrade, and a subsequent increase in capital requirements of banks. Thus, given the current approach of credit rating agencies, we have reservations concerning the effectiveness of Basel II to prevent the transmission from a currency crisis to a banking crisis, both for the case of South Korea and for potential future crises.

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