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The Output Costs of Financial Crises: Investigation of the Roles of Crisis-Management Policies and Political Institutions

BY

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A Dissertation submitted to the Faculty of Claremont Graduate University in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Graduate Faculty of Economics

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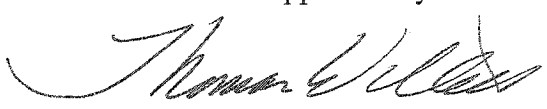

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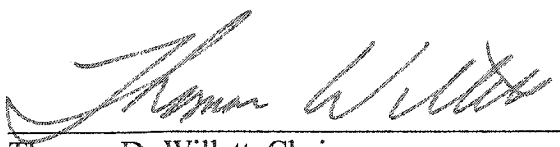

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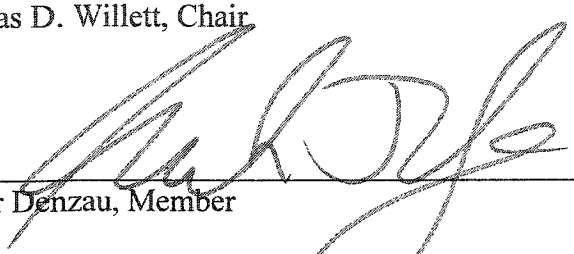

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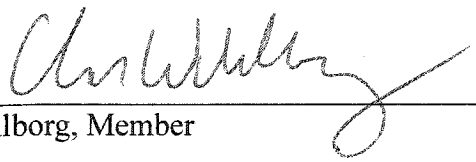

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Abstract of the Dissertation

The Output Costs of Financial Crises:
Investigation of the Roles of Crisis-Management Policies and Political Institutions

by

Apanard Angkinand

Claremont Graduate University: 2005

Severe economic recessions accompanying recent currency and financial crises have brought economists and policy-makers to analyze what went wrong in policy responses as the effect of crises on the real economy seems to be exacerbated in those crisis-hit countries. By focusing on the output effects of crises, this dissertation investigates the roles of crisis-management policies and political institutions in times of financial crises. This dissertation begins by studying the channels in which the real economy is affected by crises as well as methodologies to quantify these effects. Since there is no consensus over techniques used to estimate output losses associated with crises, different estimations are used to calculate output losses and the real GDP both in level and growth rate in order to capture the magnitude of absolute output losses and growth contractions. These estimated output losses are used to examine the relationship between economic and political factors and the output costs of crises.

By using cross-section time-series of 57 countries over the period of 1975-to-2002, the presence of an explicit deposit insurance system is empirically found to reduce the output costs of financial crises since it prevents extensive financial runs. However, this benefit of adopting an explicit deposit insurance system needs to be traded off with

the costs of increasing moral hazard incentives induced by deposit guarantee, which may make crises more likely. In addition, to study the effectiveness of any economic policies in minimizing crisis severity, the roles of domestic political institutions need to be examined since the cross-national differentiation in political structures, particularly the political decision making processes and the number of political decision makers, directly influences a government's ability to implement those policies efficiently. By applying the political theory of veto players to study the impact of domestic political institutions on severity of crises in emerging market economies, the empirical finding illustrates that countries with the absence of veto powers in their political system or with excessive veto players will severely suffer from a larger magnitude of output losses once financial crises occur according to the lack of credibility or flexibility of policy responses, respectively.

To:

My parents, sisters and brother, and

My beloved Craig Prabha

PREFACE AND ACKNOWLEDGEMENTS

I have been interested in understanding the effect of financial crises on the real economy, particularly why crises resulted in the disproportionate extent of the severity across countries. After observing the process of resolving crises in many crisis-hard hit countries, I was convinced that it is unlikely for them to achieve strong and sustainable recovery if their countries have poor institutional environments. My analysis here reflects that the inadequate financial safety net instruments, regulations, and quality of domestic institutions are important factors, which can explain why many economies are vulnerable to external shocks and are hard-hit by crises. Without improving the quality of domestic institutions in the near future, it will still be questionable for these economies to avoid the next severe crisis. I would like to genuinely convey my thanks and appreciation to Professor Thomas Willett for suggestions and insightful comments on this dissertation. His help was invaluable, allowing me to reach my goals in my research and writing. He has inspired my interest and guided me through this dissertation to successfully reveal these ideas by incorporating them with comprehensive analysis and supported evidence.

I would like to thank my dissertation committee, Professor Arther Denzau, Yi Feng, and Clas Wihlborg, for providing helpful comments to strengthen the analysis in this dissertation. I would particularly like to thank Professor Arther Denzau and Jennifer Merolla for their deep discussions on chapter five. I also would like to specially acknowledge the comments from Professor Clas Wihlborg and Darren Filson who suggest the empirical analysis in chapter four. In addition, I would like to thank Hiro Ito in suggesting the calculation techniques and sharing the data on the output losses of crises.

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CHAPTER ONE

Introduction

The depth of the recessions which accompanied recent currency and financial crises was matched by the speed of recovery in some countries, but was prolonged in others. This differentiation of the severity of crises across countries has brought researchers and policy makers to explore the reasons behind it. For instance, Bordo, et al. (2001) and Honohan and Klingebiel (2003) blame crisis-management policies such as the unlimited financial assistance to troubled financial institutions during financial distress for aggravating the costs of crises. Stone (2000) and Gupta, et al. (2003) put emphasis on the adverse effects of pre-crisis economic and financial conditions including the high level of pre-crisis corporate leverage and private capital inflows. Understanding why the severity of crises varies across crisis-hit countries and which policy responses are efficient in coping with these crises is essential for reducing the damage that crises impose on the real economy.

The objective of this dissertation is to investigate economic and political factors that can help explain the severity of crises across crisis-hit countries. Based on cross-section time-series analysis, deposit insurance is found to have statistically significant relationships with both the incidence and cost of financial crises. The estimates suggest that although a deposit insurance system may increase the likelihood of financial crises through increasing moral hazard incentives, it also substantially reduces the output costs of crises by preventing financial runs once crises occur. In addition, the structure of domestic political institutions, which can influence policy responses in timing of crises, is

found to have a significant impact on the depth of crises. The effect of political institutions on the output costs of crises is examined by testing the political theory of veto players.

This dissertation begins with discussion of how the occurrence of currency and financial crises can induce output losses. Theoretical literature illustrates that crises can cause economic recessions through various channels such as balance sheet effects, credit constraints, and the disruption of the payment systems (Krugman, 1999a; Aghion et al, 2001; Disyatat, 2001)[1]. The estimation of these real effects, however, is a difficult task. Economists and researchers have not yet agreed upon a unique technique in estimating the magnitude of output losses associated with crises (see Hoggarth et al, 2002; Mulder and Rocha, 2001). Chapter two, therefore, concentrates on the estimation of output losses. In this chapter, various issues in estimating the magnitude of output losses associated with crises are discussed. Conceptually, an output loss is defined as the downward deviation of the actual output from its potential output trend, and an output recovery can be identified when the actual output returns to its potential level. The selection of actual output variable and the estimation of potential output, therefore, could result in the sensitivity of the calculated output losses. For instance, whether the growth rate or level of real GDP should be used to observe the pattern of actual output adjustments in timing of crises is examined. Hoggarth, et al. (2002) and Mulder and Rocha (2001) argue that the use of real GDP growth rate to assess the severity of crises employed by IMF (1998), Aziz (2000), Bordo, et al. (2001), and Gupta, et al. (2003) is downwardly biased. They suggest that the extent of output losses need to be computed from the deviation of real GDP level from the estimated potential level trend. However,

[1] See chapter two, section two.

how to estimate the potential output trend to reflect the growing and stable economy is unclear, and there is no consensus on how to estimate it. The estimation technique used by Hoggarth, et al. and Mulder and Rocha also has limitations. One major problem is that the estimated potential output level trend will be inflated if the pre-crisis economic growth rate is high; the data shows that the eruption of crises are usually preceded by economic boom (Moreno, 1999; Bordo, et al., 2001; Hoggarth, et al, 2002).

Due to various limitations of each estimation technique, Mulder and Rocha employ six different alternatives to estimate the output losses associated with currency crises and test their relationships. They find that the correlations of the estimated output losses based on the different techniques are high among emerging market economies, indicating that the estimated output losses are not sensitive to the estimation criteria. However, these correlations are low for industrial countries.

In chapter two, the magnitudes of output losses are calculated for a sample of 22 developed and 43 developing countries during 1975-2000 to explore two important topics being discussed in recent literature. First is the discussion on whether twin crises are more severe than when currency or banking crises occur alone. Second is the debate on whether crises are more severe if domestic authorities decide to participate in an IMF-supported stabilization program. Recent empirical studies find different conclusions regarding these two subjects. For the severity of twin crises, Bordo, et al. (2001) find that crises are more severe when currency and banking crises simultaneously occur or when crises are twin. On the other hand, Hutchison and Noy (2002) do not find significant evidence that twin crises are more severe than the additive effect of currency and banking crises that take place independently. This chapter examines the severity of twin, banking,

and currency crises in terms of the decline in real GDP level, rather than the contraction in real GDP growth rates used by other studies. The descriptive statistics show that twin crises are associated with the losses in real GDP level more than when currency crises occur alone. However, the data does not clearly indicate whether twin crises are more severe than when banking crises occur alone. For the IMF-supported stabilization programs, the conditions of tight macroeconomic policies for member countries to receive IMF's loans during the 1997 Asian currency and financial crisis are criticized as exacerbating the severity of crises (for example, see Stiglitz, 2000). This IMF's conditionality, however, aims to restore investor confidence and stop capital outflow in order to limit economic recessions. By using the "with-without approach" to compare the output costs between the crisis episodes with and without the programs, the data shows that, on average, the real GDP level for the episodes with IMF programs deviates from and is permanently lower than its potential output trend. For a group of crisis countries without the programs, the magnitude of the decline of real GDP is smaller. This result is different from other studies such as Park and Lee (2001) and Lee and Rhee (2000) who focus only on the adjustment of real GDP growth rate and find that both economic growth contraction and recovery are stronger among countries with the IMF programs[2].

In addition, there is the discussion about whether a crisis causes economic recession, or vice versa (Bordo, et al., 2001, Lindgren, et al., 1996, and Dell'Ariccia, et al. 2004). According to Bordo, et al., although the causality between crises and economic recessions cannot be clearly distinguished, their empirical results show that crises do

[2] However, when using the regression analysis, Park and Lee (2001) as well as Hutchison (2003) do not find that the IMF programs statistically significantly aggravate economic growth contraction. The insignificance of the effect of the participation of the IMF programs on the output costs of crises may be due to the plausibility that only countries severely affected by crises are likely to request IMF's financial assistances.

worsen economic recessions. In the calculation of output costs of crises, the year in which a crisis erupts is generally used as a starting period to assess the total magnitude of output losses. The estimated total output losses, therefore, could be sensitive to the dating of the onsets of crises.

Chapter three discusses the construction of currency crisis dates by focusing on various criteria that are used to identify a currency crisis and could lead to the different starting period and length of a crisis. Additionally, since the estimated output losses depend on the dates of crises, a sensitivity analysis is performed to test whether there is a statistically significant difference for the estimated output losses when using different criteria in identifying currency crises. By using four different criteria in constructing currency crisis indices, the results show that the estimates of total output losses are not sensitive to crisis dates, but the duration of crises is found to be sensitive to those criteria. Unlike the dates of currency crises, which we can identify quantitatively, the episodes of banking crises are identified mainly by the judgments of experts on the basis of the financial data and news. Only a few studies such as Caprio and Klingebiel (2003) compile data and date banking crises for a large set of country and time coverage.

Chapter four employs different estimates of the costs of crises to explore whether a system of deposit insurance can explain the differentiation of the severity of financial crises across crisis-hit countries. In the past two decades, a formal deposit insurance system has been adopted by many nations (Garcia, 2000). The primary purposes of deposit insurance are to promote financial stability, reduce the crisis severity, and avoid crises in the future. However, whether the presence of deposit insurance stabilizes or destabilizes the financial system is controversially debated in the literature. While the

role of deposit insurance is to prevent the spread of financial panic by ensuring the safety of depositors' funds, opponents of deposit insurance argue that it induces moral hazard problems. Reducing monitoring incentives will increase banks' reckless lending causing the instability of the financial system.

The analysis in chapter four employs a sample of 73 banking crisis episodes in 48 industrial and emerging market economies during 1975-2002 to investigate the impact of deposit insurance systems on financial stability. The emphasis is given to the weighing of the benefits of deposit insurance in preventing financial runs against the costs of generating banks' incentives to take on excessive risks. The empirical results suggest three important implications. First, there is a tradeoff between the costs and benefits of deposit insurance. The presence of explicit deposit insurance schemes statistically significantly reduces the output costs of crises. Without an explicit system, massive financial panic during financial distress can cause the overall failure of the financial system and damage the real economy through the disruption in the payment system and credit mechanism. However, explicit deposit insurance is found to increase the likelihood of financial crises due to its adverse effect in generating moral hazard incentives. The benefit of deposit insurance in containing financial runs is offset by this cost. These results also hold when the analysis is separately performed for a group of industrial countries and emerging market economies. Second, the cost-benefit tradeoff becomes more apparent when considering different designs of deposit insurance schemes. Explicit deposit insurance systems that provide comprehensive deposit insurance coverage are more effective in preventing financial panic, but create a higher extent of moral hazard. Comprehensive coverage limits are measured by, for instance, whether the explicit

system protects foreign currency and/or interbank deposits or has a high ratio of deposit insurance funds to total bank assets. Third, when the analysis takes into account the role of domestic institutions and financial regulations, the results show that this benefit of deposit insurance is not necessarily cancelled out by its cost of increasing moral hazard. For countries with strong quality of institutions, banks' operations are efficiently monitored, and the moral hazard that might be generated from the presence of explicit deposit insurance can be contained.

Chapter five investigates the impact of domestic institutions characterized by the veto player framework on the output costs of financial crises. A veto player is defined as an individual or collective actor whose agreement is required for a change of status quo policy (see Tsebelis, 2002). The difference in institutional arrangements across countries may affect governments' ability in implementing policies in responding to crises. The analysis extends MacIntyre (2001)'s study of the relationship between the veto players and policy risks for the Asian financial crisis. Based on the case studies of the political institutions of Indonesia, Malaysia, the Philippines, and Thailand during 1997-98, MacIntyre explains that the degree of centralization of veto authority influences the policy responses to the crisis. Political structures that have highly centralized veto authority can lead to policy volatility; on the other hand, those with the dispersal of veto authority well tend to suffer from policy rigidity. Both policy volatility and rigidity can destroy investors' confidence, which is essential for the recovery of investment and economy. Thailand and Indonesia are two polar cases in McIntyre's study. The Thai government had six coalition parties, whereas Indonesia had a dictatorship, President Suharto, in 1997. For Thailand, high numbers of veto players, who could effectively veto

policies in responding to the crisis, resulted in the lack of government's ability to bring about timely policy adjustment. The political structure of Indonesia, on the other way, consisted of only one veto authority who had control over the policy process, which led to policy volatility. The lack of policy flexibility in Thailand and the lack of policy credibility in Indonesia made crises in these two countries more costly than other crisis-hit Asian countries. According to this analysis, the relationship between the extent of concentration of veto authority and policy risks is suggested to be U-shaped rather than linear. While adding one more veto player can reduce the risk of policy volatility, there is an inflexion point (minimum point of U-shaped curve) that an additional veto player becomes undesirable by only increasing the likelihood of policy rigidity.

The analysis in chapter five extends MacIntyre's case studies by performing the empirical tests using the sample of 45 banking crisis episodes in 27 emerging economies from 1980 to 1999. The empirical findings support MacIntyre's U-shape relationship for the number of veto players and the severity of crises. Countries with the absence of veto powers in their political system or with too many veto players will severely suffer from the larger magnitude of output losses once banking crises occur due to the lack of credibility and flexibility of policy responses. These results are robust when using different proxies for the number for veto players and different techniques in estimating the magnitude of output losses. For the proxies of the veto players, the variables are employed from two recently developed political datasets: the Database of Political Institutions or DPI (the variable called "*checks*") collected by Beck et al (2001), and Political Constraint Index constructed by Henisz (2000) (the variable called "*polconv*").

Results in this dissertation should reflect that deposit insurance and domestic institutions play important roles in influencing the severity of crises as well as the recovery process. These findings should complement recent research focusing on the role of financial safety net, crisis-management policies, and domestic institutions in preventing crises and in stimulating the long-run rate of economic growth. In addition, it is hoped that the results will encourage domestic authorities to pay more attention to the quality of their national institutions.

CHAPTER TWO

The Effect of Currency and Financial Crises on the Real Economy: Overview and Estimation Issues

2.1 Introduction

Severe economic recessions accompanying the recent currency and financial crises have encouraged theoretical and empirical researchers to investigate the channels in which the real economy is affected by the crises as well as techniques to quantify these effects. Theoretically, the occurrence of crises can induce an economic recession in various ways such as balance sheet effects, credit constraints, and the disruption of the payment systems (Krugman, 1999a; Aghion, et al., 2001; and Disyatat, 2001) (see section 2.2). To assess these real effects, several empirical studies have attempted to use different criteria to estimate the magnitude of output cost associated with each crisis episode. The extent of output loss for each crisis that is reported varies substantially across studies. Since the estimated output losses are important in order to analyze the policy implications in responding to crises in the empirical study, this chapter aims to discuss various issues arising from the estimation of the output costs of crises.

Growing literature on the severity of crises has disagreed over techniques used to estimate the output losses associated with crises. Hoggarth, et al. (2002) and Mulder and Rocha (2001) point out many biases, especially the underestimation of the magnitude of output losses calculated from the estimation technique used by, for example, IMF (1998), Aziz, et al. (2000), and Bordo, et al. (2001). The latter three studies estimate an output loss from the downward deviation of the actual real GDP growth rate from its potential growth trend. With this methodology, although the growth rate recovers to its pre-crisis

growth trend, the level of real GDP does not necessarily return to its pre-crisis capacity. The economic recessions, which accompanied the 1997 Asian crisis, strongly support this argument. By using the empirical test, Cerra and Saxena (2003) find that the Asian crisis incurred the permanent losses in the aggregate level of output. However, if looking only at the adjustment of economic growth rates, their analysis shows that the Asian economies recovered to their pre-crisis growth trends within a few years after the deep decline of growth rates in 1997-98.

The review of literature on the determinants of the output costs of crises in section 2.3 illustrates that not only have the recent empirical studies focused on a wide range of economic factors and policies in explaining the differentiation of the crisis severity[1], but they also use different criteria in estimating the output losses. Mulder and Rocha (2001) employ six techniques to estimate the output losses associated with 97 currency crisis episodes. They find that the correlations of the magnitude of output losses estimated from each different technique are quite low among industrial countries, but highly correlated among emerging market economies.

Techniques used to estimate the output losses in this dissertation are described in section 2.4. The magnitude of output losses is calculated from the deviation of actual output from its potential output trend. In this section, various controversial estimation issues are discussed. These include the questions such as whether the level or growth rate of real GDP should be used to estimate output losses, and how to estimate the potential output trend. The limitations of each estimation technique are also emphasized. For instance, as discussed in section 2.4.3, the technique used by Hoggart, et al. (2002) and

[1] See the appendix table (A2.2) for the analytical summary of studies on the determinants of output costs of crises.

Mulder and Rocha (2001) inflates the estimated potential output level trend, particularly when an economy experiences an economic boom before a crisis. As a result, the estimated magnitude of output losses is exaggerated and an economic recovery will never be recognized. The alternative estimation technique, which can resolve the problem of the explosive potential output trend, is introduced in section 2.4.4.

In section 2.5, the magnitudes of output losses are calculated for 22 developed and 43 developing countries that experienced currency and financial crises during the period from 1975-2000[2] to explore two interesting issues being discussed in the recent literature. First is the discussion on whether twin crises are more severe than when currency or banking crises occur alone. Second is the debate on whether crises are more severe if domestic authorities decide to accept the financial assistance from the IMF.

Recent empirical literature has reached different conclusions regarding the severity of twin crises. Kaminksy and Reinhart (1999) and Bordo, et al. (2001) find that crises are more severe when currency and banking crises simultaneously occur. On the other hand, some studies such as Hutchison and Noy (2002) do not find evidence supporting that the severity of twin crises is larger than the additive effects of currency and banking crises that take place independently. The difference between the findings in the studies of Bordo, et al. and Hutchison and Noy might be due to the different measures of the severity of crises in terms of output costs. These two studies use the same methodology in their analysis, i.e. they use the dummy variables to capture the different effects of currency, banking, and twin crises on the output costs. However, Bordo, et al. estimate the total output growth losses per crisis as the percentage of GDP, whereas

[2] These data is from the collaborative work with Hiro Ito.

Hutchison and Noy use the annual output growth rate to assess the output costs of crises. In section 2.5.1, the descriptive statistics for the averaged absolute output losses (or the losses in the real GDP level) classified by types of crises are reported. The data shows that the magnitude of output losses associated with twin crises are considerably higher than when currency crises occur alone. However, it does not clearly distinguish whether twin crises are more severe than when banking crises occur alone. These findings may reflect different conclusions on the severity of twin crises found in the recent studies.

There are substantial debates over whether a crisis-hit country should participate in an IMF-supported stabilization program[3]. The IMF lending to crisis countries proposes to restore investor confidence and stop capital outflows in order to limit economic recessions. However, the conditions attached to the loans have been criticized, particularly after the Asian crisis, as the factors that worsened economic recession. These conditions include the requirements for crisis countries to pursue tight monetary policies by hiking interest rates to stop capital outflow and tight fiscal policies to reduce budget deficit. These contractionary policies, particularly by raising interest rates, as well as the policy for closing insolvent financial institutions have been blamed as the causes of widespread bankruptcies of banks and firms, which exacerbate economic recessions (Stiglitz, 2000). Section 2.5.2 uses the "with-without approach" to compare the output costs of crises in terms of the decline in the real GDP level between the crisis episodes with and without IMF programs. The data shows that the reduction of the real GDP level tends to be deeper and the recovery is substantially slower in a group of currency crisis episodes with IMF programs than those without the programs. This result is different from other studies such as Park and Lee (2001) and Lee and Rhee (2000) who focus only

[3] See Willett (2001) for the discussions and evaluations of the literature which debates on the roles of IMF.

on the adjustment of real GDP growth rates and find that economic growth contraction and recovery are stronger among countries with the IMF programs.

2.2 The Linkage between Currency and Financial Crises and the Real Economy

The eruption of currency and/or financial crises could induce or worsen economic recession through various channels. For financial or banking crises, a breakdown of a financial system causes the disruption of payment system and credit constraints to the corporate sector. The decrease in the efficiency of financial intermediation and tightening of the supply of credits, which reduce households' and firms' productive activities as well as the incentives in spending and investing, could generate the reduction in the aggregate outputs in the economy[4].

When a currency devaluation or currency crisis induces an economic recession it can be explained by, for example, the J-curve effect or the "third-generation" crisis model. The elasticity approach to the balance of payments state that a currency devaluation could deteriorate the current account balance, which may lead to economic recession in the short-run since the Marshal-Lerner condition may not hold, or the sum of the elasticity of demand for imports and exports less than one. This is also known as the J-curve effect, in which the devaluation initially worsens the current account balance, but improves it in the long run. For the third-generation model of speculative attack, according to Krugman (1999a), the model is built from the link between the adjustment of the current accounts and corporate balance sheets in order to explain the severity of the crises in the emerging market economies in the 1990s. While the currency devaluation

[4] See Lindgren, Garcia, and Saal (1996) and Hoggarth, et al. (2002) for the discussions on the various channels that the eruption of banking crisis can affect the real economy and cause the reduction in output.

could have an expansionary effect on the outputs by expanding exports and increasing the competitiveness as in the standard Mundell-Flemming framework (Fleming, 1962 and Mundell, 1962), it could also lead to output contraction through the balance sheet effects. In a country where the corporate sector has a high level of short-term debt denominated in foreign currency, the domestic currency depreciation will severely deteriorate the companies' balance sheet. The reductions of the companies' investment capacity or cutoffs of their investment projects can significantly impair economic growth. Empirical studies show that crises will disrupt the process of economic growth and be more severe among countries that depend heavily on external finance (Stone, 2000 and Dell'Ariccia, et al. 2004) or have a relatively large import and export sector (Lee and Rhee, 2000)[5].

In addition, the depth of economic recessions associated with currency crises could be relatively larger in an economy with unsound financial institutions (Aghion, et al., 2001; Disyatat, 2001). When currency crises and sudden stops of capital inflows make firms approach insolvency, banks and financial institutions may become more cautious in their lending. Particularly, in an economy with less developed financial systems, banks and financial institutions may drastically increase the constraints on credits and consequently amplify economic recessions. As noted by Disyatat (2001), "a banking sector with a healthy balance sheet, in terms of high net worth and little unhedged foreign debt, will be in a much better position to absorb the exchange rate losses associated with unexpected depreciations than one that lacks this equity cushion" (p.13). In addition, the magnitude of output losses can be magnified by credit cycles where the cutback of bank credit supply deteriorates non-bank firms' financial positions

[5] Lee and Rhee (2000) find that the adjustment of economic growth rates (measured by the reversal of real GDP growth rates during the post-crisis periods relative to the pre-crisis periods) is stronger among export-oriented countries.

and consequently firms' inability to repay debts exacerbates banks' illiquidity problem (Kiyotaki and Moore, 1997).

Recent empirical studies have found evidence supporting that the occurrence of currency and/or financial crises on average is accompanied by substantial reduction in the GDP growth rates. To quantify the effects of crises on the real economy, Hutchison and Noy (2002) regress the annual real GDP growth rates on the contemporaneous crisis dummies, which take values of 1 in the crisis years for banking, currency, and twin crises, and lags of these crisis dummies. The significantly estimated coefficients of these crisis dummies will indicate the sizes of the annual economic growth contraction accompanying the crises. By controlling economic variables in the model, they find that the occurrence of currency crises among 24 emerging market economies over the period 1975-to-1997 on average reduces the GDP growth rate by 2.9 percentage points in the crisis year and 2.5 percentage points in the following year. Since the effect of currency crises on the real economy lasts approximately 2-3 years, the averaged cumulative growth reduction is about 5-8 percent per a crisis. For banking crises, on average, the annual reduction of the growth rate is 3-3.5 percentage points and lasts about 3.3 years; therefore, the cumulative growth losses is about 8-10 percent per a banking crisis. If banking and currency crises occur simultaneously and their effects on the real economy are measured independently, the total losses in the GDP growth rates predicted by the model will be as much as 13-18 percent. However, they do not find that the estimates of twin crisis dummy, which is constructed form the interaction term between the currency and banking crisis dummies, are significant. This indicates that the magnitude of output

losses associated with twin crises is not larger than the additive magnitude of output losses from those of currency and banking crises.

To test the effect of crises on the intermediate and long term economic growth rates, Barro (2001) regresses currency and banking crisis dummies on the long-run averaged growth rates for 67 developed and developing countries from 1965-2000. Unlike Hutchison and Noy who focus on the short-run effect of the crises, Barro tests these effects on the average of every five-year growth rate by using the long-run economic growth equations[6]. With the different approach, the magnitudes of growth reduction per year associated with crises, found by Hutchison and Noy, are more than double those found by Barro. In Barro's study, the contemporaneous occurrence of a currency and banking crisis is accompanied by the reduction of the real GDP per capita growth rate by 2 percent a year over a five-year period. This effect is a combination of 1.3 percent of the growth reduction associated with a currency crisis and 0.6 percent for that of a banking crisis.

Barro also modifies his long-run growth regressions in order to capture the severity of the 1997-98 Asian crisis. He creates two sets of dummy variables for Asian countries. The first set is for five severely crisis-hit countries (Indonesia, South Korea, Malaysia, the Philippines, and Thailand), and the second set is for the group of nine East Asian countries (five Asian countries and Hong Kong, Japan, Singapore, and Taiwan). Only the estimated coefficient of the dummy for the first group is significant. The large

[6] The dependent variable in Barro's model is the averaged growth rates of real GDP per capita for every five year period from 1965-to-2000 (i.e. the average growth rate during 1965-70,..., and 1995-2000). The independent variables are the currency and banking crisis dummies, which are created based on whether there is a crisis in any of these five-year periods, and the control variables used in the long run economic growth model such as the GDP per capita to test for the conditional convergence, human capital, investment rate, macroeconomic policies, etc.

magnitude of the coefficient indicates that the 1997-98 Asian crisis reduced economic growth rates in each country by approximately 4 percent.

Related studies that use dummy variables to capture the effect of crises on the economic growth rates include Demirgüç-Kunt, et al. (2000) and Hanna and Huang (2002). Both studies test whether the GDP growth rate in the three years following the onset of a crisis is significantly different from the mean of that of three years preceding the crisis year. They regress the GDP growth rates on the time dummy variables, which take values of 1 in the crisis year and three years following the crisis year. The significance of the estimated coefficients of the time dummies can indicate the magnitude of growth contraction in each year, during the post-crisis periods. By focusing on banking crises in 35 developed and developing countries between 1980 and 1998, Demirgüç-Kunt, et al. (2000) find that the average GDP growth rate significantly declines by 4 and 3.5 percentage points in the crisis year and the following year. The growth rate goes back to its pre-crisis growth level (calculated by the averaged three-year pre-crisis growth rates) in the second year after the crisis year. In addition, after controlling for the level of development, they find that the averaged GDP growth rate for developing countries declines more severely than that of developed countries when the crises occur. The level of development is proxied by the interaction term between the GDP per capita and the time dummy variables. Hanna and Huang (2002) apply the methodology of Demirgüç-Kunt, et al. (2000), but focus only on the 1997 Asian crisis. Their study includes nine Asian countries with Indonesia, Korea, Malaysia, and Thailand as the crisis countries, and China, Hong Kong, Philippines, Singapore, and Taiwan as other Asian countries controlled in the model. Their results show that in 1998 the averaged GDP growth rate

declined by 17.9 percentage points for the crisis-affected Asian countries, which is considerably higher than 5.8 percentage points for the other Asian countries. The growth rates improved in 1999, although they were still negative, and returned to the pre-crisis growth levels in 2000 for both groups of Asian countries.

The methodology of the dummy variables can be used to identify only the averaged magnitude of growth contraction associated with crises for countries in the sample. It does not take into account the extent of the crisis severity for an individual crisis episode. For example, the output loss data from Hoggarth, et al. (2002) shows that the magnitude of economic growth contraction associated with banking crises can vary from 0 percent (i.e. the crisis is not accompanied by economic contraction) to larger than 40 percent. In addition, for some crisis episodes, the GDP growth rate can take more than 10 years before it recovers to its potential growth trend. Since the effect of crises on the real economy substantially varies across countries, "to measure the output loss during a crisis it is therefore necessary to measure actual output compared with its trend, or potential" (Hoggarth, et al., 2002; p. 836). The next section will review studies on the costs of currency and financial crises; these studies estimate the output costs from the deviation of the actual output from the potential trend.

2.3 Literature Reviews on the Factors Determining the Output Losses and the Measures of Output Losses Associated with Crises

A growing number of empirical studies attempt to determine which economic factors and domestic policy responses may help explain the differentiation of the crisis severity across crisis-hit countries. Measuring the severity of crises, however, is a difficult task. The severity of a currency crisis may be assessed from the losses of

international reserves and the real exchange rate depreciation (Kaminsky and Reinhart, 1999). The fiscal costs of crisis resolutions are also used widely to measure the depth of a banking crisis (Caprio and Klingebiel, 2003; Frydl, 1999; Demirgüç-Kunt and Detragiache, 1997). Nonetheless, these costs do not reflect the overall costs to the economy. As noted by Hoggarth, et al. (2002), "Resolution costs may not always be a good measure of the costs of crises to the economy more generally but rather a transfer cost" (p. 834). Total economic costs of crises can be measured from the foregone economic growth or the loss in output, which can be estimated from the deviation of the actual output from the estimated potential output trend.

For the determinants of the output costs of banking crises, Bordo, et al. (2001), Hohohan and Klingebiel (2003), and Claessens, et al. (2004) focus on the role of crisis-resolution policies including open-ended liquidity support, unlimited government guarantee, and regulatory forbearance[7]. All three studies find similar results indicating that the central banks' open-ended liquidity support to the failing financial institutions has a highly significant effect by increasing the output costs of banking crises. The unlimited liquidity support to insolvent banks allows them to expand risky activities without the conditions on restructuring and recapitalizing. Bordo, et al. also finds that the pegged exchange rate regime makes banking crises more costly, since it provides the implicit guarantee against the exchange rate risks for foreign exchange investors. In addition to the focus on these crisis-management policies, Claessens, et al. also test the effect of the domestic institutions on the output costs of crises. They find that countries with weak quality of institutions (high corruption, low law and order, weak bureaucratic

[7] The data for these three resolution policies is coded by Honohan and Klingebiel.

quality, and less efficient judicial system) tend to suffer from larger magnitude of output losses.

Hutchison and McDill (1998) and Hoggarth, et al. (2005) examine the relationship between deposit insurance and the costs of crises. Hutchison and McDill find that the existence of an explicit deposit insurance system significantly decreases the magnitude of losses in the real GDP level. They also test the impact of other economic and institutional variables and find that the speed of the resolve of banking sector problems and the stability of exchange rates also significantly decrease the output costs of banking crises. By focusing on the coverage of deposit insurance, Hoggarth et al. point out that countries with limited explicit deposit protection schemes may experience higher output costs of crises. The unlimited coverage, on the other hand, should more efficient in preventing widespread financial panic. However, their estimates are not significant at the conventional level and they explain these results based on the signs of the estimated coefficients.

For the case of currency crises, Bordo, et al. find that the ratio of current account surplus to GDP significantly decreases the output costs of currency crises for the sample of 1973-1997, but does not have a significant impact of the whole period of 1880-1997. They explain this finding based on the increasing extent of capital mobility, particularly after the Bretton Wood period. For crisis-hit countries with a fixed exchange rate regime, the sudden stop of capital inflows needs to be offset by removing the current account deficit. This can be done by reducing the components of aggregate demand including consumption, investment, and import spending, which could lead to a sharp reduction of outputs. Gupta, et al. (2003) also find that economic growth contraction associated with

currency crises is larger if countries have the high level of pre-crisis private capital flows and when there is no capital account restrictions. Stone (2000) focuses on the relationship between crises and the corporate sector in emerging market economies during 1997-98. He finds that the higher level of corporate leverage, measured by the debt-to-equity ratio, in 1996 significantly led to large downward deviation of 1998 growth rate from its past trend. The corporate sector' balance sheet problem, which can be triggered by the sudden-stop of capital inflows, is the channel that transmits the shocks of exchange rate deprecation to the real sector.

Additionally, there are many economic and financial variables that have significant impacts in decreasing economic growth in timing of currency crises. Gupta, et al. and Gregorio and Lee (2004) show that the inadequacy of international reserve measured by the ratio of foreign reserves to M2 or the ratio of short-term external debt to reserves significantly increase the magnitude of growth contraction. Other macroeconomic variables that are found to be statistically significant in increasing the cost of crises regression include the tight monetary policy measured by the high real interest rates (Stone; Gupta, et al.) and twin crisis dummy (Bordo, et al.; Gregorio and Lee). The twin crisis indicates that a currency crisis will be more severe if it is accompanied by a banking crisis. The higher export growth rate in response to the real exchange rate depreciation also has a significant effect in decreasing the output losses (Gupta, et al.; Gregorio and Lee). On the other hand, the ratio of budget deficit to GDP is not found to be significant in determining the output costs of crises (Bordo, et al.; Gupta, et al.; and Gregorio and Lee).

The appendix table (A2.2) analytically summarizes the methodologies and results of these studies, which find a wide range of economic and policy variables as the significant factors in explaining the differentiation of the severity of crises across crisis-hit countries. The table also includes the column of how these studies measure the costs of crises. Among studies that focus on the output costs of crises, the criteria used to estimate output losses is also employed differently. IMF (1998), Aziz, et al. (2000), Bordo, et al. (2001); Hohohan and Klingebiel (2003); and Claessens, et al. (2004) use the similar concept of the output loss associated with a crisis. They estimate the loss from the annual cumulative deviation of the actual GDP growth rate from the potential growth trend. However, criteria used to estimate the potential growth rate are used differently. IMF (1998) and Aziz, et al. (2000) estimate this potential trend by assuming that the growth rates after the onset of crises should be at the rate of the averaged three-year pre-crisis growth rates. Bordo, et al. (2001) use the averaged five-year pre-crisis growth rates since they find that "considering only three years yields unstable and unreliable results" (Bordo, et al. 2001; Web Appendix). Nevertheless, Mulder and Rocha (2001), whose work focuses on the estimation of output losses associated with currency crises, illustrate that there is no significant difference for the magnitude of output losses calculated by using the average of three-year or five-year pre-crisis growth rates. Claessens, et al. (2004) suggest an alternative estimation of the potential growth trend, which can be estimated from the prediction of growth rates based on the growth model. They estimate the potential growth trend from the predicted values of Barro (1991)'s long-run economic growth model. Barro's model is: average GDP per capita growth (from 1960 to 1980) = $0.0302 - (0.0222 * \text{GDP per capita in 1960}) + (0.00051 * \text{GDP per capita in 1960})^2 +$

(0.0323 * second school enrollment rate) + (0.0270 * primary school enrollment rate) – (0.122 * government consumption to GDP).

Stone (2000), Gupta, et al. (2003), and Gregorio and Lee (2004) use a comparable method in estimating the output losses. However, they assume that the actual growth rate will return to its growth trend within the fixed number of years in the aftermath of crises, and this fixed period is the same for every crisis episode. For instance, Gregorio and Lee assume that the actual growth rate for each crisis episode will return to its potential growth trend in the third year after the crisis year. Then, they calculate the total magnitude of output losses by summing up the difference between the actual and potential growth rates for three years after a crisis (Gupta, et al. use two years as the fixed period)[8]. Their potential growth trend is calculated from the average of the two-year pre-crisis growth rates (Gupta, et al. use the averaged three-year pre-crisis growth rates). Stone (2000) uses a similar measurement by focusing on the output losses associated with the crises in emerging market economies in 1997-98. He calculates the magnitude of output losses in 1998 from the accumulative difference between the real GDP growth rate in 1998 and the potential growth trend, which are estimated from the averaged growth rates of 1987-to-1996.

Hutchison and McDill (1998), Hoggarth, et al. (2002), and Mulder and Rocha (2001) instead calculate the output losses from the deviation of the actual GDP *level* from the potential *level* trend. The latter two studies point out many biases when using the

[8] The assumption that the growth rate will return to its growth trend within 2-3 years after the crisis is questionable, since the economic contraction accompanying a crisis could end as fast as one year. The study by Hoggarth, et al. (2001) shows that there are 11 out of 47 crisis episodes that their growth rates return to trends within the crisis year, and 10 out of 47 crisis episodes that the growth rates recover to their trends within one year following the crisis year.

deviation of growth rates to assess the economic costs of crises. These biases are examined in section 2.4.2.

2.4 The Measures of Output Losses: the Concept

2.4.1 Definitions and the Methodologies in Estimating Output Losses

The output losses associated with currency and/or financial crises occur when the actual output declines or downwardly deviates from its potential output trend after the onset of crises. The total magnitude of output losses per a crisis episode can be estimated by adding up the difference between the actual and potential outputs over the duration of crises, which is the number of years from the crisis year to the year that the actual output returns to its potential trend. Although this overall concept has been accepted and used in a number of studies, the unique technique in estimating the output loss has not yet been agreed upon. The methodologies used to estimate the output losses associated with the crises in the existing studies can be categorized into two major groups. The first group computes the output losses from the deviation of the actual real GDP *growth rate* from its potential *growth* trend (IMF, 1998; Aziz, et al., 2000; Bordo, et al., 2001; Hohohan and Klingebiel 2003, Claessens, et al., 2004). The second group calculates the output losses from the deviation of the actual real GDP *level* from its potential *level* trend (Hutchison and McDill, 1998; Mulder an Rocha, 2001; Hoggarth, et al., 2002).

This dissertation employs both the growth rate and level of real GDP to estimate the output losses. The magnitude of growth contraction as the percentage of GDP, or so-called GROWTHLOSS, is calculated by summing up the difference between the actual

real GDP growth rate and the potential growth trend from the crisis quarter until the quarter that the actual output returns to its trend[9], or by using the following formula:

$$\text{Total losses in output growth rate (\%)} = \sum_{t=t_0}^{t=t_N} \left(Growth_{i,T} - Growth_{i,t} \right) \qquad (1)$$

, where $Growth_{i,t}$ is the quarterly real GDP growth rate of the crisis episode i at the quarter t. The crisis quarter is identified at period $t=t_0$ and the period that the actual growth rate returns to its trend is identified at period $t= t_N$. Therefore, the duration of crises can be calculated from the number of quarters (or years) from $t= t_0$ to $t= t_N$[10]. $Growth_{i,T}$ is the potential growth trend, which is measured by the averaged three-year pre-crisis growth rates[11].

The total absolute output losses (% of GDP) or LEVELLOSS is calculated from the net present value of the deviation of the real GDP level from the estimated potential trend. The discount rate of 4% annually is applied. Based on Mulder and Rocha (2001) and Hoggarth, et al. (2002), the LEVELLOSS can be calculated from

$$\text{Total absolute output losses (\%)} = \sum_{t=t_0}^{t=t_N} \left(GDP_{i,t,T} - GDP_{i,t} \right) \qquad (2)$$

$GDP_{i,t}$ is the actual real GDP level for the crisis episode i at the period t. $GDP_{i,t,T}$ is the potential level trend, which is computed from the past levels of the real GDP that is smoothed by Hodrick-Prescott filter (HP filter) from 1970 up to each crisis quarter. The potential level trend is assumed to grow constantly at the rate of the averaged three-year

[9] Since the dates of banking crises are available in an annual basis, the first quarter of the crisis year is assumed to be the onset of a crisis. The data for banking crises is from Caprio and Klingebiel (2003). See section 2.5.1 for the dating of currency crises.

[10] To compare the estimated output losses with other studies, total magnitude of output losses is reported in term of the annual loss, which can be calculated by multiplying the quarterly deviation of real GDP by the duration of crises (the number of years from the onset of crises until when the actual output returns to the trend).

[11] This method follows IMF (1998). When the quarterly real GDP is used, the pre-crisis growth rate is quarter-to-quarter growth rates, which are calculated from 36 quarters prior to the crisis quarter.

pre-crisis growth rates of the HP filter estimates. Mulder and Rocha (2001) state that this estimated potential trend would reflect the level the real GDP would be if the crisis had not occurred.

For a crisis episode *i*, the potential output level can be calculated from

$$\begin{aligned} GDP_{t_0,T} &= (1+g^*)GDP_{HP,t_{0-1}} \\ GDP_{t_1,T} &= (1+g^*)GDP_{t_0,T} \\ &\vdots \\ GDP_{t_N,T} &= (1+g^*)GDP_{t_{N-1},T} \end{aligned} \qquad (3)$$

$GDP_{HP,t_{0-1}}$ is the HP filter estimate of the real GDP of the quarter prior to the crisis quarter, and g^* is the averaged three-year pre-crisis growth rates of the HP filter estimate[12]. The potential output level at the crisis quarter is $GDP_{t_0,T}$, and the potential output level at the end of the crisis, i.e. when the actual real GDP level returns to its trend, is $GDP_{t_N,T}$.

The Criteria to Identify Whether A Crisis is Accompanied by Output Losses

A crisis episode is identified as accompanied by output losses if the actual output declines and is below the potential output trend in any quarters within the crisis year (i.e. within four quarters after the crisis quarter is identified). The decline of the real GDP is

[12] g^* is assigned a value of zero if it has a negative value (i.e. if there is economic recession prior to a crisis). The negative g^* causes the downward slope of estimated output trend. Therefore, if the estimated potential trend continually declines, the identification of output recovery, which is the point where the actual output returns to its trend, seems to be inaccurate.

also required to last at least two consecutive quarters. These criteria are applied to both measures of output losses, i.e. both GROWTHLOSS and LEVELLOSS[13].

Figure (2.1) plots the actual and potential real GDP level, estimated from equations (2) and (3), for some selected countries. Four upper graphs show the output adjustments for crisis episodes that are identified as accompanied by the output losses. The Mexican crisis and Turkish crisis in 1994 are the examples of crisis episodes that apparently induce economic recessions, since their real GDP levels sharply decline after the crises start. However, there are some crises episodes such as the ERM crisis of Finland in 1992 and Hong Kong crisis in 1998 in which economic recessions precede crises, and subsequently the crises aggravate recessions[14]. These examples illustrate that it is difficult to distinguish whether the occurrence of crises causes economic recession or vice versa.

To determine whether the output losses following crises are the consequence of crises, Bordo, et al. (2001) compare the output losses associated with the crises to the output losses occurred in recessions of business-cycle chronicle without crises. With the control of other factors that may cause severely economic recessions, they find that, for the post-1973 periods, the cumulative output losses are on average about 10.5 percentage points larger when economic recessions accompany the crises. Their results, however, do not imply that crises cause economic recessions.

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[13] This dissertation, however, does not consider the output gains from the crises, i.e. the expansionary output effect of the currency devaluation is not measured. Instead, it has the focus on the explanations of the differentiation of the output costs of crises across crisis-hit countries. When the actual GDP does not lower than the potential trend, that crisis episode is identified as no output losses.

[14] While the economic recession in Hong Kong preceding the 1998 crisis may be the consequence of the 1997 Asian crisis, it does not necessarily indicate that economic recession causes the crisis.

The last two graphs in figure (2.1) are the examples of crisis episodes that do not have an impact on aggregate outputs, indicated by evidence that the actual real GDP levels do not downwardly deviate from their potential trends within four quarters after the onset of crisis. These crisis episodes include the U.S.'s savings and loan association crisis in 1984 and the 1992 ERM crisis in Norway.

2.4.2 The Estimation of the Output Losses: Using the Level or Growth Rate of Real GDP?

Most empirical studies that attempt to discover the determinants of the output costs of crises estimate the output loss from the magnitude of the growth contraction (for examples, Aziz, et al., 2000; Bordo, et al., 2001; Hohohan and Klingebiel, 2003, Claessens, et al., 2004; Gupta, et al., 2003; Gregorio and Lee, 2004). Hoggarth, et al. (2002) and Mulder and Rocha (2001), however, comprehensively discuss several biases from the use of the real GDP growth rates in estimating the output losses associated with the crises. The major bias is the underestimation of the severity of crises. As noted by Hoggarth, et al. on the estimation of growth contraction,

> "this method will understate losses associated with crises lasting for more than two years because it does not recognize the reduction in the output level in previous years. Thus, other things being equal, given that crises usually last for more than two years, estimates which sum up the differences in the level of actual output from its trend during the crisis period give a higher measure of output losses", p837.

Both Hoggarth, et al. and Mulder and Rocha provide empirical evidence illustrating that the average magnitude of losses in the real GDP levels is substantially larger than losses in the real GDP growth rates. With the focus on the output costs of banking crises, Hoggarth, et al. show that the average of magnitude of absolute output losses for 47 banking crisis episodes in 38 developed and developing countries from

1974-1998 is 16.9 percent, which is double the 8.7 percent of the losses in real GDP growth rates. Similarly, by using 97 currency crisis episodes in 29 countries, Mulder and Rocha show that the average absolute output losses are 47.8 percent in industrial countries and 21.9 percent in emerging market economies. These numbers are substantially higher than 1.8 and 8 percents in industrial and emerging market countries calculated from the losses in the real GDP growth rates.

The use of real GDP growth rates leads to the underestimation of the severity of crises, which is supported by evidence of the 1997-98 Asian crisis. Figure (2.2) plots the adjustments of real GDP levels and growth rates as well as their estimated potential trends for five crisis-hit Asian countries. By looking at the adjustment of GDP growth rates (graphs on the right-hand side), economic recovery for each Asian country was found to be strong, indicated by the return of its growth rate to pre-crisis growth trend within 2-3 years after the onset of crises. The recovery was strongest in South Korea, where the post-crisis GDP growth rate was noticeably higher than its pre-crisis growth rate after 1999. However, South Korea's real GDP level as well as other Asian countries' have not yet returned to its potential real GDP level trend (graphs on the left hand side)[15]. The patterns of the movement of the real GDP levels and growth rates for these crisis-hit Asian countries are consistent with the study of Cerra and Saxena (2003). By using a regime-switching approach to decompose the adjustment of the real GDP levels for six Asian countries into permanent and transitory components, they find that the Asian crisis was associated with the permanent losses in outputs. Nevertheless, based on the graphical analysis, whether the output loss is permanent, i.e. the actual output level does not

[15] The real GDP data is available and used up to 2003. That is, up to the end of 2003 the actual real GDP levels for these five Asian countries have still not returned to their potential output levels.

recover to the potential output trend, could also depend on techniques and assumptions in estimating the potential output trend.

2.4.3 The Uncertainty in Estimating the Potential Output Trend

The major uncertainty and variation of the estimated output losses as well as the identification of economic recovery from a crisis across studies can be due to the calculation of the potential output trend[16]. If the estimated potential output trend is low, the magnitude of output can be underestimated. On the opposite, if the estimated trend is high, it may lead to very large magnitude of output losses or even the permanent output loss, which is identified when the actual output does not recover to its trend.

In order to estimate the potential output level, Mulder and Rocha (2001) suggest that it should reflect the level of output that should be if a crisis would not have occurred, and Hoggarth, et al. (2002) suggest that it should be calculated from the past performance of the economy prior to the onset of a crisis. In other words, the potential output trend should be the level of output that is assumed to grow at some constant rates based on the pre-crisis levels of real GDP. If the real economy is not affected by a crisis, the actual output level should continually grow at the rate close to the estimated potential trend in the aftermath of a crisis. However, if a crisis has an adverse impact on the real economy, the actual output level will be substantially lowered relative to its past performance.

As mentioned by many empirical studies, there is an uncertainty in choosing the number of years prior to a crisis, which can suitably reflect economic past performance, to estimate the trend. Studies that use long periods (i.e. 5-10 years before a crisis) are

[16] In addition to the uncertainty of estimated potential output trend, other factors such as identifying the onsets of currency crises can also lead to different values of the magnitude of output losses. Chapter three of this dissertation provides the sensitivity tests for the estimated output losses when the dates of currency crises are identified from different criteria.

questioned on whether those periods are really tranquil periods, since in many countries the frequency of crises is high, or crises may occur every few years. On the other hand, studies that use short periods (i.e. 3-5 years prior to a crisis) for the real GDP to estimate the potential output trend may be subjected to the bias of the estimated output losses due to the unstable conditions of the pre-crisis economy. Whether economic recessions or booms precede crises, however, are demonstrated differently across studies. Hutchison and McDill (1998) and Demirgüç-Kunt and Detragiache (1997) find that the eruption of crises are more likely to be preceded by economic recessions. In their studies, the estimated coefficients of the pre-crisis growth rates are significantly negative in the probability of banking crisis regressions, indicating that a sharp economic recession leads to the higher probability of banking crises. Additionally, Kaminsky and Reinhart (1999) observe the adjustments of real GDP growth rates during the pre- and post-crisis periods. The growth rates prior to crises are found to be below the averaged growth rate, which is estimated from tranquil periods. On the other hand, Moreno (1999), Bordo, et al. (2001), and Tornell, et al. (2004) illustrate that crises are usually preceded by economic and credit booms, which occur from banks' expanding their lending activities. They explain this situation from the 'credit boom hypothesis', which states that banking crises typically occur after a financial liberalization. Similar evidence is found by the study of Hoggarth, et al. (2002) for the estimation of output losses associated with 47 banking crises. They calculate the potential output trends based on the average of ten-, three-, and one-year pre-crisis growth rates. Their results show that the estimated magnitude of growth losses when using three- or one-year pre-crisis growth rates as the benchmark to estimate the potential trends is considerable higher than when using ten-year pre-crisis growth rates.

This supports evidence of economic boom preceding banking crises, since high economic growth rates in one or three years prior to crises lead to the high potential growth trend and set a high standard for the actual GDP to catch up. Consequently, the large deviation of the actual output from this estimated trend suggests that the crisis is very severe and economic recovery may never be recognized.

2.4.4 The Alternative Estimation of The Potential Output Trend: The Rolling-HP Method

This section focuses on the estimation of the absolute output losses associated with currency and banking crises. From a sample of 65 developed and developing countries during the period 1975-to-2000[17], the data shows that the majority of crisis episodes have high economic growth rates preceding crises. As discussed in section 2.4.3, the estimation of the potential outputs based on Hoggarth, et al.'s and Mulder and Rocha's technique result in the explosive potential output level trend, and subsequently lead to the huge magnitude of output losses. Mulder and Rocha also state that, "in the cases for which we observe a new crisis before full recovery was observed, we have truncated the computation of the output deviations referring to the previous crisis and commenced computing the deviations concerning the new crisis" (p. 9). Consequently, the magnitude of output losses associated with crises in the early 1980s will automatically be very large relative to that of crises in the late of 1990s[18].

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[17] The list of countries is reported in the appendix table A2.1.

[18] For instance, the magnitude of output loss for a country that had a crisis once in 1980 will be calculated from the summation of the difference between the actual and potential GDP level from 1980 to 2002, while for a crisis occurred in 1997, the output losses will be calculated by using the data from 1997 to 2002. This calculation is based on two assumptions/conditions: first, a country had high economic growth rate before the eruption of a crisis; therefore, the calculated potential output trend was inflated and the actual GDP was not be able to recover to the trend. Second, the data of the real GDP is available until 2002.

Mulder and Rocha also recognize the problem of explosive potential trends and use other alternative techniques to estimate them. Figure (2.3) plots the actual and potential output level trends, which are computed by replicating Mulder and Rocha's techniques for the sample of crisis-hit Asian countries. The MULTIHP method is estimated by applying the HP filter to the real GDP levels from the starting of the estimation period *up to* the crisis period, and using the average of three-year pre-crisis growth rates of these HP filter estimates to project the potential output trend (see equations 3 in section 2.4.1). Alternatively, the HP method is employed. This method applies the HP filters to the real GDP levels for the *entire* estimation period and uses these estimates for the potential output trend.

According to the collaborative work with Hiro Ito[19], the limitations of Mulder and Rocha's MULTIHP and HP methods in estimating potential output trends are discussed. For the HP method, although it makes the recovery possible and leads to smaller magnitude of output losses, it causes the downward bias of the estimated output losses, because the HP filter also smoothes the decline of the output during and after crisis periods. For the MULTIHP method, the assumption used to estimate potential outputs, i.e. the potential output trend should reflect the level of output if the crisis had not occurred, is the strong assumption, which leads to the explosion of estimated potential trends. This assumption suggests that if there were no crisis, there would be no change in the productivity growth in long run. Alternatively, it sets the high benchmark for economic recovery, particularly if an economy experiences economic boom prior to the crisis. Due to these limitations, alternative technique in estimating potential output trends, which is so-called a "Rolling-HP" method is introduced. This technique relaxes Mulder

[19] Hiro Ito is a Visiting Assistant Professor at Claremont McKenna College in 2003.

and Rocha's strong assumption by allowing shocks in the productivity growth in the estimation of potential trends. This relaxed assumption will solve the problem of explosive potential trends and allow economic recovery to be possible.

The Rolling-HP method computes the potential output trend by applying the HP filter to the real GDP levels from the beginning of estimation period *up to* the crisis period (the quarterly real GDP is used). Then the average of three-year pre-crisis growth rates is calculated from those HP filter estimates, and used to project the potential real GDP level in the crisis quarter. Based on this new trend (i.e. the pre-crisis real GDP levels plus the previously estimated potential real GDP level in the crisis quarter), the HP filter is applied again from the beginning of estimation period *to* the crisis quarter. Then, the average of the last three years' growth rates is calculated and used to project the potential output level for the quarter after the crisis quarter. The new trend of real GDP levels is continuously updated, and this process is continued until the actual output recovers to the estimated potential output trend.

2.5 The Measures of Output Losses: the Empirics

2.5.1 The Output Losses Associated with Banking, Currency, and Twin Crises

Table (2.1) reports the magnitude of output losses categorized by the types of crises and countries' level of development (i.e. developed and developing countries). The sample is comprised of 22 developed and 43 developing countries from 1975-2000. The types of crises are classified into currency, banking, and twin crises. Currency crises are also separated into severe and mild crises. From the sample, there are 80 banking crisis episodes, 76 severe and 154 mild currency crisis episodes, and 30 twin crises. The dates

of banking crises are from Capiro and Klingebiel (2003). Banking crises are defined from the exhaustion of banks' capitals in the financial sector and the significant events of financial problems such as a large-scale government intervention in banks and financial institutions. The dates of currency crises are constructed from the exchange market pressure index (EMP), which is calculated from the weighted average of the changes in exchange rates and international reserves. A currency crisis is identified when the EMP index is larger than two/three standard deviations above the country-specific mean[20]. A twin crisis is defined when a banking crisis occurs two years before, during, or after the onset of a severe currency crisis, which follows the definition of twin crises by Hutchison and Noy (2002).

In part I of table (2.1), the average of the absolute output losses associated with severe currency crises is unsurprisingly higher than that of mild crises. Currency and banking crises are also found to be more severe in developing countries than in developed countries. While this finding contrast with Mulder and Rocha (2001) who illustrate that the output losses associated with currency crises are higher for industrial countries than for emerging market economies, it supports the theoretical discussions by Aghion, et al. (2001) and Disyatat (2001). The latter two studies argue that the extent of which the depreciation exerts an output contraction depends on the soundness of banks and financial institutions, which perform an important role in lending and credit-constraining to a corporate sector. Banks' unwillingness to lend or cutoff the extension of credit lines

[20] This method follows Eichengreen, et al. (1994, 1995) and Kaminsky and Reinhart (1999). Severe currency crises are identified when the EMP is larger than three standard deviations above the country-specific mean, and mild crises are identified by using two standard deviations. Crisis dates are also separately calculated for countries that experienced hyperinflation, which is defined if the inflation in the previous six months is higher than 150 percent. Chapter 3 of this dissertation also uses other criteria to identify currency crises as well as discusses various limitations of those criteria used to calculate the exchange market pressure.

to the corporate sector is due to the deterioration of their balance sheets, which are affected by crises. The cutoff of credits will lead to the decline or even the collapse of companies' investments resulting in an economic recession. The healthier financial institutions in developed countries should be able to absorb the impact of currency devaluation and continue their lending to a corporate sector. This can explain why currency crises tend to be less severe among developed countries.

Part II of table (2.1) compares the magnitudes of output losses accompanying twin crises with those when banking or currency crises occur alone. While descriptive statistics show that twin crises are associated with larger output losses than when currency crises occur alone, they do not clearly indicate whether twin crises are more severe than when banking crises occur alone. This result may reflect the different conclusions on the severity of twin crises found in recent literature. For instance, Hutchison and Noy (2002) consider the effect of twin crises on GDP growth rates and compare it with the effects of banking and currency crises when they occur independently. Their results do not show that twin crises contribute to the additional severity of crises. On the other hand, Kaminsky and Reinhart (1999) and Bordo, et al. (2001) show that twin crises are significantly more severe than when currency or banking crises occur alone. The relatively severe twin crises, or the strong linkage between banking and currency crises, are commonly used to describe the severity of the 1997-98 Asian crisis (see Moreno, 1999; Glick and Hutchison, 2001; and Kaminsky and Reinhart).

2.5.2 The Output Losses Associated with Crisis Episodes With and Without IMF-Supported Programs

Empirical studies employ different approaches in order to analyze whether the severity of crises is larger in a group of currency crisis-hit countries that participate in the IMF-supported stabilization programs than in a group without the programs[21]. This analysis is based on the argument about the role the IMF played in bailing out crisis-hit Asian countries during 1997-98. The tight macroeconomic policies, which the IMF demanded that participating countries follow, are criticized as worsening economic recessions and problems in the financial sector (Stiglitz, 2000). These conditions are attached to this IMF's lending that was proposed to replenish crisis-hit countries' international reserves in order to restore investor confidence in order to limit the financial failures and recessions. The tight monetary policies aim to prevent capital outflows and reduce inflation, and the tight fiscal policies would stimulate domestic saving. The successful programs would improve the current account and the balance of payments, reduce inflation and government budget deficits, and prevent the alteration of the parity exchange rates (see the Meltzer Commission's report, 2000).

Studies on the impact of IMF programs on the output costs of crises have different conclusions. For instance, Lee and Rhee (2000) and Park and Lee (2001) use the "with and without approach", which compares the macroeconomic performance between crisis countries with the programs and a control-group of countries without the programs, for a large set of developing countries from 1975-1990s. They find that growth contraction and recovery are stronger in the participating countries. On the other hand, by focusing on only Latin American and Asian countries, Bordo and Schwartz (2000) find that the

[21] See Haque and Khan (1998) for survey of different approaches used to test the impact of the IMF-stabilization programs on the macroeconomy.

growth adjustments are stronger among non-participating countries. However, when using regression analysis, Park and Lee do not find that the IMF-supported programs significantly assist the post-crisis economic growth recovery to be faster or stronger. Similarly, Hutchison (2003) and Bordo and Schwartz (2000) estimate the model of the impact of IMF programs on the real GDP growth rates and do not find that the participation of the IMF programs significantly worsens the real GDP growth rates during crises. Nevertheless, Bordo and Schwartz find that IMF programs significantly increase the real GDP growth rate in one year after a crisis year. On the other hand, Przeworski and Vreeland (2000) find that the participation of IMF programs lower growth rates in a sample of 73 developing countries from 1970-1990.

Figure (2.4) uses the "with and without approach" to compare the output adjustment for countries with and without IMF-supported programs. Unlike other studies that focus on the adjustment of the real GDP growth rate, this figure plots the averaged real GDP level relative to its estimated potential level trend. A currency crisis-hit country is classified as participating in an IMF-supported program if the approval dates of IMF's financial arrangements are within the crisis year or the year following the crisis[22]. From the sample of 78 currency crisis episodes in 65 countries from 1975-2000, the IMF's financial assistance was provided in 31 episodes. Figure (2.4) shows that currency crisis-hit countries that receive IMF's financial assistance on average experience more severe

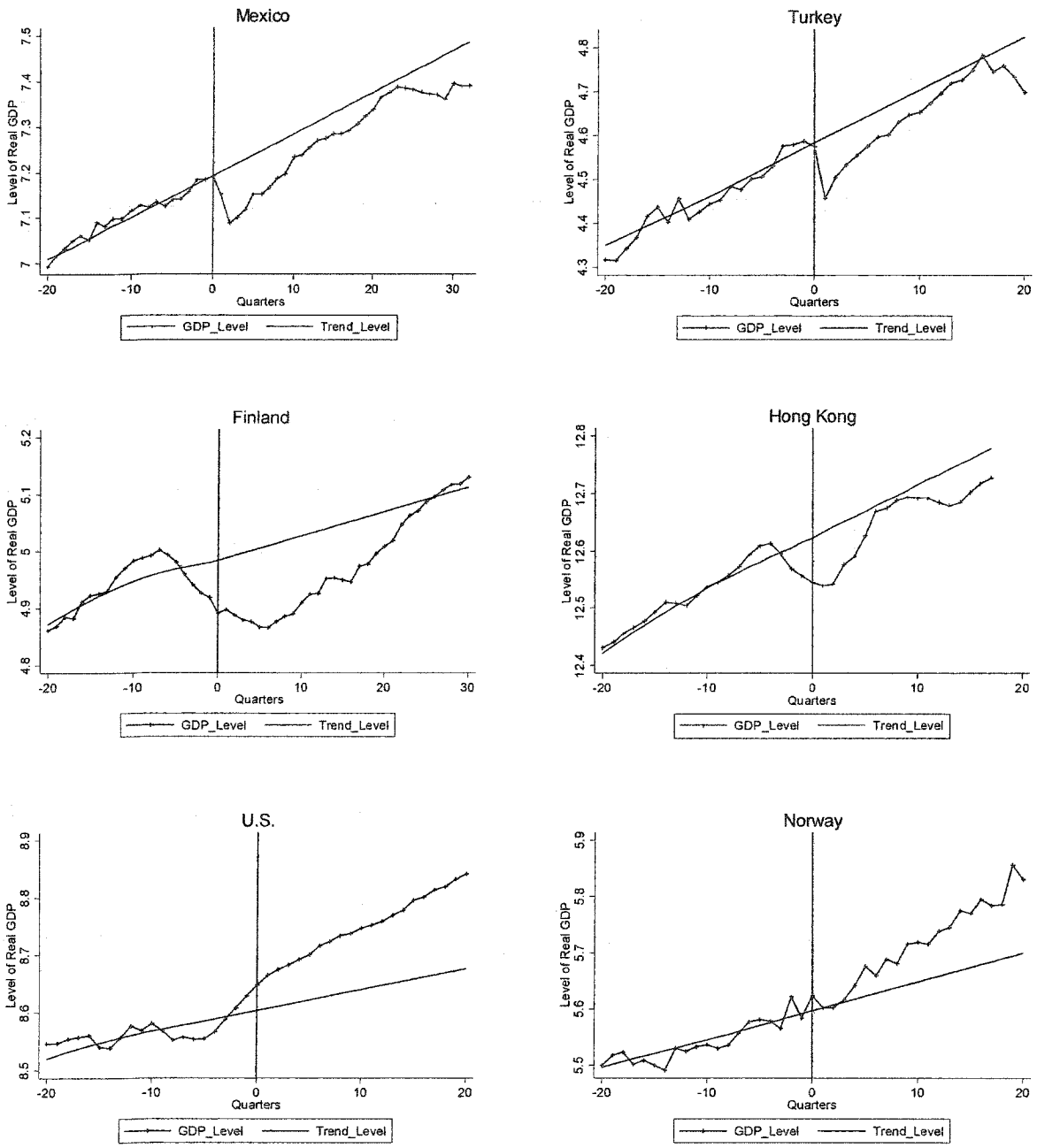
[22] The dates that the IMF programs are approved across countries are from IMF website http://www.imf.org/external/np/tre/tad/exfin1.cfm (the dates of IMF programs before 1980 is from Hutchison, 2000). The IMF's financial facilities can be in the forms of Standby Arrangement, Extended Fund Facility, of which Supplemental Reserve Facility, Structural Adjustment Facility Commitment, PRGF Commitments. The dates of currency crises are identified when the exchange market pressure (based on the changes in exchange rates and international reserves) is larger than three standard deviations above the country-specific mean.

crises with the doubled magnitude of absolute output losses.[23] On the other hand, the averaged real GDP level for crisis episodes without IMF programs moves closely and returns to its potential trend within a few years. However, this graphical comparison does not necessarily indicate that the IMF programs aggravate the output losses. Whether the IMF's financial assistance exacerbates the severity of crises should be concluded on the basis of the empirical results of a causality test, since the figure may plausibly imply that only an economy severely affected by a crisis is forced to enter the IMF-supported stabilization programs.

The magnitudes of output losses calculated by using different techniques in this chapter are employed to analyze their relationships with deposit insurance and domestic political institutions in chapters four and five. Specifically, the output losses are estimated by using both the level and growth rate of real GDP to capture both the magnitude of absolute output losses (LEVELLOSS) and the magnitude of growth contraction (GROWTHLOSS). The use of different estimation methods will strengthen the robustness of empirical findings. Only a few studies, such as Claesesen, et al. (2003), employ different alternatives in estimating output losses. However, they consider only the output costs in terms of the loss in real GDP growth rate, which is previously discussed in that it underestimates the severity of crises.

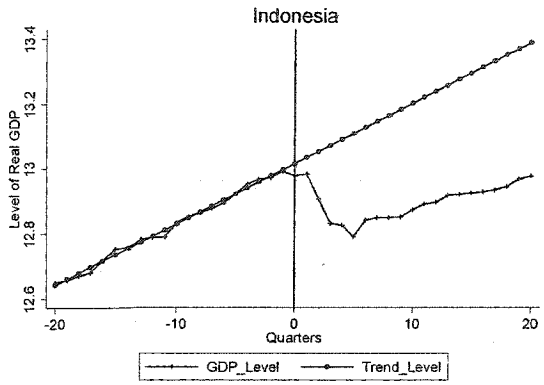
[23] The patterns of output adjustments for currency crisis episodes with and without the IMF programs do not significantly change when using other criteria in dating currency crises.

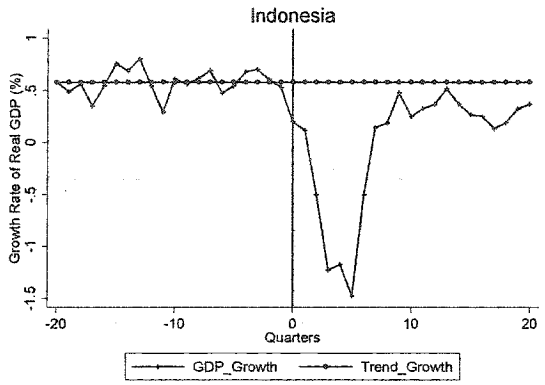
Figure (2.1) The Actual Real GDP Levels and the Potential Trends during Currency and Financial Crises for Some Selected Countries

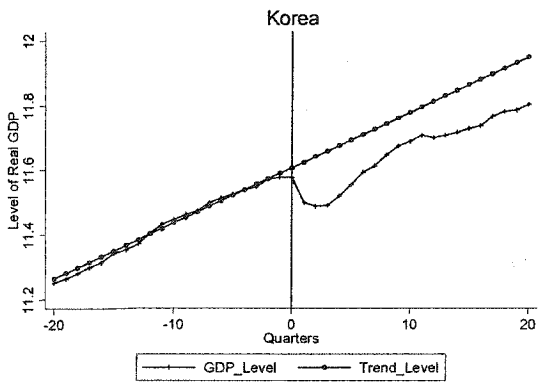


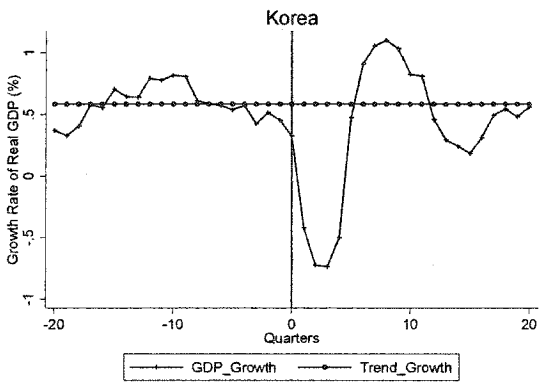
Note: Quarter 0 is the crisis quarter. The crises occured in 1994Q4 for Mexico, 1994Q1 for Turkey, 1991Q4 for Finland, 1984Q1 for U.S., and 1992Q3 for Norway. The GDP_Level is the actual real GDP level and Trend_Level is the potential output trend estimated by using equation (3) in section 2.4.1.

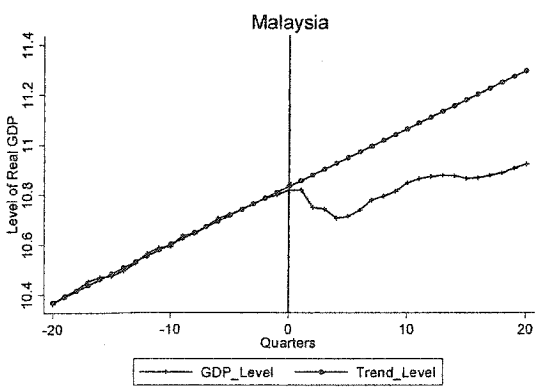
Figure (2.2) The Deviations of the Levels and the Growth Rates of Real GDP from the Potential Trends for Five Crisis-hit Asian Countries in 1997











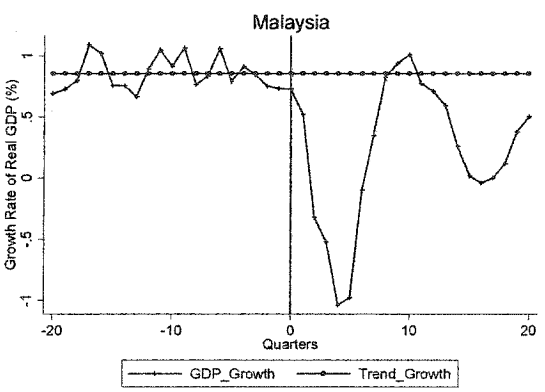
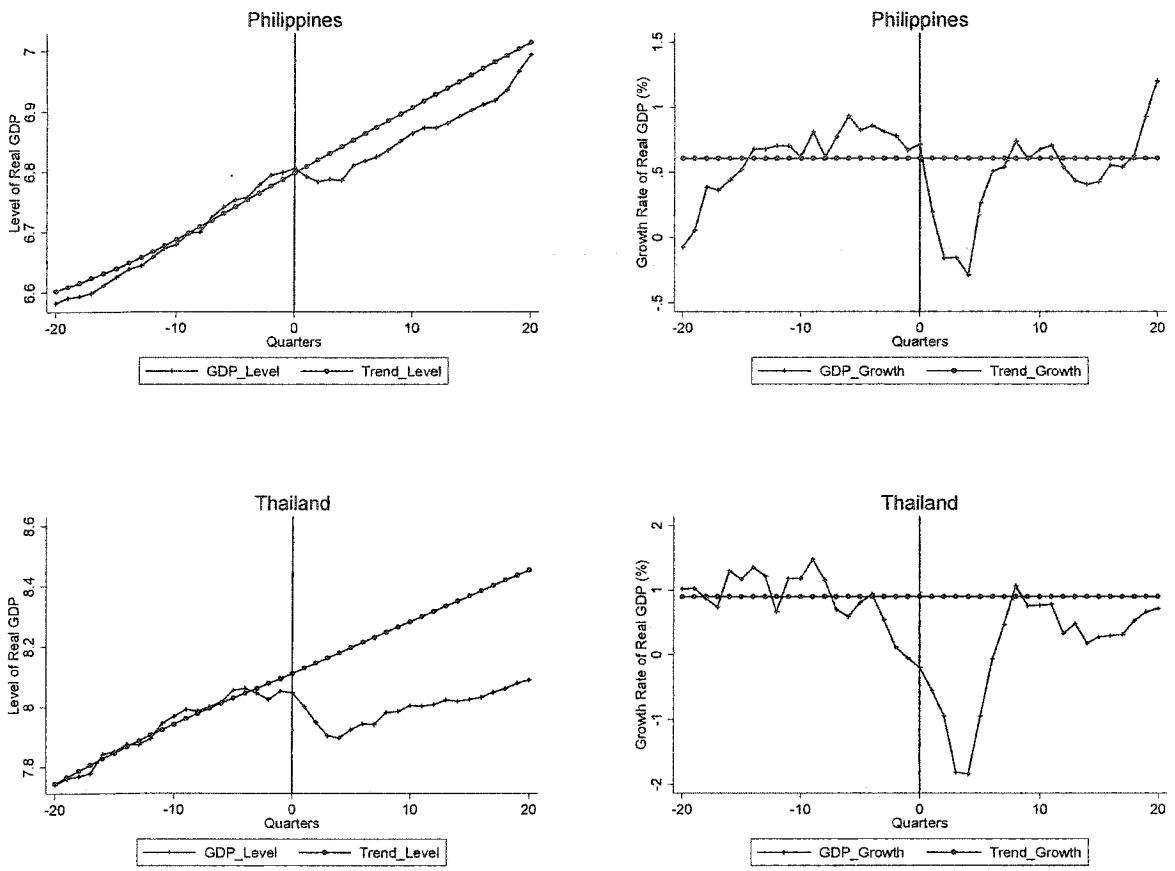
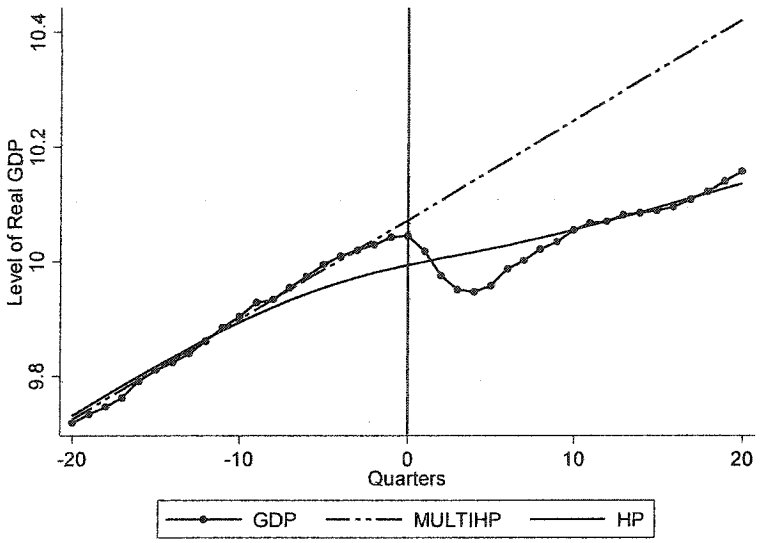


Figure (2.2) Continued



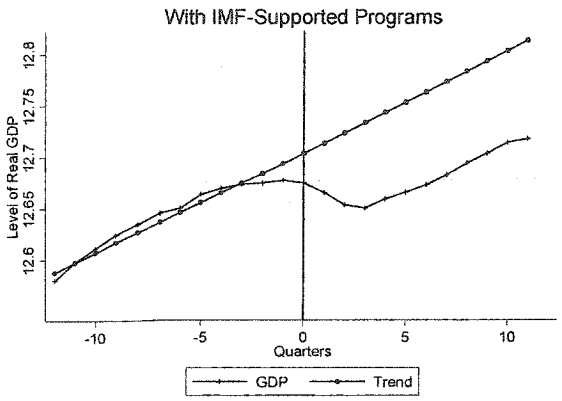
Note: Quarter 0 is the crisis quarter. The crises occured in 1997Q3 for Indonesia, Malaysia, and Thailand; and in 1997Q4 for South Korea, and the Philippines. The GDP_Level is the actual real GDP level and Trend_Level is the potential GDP level trend estimated by using equation (3) in section 2.4.1. The GDP_Growth is the quarter-to-quarter growth rate of real GDP and Trend_Growth is the potential growth trend estimated from the average of three-year pre-crisis growth rates.

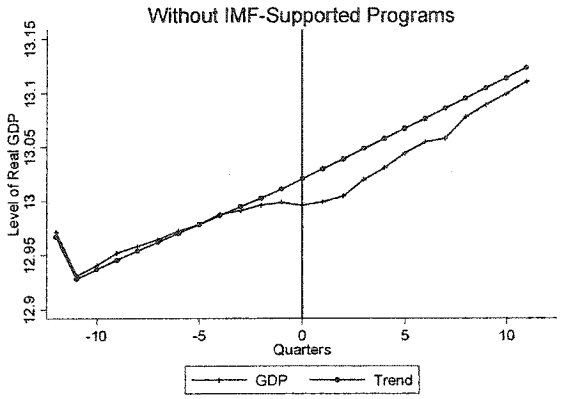
Figure (2.3) The Comparison between Two Different Potential Output Trends (averaged for five crisis-hit Asian countries during 1997-98)



Note: Quarter 0 is the crisis quarter. GDP is the actual real GDP level, which is the average GDP level for five Asian countries. MULTIHP is the potential trend estimated by using Mulder and Rocha (2001)'s method, or from equation (3) in section 2.4.1. HP is the alternative potential output trend used also by Mulder and Rocha. While the MULTIHP trend is computed by applying the HP filter to the real GDP levels from 1970Q1 to 1997Q3/Q4, the HP trend applies the HP filters to the real GDP level from 1970Q1 to 2002Q4 (see section 2.4.4 in this chapter).

Figure (2.4) The Actual Real GDP Levels and the Potential Trends Averaged for Currency Crisis Episodes With and Without the IMF-Supported Programs





Output losses = 71.4% (31 crisis episodes)

Output losses = 37.4% (47 crisis episodes)

Table (2.1) The Averaged Magnitude of Absolute Output Losses (%) Associated with Currency, Banking, and Twin Crises (only crises with output losses) [a]

	All	Developed countries	Developing countries
Part I			
Severe currency crisis [b]	52.2 (76)	38.9 (15)	55.5 (61)
Mild currency crisis [b]	31.8 (154)	18.6 (61)	40.4 (93)
Banking crisis	66.7 (80)	54.9 (19)	70.4 (61)
Part II			
Twin crisis [c]	75.7 (30)	84.5 (5)	73.9 (25)
Currency Crises Alone	36.9 (46)	16.2 (10)	42.7 (36)
Banking Crises Alone	73.8 (33)	74.9 (7)	73.6 (26)

Notes: Figures in parenthesis is the numbers of crisis episodes

[a] The magnitudes of absolute output losses are calculated by using Hoggarth, et al.'s and Mulder and Rocha's methodology (see equations 2 and 3 in section 2.4.1). These reported magnitudes are higher than those reported in Hoggarth, et al. or Mulder and Rocha since the data is calculated by using the quarterly real GDP and then converted to the annual output losses. In addition, only crises with output losses are included in the calculation.

[b] The severe currency crises are identified when the exchange market pressure (calculated from the weighted average of the change in exchange rates and international reserves) is larger than three standard deviation above the country-specific mean and the mild crises are identified by using two standard deviation above the mean as the threshold.

[c] twin is identified when banking crises occur within two years before, during, or after the onset of severe currency crises.

Appendix Table (A2.1) Lists of Countries

Developed Countries	**Developing Countries**	
Australia	Argentina	Mauritius
Austria	Bolivia	Mexico
Belgium	Botswana	Morocco
Canada	Brazil	Nigeria
Denmark	Chile	Paraguay
Finland	China	Peru
France	Colombia	Philippines
Germany	Costa Rica	Poland
Greece	Ecuador	Romania
Iceland	Egypt	Russia
Ireland	Ghana	Senegal
Italy	Hong Kong	Singapore
Japan	Hungary	South Africa
Netherlands	India	Sri Lanka
New Zealand	Indonesia	Thailand
Norway	Israel	Tunisia
Portugal	Jamaica	Turkey
Spain	Jordan	Uruguay
Sweden	Kenya	Venezuela
Switzerland	Korea	Zambia
United Kingdom	Latvia	Zimbabwe
United States	Malaysia	

Appendix Table (A2.2) Studies on the determinants of costs of crises

This table categorizes the studies on the determinants of costs of crises into four groups: 1) Crisis-Management Policies 2) Deposit Insurance 3) IMF programs, and 4) Key Macroeconomic Variables. Crisis-management policies and deposit insurance are generally employed to explain the costs of banking crises, whereas IMF programs are examined with the costs of currency crises. Key macroeconomic variables are included in both studies of banking and currency crises.

Studies	Measures of the Costs of Crises	Primary Purpose (relating to the costs of crises)	Findings	Sample
a.) Output Cost of Banking Crises: Crisis-Management Policies (liquidity support, blanket guarantee, forbearance)				
Hohohan and Klingebiel (2003)	- Fiscal cost [a] - Output cost: The sum of the difference between the actual and potential growth trend, which is calculated from the averaged three-year pre- crisis growth rates	Test the impact of crisis resolution policies on the fiscal and output costs of crises	1) Unlimited liquidity support, unlimited deposit guarantees, and regulator forbearance significantly increases the fiscal costs 2) Only unlimited liquidity support significantly increase the output costs of crises	40 crisis episodes in 33 developed and developing countries, 1980-2002
Claessens, et al. (2004)	- Fiscal cost [a] - Output Cost: The sum of the difference between the actual and potential growth trend. This trend is calculated from 1) the averaged three-year pre- crisis growth rates and 2) the predicted value of growth rate based on Barro (1991)'s long-run growth model	Test the impact of crisis resolution policies and the quality of domestic institutions on the	Unlimited liquidity support, unlimited deposit guarantees, regulator forbearance, poor institutional quality (high corruption, lower law and order, weak bureaucratic quality, and less efficient judicial system) significantly increases both fiscal and output costs of banking crises	35 crisis episodes, 1980-2002
Bordo, et al. (2001)	Output cost: The sum of the difference between the actual and potential growth trend, which is calculated from the averaged five-year pre-crisis growth rates	Test the determinants of output costs of banking crises	The unlimited liquidity support and pegged exchange rate regime increase the output costs of banking crises. Other policies such as capital support and unlimited guarantee are not found to significantly determine to output costs of crises.	56 developed and developing countries, 1973-1998

Studies	Measures of the Costs of Crises	Primary Purpose (relating to the costs of crises)	Findings	Sample
b.) Output Cost of Banking Crises: Deposit Insurance				
Hutchison and McDill (1998)	Output cost: The present discounted value of the difference between the actual and potential output level. The Hodrick-Prescott filter is used to estimate the trend output level	Test the determinants of the output cost associated with banking crises	The output cost of banking crises is smaller with the existence of the explicit deposit insurance, the more quickly banking sector problems are resolved, and when exchange rate stability is maintained.	65 episodes of banking crises in 98 countries, 1975-1997
Hoggarth, et al. (2005)	- Fiscal cost [a] - Output cost: The cumulative deviation in the growth of GDP during the crisis period from its pre-crisis ten year trend	Test the impact of the design of safety nets on the probability and the costs of crisis resolution	Deposit insurance variables are not significant in both fiscal and output costs regressions. However the signs of estimates show that explicit and limited deposit insurance schemes increase output costs, but decrease fiscal costs of crises. On the other hand, explicit and unlimited schemes decreases output costs, but increases fiscal costs.	29 developed and developing countries, 1994-2001
Demirgüç-Kunt and Detragiache (1997)	- Fiscal cost [a]	Test the impact of various macroeconomic variables on the fiscal costs of crises	Low economic growth, poor quality of law and order, high real interest rate, high inflation, large share of credit to the private sector, and high ratio of M2 to reserve significantly increase the probability of banking crises	24 crises in 24 developed and developing countries, 1980-1994
c.) Output Cost of Currency Crises: IMF programs				
Hutchison (2003)	Output cost: annual real GDP growth rate	Test the output cost of IMF-supported stabilization programs	By controlling for the effect of a currency crisis on real GDP growth, IMF programs do not appear to have significantly additional effect in reducing the short-run growth rates	67 developing and emerging-market economies, 1975-97

Studies	Measures of the Costs of Crises	Primary Purpose (relating to the costs of crises)	Findings	Sample
Park and Lee (2001)	Output recovery: average growth rate during post-crisis periods (t+1 to t+5), t is the year of crisis	Analyze the key macroeconomic variables that can determine the adjustment of output recovery process.	By using cross-sectional regressions, the quick recoveries are driven by exchange rate depreciation, expansionary macroeconomic policies, export-oriented structure, and favorable global environments. IMF programs has no significant impact on the recovery process	Quarterly data from 1970-1997 for a large set of developing countries
Lee and Rhee (2000)	Output cost: the reversal of GDP growth rate between the crisis period (t-1, t) and the post-crisis period. (t+1 to t+3), t is the year of approval of an IMF program	Analyze the macroeconomic adjustment progress of the Korean financial crises in 1997 based on cross-country regression analysis	Based on cross-sectional regressions, both the exported-oriented structure and the adjustment of macroeconomic policies contributed to the speedy adjustment of an economy after the approval of an IMF program. These results can explain the adjustment of Korean economy well.	88 developing countries from 1974-1994
Bordo and Schwartz (2000)	Dependent variable: annual real GDP growth rate	Test the impact of IMF participation programs on four macroeconomic variables (real GDP growth rate, the current account, the balance of payments, and inflation)	An IMF program has a negative but insignificant effect on the real GDP growth rates in crisis years. However, it significantly increases growth rate in the following year. In addition, a program is not found to have a significant impact on the current account, balance of payments, and inflation.	11 Latin America and 13 Asian countries from 1973-1998.
d-i) Output Cost of Currency Crises: Macroeconomic Variables				
Gupta et al (2003)	Output cost: The sum of the difference of growth rate between the post-crisis period (2 years after a crisis) and pre-crisis period (3 years before a crisis)	Test the impact of the key macroeconomic variables on output responses during currency crises	Economic growth contraction associated with currency crises is larger if countries have the high level of pre-crisis private capital flows and when there is no capital account restrictions	91 developing countries during 1970-1998

Studies	Measures of the Costs of Crises	Primary Purpose (relating to the costs of crises)	Findings	Sample
Gregorio and Lee (2004)	Output cost: The sum of the difference of growth rate between the post-crisis period (3 years after a crisis) and pre-crisis period (2 years before a crisis)	Test the determinants of output costs of currency crises	The macroeconomic variables that significantly reduce the output cost of crises include the real exchange rate depreciation, the higher ratio of foreign reserve to money supply, and the higher world growth rate.	11 Asian and 21 Latin American countries from 1970-1999
d-ii) Output Cost of Banking Crises: Macroeconomic Variables				
Bordo, et al. (2001)	Output cost: The sum of the difference between the actual and potential growth trend, which is calculated from the averaged five-year pre-crisis growth rates	Test the determinants of output costs of currency crises	Higher ratio of current account surplus to GDP is associated with lower output cost of currency crises. This cost is also higher if a crisis is twin or accompanied by banking-sector problems.	56 developed and developing countries, 1973-1998
Stone (2000)	Output cost: The difference between real GDP growth in 1998 and trend growth from 1987-1996	Test the relationship between the level of corporate leverage and economic recessions associated with crises in 1998.	Based on cross-section regression of 1998, the level of corporate leverage, measured by the debt-to-equity ratio in 1996, significantly leads to the larger downward deviation of 1998 growth rate from its pre-crisis growth trend.	21 emerging market economies during 1997-98

[a] Data for fiscal cost of crises is from Caprio and Klingebiel (2003).

CHAPTER THREE

The Measures of Currency Crises

3.1 Introduction

The construction of currency crisis indices from the exchange market pressure (EMP) developed by Eichengreen, et al. (1994, 1995) has been generally acknowledged among empirical researches as the best method for currency crisis identification[1]. The EMP indices are measured from the composite behaviors of exchange rates, international reserves, and sometimes interest rates. The occurrences of currency crises are identified by the periods with large values of EMP or when EMP indices exceed particular thresholds such as two or three standard deviations above their means. This construction of currency crisis indices will capture both successful and unsuccessful attacks on domestic currency. At the time of a speculative attack, a government can decide to devalue the currency if it comes under the extreme pressure, or the attack can be unsuccessful if a government intervenes in the foreign exchange markets by selling international reserves or increasing interest rates to counter capital outflows. Although these concepts and definitions of currency crises are commonly employed in recent studies, criteria used to identify crisis episodes are variously modified and even selected arbitrarily. Consequently, the dates of crises reported in recent studies appear to be substantially different.

The objective of this chapter is to discuss many controversies on the measures of currency crisis indices and assess those different techniques and criteria, which could lead to the sensitivity of the identification of currency crisis episodes. These arguments

[1] The concept of exchange market pressure is originally purposed by Girton and Roper (1977).

on measures of currency crises include, for instance, the necessity of the inclusion of interest rate change as a component of EMP index, the calculation of weights attached to the components of the EMP index, and the identification of crisis thresholds. In studies that concentrate on the incidence of currency crises in emerging market economies, the change in interest rates are often excluded in EMP's components due to the lack and unreliability of market-determined interest rate data. However, only the changes in exchange rate and international reserve could not indicate the currency crisis in Hong Kong in 1998, since the government's policy to defend speculative attack was by raising interest rates.

For a technique used to calculate weights of EMP's components, most studies on currency crises follow Eichengreen, et al.'s suggestions by applying the precision weight to the components of the EMP index. The precision weight, or the inverse of each component's variance, aims to equalize the volatilities of the changes in exchange rates, reserves, and/or interest rates so that the large volatility of one component will not dominate the movement of the EMP index. Eichengreen, et al. and other studies such as Nitithanprapas and Willett (2000) point out the problems of precision weight. One of them is that the precision weight will underestimate the unsuccessful speculative attacks for a sample with fixed exchange rate regimes. This explains why three studies, which are reported in section 3.3, identify currency crises by constructing EMP indices and do not detect Argentina as having a currency crisis in 1995, during the adoption of the currency board regime. In April, 1995, Argentina lost its international reserve by 25.5% from the previous month from the defense of speculative attacks[2].

[2] This data is from International Financial Statistics or IFS.

Furthermore, the differentiation of crisis episodes reported in each study may have resulted from the arbitrary selection of a crisis threshold, i.e. two or three standard deviations above the mean of EMP index, and/or the calculation of crisis thresholds. Zhang (2001) notes the problem of Eichengreen, et al.'s constructing a crisis threshold, which is computed from the mean and standard deviation of the EMP index from the entire sample[3]. When a sample includes countries with fixed and flexible exchange rate regimes, the calculated crisis threshold will be influenced by observations with high volatility of exchange rates and reserves and, as a result, this crisis threshold will fail to detect currency crises in countries with a low volatility regime. These arguments on the construction of currency crisis indices are summarized and discussed in detail in section 3.2.

In order to establish the evidence that the dates of currency crises could be very sensitive to the selected criteria, section 3.3 examines and compares currency crisis dates reported by four recent studies: Glick and Hutchison (2001), Bordo, et al. (2001), Edison (2003), and Kamin, et al. (2001). These studies use various criteria in constructing EMP indices and identifying crisis thresholds. Among 19 emerging market economies, which is the largest set of countries included in all four studies, Pakistan's currency crisis episodes are the least agreed upon. While Glick and Hutchison claim Pakistan never experienced a currency crisis from 1975 to 1997, Bordo, et al. identify six currency crisis episodes occurring in Pakistan between 1972 and 1998. For other countries, the percentages of agreement on identified crisis dates vary from approximately 40 to 70

[3] Eichengreen, et al. identify a currency crisis when the EMP index exceeds crisis threshold, which is defined by two times pooled standard deviation plus pooled mean of the index.

percent. Only severe crises such as currency crises in Asian countries in 1997 are detected similarly in all studies.

Since different criteria in constructing currency crisis indices could lead to the sensitivity of the dates of crises, the estimated output loss associated with a crisis, which is measured from the onset of crises[4], could be uncertain and dependent upon how currency crises are dated. A sensitivity analysis of the calculation of output losses is performed in section 3.4. This analysis employs a simple pair t-test to examine whether there are the significant differences of the magnitudes of output losses estimated by using different criteria in identifying the onset of crises. Four different criteria are constructed to date currency crises. The results show that while the estimated output losses are not sensitive to the criteria in dating currency crises, the duration of crises, which is the number of years from the onset of a crisis until the year that actual output returns to trend, is sensitive to crisis dates.

3.2 The Construction of Currency Crisis Indices: Discussion

Since the occurrence of a currency crisis is in general identified when the EMP index exceeds a particular crisis threshold, the arbitrary selection of any criteria in constructing the EMP index and/or calculating crisis thresholds could result in the different identification of currency crisis episodes. This section examines techniques and criteria used to date currency crises in recent studies in two steps. The first step is the construction of EMP indices, which is a weighted average of changes in nominal exchange rates, international reserves, and/or interest rates. The second step is the

[4] The total magnitude of output loss per crisis is measured by adding up the difference between the actual output and the potential output trend from the onset of a crisis to when the actual output returns to its trend, see chapter two for more details.

identification of crisis thresholds. These techniques and criteria sorted by studies are also presented in the analytical summary table in the appendix table (A3.1).

3.2.1 The Construction of Exchange Market Pressure Indices

The disputes over the construction of EMP indices are both the selection of EMP's components and the techniques to weigh these components. Eichengreen, et al. (1994, 1995) compute EMP indices from the weighted average of three components: percentage depreciations in the exchange rate, percentage declines in international reserves, and the changes in short-term interest rates. Since the change in reserves is more volatile than that of exchange rates, which is also several times more volatile than the change in interest rate differentials, these components are weighted to equalize their volatilities. By weighting each component by the inverse of its variance (or the precision weight), a unit change in exchange rate can be comparable to unit changes in international reserve and interest rate.

i.) The components of EMP indices: exchange rates, reserves, and interest rates

The selection of EMP's components to construct currency crisis indices varies across studies. Many studies exclude the change in interest rates due to the lack of reliable market-determined short-term interest rate data, particularly among developing countries (e.g. Aziz, et al., 2000; Kaminsky and Reinhart, 1999; Glick and Hutchison, 2001). Some studies such as Glick and Moreno (1999) and Bubula and Otker-Robe (2003) exclude the change in international reserves. They argue that the reserve data are noisy measures of exchange market intervention[5].

[5] According to Glick and Moreno (1999), the example that the losses in international reserve may not be a useful indicator of currency crises is the speculative attack in Thailand in 1997, which the government

In addition, the data to measure EMP's components are employed differently. The selection of exchange rate data varies from nominal exchange rates (Kaminsky and Reinhart, 1999; Edison, 2001; Bubula and Otker-Robe, 2003), real bilateral exchange rates (Kamin, et al., 2001; Glick and Hutchison, 2001; Bussière and Fratzscher, 2002), detrended exchange rates (IMF, 1998; Aziz, et al., 2000), or real effective exchange rates (Cartapanis, et al., 2002). The use of real exchange rates is preferable to nominal exchange rates if a sample includes countries that experienced high inflation, since large devaluations may be accompanying hyperinflation rather than being caused by the attack on currencies. Some studies such as Kaminsky and Reinhart, and Edison take into account a sample with high inflation observations by dividing it into high- and low-inflation periods and construct currency crisis indices separately for these two subsamples. The lack of the consideration of devaluation led by inflation will lead to misidentify currency crisis episodes. Furthermore, Cartapanis, et al. use the real effective exchange rates rather than the real or nominal bilateral exchange rates. They argue that the depreciations of real effective exchange rates would take into account depreciation led by inflation as well as the overall loss in competitiveness relative to all trading partners. Since they focus on the forecast of the extent of vulnerability to crises for six Asian countries, their EMP indices aim to reflect an unsustainable and vulnerable economic situation and/or contagion.

While many studies exclude the change in interest rates in the components of EMP indices due to the lack of reliable data, some studies take into account the unsuccessful speculative attack resulting from the governments' intervention in the

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defended currency by selling foreign currency reserves through the forward market and off the central bank's balance sheet.

foreign exchange markets by raising interest rates to counter capital flows. These studies include Eichengreen (1994, 1995), Galindo and Maloney (2002), and Bubula and Otker-Robe (2003). In a large set of developed and developing countries, Bubula and Otker-Robe use the money market rates data when available. Otherwise, t-bill, bank lending, or deposit rates are used, respectively. These studies include the change in interest rates in EMP's components in terms of interest rate differential or the basis point change (not the percentage of the rate of change). In constructing currency crisis indices, the exclusion of interest rate change may fail to detect a currency crisis if a government chooses to defend the speculative attack by hiking interest rates, which is exemplified by the currency crisis in Hong Kong in 1998 (see figure 3.1)[6].

ii.) the weighting schemes of EMP's components

Not only do the choices of EMP's components differ, but how to weigh these components also varies across studies. Eichengreen, et al. (1994) suggest that the ideal weight should be derived from the excess demand of foreign exchange, but it is difficult to estimate. As noted by Eichengreen, et al.:

> "We utilized a monetary model to illustrate how indices of speculative pressure might be derived. So long as we are unable to build reasonable empirical models linking macroeconomic fundamentals to the exchange rate, however, we will be incapable of using such models to link the exchange rate to instruments link interest rates and reserves that can be used to defend it or to derive weights to be attached to the components of an index in a defensible way (p. 16)".

Alternatively, they suggest that weights attached to each component, which should equalize the conditional volatilities of each component, can be computed from the inverse of each component's variance from the entire sample. This weighting technique is

[6] Galindo and Moloney (1999) calculate EMP indices by both including and excluding interest rates to test for the robustness of their results. They note that interest rate changes could be excluded, since the sharp movement of interest rates in Latin American countries is often unrelated to speculative attacks.

called a "precision weight." In Eichengreen et al.'s 1994 and 1995 studies, the precision weights attached to the percentage change in international reserves, the percentage change in exchange rates, and the change in the interest differential are reported with the ratio of 0.08: 1: 7 and 1: 7.5: 51.9, respectively. Eichengreen, et al. also note that a study should check on the sensitivity of results based on the weights used, since the precision weights will be dependent on the country and period coverage. In both the 1994 and 1995 studies, Eichengreen, et al. conducted the sensitivity analysis by employing a number of different weighting schemes such as the doubled weight, which is assigned to attach the change in reserves. However, they did not find that the results were sensitive to the change in weights.

Only a few studies, such as Galindo and Maloney (2002), Perry and Lederman (1999), and Nitithanprapas and Willett (2000), follow Eichengreen, et al.'s suggestion by employing different weighting schemes to check the sensitivity of their results. According to Nitithanprapas and Willett, the precision weights are inappropriate for equalizing the volatility of foreign exchange variables, since the movements of exchange rates, reserves, or interest rates are driven by policy-makers' decisions. As a result, the precision weights will lead to a downward bias for an estimate of the unsuccessful speculative attack on pegged exchange rates (see section 3.3). The precision weights are, however, proper to weigh and equalize the volatility of free market variables such as stock market indices, because the weights that use the inverse of their variances will capture the degree of volatilities and distinguish the movement of indices in a crisis period from the movement of indices in a tranquil period. Nitithanprapas and Willett also

consider other different weights including equal weights and do not find any significant change of their empirical results[7].

3.2.2 The Crisis Threshold

Most studies calculate a crisis threshold from the extreme value of the EMP index. The criteria in constructing and identifying a crisis threshold used in recent studies, however, are found to be different. Some studies also use more than one criterion to test the sensitivity of their results (see table A3.1 in the appendix). These differences can be classified into four groups.

i.) The cut-off point of a crisis threshold is arbitrarily chosen. The selection of cut-off points, which are generally identified from a large deviation of the EMP index from its mean, vary from 1.5 (IMF, 1998; Aziz, et al., 2000; Ahluwalia 2000, Bordo, et al., 2001), 1.645 (Caramazza, et al., 2000), 1.75 (Kamin, et al., 2001), 2.0 (Eichengreen, et al., 1995; Glick and Hutchison, 2001), 2.5 (Edison, 2000) and 3.0 standard deviation above its mean (Kaminsky and Reinhart, 1999; Berg and Pattillo, 1999; Bubula and Otker-Robe, 2003). According to Aziz, et al. (2000), these different crisis thresholds simply distinguish between mild and severe crises; the higher the value of a crisis threshold, the more the severity of currency crisis. Kamin, et al. also note that a crisis threshold is selected in constructing currency crisis indices to improve the fit of the model[8]. In addition, some studies use more than one criterion to identify the crisis threshold. For instance, Moreno (2000) identifies a currency crisis if the depreciation of

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[7] They refer to Weber (1995) who questions Eichengreen et al (1995)'s weighting methodology and suggests an equal weight attached to EMP's components.

[8] "While the estimated probit models were generally robust to changes in these parameters, we found that the fit of the model, as well as the conformance of estimated coefficients with their expected signs, was greatest for 'window lengths' and crisis thresholds in the neighborhood of two months and 1.75 standard deviations (Kamin, et al.; p.4)."

exchange rate exceeds 2.0 standard deviations above its mean, given that it is also larger than 25% from the previous year. Frankel and Rose (1996) define a currency crash when the exchange rate depreciates by at least 25% in a year and at least 10% from the previous year. Zhang (2001) identifies a currency crisis from two separate thresholds, i.e. 3.0 standard deviations above the mean of exchange rate changes, and those of reserve changes.

ii.) The standard deviation and mean of the EMP index are calculated either from an entire sample or from each individual country sample. Eichengreen, et al. (1994, 1995), IMF (1998), Aziz, et al. (2000) identify the crisis threshold as 1.5 pooled standard deviation plus pooled mean. Other studies such as Kaminsky and Reinhart (1999), Glick and Hutchison (2001), and Edison (2000) use country-specific means and country-specific standard deviations in calculating crisis thresholds. The calculation of a crisis threshold based on the mean and variance of the entire sample, however, is inappropriate if a sample includes the large variation of exchange rate regimes. The pooled threshold will be overestimated, since it is dominated by the high value of EMP indices, which are calculated from the data of countries with high volatility of exchange rates, reserves and/or interest rates. As a result, this pooled threshold will fail to detect currency crises in a country with low volatilities of the components of the EMP index and over identify crises in a country with high volatility of these components (see Zhang, 2001).

iii.) Some studies separately calculate crisis thresholds for the periods with high and low inflation. Kaminsky and Reinhart (1999) and Edison (2003) define a period with hyperinflation when the inflation rate from the previous six months is greater than 150%, and calculate a crisis threshold (as well as weights attached to EMP's components)

separately for this sub-sample. Similarly, Aziz, et al. (2000) and IMF (1998) perform separate calculation, but define high inflation as 12-month inflation rates greater than 80%. Some other studies use real exchange rate to take into account the effect of high inflation (Glick and Hutchison, 2001; Bussière and Fratzscher, 2002). These studies emphasize that a large nominal devaluation driven by hyperinflation should not be considered as a currency crisis, since it is driven by inflation, not by speculative attack on the currency.

iv.) Crisis windows are defined differently across studies. When an EMP index is greater than a crisis threshold in some periods, that crisis needs to be identified whether it is a new crisis or the part of previous crisis. The values of an EMP index, which exceed a crisis threshold within the crisis window period, will be treated as the same crisis. Similar to the selection of crisis thresholds, crisis windows are also defined arbitrarily. These windows vary from 3 months (Eichengreen, et al. 1994) , 12 months (Glick and Moreno, 1999), 18 months (IMF, 1998; Aziz, et al., 2000), 24 months (Glick and Hutchison, 2001; Hutchison and Noy, 2002), to 36 months (Frankel and Rose, 1996). Some studies such as Eichengreen, et al. (1994) use different crisis windows (i.e. 3, 6, and 12 month windows) to test the robustness of their empirical results. Alternatively, Kamin, et al. (2001) identify the crisis window from specific events. They identify a new currency crisis if "1) the EMP recovers to its prior to level before falling significantly again, 2) there is a lapse of more than four months in which no monthly crisis is signaled, or 3) a monthly crisis is signaled after June in the second year." (p.5). These different selections of crisis windows will affect the frequency of crises. For instance, without considering a crisis window, Bordo, et al. (2001) identify Indonesia, Korea, Malaysia, and Thailand as having

the currency crises in 1997 and other new crises in 1998. On the other hand, Kamin, et al. and Edison (2003) report the eruption of crises for these countries only in 1997; they count the crises in 1998 as a part of the same currency crisis episodes (see the appendix table A3.2).

3.3 The Degree of Agreement on Currency Crisis Dates

This section analyzes the comparison of currency crisis dates, which are reported in four studies: Glick and Hutchison (2001) (thereafter, GH), Bordo, et al. (2001) (thereafter BEKM[9]), Edison (2000), and Kamin, et al. (2001) (thereafter KSS[10]). These four studies include 19 similar emerging market countries with the overlapped time periods from 1970s/1980s to late 1990s. The criteria in constructing EMP indices and crisis thresholds used in each study are included in the analytical summary table (A3.1) in the appendix. The dates of currency crises listed by these four studies are reported in appendix table (A3.2). These tables show that currency crises are dated differently across countries due to different selected criteria.

In addition, the dates of currency crises reported in these four studies are compared by employing the method of the percentage of agreement used by Kamin, et al. (2001). The percentage of agreement of the dates of crises between any two crisis dating systems is calculated by, first, identifying the number of agreement and the total number of crises identified by any two studies. *The number of agreement* is the number of times that any two studies identify a currency crisis in the same year for the same country. *The total numbers of crises identified in any two studies* are the summation of the number of

[9] Bordo, Eichengreen, Klingebiel and Martinez-Peria (2001)
[10] Kamin, Schindler and Samuel (2001)

years that crises are dated in any two studies[11]. The percentage of agreement can be calculated by multiplying *the number of agreement* by two and then dividing this number by *the total numbers of crises identified in any two studies* in the percentage term[12]. Table (3.1) reports the percentages of agreement of the dates of currency crises among these four studies averaged for entire selected samples and by regions (East & Southeast Asia, and Central & Latin America, and others). The percentages of agreement between any two studies for each individual country are reported in the appendix table (A3.3).

From table (3.1), the highest percentages of agreement of crisis dates are between the studies of GH and KSS (68.4%) and between GH and Edison (68.1%). The commonality between GH's and KSS's methodologies is that these two studies include real exchange rates and international reserves in the components of EMP indices, and closely select the crisis thresholds, which are 2.0 and 1.75 times country-specific standard deviation above their means. For Edison's methodology, although she uses nominal rather than real exchange rates, she also takes into account the change in exchange rates led by hyperinflation by separately calculating currency crisis indices for the sub-sample with high inflations. On the other hand, BEKM's different criteria in identifying currency crises result in a low percentage of agreement on currency crisis dates from the other three studies. In addition to identifying currency crises from the large movement of EMP indices, BEKM also use a supplementary qualitative decision to identify crisis episodes that are not detected by EMP indices (or excluding crisis dates that are mistakenly

[11] If the studies have overlapped time periods, only the periods that are present in both studies are taken into account. For example, Glick and Hutchison's samples are during 1975-97 while Bordo et al's are during 1972-98. The percentage of agreement is therefore considered from 1975 to 1997.

[12] For example, while Glick and Hutchison (1999) identify currency crises in Thailand occurred in 1981, 1984, and 1997, Bordo, et al. (2001) identify the crisis only in 1997. The number of agreement is 1, which is the crisis in 1997, and the total number of crises identified in these two studies is 4. Therefore, the percentage of agreement in identifying currency crises for Thailand between these two studies is equal to ((2*1)/4) *100 = 50%.

detected by EMP indices). For example, among these four studies, only BEKM identify Argentina as having the currency crisis in 1995 (see table A3.2) due to the significant losses of international reserves.

The EMP index, which does not detect the Argentinean crisis, exemplifies the problem of precision weights. As mentioned in section 3.2, the precision weights will downwardly bias unsuccessful speculative attacks under the hard pegged regimes. Argentina adopted a currency board in April, 1991. The commitment to maintain the Peso at a unit of the U.S. dollar reflects that the eruption of a currency crisis after this period would be detected only from the large decline in international reserves. That is, the large percentage loss in international reserves of 25.5% in March, 1995 relative to the previous month should point to the 1995 Argentinean currency crisis. However, if a currency crisis is identified from the extreme value of the weighted average of exchange rate and reserve changes, this crisis would not be detected. This is because the precision weights (or the inverse of each component's variance) will assign a unit weight to the change in exchange rate and a zero weight to the reserve component; as a result, the EMP will not show the fluctuation during this period.

Table (3.1) also illustrates that for any two dating systems, the percentages of agreement among Asian currency crisis episodes are higher than for those of Central and Latin America and countries in other regions. These high percentages of agreement are dominated by common agreements of what Asian countries were hit by crises in 1997. The large movement of both exchange rates and international reserves for Indonesia, Malaysia, the Philippines, South Korea, and Thailand in 1997 makes the identification of

crisis dates insensitive to the criteria in constructing EMP indices and the crisis thresholds (see also the appendix tables A3.2-A3.3).

3.4 Sensitivity Analysis for the Measure of Output Losses Associated with Currency Crises

As discussed in chapter 2, the output loss associated with crises can be estimated by summing up the difference between the actual and potential outputs from the onset of a crisis to when the actual output returns to its potential output trend. According to this general concept, the estimated magnitude of output loss may be sensitive to the selection of actual output variables, techniques used to compute the potential output trend, or the identification of the onset of a crisis.

This section aims to test whether the estimated output losses are sensitive to the dates of currency crises. Four different criteria are applied to define currency crisis episodes from the sample of 65 developed and developing countries during 1975-2002[13]. These general criteria are based on Kaminsky and Reinhart (1999)'s methodology, which EMP indices are constructed from a weighted average of the percentage changes of monthly nominal exchange rates and international reserves, and the weights are calculated from the inverse of each sample component's variance. The crisis threshold is identified by using a country-specific mean and standard deviation. EMP indices and crisis thresholds are also calculated separately for samples with hyperinflation (identified when inflation in the previous six months is higher than 150%). The first two criteria include only the change in exchange rates (vis-à-vis US$ for developing countries and DM for industrial European countries) and the change in international reserves in EMP's components. The difference is crisis thresholds, which are identified from two and three

[13] These are the same sample used in chapter two; see the appendix table (A2.1) for the list of countries.

country-specific standard deviation above country-specific mean. The other two criteria include the change in interest rates[14] as the third component of the EMP and similarly identify the crisis thresholds from two- and three country-specific standard deviation plus country-specific mean. While the selection of crisis threshold of three times standard deviation plus mean is by following Kaminksy and Reinhart, it significantly eliminates the ERM crisis in 1992. The threshold of two standard deviation plus mean; therefore, is alternatively used. The two-year crisis window is applied to treat a large value of EMP index that occurs within two years as the same currency crisis episode. From the sample of 65 countries, there are 159 and 78 currency crisis episodes identified from the first two criteria, and 141 and 77 episodes from the second two criteria. These crisis dates are constructed using the monthly data, but identified the onset in terms of quarterly basis since the magnitude of output losses is estimated by using the quarterly real GDP.

All four sets of the estimated magnitudes of output losses are then calculated based on these four different criteria in identifying the onset of currency crises. The output loss is calculated by using Hoggart, et al. (2002)'s and Mulder and Rocha (2001)' methodology (see section 2.4, chapter 2). The paired sample t-test is employed to test the sensitivity of these estimates of output losses. If the magnitudes of output losses are not sensitive to the dates of currency crises, the null hypothesis that there is no difference in means between any two estimates should not be rejected at the conventional significance level. Table (3.2) presents the results. The statistics above the diagonal are the paired sample t-tests for the magnitudes of output losses. Those below diagonal are the pair sample t-tests of the durations of crises, which is the number of quarters from the crisis

[14] Market interest rates are used when available, otherwise lending interest rate and T-bill (if both market and lending interest rates are not available) are used.

quarter to the quarter that the actual GDP levels recover to their potential trends. The results show that the estimated output losses accompanying currency crises are not found to be sensitive to the starting dates of currency crises, since the means of any two estimates are not significantly different from each other. One exception, which point to the sensitivity of estimated output losses, is when the dates of crises are calculated from the EMP index that includes the interest rate changes as the components, and a crisis threshold is identified from three standard deviations plus means. In this case, the means of estimated output losses are statistically significantly different from those when currency crisis indices are constructed by excluding interest rates in the EMP's components. However, the t-statistics is significant only at 10 percent level.

On the other hand, the estimated durations of crises are found to be more sensitive to the criteria in dating currency crises indicated by the insignificance of the sample paired t-tests in many cases. As discussed in sections 2.4.3 and 2.4.4 in chapter 2, the duration of crises, which are calculated based on Hoggart et al's and Mulder and Rocha' methodology, could depend solely on the frequency of crises. In other words, their method inflates the estimated potential output trends. As a result, the actual output levels will never be able to return to their potential trends for most currency crisis episodes. The severity and duration of crises then will be truncated and the end of a crisis will be determined when the next crisis occurs, that is, the duration of crises is dependent on the dating of the onsets of currency crises.

3.5 Conclusion

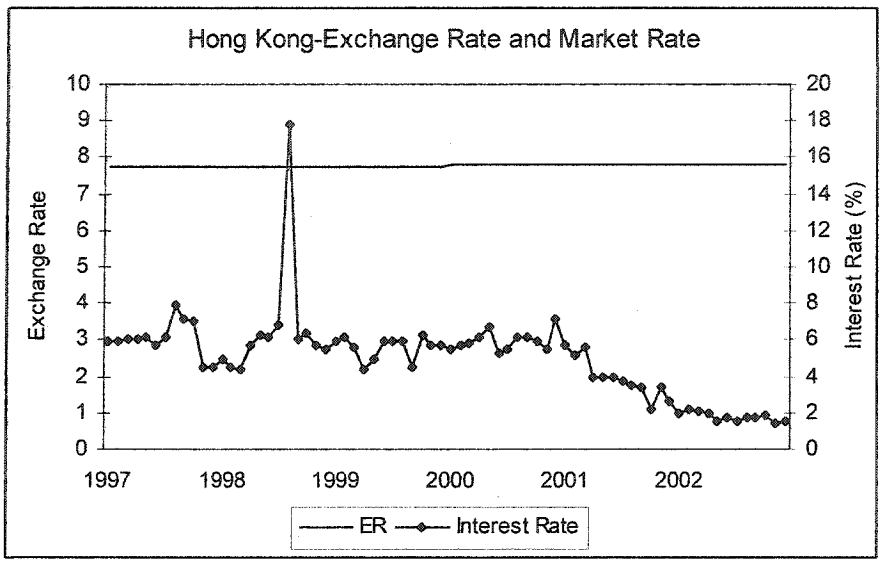
The analytical summary of the measures of currency crises demonstrates that recent studies have used various criteria in identifying crisis episodes. A currency crisis is

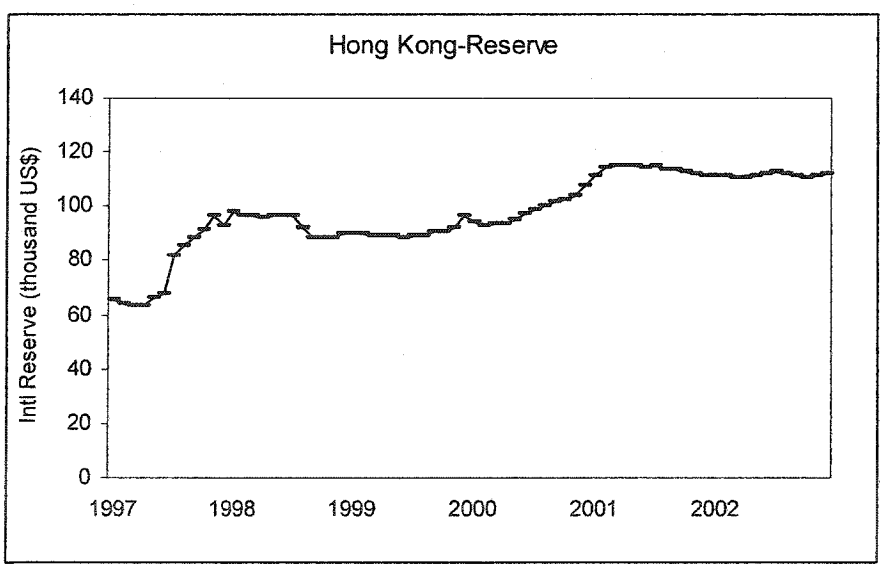
identified when the exchange market pressure (EMP) index, which is the weighted average of the changes in exchange rates, international reserves, and/or interest rates, exceeds some values of a crisis threshold. The difference in criteria and techniques are recognized in both the construction of the EMP index and the calculation of a crisis threshold.

The survey and discussion in this chapter points out that some conditions, such as the inclusion of interest rate changes in the components of the EMP index or the exclusion of the currency depreciation led by inflation, need to be taken into consideration when calculating the EMP index. In addition, the test for the sensitivity of empirical results should be performed when currency crisis indices are computed based on some criteria, which are selected arbitrarily such as crisis thresholds and crisis windows. These criteria also include weighting schemes used to weigh the components of the EMP index. The precision weights, or the inverse of each component's variance, which are attached to the EMP components could lead to the underestimation of the speculative pressure for crisis episodes under the fixed exchange rate regimes.

Although many studies find that their results are not sensitive to the dates of currency crises, the comparison of crisis dates show that those crisis episodes reported across studies have the low percentage of agreement. By comparing crisis episodes from four studies, the percentage of agreement for any two studies to identify the similar crisis episodes, or a crisis that occurs in the same country and the same year, is on average around 40-70%. Based on this evidence, which shows the variation of crisis dates, the check for the robustness of empirical results by using different criteria to construct currency crisis indices seems to be necessary.

Figure (3.1) The exchange rate, international reserve and interest rate of Hong Kong during the Asian crisis





Source: International Financial Statistics

Table (3.1) The Percentages of Agreement in Identifying Currency Crises among Four Selected Studies (averaged for entire samples and by regions)

	Kamin et al (2001)	Glick and Hutchison (2001)	Bordo et al (2001)
Edison (2000)	All 57.3 Asia 66.2 Latin 63.7 Others 38.8	All 68.1 Asia 77.8 Latin 68.3 Others 53.3	All 42.7 Asia 57.2 Latin 32.1 Others 42.0
Kamin et al (2001)		All 68.4 Asia 77.1 Latin 65.6 Others 64.3	All 54.1 Asia 67.9 Latin 48.6 Others 49.3
Glick and Hutchison (1999)			All 46.0 Asia 57.8 Latin 41.8 Others 39.7

Note: Asia (East and Southeast Asia): Indonesia, S. Korea, Malaysia, Philippines, Singapore, Thailand. Latin (Central and Latin America): Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay, Venezuela. Others: Egypt, India, Pakistan, South Africa, Turkey

Table (3.2) The Sample Paired t-test for the Magnitudes of Output Losses Estimated from Different Criteria in Dating Currency Crises.

H_0: there is no different between the means of magnitudes of output losses

	3sd_int	3sd_noint	2sd_int	2sd_noint
3sd_int		t = -1.8377 P > |t| = 0.0754 (33)	t = 0.5320 P > |t| = 0.5973 (47)	t = 0.1990 P > |t| = 0.8434 (37)
3sd_noint	t = -2.1846 P > |t| = 0.0364 (33)		t = 1.6417 P > |t| = 0.1104 (33)	t = 1.6073 P > |t| = 0.1153 (44)
2sd_int	t = 1.0668 P > |t| = 0.2916 (47)	t = 1.8883 P > |t| = 0.0681 (33)		t = 0.4921 P > |t| = 0.6243 (66)
2sd_noint	t = 0.7294 P > |t| = 0.4705 (37)	t = 2.5204 P > |t| = 0.0155 (44)	t = 0.9123 P > |t| = 0.3650 (66)	

Note: the statistics above diagonal are the t-tests for the mean differences between the magnitude of output losses and below the diagonal are those for the duration of crises. P > |t| is the p-value. The 2sd_int and 3sd_int stand for the criteria in constructing currency crisis indices, which the crisis threshold equal to two and three standard deviation above the mean of the EMP and the change in interest rate is included as the components of EMP as well as the change in exchange rates and in international reserves. The similar descriptions are for 2sd_noint and 3sd_noint, but the change in interest rates is excluded from the EMP components. Figures in parenthesis are the number of observations used to calculate t-test for any pairs.

Appendix Table (A3.1) Summary of Methodologies Criteria in Identifying Currency Crises from Recent Studies

Authors	Exchange Market Pressure Indices*		Identification of Currency Crisis	Sample	Notes**
	Components	Weight			
Eichengreen, Rose, and Wyplosz (1994)	The EMP index is a weighted average of monthly changes in the exchange rate (e) relative to DM, changes in interest rates (i) and international reserves (r) relative to those of Germany, or $EMP_{i,t} = [(\alpha\%\Delta e_{i,t}) + (\beta\Delta(i_{i,t} - i_{,G,t})) - (\gamma(\%\Delta r_{i,t} - \%\Delta r_{G,t}))]$	Pooled precision weight (weights of e:i:r=1:7:0.8)	A crisis is identified when the EMP index exceeds 3 times pooled standard deviations plus pooled mean of the index, or $Crisis_{i,t} = 1$ if $EMP > 3\sigma_{EMP} + \mu$	Monthly data from 1967-92 for 22 OECD countries	Test robustness by using different criteria in identifying currency crises including double weight attached to the change in reserve, change of crisis threshold to $2\sigma_{EMP} + \mu$, and use 3, 6, and 12 months for crisis window
Eichengreen, Rose, and Wyplosz (1995)	Similar to Eichengreen, Rose, and Wyplosz (1994), but use quarterly data	Pooled precision weight (weights of e:i:r=7.5:51.9:1)	A crisis is identified when the EMP index exceeds 2 times pooled standard deviations plus pooled mean of the index, or $Crisis_{i,t} = 1$ if $EMP > 2\sigma_{EMP} + \mu$	Quarterly data for 20 industrial countries during 1959-93	- Crisis window: 2 quarters
Kaminsky and Reinhart (1999)	The EMP is a weighted average of monthly bilateral nominal exchange rate (vis-à-vis US$ or DM) changes and reserve changes	Pooled precision weight	A crisis is identified if the EMP index exceeds 3 times country-specific standard deviations plus country-specific mean.	5 developed and 15 developing countries, 1970-95	- The EMP index and crisis threshold are calculated separately for hyperinflation periods (identified when inflation in the previous six months was higher than 150%)
Bubula and Otker-Robe (2003)	The EMP index is a weighted average of monthly percentage change in exchange rate vis-à-vis the anchor country and monthly variation in percentage points in the domestic interest rate, or $EMP = \alpha_1\%\Delta e + \alpha_2\Delta i$	Pooled precision weight	Currency crises are identified if the EMP index exceeds 3 times standard deviations plus its country-specific sample mean	196 currency crisis episodes in 165 countries, 1990-2001	

Appendix Table (A3.1) Cont.

Authors	Exchange Market Pressure Indices*		Identification of Currency Crisis	Sample	Notes**
	Components	Weight			
Bordo, et al. (2001)	The EMP is a weighted average of monthly exchange rate change, short-term interest rate change, and reserve change relative to the $US.	Precision weight	A crisis is said to occur when this index exceeds 1.5 standard deviations above its mean.	22 industrial and 34 developing countries1972-1998	- Currency crises are also identified qualitatively from the evidence of a forced change in parity, abandonment of pegged exchange rate, or an international rescue.
Edison (2003)	The EMP index is a weighted average of monthly bilateral nominal exchange rate (vis-à-vis US$ or DM) changes and reserve changes	Precision weight	A crisis is identified when the EMP index exceeds 2.5 times country-specific standard deviation and country-specific mean	5 developed and 15 emerging market economies, 1975-97	- Separate calculation for sample with high inflation (identified when inflation in the previous six months was higher than 150%)
Kamin, et al. (2001)	The EMP index is a weighted average of two-month percentage changes in the real bilateral exchange rate against dollar and in international reserves.	Pooled precision weights	Crisis is identified when the EMP index exceeds 1.75 times country-specific standard deviation and country-specific mean	26 emerging market economies, 1980-99	- A crisis in subsequent year will be considered a new crisis if 1. the EMP recovers to its prior to level before falling significantly again, 2. there is a lapse of more than four months in which no monthly crisis is signaled, or 3. a monthly crisis is signaled after June in the second year (p.5).
Glick and Hutchison (2001)	The EMP is a weighted average of monthly real exchange rate changes and reserve loss	Country-specific precision weight	A crisis is identified when the EMP index exceeds 2 times country-specific standard deviation and country-specific mean	90 countries (21, 32, 37 developed , emerging markets, and other developing countries, 1975-97	- Crisis window: 24 months

Appendix Table (A3.1) Cont.

Authors	Exchange Market Pressure Indices*		Identification of Currency Crisis	Sample	Notes**
	Components	Weight			
Hutchison and Noy (2002)	A weighted average of monthly real exchange rate changes and monthly (percent) international reserve losses.	Country-specific precision weight	A crisis is identified when the EMP index exceeds 2 times country-specific standard deviation and country-specific mean, provided that it also exceeds 5 percent (the latter condition will screen out the values of index that are insufficiently large)	24 emerging-market economies, 1975-1997	- Crisis window: 24 months
Berg and Pattillo (1999)	The EMP index is a weighted average of monthly percentage depreciations in the exchange rate and monthly percentage declines in reserves	Pooled precision weight	A crisis is identified when the EMP index exceeds its mean by more than 3 standard deviation	5 European economies and 8 emerging markets, 1970-April 1995)	- Separate calculation for sample with high inflation (identified when inflation in the previous six months was higher than 150%)
Aziz, et al. (2000) and IMF (1998)	The EMP index is a weighted average of detrended monthly exchange rate changes and reserve changes.	Pooled precision weights	Crisis is identified when the index exceeded 1.5 times the pooled standard deviation of the calculated index plus the pooled mean of the index	Aziz et al: 20 industrial countries and 30 developing countries Jan 75-Nov 97 IMF: 22 industrial and 31 emerging market economies, 1975-97	- The EMP index and crisis threshold are calculated separately for hyperinflation periods (identified when the 12-month inflation rate >80%) - Crisis window: 18 months
Bussière and Fratzscher (2002)	The EMP is a weighted average of the change of the real exchange rate, the change in the interest rate and the change in foreign exchange reserves.	Pooled precision weights	Currency crises are identified if the EMP index exceeds 2 times standard deviations plus its country-specific sample mean	32 developing countries, 1993M12-2001M9	

Appendix Table (A3.1) Cont.

Authors	Exchange Market Pressure Indices*		Identification of Currency Crisis	Sample	Notes**
	Components	Weight			
Galindo and Maloney (2002)	- the EMP is a weighted average of monthly real exchange rate, reserves, and short term interest rates - the EMP is a weighted average of monthly real exchange rate and reserves	- Precision weights - allow weights to vary over time using a rolling window of six months	Use index of speculative pressure to measure the degree of crisis intensity	19 countries (Europe, Latin America and Asia) 1987-97	
Nitithanprapas and Willett (2000)	The EMP index is a weighted average of the depreciation rate of nominal exchange rates (vis-à-vis US$) and the percentage changes in international reserve	Equal weighting (for sensitivity analysis, the weights are ratios of 4-to-1 and 1-to-4)	Use index of speculative pressure to measure the degree of crisis intensity	26 emerging countries and 2 developed countries Nov94-Mar95 (Mexican crisis) and Jun97- Oct97 (Asian crisis)	
Perry and Lederman (1999)	The EMP index is a monthly changes in nominal exchange rates and the changes in international reserves	- Precision Weights - Equal weights	Use index of speculative pressure to measure the degree of crisis intensity	Argentina and Mexico (Dec, 94); Brazil (Oct, 97); Indonesia and Thailand (Jul, 97); Korea (Oct, 97)	
Glick and Moreno (1999)	Currency crisis index is constructed from large depreciation of the US$ nominal exchange rates. However, foreign reserve data is also assessed for whether it contains any useful information in signaling episodes of sharp depreciation	NA	A crisis is identified if the percentage change in the exchange rate exceeds the pooled mean plus two pooled standard deviations.	6 East Asia and 7 Latin American countries, 1972:01-1997:10	- Separate calculation for sample with high inflation (identified when inflation in the previous six months was higher than 150%) - Crisis window: 12 months after each crisis episodes

Appendix Table (A3.1) Cont.

Authors	Exchange Market Pressure Indices*		Identification of Currency Crisis	Sample	Notes**
	Components	Weight			
Frankel and Rose (1996)	A Currency crash is identified from the depreciation of nominal exchange rates.	NA	A crash is defined when exchange rates depreciate by at least 25% in a year and depreciate by 10% for than it did in the previous year.	105 developing countries, 1971-1992.	Crisis window: 3 years
Kumar, et al. (2003)	Currency crisis index is constructed from large depreciation of nominal exchange rates vis-à-vis the US dollar (e) and/or adjusted for the difference between domestic and foreign interest rates.	NA	A crisis is identified when $100\left[\frac{e_{t+\Delta}-e_t}{e_t}\right]\left[\frac{1+r_t^*}{1+r_t}\right] > 5\%$ or 10% r and r* are domestic and foreign interest rates of maturity Δ **Or** when $100\left[\frac{e_{t+\Delta}-e_t}{e_t}\right] > 5\%$ or 10% and $\left[\frac{e_{t+\Delta}-e_t}{e_t}\right] > (1+\gamma_3)\left[\frac{e_t-e_{t-\Delta}}{e_{t-\Delta}}\right], \gamma_3 = 100\%$	32 emerging market economies from Jan, 1985-Mar, 1998	
Moreno (2000)	Currency crisis index is constructed from large depreciation of the US$ nominal exchange rates.	NA	A crisis is identified if the year-to-year percentage change in the exchange rate exceeds the pooled mean plus three pooled standard deviations and also exceeds 25% (the 25% criterion rules out changes that may exceed 2 standard deviation, but are quantitatively small)	7 East Asian countries, 1974-99	
Studies focusing on "contagion" in currency crises					
Sachs, et al. (1996)	The EMP is a weighted average of monthly bilateral nominal exchange rate (vis-à-vis US$) changes and reserve changes	Country-specific precision weights (calculated over the past 10 years of 1994)	Use the EMP index (the continuous index) to measure the degree of crisis intensity	20 emerging markets in Asia, Middle East, Africa, Latin America, Nov 1994-Arpil 1995	

Appendix Table (A3.1) Cont.

Authors	Exchange Market Pressure Indices*		Identification of Currency Crisis	Sample	Notes**
	Components	Weight			
Ahluwalia (2000)	The EMP index is a weighted average of monthly percentage change in exchange rates and international reserves	Pooled precision weights	- Crisis is identified when the EMP index exceeded 1.5 times the pooled standard deviation plus the pooled mean of the index, and - Use the EMP index (the continuous index) to measure the degree of crisis intensity (the index is constructed using the period 1994M11-1995M4, 1997M5-1997M10, 1998M7-1998M10)	19 emerging markets, 1990-1999	
Bussière and Mulder (1999)	The EMP index is a weighted average of the nominal exchange rate (vis-à-vis the US dollar) depreciation and the loss of reserves during the crisis period (reserve data is used both from total reserves minus gold and include gold at market price)	Pooled precision weight (calculated from a monthly series of previous 10 years)	Use the EMP index (the continuous index) to measure the degree of crisis intensity	Crisis periods are 1994M11-1995M4, 1997M5-1997M10, and 1998M7-1998M10 for 23 emerging market economies	
Caramazza, et al. (2000)	The EMP index is a weighted averaged of detrended monthly exchange rate changes and reserve changes.	Precision weights	Crisis is identified when EMP index exceeds 1.645 times the pooled standard deviation plus the pooled mean of the index within 6 months of the beginning of these episodes: ERM crisis-Sept92, Mexican crisis-Dec94, Asian crisis-July97 and Russian crisis-Aug98 (focus on contagion)	20 industrial countries and 41 emerging market economies, 1990-98	- High inflation periods (identified when the 12-month inflation rate >100%) are excluded - For robustness test, (a) threshold is changed to 1.96 and 1.28, (b) EMP index includes (i) interest rates, (ii) stock prices, and (iii) interest rates and stock prices.

Appendix Table (A3.1) Cont.

Authors	Exchange Market Pressure Indices		Identification of Currency Crisis	Sample	Notes**
	Components	Weight*			
Zhang (2001)	Currency crisis index is constructed from large depreciation exchange rates, OR Large reserve loss	NA	Crisis thresholds: $\Delta e > 3 \times \sigma\Delta e + \mu\,\Delta e$ Or, $\Delta r > -3 \times \sigma\Delta r + \mu\,\Delta r$ (σ = standard deviation, which is calculated by using 3-year moving window and μ = mean) Crisis is identified from separate thresholds of exchange rate and reserve changes	5 Asian countries, 1997	
Cartapanis, Dropsy, and Mametz (2002)	Weighted average of real effective (multilateral) exchange rates changes and reserve changes	Pooled precision weight (calculated from a monthly series of previous 5 years)	-Crisis is identified when the EMP index exceeded 2 times standard deviation plus mean of the index, and - Use the EMP index (the continuous index) to measure the degree of crisis intensity	6 Asian countries from 1976-1997	

*Precision weights= the inverse of variance for each component of EMP indices, which are calculated from the entire sample in the case of 'pooled precision weights' and calculated from the sample of individual country for 'country-specific precision weight'. NA = not applicable
For Studies focusing on "contagion" in currency crises, the EMP index will be calculated over different intervals (such as during the ERM, Mexican, Asian, and/or Russian crisis episodes) to reflect the extent to which countries are affected from the occurrence of currency crises in other countries or contagion.

**Crisis window: the period which will treat the extreme value of EMP indices as the same crises. That is, if crises are identified (or EMP index exceeds the crisis threshold) within the window periods, they will be counted as a part of the same currency crisis episode.

Appendix Table (A3.2) The Dates of Currency Crises for 19 Emerging Economies Listed by Four Recent Studies

	Edison 1970-99	BEKM 1972-1998	GH 1975-1997	KSS 1980-99
Indonesia		1975		-
	Nov-78	1978	1978	-
	Apr-83	1983	1983	1983
	Sep-86	1986	1986	1986
	Dec-97	1997	1997	1997
		1998	-	
Korea, S.	Jan-80	1980	1980	1980
				1982
	Nov-97	1997	1997	1997
		1998	-	
Malaysia		1975		-
				1982
				1985
			1986	1986
	Jul-97	1997	1997	1997
		1998	-	1998
Philippines		1982		
	Oct-83	1983	1983-84	1983
	Jun-84			1984
	Feb-86	1986	1986	1986
		1990		1990
	Dec-97	1997	1997	1997
Singapore	Dec-70	-	-	-
	Jul-75		1975	-
	Mar-80			-
	Dec-97		-	-
		1998	-	-
Thailand				1980
			1981	1981
				1982
			1984	
				1985
	Jul-97	1997	1997	1997
		1998	-	1998
Argentina	Mar-75	1975	1975-76	-
				1981
	Jul-82	1982	1982-83	1982
		1984		
		1987		
	Apr-89, Dec-89	1989	1989-91	1989
		1991		1991
		1995		
Brazil				1980
	Sep-82		1982-83	1982
		1987	1987	
				1989
	Mar-90, Nov-90	1990	1990-91	1990
	Sep-91			1991
			1995	
		1998	-	1998
	Jan-99	-	-	1999

Table (A3.2) Cont.

	Edison 1970-99	BEKM 1972-1998	GH 1975-1997	KSS 1980-99
Chile	Jul-71	-	-	-
	Sep-72		-	-
	May-73		-	-
	Dec-74		-	-
		1975		-
		1977		-
		1982		1982
		1984		1984
	Jul-85		1985	1985
Colombia				1983
				1984
	Jan-85		1985	1985
	Sep-97			1997
	Sep-98		-	1998
	Jul-99	-	-	1999
Mexico	Sep-76	1976	1976	-
	Feb-82, Dec-82	1982	1982	1982
		1983		
		1985	1985	1985
		1990		
	Dec-94	1994	1994-95	1994
		1995		1995
Peru		1975		-
	Jun-76		1976	-
		1977		-
			1979	-
		1983		
	Oct-87		1987-88	1987
		1988		1988
		1990		
		1992		
Uruguay	Mar-72		-	-
		1975		-
		1979		-
	Nov-82	1982	1982-83	1982
		1983		
				1984
				1985
		1986		
				1989
Venezuela	Mar-84		1984	1984
	Dec-86	1986	1986	1986
	Mar-89	1989		1989
		1994	1994-96	1994
	Dec-95	1995		
				1996

Table (A3.2) cont.

	Edison 1970-99	BEKM 1972-1998	GH 1975-1997	KSS 1980-99
Egypt	-	1975		-
	-	1979	1979	-
	-	1989	1989-91	1989
	-			1990
	-			1991
India			1976	-
				1990
	Jul-91	1991	1991	1991
	Mar-93	1993	1993	1993
			1995	1995
Pakistan	May-72		-	-
		1979		-
				1982
				1985
		1988		
				1989
		1990		
		1993		
		1995		1995
				1996
		1997		1997
			-	1998
South Africa	Sep-75	1975	1975	-
		1978	1978	-
		1981		
		1982		
	Jul-84	1984	1984-86	1984
	Aug-85			
	May-86	1986		1986
		1988		
		1992		
		1995		
			1996	1996
	Jun-98		-	1998
Turkey	Aug-70	-	-	-
		1977		-
			1978-80	-
		1979		
	Jan-80			1980
				1981
				1983
		1984		1984
		1991		1991
	Mar-94	1994	1994	1994
		1995		

Note: "-" indicates time periods that are not included in the study
Edison = Edison (2000)
BEKM = Bordo, Eichengreen, Klingebiel and Martinez-Peria (2001)
GH = Glick and Hutchison (2001)
KSS = Kamin, Schindler and Samuel (2001)

Appendix Table (A3.3) The Percentages of Agreement in Identifying Currency Crises among Four Selected Studies (by countries)

	Edison	GH	No. of Agreement	% of Agreement
Indonesia	4	4	4	100.0
Korea	2	2	2	100.0
Malaysia	1	2	1	66.7
Philippines	4	4	4	100.0
Singapore	3	1	1	50.0
Thailand	1	3	1	50.0
Argentina	3	7	3	60.0
Brazil	3	6	2	44.4
Chile	1	1	1	100.0
Colombia	2	1	1	66.7
Mexico	3	5	3	75.0
Peru	2	4	2	66.7
Uruguay	1	2	1	66.7
Venezuela	4	5	3	66.7
Egypt	-	4	-	-
India	2	4	2	66.7
Pakistan	1	0	0	0.0
S. Africa	4	6	4	80.0
Turkey	2	4	2	66.7

	GH	BEKM	No. of Agreement	% of Agreement
Indonesia	4	6	4	80.0
Korea	2	2	2	100.0
Malaysia	2	2	1	50.0
Philippines	4	5	3	66.7
Singapore	1	0	0	0.0
Thailand	3	1	1	50.0
Argentina	7	7	4	57.1
Brazil	6	2	2	50.0
Chile	1	4	0	0.0
Colombia	1	0	0	0.0
Mexico	5	7	5	83.3
Peru	4	6	1	20.0
Uruguay	2	5	2	57.1
Venezuela	5	4	3	66.7
Egypt	4	3	2	57.1
India	4	3	2	57.1
Pakistan	0	6	0	0.0
S. Africa	6	9	4	53.3
Turkey	4	6	2	40.0

	Edison	BEKM	No. of Agreement	% of Agreement
Indonesia	4	6	4	80.0
Korea	2	3	2	80.0
Malaysia	1	3	1	50.0
Philippines	4	5	3.0	66.7
Singapore	3	1	0	0.0
Thailand	1	2	1	66.7
Argentina	3	7	3	60.0
Brazil	3	3	1	33.3
Chile	4	4	0	0.0
Colombia	3	0	0	0.0
Mexico	3	7	3	60.0
Peru	2	6	0	0.0
Uruguay	2	5	1	28.6
Venezuela	4	4	3	75.0
Egypt	-	3	-	-
India	2	2	2	100.0
Pakistan	1	6	0	0.0
S. Africa	5	9	3	42.9
Turkey	2	6	1	25.0

	KSS	BEKM	No. of Agreement	% of Agreement
Indonesia	3	4	3	85.7
Korea	3	3	2	66.7
Malaysia	5	2	2	57.1
Philippines	5	5	4	80.0
Singapore	-	1	-	-
Thailand	6	2	2	50.0
Argentina	4	6	3	60.0
Brazil	7	3	2	40.0
Chile	3	2	2	80.0
Colombia	6	0	0	0.0
Mexico	4	6	4	80.0
Peru	2	4	1	33.3
Uruguay	4	3	1	28.6
Venezuela	5	4	3	66.7
Egypt	3	1	1	50.0
India	4	2	2	66.7
Pakistan	7	5	2	33.3
S. Africa	4	7	2	36.4
Turkey	6	4	3	60.0

Table (A3.3) cont.

	KSS	GH	No. of Agreement	% of Agreement
Indonesia	3	3	3	100.0
Korea	3	2	2	80.0
Malaysia	4	2	2	66.7
Philippines	5	4	4	88.9
Singapore	-	1	-	-
Thailand	5	3	2	50.0
Argentina	4	5	3	66.7
Brazil	5	6	3	54.5
Chile	3	1	1	50.0
Colombia	4	1	1	40.0
Mexico	4	4	4	100.0
Peru	2	2	2	100.0
Uruguay	4	2	1	33.3
Venezuela	5	5	4	80.0
Egypt	3	3	3	100.0
India	4	3	3	85.7
Pakistan	6	0	0	0.0
S. Africa	3	4	3	85.7
Turkey	6	2	2	50.0

	Edison	KSS	No. of Agreement	% of Agreement
Indonesia	3	3	3	100.0
Korea	2	3	2	80.0
Malaysia	1	5	1	33.3
Philippines	4	5	4	88.9
Singapore	2	-	-	-
Thailand	1	6	1	28.6
Argentina	2	4	2	66.7
Brazil	4	7	4	72.7
Chile	1	3	1	50.0
Colombia	4	6	4	80.0
Mexico	2	4	2	66.7
Peru	1	2	1	66.7
Uruguay	1	4	1	40.0
Venezuela	4	5	3	66.7
Egypt	-	3	-	-
India	2	4	2	66.7
Pakistan	0	7	0	0.0
S. Africa	4	4	3	75.0
Turkey	2	6	2	50.0

Note: "-" is indicated when the country is not included in the study.
Edison = Edison (2000)
BEKM = Bordo, Eichengreen, Klingebiel and Martinez-Peria (2001)
GH = Glick and Hutchison (2001)
KSS = Kamin, Schindler and Samuel (2001)

Note: Column 2 and 3, which are identified by the authors, are the total number of years that crisis occurs for each country. These numbers are from table A3.2. If any two studies have overlapped time periods, only the periods that are present in both studies are taken into account.

No. of agreement (column 3) is the number of times that any two studies identify currency crisis in the same year for the same country. The percentage of agreement (column 5) is calculated by dividing two multiply the no. of agreement by the total numbers of crises identified in any two studies. Alternatively, the numbers in column 5 is calculated by dividing two multiply column 4 by the summation of column 2 and 3 in the percentage term.

CHAPTER FOUR

Deposit Insurance and Financial Crises: Investigation of the Cost-Benefit Tradeoff

4.1 Introduction

A system of deposit insurance is one type of financial safety net instrument that has been adopted or putting forward in many countries in the last two decades. There is evidence showing that the decision to adopt the formal deposit insurance system tends to occur after a country experiences a systemic banking crisis in order to avoid future crises (Cull, et al., 2002). From theoretical and empirical perspectives, however, the establishment of a deposit insurance system has both advantages and disadvantages, and whether it strengthens or weakens the soundness of the financial systems is still ambiguous. This study employs empirical analysis to investigate the effect of deposit insurance on financial stability. The emphasis is given to the weighting of the benefits of deposit insurance in preventing financial run against the costs of generating banks' incentives to take on excessive risks.

The theoretical rationale for the need for deposit insurance is demonstrated by Diamond and Dybvig (1983). In their model, the provision of deposit insurance, which can eliminate depositors' panic in times of financial distress, is the government's optimal policy in preventing the incidence of financial crises generated by bank runs. However, this benefit of deposit insurance, which can reduce the spread of financial panic today, is traded off with the costs of the increasing probability of financial instability in the future. The guarantee on deposits in times of financial distress can generate public expectations for government bailouts of depositors and troubled financial institutions in the next crisis,

thus encouraging more risky investments and making future crises more likely. From a formal theoretical model, Bhattacharya and Thakor (1993) show that deposit insurance reduces monitoring incentives, and encourages insured banks to seek excessively risky projects and maintain liquid reserves lower than the social optimal. As a result, financial instability is likely to occur due to banks' increasingly bad lending and risks of default.

The arguments over the role of deposit insurance have led to substantially different proposals and suggestions from economists and commentators on the adoption of an explicit deposit insurance system. The supporters of explicit deposit insurance, Garcia (1996, 2000), Mas and Tally (1990), and Choi (1999), point to the advantages of an ex-ante rule. A formal deposit insurance system, which contains a written law regarding the legal obligation on failing financial institutions as well as the compensations to their depositors, should be more efficient in minimizing the spread of financial panic, controlling moral hazard incentives, and improving efficiency of financial markets. Other studies suggest that countries should adopt an explicit system, but only if they have strong financial regulations. These include requirements for banks to hold full reserves against deposits in the form of highly liquid securities (Miller, 1998), adequate capital requirements (Cooper and Ross, 2002), or limited regulatory forbearance as well as tough bank closure rules (Bhattacharya, et al., 1998). These regulations can control banks' reckless risk-taking behaviors due to deposit insurance. On the other hand, the opponents put more emphasis on the problem of moral hazard. They suggest that an explicit deposit insurance system should be abolished and replaced by a private deposit insurance scheme (Calomiris, 1997), particularly in developing and transitional countries

(While, 1995), or by the coordination of guarantees among private financial institutions (Calomiris, 1990).

Similar to theoretical ambiguity on the role of deposit insurance, empirical studies lack strong evidence on whether deposit insurance increases or decreases financial stability[1]. Many studies such as Demirgüç-Kunt and Detragiache (2002), Hutchison and McDill (1999), Rossi (1999), and Barth, et al. (2004) find that explicit deposit insurance schemes increase the probability of financial crises. Demirgüç-Kunt and Detragiache (1997) also show that countries with an explicit deposit insurance system are likely to experience both higher probability and fiscal costs of crises. In addition, in the study of the relationship between deposit insurance and financial development by Cull, et al. (2002, 2004), explicit deposit insurance schemes are found to lower both short-run and long-run financial development. As explained by these studies, the adverse effect of deposit insurance on a financial system is due to the establishment of an explicit system in a weak institutional environment, where moral hazard incentives cannot be effectively contained.

However, there are some studies which find empirical evidence supporting the adoption of explicit deposit insurance. For instance, by using a large sample of developing countries, Eichengreen and Arleta (2002) find that an explicit deposit insurance system reduces the likelihood of financial crises[2]. Gropp and Vesala (2001) also find that an explicit system statistically significantly reduces banks' risk-taking

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[1] Empirical studies using cross-section time-series analysis have been increasing by making use of the recent development of the Deposit Insurance Database around the World, published by the World Bank in 2000. Appendix table (4.1) analytically summarizes empirical findings of those studies on deposit insurance.

[2] Eichengreen and Arleta note that their different results from the test of the effect of deposit insurance on the probability of financial crises are primarily due to the different sample. When replicating Demirgüç-Kunt and Detragiache's study by using the sample that includes both developed and developing countries, they find that an explicit deposit insurance system increases the probability of banking crises.

incentives for a sample of European countries. Chu (2003) also shows that although an explicit system may damage financial stability in the long-run, it increases the stability in short-run.

This chapter examines the role of deposit insurance in preventing the spread of financial runs by taking into account the possibility that it can cause financial instability. The analysis employs a cross-section time-series for a sample of 73 banking crisis episodes in 48 industrial and emerging market countries over the period of 1975 to 2002. Empirical findings show that the presence of explicit deposit insurance schemes can reduce the costs of crises measured in terms of output losses. For countries without explicit deposit guarantees, massive financial panic during financial distress can cause the overall failure of the financial system and damage the real economy through the disruption in the payment system and credit mechanism[3]. However, by using the same sample, explicit deposit insurance is found to increase the likelihood of financial crises.

While these results are similar to Hutchison and McDill (1998) and some parts are close to Hoggarth, et al. (2005), this study aims to provide broader analysis with three major contributions. First, since the adoption of explicit deposit insurance has both advantage and disadvantage, the analysis on whether its benefit in preventing financial panic dominates its cost in generating moral hazard is performed. The results indicate that the desirable effect of deposit insurance can only offset its adverse effect in generating financial instability. These results also hold when the analysis is separately performed for a group of industrial countries and emerging market economies. Second, this cost-benefit tradeoff is more apparent when considering different designs of deposit insurance

[3] See Lindgren and Saal (1996) and Hoggarth et al. (2002) for the discussions on the various channels that the eruption of banking crisis can affect the real economy and cause the reduction in output.

schemes. The output costs of financial crises are found to be lower in countries where deposit insurance systems explicitly provide comprehensive insurance coverage, including the protection of foreign currency and interbank deposits, have high ratio of deposit insurance funds to total bank assets, or have no co-insurance. Large deposit insurance coverage is, however, the source of moral hazard, which increases the instability of the financial system (Garcia, 2000; Demirgüç-Kunt and Detragiache, 2002; and Cull, et al., 2004). Third, by taking into account the role of domestic institutions and financial regulations, the results suggest that for countries with strong institutional quality, deposit insurance's cost-benefit tradeoff disappears, and countries benefit from the presence of explicit deposit insurance.

The remainder of this chapter is organized as follows: Section 4.2 discusses the relationship between deposit insurance schemes and the financial system stability as well as the costs of financial system instability. Section 4.3 identifies the model specification, and section 4.3 describes the data used in the model. The empirical results and the analysis of empirical findings are reported in section 4.5 and 4.6. The policy implications and conclusions are in section 4.7.

4.2 Deposit Insurance Systems and Financial Crises

The primary purpose of deposit insurance is to maintain the stability of the financial system by eliminating depositor runs. Bank runs initiate when a liquidity problem or deterioration of asset quality of an individual bank emerges. Depositors may face uncertainty in accessing their funds, triggering financial panic and deposit withdrawals. A run on a bank can spread contagiously through the financial system as a whole if depositors, who have incomplete information on whether financial problems are

bank-specific, panic and withdraw their funds simply because other depositors are withdrawing. As Diamond and Dybvig (1983) have theoretically addressed, bank runs are self-fulfilling phenomena. Bank runs can turn into a banking crisis when the excessive withdrawals lead to the exhaustion of banks' capital and result in their insolvencies.

Advocates of the adoption of explicit deposit insurance systems suggest that the credible guarantee on deposits will prevent financial panic in times of financial vulnerability by providing public confidence, since the depositors' funds are insured and guaranteed for prompt access (figure 4.1, arrow [a]). Opponents, however, argue that explicit deposit insurance may reduce market discipline, since bank management has incentives to engage in additional risky activities under the assurance that depositors' funds are guaranteed. These adverse incentives can cause financial instability and are likely to occur in countries with weak regulations and supervisions in the financial sector in controlling and monitoring banks' activities (Bhattacharya, et al., 1998; Cooper and Ross, 2002; Demirgüç-Kunt and Detragiache, 2002; Cull, et al., 2004) (figure 4.1, arrow [b]).

Supporters of explicit deposit insurance also emphasize the role of deposit insurance in protecting the payments system and reducing the costs of crises. (e.g. Garcia, 2000; Krugman, 1999b)[4]. Financial crises may impose two major types of costs on the economy: fiscal costs of crisis resolution and output costs. With the absence of formal deposit insurance, governments could end up protecting and bailing out insolvent financial institutions, which will induce huge resolution costs of crises (figure 4.1, arrow

[4] According to Garcia (2000), the presence of an explicit deposit insurance system may not eliminate financial crises, particularly when there is a massive unforeseen shock, but it can reduce their severity. This is because the system of deposit insurance is in general designed to protect small depositors from the failure of their financial institutions, not creditors from large financial institutions.

[c]). This action of government is likely to occur in a country dominated by stated-owned, politically well-connected and/or too- big-to-fail financial institutions. Financial crises can also induce a contraction in production and an economic recession through the disruption of banks' functions as financial intermediation. The role of deposit insurance in ensuring the safety of depositors' funds should efficiently protect the payment system and alleviate the magnitude of output losses associated with crises (figure 4.1, arrow [d]).

Figure (4.1) the Relationship between the Explicit Deposit Insurance System and Financial Stability

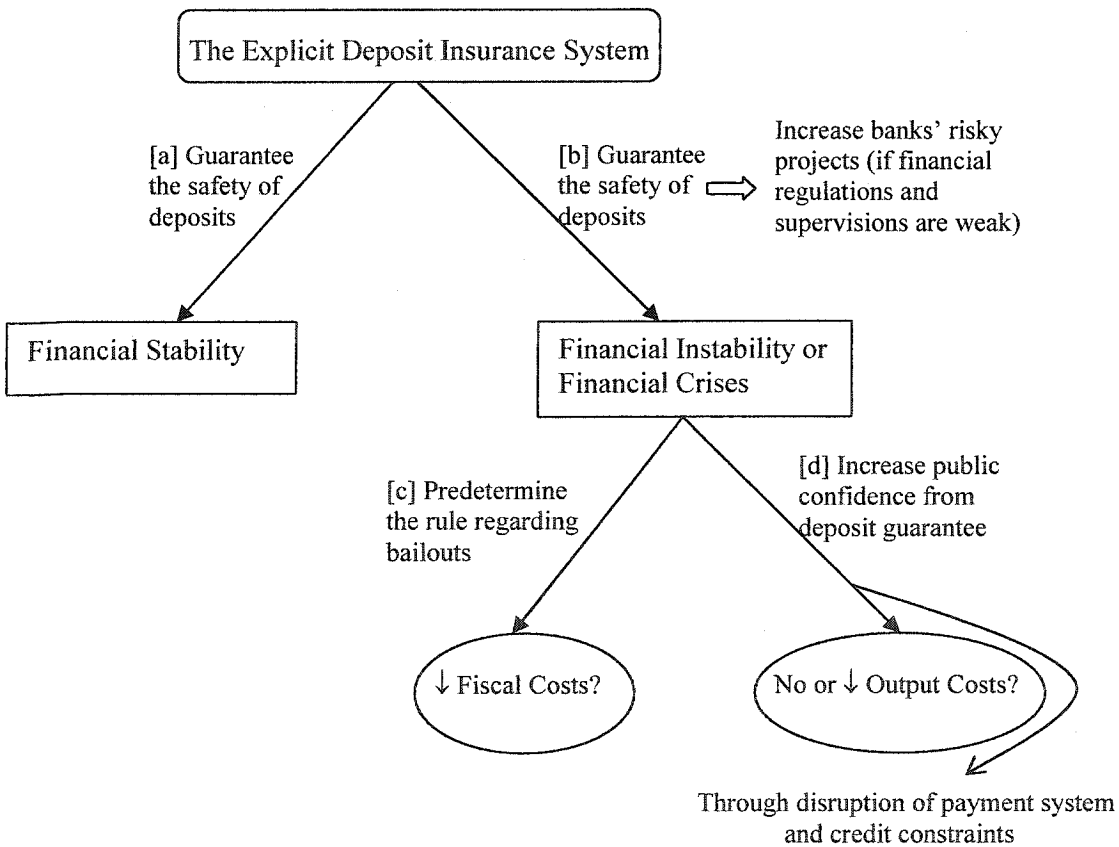

Figure (4.1) shows that whether the advantages or disadvantages of explicit deposit insurance are higher is ambiguous. Having explicit deposit insurance can prevent financial panic, increase financial stability, and reduce the impact of economic recession

accompanying financial crises. However, the disadvantage of its generating moral hazard incentives can make crises more likely. To assess the role of deposit insurance, an analysis needs to take into account the tradeoff between costs and benefits of deposit insurance.

Many empirical studies such as Demirgüç-Kunt and Detragiache (2002) and Demirgüç-Kunt and Huizinga (2004) illustrate that adverse effects of deposit insurance in raising the probability of crises and reducing market discipline may arise from poor designs of deposit insurance schemes. These designs include a broad deposit insurance coverage, i.e. covering foreign currency and interbank deposits, and/or no-coinsurance, where depositors are not required to bear risk from their losses due to their bank's failure. Moral hazard would also be aggravated if a deposit insurance system is funded ex-post and/or the source of funding comes from a government. Alternatively, deposit insurance schemes should be designed for banks to hold the responsibility for covering the insured deposits of a failed bank, since they will encourage banks to keep their institutions sound, and then reduce outlays by the system.

In addition, Demirgüç-Kunt and Detragiache (2002) suggest that the presence of explicit deposit insurance system needs to be accompanied by effective prudential regulation and supervision of a financial system as well as a strong legal system in order for it to efficiently prevent financial crises. Based on a sample of 61 countries during 1980-1997, the negative significance of the interaction terms between explicit deposit insurance schemes and institutional variables indicates that the likelihood of crises is reduced substantially in countries with explicit deposit insurance and having high level of institutional quality. For institutional variables, they use the rule of law, bureaucratic

quality, and corruption[5] to proxy for prudential regulations and supervisions in a financial system. Alternatively, Barth, et al. (2004) employ the new database on bank regulations and supervisions compiled from the surveyed data for a large set of countries by Barth, et al. (2001) to test Demirgüç-Kunt and Detragiache's model by using cross-sectional analysis. These alternative measures, however, do not have a significant effect on the probability of banking crises. When using these new data on bank regulations and supervisions, Cull, et al. (2004) do not find results supporting that a strong level of regulations and supervisions is associated with higher long run economic development. On the other hand, when using the rule of law variable, both Barth, et al. and Cull, et al. find that the estimates of the interaction terms between explicit deposit insurance schemes and the rule of law variable are significant.

Other empirical studies such as Hutchison and McDill (1998), Chu (2003), Demirgüç-Kunt and Huizinga (2004) and Hoggarth, et al. (2005) emphasize the tradeoff between costs and benefits of explicit deposit insurance. In Hutchison and McDill, the explicit deposit insurance dummy variable has a statistically significant impact in increasing the probability of banking crises, as well as reducing the output costs of crises for the sample of 65 crisis episodes during 1975-1997[6]. They find that the change from an implicit to explicit system increases the probability of banking crises by approximately 50 percent and reduces the real output cost by 5-6 percent of GDP in relation to the sample average of the output cost of 7.3 percent of GDP.

On the other hand, by using a sample of 29 developed and developing countries during 1994-2001, Hoggarth, et al. (2005) do not find a significant relationship between

[5] These institutional variables are from International Country Risk Guide.
[6] Hutchison and McDill also focus on the impacts of other institutional variables including central bank independence and financial liberalization on the probability of banking crises; see appendix table (A4.1).

the explicit deposit insurance dummy and the probability of crises. However, when separating explicit deposit insurance systems into limited and unlimited schemes, they find that the system with limited coverage, and particularly when it is co-insured, is statistically significantly associated with a smaller probability of crises. The magnitude of this effect indicates that having an explicit system with limited coverage decreases the probability of crises by 95 percent. These results, however, seem to be overestimated. Hoggarth, et al.'s findings also contradict Demirgüç-Kunt and Detragiache (2002), who find that explicit deposit insurance schemes significantly increase the likelihood of crises regardless of their designs. These different results may result from the different types of data used in their empirical analyses. While Demirgüç-Kunt and Detragiache (2002) employ the cross-section time series data (they have total observations about 900), Hoggarth, et al. use (unbalance) cross-section analysis[7]. For the latter study, each country is considered as one observation, which results in the total of 29 observations[8].

In addition, Hoggarth, et al. also explore the effect of deposit insurance on the costs of crises. They find that a limited deposit insurance coverage scheme significantly reduces the fiscal cost of crises by 8.4 percent of GDP, which is around half of the averaged fiscal costs of 15 percent of GDP from the sample. They also note that countries with limited deposit insurance coverage may experience higher output costs of crises according to the positive (but insignificant) relationship between the limited coverage and the magnitude of output growth contraction. The opposite effect is found for unlimited deposit insurance coverage schemes. Hoggarth, et al. discover that although the unlimited

[7] This is the unbalance cross-section data because although there is one observation for one country, the data is not collected at the same point in time.

[8] Hoggarth, et al. employ the Probit model to estimate the probability of crises. For the crisis dummy variable as the dependent variable, they assigned a value of one if a country experienced a banking crisis between 1994 and 2001, and zero otherwise.

coverage scheme significantly increases the probability of crises by 96 percent, it may reduce the magnitude of growth contraction. The latter estimated coefficient is negative, but insignificant. Their study, however, does not clearly distinguish the type of deposit insurance systems. In the probability of crises regressions, they include countries that adopt unlimited coverage schemes regardless of whether they have explicit or implicit systems, whereas only countries with unlimited and explicit systems are included in the costs of crises regressions.

Demirgüç-Kunt and Huizinga (2004) also suggest that the adoption of an explicit deposit insurance system involves a tradeoff between the increase in the safety of deposits and the decrease in bank creditors' market discipline. They regress the interest rates on deposit insurance and the interaction terms between deposit insurance and bank risk factors (proxied by equity, profit, and liquidity of banks) by using bank-level data for a sample of 30 countries. They find that the presence of explicit deposit insurance statistically significantly reduces interest rates. This indicates the desirability of deposit insurance, since depositors demand lower interest rates when they perceive their bank to be less risky. However, there is a tradeoff with market discipline. The statistical significance of the interaction terms indicates that with the presence of explicit deposit insurance, the required interest rate is higher when risk factors are higher. Chu (2003) uses the contingency table analysis to test whether there is an association between the system of deposit insurance and banking crises. He finds that an explicit system promotes short-run banking stability, but damages the stability in the long run. Of the 36 countries in the sample, 15 experience systemic banking crises before adopting explicit deposit insurance, but successfully avert crises after they introduce the explicit system. However,

the frequency of banking crises among countries with explicit deposit insurance tends to rise in the long-run due to the increased moral hazard associated with deposit insurance.

4.3 Model Specifications

To test the effect of deposit insurance on the likelihood and the costs of financial crises, two separate models are employed due to the different characteristics of dependent variables. The aggregate or net effect of deposit insurance is calculated from the product of marginal effects from these two models. The effect of the deposit insurance on the probability of financial crises is tested by using the Logit regression model (this effect is defined by arrow [a] and [b] in figure 4.1). For the effect of deposit insurance on the costs of crises, both fiscal and output costs are regressed on deposit insurance variables and a set of control variables (this effect is defined by arrow [c] and [d] in figure 4.1). This effect is conditioned on the occurrence of crises. The ordinary least square methodology is employed for the fiscal cost regressions. However, when the dependent variable is the magnitude of output losses, which assigns a value of zero for those countries that financial crises are not accompanied by the output contraction, the Tobit regression is the appropriate estimation methodology for these censored samples[9]. Data for each variable used in these models is described in the next section.

A. Logit Model: Tests the effect of deposit insurance on the probability of financial crises

$$L_i = \ln\left[\frac{P_{i,t}}{1-P_{i,t}}\right] = \alpha + \beta_k x_{k,i,t} + \delta DI_{i,t} + \varepsilon_{i,t}$$

[9] When the dependent variable is censored, performing the OLS methodology yields biased and inconsistent parameter estimates while Tobit estimation produces consistent and asymptotically efficient parameter estimates. See Greene (1997) and Long (1997) for more discussions on Tobit estimation.

$$, \text{where } P_{i,t} = prob(FC_{i,t} = 1 \mid x_{i,t}, DI_{i,t}) = \frac{1}{1+e^{-(\alpha+\beta_k x_{i,t}+\delta DI_{i,t})}}$$

$FC_{i,t}$ is a financial crisis dummy variable, which takes a value of 1 in a crisis year for any country i at time t, and 0 if there is no banking crisis. $\ln[P_{i,t}/1\text{-}P_{i,t}]$ is the odd ratio of the Logit estimation, where $P_{i,t}$ is the probability that a financial crisis occurs, or when $FC_{i,t}$ equals to 1. For the determinants of the probability of banking crises, β_k, δ are coefficients, which capture the effect of the change in k control variables and the deposit insurance dummy variable on the change in the odd ratio. DI is the deposit insurance dummy variable, which takes a value of 1 if a country establishes the explicit deposit insurance system before or in crisis year, and 0 otherwise. In addition, when the role of institutional quality, and bank regulation and supervision is taken into account, the interaction term between deposit insurance dummy variable and each of institutional variables is included in the Logit regression. x is a k-element vector of economic and financial variables as described in the next section. The current account surplus is expected to reduce the probability of crises. The ratio of M2 to foreign reserves, the growth rate of the ratio of domestic credit to GDP, and the rate of inflation are expected to have a positive relationship with the probability of crises. The increase in the money supply relative to reserves and the credit growth rate reflects the expansion of credits that may contribute to unsustainable rise in assets prices and the bank exposure to foreign exchange risk, which may increase the likelihood of financial crises[10]. ε_i is the error term.

B. Tobit Model: Tests the effect of deposit insurance on output costs of crises:

[10] By following Demirgüç-Kunt and Detragiache (2002), a lag of the ratio of current account to GDP and two lags of credit growth are used.

$$y^{*}_{i,T} = \alpha + \beta_k x_{k,i,t-1} + \delta DI_{i,t} + \varepsilon_{i,t}$$
$$y^{FC}_{i,T} = y^{*}_{i,T} \quad \text{if} \quad y^{*}_{i,T} > 0$$
$$y^{FC}_{i,T} = 0 \quad \text{if} \quad y^{*}_{i,T} \leq 0$$

The dependent variable $y^{FC}_{i,T}$ is the observed total magnitude of output losses associated with the occurrence of financial crisis i over crisis duration T and $y^{*}_{i,T}$ is the latent dependent variable. For each observation, $y^{FC}_{i,T}$ takes a specific magnitude or a value of zero, where zero corresponds to no economic contraction associated with the occurrence of banking crises. DI is an explicit deposit insurance dummy variable as well as various designs of deposit insurance on the coverage of deposit insurance, and x is the vector of control variables. One lag of economic and financial variables is used in order to avoid the endogeneity problem, or the feedback effects from output contraction in crisis years to other economic variables and financial sector. The control variables in the costs of crises regressions include two dummy variables. The first dummy is the Twin Crisis dummy, which takes values of 1 if there is a currency crisis in two years before or after the onset of banking crisis, and 0 otherwise[11]. The second dummy is the Systemic Crisis dummy, which is assigned a value of 1 if a banking crisis is systemic, and 0 for nonsystemic one. A banking crisis episode that is systemic and/or simultaneously accompanied by a currency crisis can expect to be very costly. The summary statistics of variables used in the Logit and Tobit models are reported in table (4.1).

Since deposit insurance can affect both the probability and the costs of financial crises, the aggregate (or net) effect of the change in the deposit insurance system is

[11] The dates of currency crises are calculated by following Kaminsky and Reinhart (1999)'s methodology, which the occurrence of crisis is identified when exchange market pressure (EMP) is above the sample mean plus three standard deviations. EMP is calculated from the weighted averages of three components: the exchange rate depreciation, the percentage changes in reserves, and the change in interest rates. The crisis dates are separately calculated for countries that experienced hyperinflation.

calculated from:

$$\left[prob(FC \mid \mathbf{x}, DI=1)\cdot E(y^{FC} \mid FC, \mathbf{x}, DI=1)\right]-\left[prob(FC \mid \mathbf{x}, DI=0)\cdot E(y^{FC} \mid FC, \mathbf{x}, DI=0)\right]$$

$[prob(FC \mid \mathbf{x}, DI)]$ is the predicted probability of crisis evaluated at the mean values of control variables and an existed deposit insurance system (i.e. the implicit or explicit system). $[E(y^{FC} \mid FC, \mathbf{x}, DI)]$ is the predicted cost of crisis, conditioned on the occurrence of crises[12]. The negative value of this aggregate effect indicates the desirability of the presence of explicit deposit insurance.

4.4 Data

Dates of Banking Crises

Banking crisis dates are from Caprio and Klingebiel (2003), who compile the data based on the published financial sources and interviews with experts. These banking problems are organized into systemic and nonsystemic (i.e. smaller or borderline) events. A systemic banking crisis is defined as the situation when much or all of bank capital is exhausted, and a nonsystemic or smaller banking crisis is identified when there is evidence of significant banking problems such as a government intervention in banks and financial institutions. The sample comprises 73 episodes of banking crisis in 49 industrial and emerging market countries from 1975 to 2002[13]. Countries in the sample are selected based on the availability of quarterly real GDP data, which is used to calculate the magnitude of output losses, and data for deposit insurance and control variables. The

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[12] That is, the predicted value of costs of crises will be adjusted by the probability that financial crises occur.

[13] Argentina, Australia, Botswana, Brazil, Canada, Chile, Colombia, Costa Rica, Denmark, Ecuador, Egypt, Finland, France, Germany, Ghana, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Malaysia, Mexico, Peru, Portugal, Nigeria, Norway, the Philippines, Russia, Senegal, Singapore, South Africa, Spain, Sri Lanka, Sweden, Thailand, Turkey, U.K., U.S., Uruguay, Venezuela, Zimbabwe.

sample of industrial countries is included with that of emerging market economies, since it will provide a benchmark for a low level of risk-taking financial institutions. It will also increase the variation of deposit insurance data in the regressions. While most industrial countries have had explicit deposit protection schemes, only some emerging market economies have an explicit system and some of them start adopting it recently (see Kyei, 1995; Garcia, 2000)[14].

Costs of Financial Crises

Costs of banking or financial crises are measured using both fiscal and output costs. Resolution costs involve the costs of recapitalization, restructuring, and rehabilitation of troubled financial institutions. They fall on the government budget and are a direct cost to taxpayers. The data for resolution or fiscal costs (as the percentage of GDP) is from Caprio and Kligebiel (2003). For the output costs of crises, the total magnitude of output loss per crisis is estimated from the deviation of real GDP from its potential trend (see IMF, 1998, Bordo, et al., 2001). A crisis episode is identified as being accompanied by economic contraction or output loss if the actual real GDP is lower than the estimated potential trend in a crisis year (or a year after the crisis)[15], then. The total magnitude of output losses is calculated by adding up the difference between the quarterly real GDP and its estimated potential level from the crisis period until the period that the actual real GDP returns to its trend.

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[14] From the panel data of 73 banking crisis episodes during 1975-2002, 53.6 percent of the sample of industrial countries have an explicit deposit insurance system, and 26 percent for the sample of emerging market countries.

[15] Two-year window is imposed on crisis dates, i.e. a crisis that consecutively occurs within two years will be counted as the same crisis, in order to allow some periods for output to recover.

Both the growth rate and level of real GDP are employed to estimate the output losses[16]. The output losses measured from the magnitude of growth contraction (GROWTHLOSS) are used by many studies such as IMF (1998), Bordo, et al. (2001), Honohan and Klingebiel (2003), Classes, et al. (2003), and Hoggarth, et al, (2005). Hoggarth, et al. (2002) and Mulder and Rocha (2001), however, point out many biases from using the downward deviation of the real GDP growth rate to estimate the severity of crises. One major bias is the underestimation of the extent of output losses. In many cases, when the real GDP growth rate returns to its growth trend or when economic recovery is identified, the real GDP level may be far below its pre-crisis level capacity. Therefore, the downward deviation of real GDP level from its potential output level, or the absolute output loss (LEVELLOSS) is also estimated[17][18].

Data for Deposit Insurance, Bank Regulation and Supervision, and Institutional Quality

Data for the deposit insurance schemes is from the database of Deposit Insurance around the World published by Demirgüç-Kunt and Sobaci (2000) at the World Bank. This database contains the dates in which a formal explicit deposit insurance system was established across countries as well as various designs of deposit insurance schemes. The Explicit Deposit Insurance dummy variable is assigned a value of 1 if a country adopts a formal explicit deposit insurance system prior to or on the year that banking crisis erupts, and 0 otherwise. The unlimited coverage dummy=1 for explicit deposit insurance with

[16] There is no consensus on techniques in estimating output losses (see Hoggarth et al., 2002; Mulder and Rocha, 2001). Chapter 2 of this dissertation comprehensively discusses different techniques in measuring output losses associated with crises, as well as their advantages and disadvantages.
[17] See section 4.4, chapter 2 for the technique is estimating LEVELLOSS.
[18] By testing the hypothesis that there is the significant difference between the means of these two measures of output losses, the statistics of the paired sample t-test is rejected at 1 percent significant level, indicating that the mean of LEVELLOSS is significantly different from the means of GROWTHLOSS.

unlimited coverage, and 0 otherwise. The dummy of foreign currency (interbank) deposits covered=1 for explicit deposit insurance that protects foreign currency (interbank) deposits, and 0 otherwise. The coinsurance dummy=1 if the explicit system has co-insurance, and 0 otherwise. The aggregate index for deposit insurance designs is also employed. This index, which is constructed by Demirgüç-Kunt and Detragiache (2002), is built from the first principal component of deposit insurance features for no-coinsurance, foreign currency deposits covered, interbank deposits covered, type of funding, source of funding, management, membership and the level of explicit coverage. Since an explicit system could adopt the different features of deposit insurance, this index, so-called the moral hazard index, should capture the overall degree of moral hazard created by deposit insurance schemes. The higher value of this index reflects higher extent of moral hazard.

Data for bank regulation and supervision is from two datasets. The variables from the first dataset comprise Rule of Law, Corruption, and Bureaucratic Quality compiled by the International Country Risk Guide. By following Demirgüç-Kunt and Detragiache (2002), these institutional quality variables are used to proxy the extent of bank regulations and supervisions. Each variable is scaled from 0-6[19]; higher value indicates better quality of domestic institutions, which reflects prudential regulations and supervisions in the financial system. The data in the second dataset is from Barth, et al. (2004), who compile bank regulation and supervision data from a survey of national regulation agencies. Two variables from this dataset are Official Supervisory Power and Capital Regulatory Index. Official Supervisory Power measures the extent of supervisory authority power in taking actions to prevent and resolve financial problems. This variable

[19] Bureaucratic Quality variable is scaled 0-4.

is scaled 0-16, based on 16 surveyed questions; higher score indicates greater supervisory power. Capital Regulatory Index captures the extent of capital stringency, which scaled 0-9 on the basis of 9 survey questions[20]. In addition, the Deposit Insurance Funds-to-Total Bank Assets variable from this dataset is used to distinguish different deposit insurance designs across countries. This variable measures the size of the deposit insurance fund relative to total bank assets.

Macroeconomic and Control Variables

The set of control variables in all regressions includes real GDP per capita to control for the level of development; the ratio of current account to GDP and the pre-crisis real GDP growth rate control for government macroeconomic policy and economic conditions; the ratio of M2 to international reserves and the rate of credit growth control for the size of financial sector. These are standard macroeconomic and financial variables that are used in other related studies. The data for these variables are from the International Financial Statistics and World Development Indicators, the World Bank.

4. 5 Empirical Results

A. The effect of deposit insurance on the probability of financial crises

Table (4.2) reports results of the Logit regressions by presenting both the Logit coefficients and marginal effects of each independent variable evaluated at its mean value. The marginal effect of dummy variables is the discrete effect of the change in the value of the dummy variable from 0 to 1 on the probability of crises. The positive

[20] The data for Rule of Law, Corruption, and Bureaucratic Quality is available from 1984 to present; the average of 1984-1986 data is used for the periods prior to 1984. The data for bank regulations and supervisions is primarily available from 1999, so the extent of regulations and supervisions is assumed not varying overtime. Barth et al. (2004) compile historical data for some regulation and supervision variables and find that those variables have only marginal change over time.

significance of deposit insurance estimated coefficient indicates the adverse effect of explicit deposit insurance. The marginal effect of 0.1475 suggests that when a country's deposit insurance system changes from an implicit to explicit system[21], the probability of crises over 1975-2002 will increase by 14.75 percent (column 1b). In other words, by holding other control variables constant at their means, the model predicts that on average the probability of crises is equal to 30.45 and 14.7 percent for a country with and without an explicit deposit insurance system, respectively, i.e. having explicit deposit insurance doubles the probability of crises.

For control variables, the coefficients of real GDP per capita and real GDP growth rate are negative and statistically significant at the 1 percent level suggesting that countries with high standards of living and economic growth rate on average experience less probability of banking crises. The positive significance of inflation coefficient indicates that a crisis tends be more likely in a country with high rate of inflation. The other control variables are not significant at the conventional level.

Table (4.2) also reports the regression results when observations are separated into industrial countries and emerging market economies. The estimated coefficients of deposit insurance variables are significant in both country groups. Among countries with explicit deposit insurance, the model predicts that the probability of crises is on average 24 percent for industrial countries and 33.8 percent in emerging market economies. For those countries without an explicit system, the probability of crises is 6.3 and 21 percent for industrial and emerging market countries, respectively. For overall performance of the

[21] In the survey of the deposit insurance system around the world by Keyi (1995), policy makers around the world have adopted a system of deposit insurance either in the forms of an explicit deposit insurance system or an implicit deposit guarantee. New Zealand is only country that employs stringent disclosure requirement without adopting deposit insurance either explicitly or implicitly.

model, the high significance of chi-square statistics indicates that the model fits the data very well. The overall correct prediction rate is about 75-82 percent.

The presence of explicit deposit insurance, which leads to the increasing probability of crises, may reflect the problem of moral hazard. The analysis in table (4.3) test whether moral hazard created by explicit deposit insurance can be effectively contained in countries with strong institutional environment. Each regression in this table includes a deposit insurance dummy, each institutional variable, and their interaction term. A set of control variables is from the baseline regression, i.e. column (1a), table (4.2)[22]. If coefficients of institutional variables and interactions terms are significant, and their aggregate marginal effect is negative[23], the results can be interpreted as follows: for a country with an explicit deposit insurance system, higher quality of institutions can reduce the probability of crises.

From column (1) in table (4.3), among countries with explicit deposit insurance, the change in the rule of law by one scale from its mean statistically significantly decreases the probability of banking crises by 1.89% (= -0.0454 + 0.0265). Likewise, a one scale increase in corruption (less corruption) and bureaucratic quality from their means reduce the probability of crises by 3.76% (= -0.0573 + 0.0197)[24] and 1.57% (= -0.0796 + 0.0639), respectively (column 2 and 3). These results are consistent with Demirgüç-Kunt and Detragiache (2002), who find that the adverse effect of different deposit insurance schemes is smaller or even negligible for countries with better

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[22] The real GDP per capita is excluded when the variables of rule of law, corruption, or bureaucratic quality are included in the model, since it can reflect the extent of quality of domestic institutions.

[23] That is, for regression $Y_i = \beta_0 + \beta_1 D_i + \beta_2 X_i + \beta_3 (D_i \times X_i) + \varepsilon_i$, the effect of the change in X_i on the change in Y_i equals to $\beta_2 + \beta_3$, when D_i =1.

[24] The coefficient of interaction term between corruption and deposit insurance is not significant at conventional level.

institutions. Similarly, Kane (2000) recommends that an economy without transparency, accountability, and deterrence should not establish explicit deposit insurance schemes. In weak institutional environments, explicit deposit insurance could generate moral hazard, and lead to the instability of the financial system.

Regressions in column (4) and (5), table (4.3), use the data for bank regulations and supervisions compiled by Barth, et al. (2001)[25]. Although the coefficients of bank capital regulation and its interaction with the deposit insurance dummy are significant, the net marginal effect is positive in the probability of crises regression. Since the data for bank regulations and supervisions is available only in 1998-1999, the assumption that the extent of bank regulations and supervisions does not change over time may be too strong in panel data analysis[26]. In addition, the results become insignificant in most regressions when the similar analysis, i.e. including institutional variables in the probability of crises regressions, is separately performed for a group of industrial and emerging market economies. This may be due to the less variation of the extent of institutional quality within each of these two groups. Since the quality of institutions is high overall among industrial countries and low among emerging market economies, combining of observations from all countries will increase the variation of values of institutional variables, and make them significant in regressions.

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[25] The data for bank regulations and supervisions is primarily available from 1998-99, so the assumption that the extent of regulations and supervisions do not vary overtime is imposed. Barth et al. (2004) also state that they are able to compile historical data for some regulation and supervision variables, and those variables have only marginal change over time. For rule of law, corruption and bureaucratic quality data, which is available from 1984 to present, the average of 1984-1986 data is used for the periods prior to 1984.

[26] When the cross-section analysis of 48 countries in 1998 is tested, the coefficient of bank capital regulation becomes insignificant. In Barth et al.'s banking crises regressions, which use cross-section of 52 countries in 1998, both estimates of bank capital regulations and official supervisory powers are not statistically significant.

B. Deposit insurance and costs of crises

Table (4.4) reports results of the effects of explicit deposit insurance on the costs of banking crises, which are the magnitude of output losses (LEVELLOSS and GROWTHLOSS) and the fiscal costs of crisis resolution. The estimated coefficients of the explicit deposit insurance dummy are negative in all model specifications, suggesting the change from an implicit to explicit deposit insurance system on average reduces the costs of crises. However, the estimates of the deposit insurance dummy are significant at the traditional level only in the LEVELLOSS regressions. The marginal effect of deposit insurance in column (1b) indicates that the magnitude of absolute output losses for countries with an explicit system is lower than countries with an implicit guarantee by about 2.4 percent of GDP. With the average magnitude of output losses in the sample of 4.9 percent of GDP (table 4.1), the effect of the explicit system in alleviating costs of crises is substantial. However, the coefficients of deposit insurance become insignificant when performing separate analysis for the effect of deposit insurance in industrial and emerging market economies (columns 1 and 2, table 4.5). This may be due to the decrease in the number of observations (i.e. the number of crisis episodes), particularly among industrial countries. For the group of emerging market economies, the estimated coefficient of deposit insurance is significant at the 15 percent level, and its marginal effect is close to that of the estimate from all observations (column 1, table 4.4). In addition, when separately examining the effect of deposit insurance on the output costs of systemic and nonsystemic crises, the results show that explicit deposit insurance is more effective in preventing nonsystemic or smaller financial crises. This finding is consistent to Garcia (2000)'s analysis, which states that the system of deposit insurance is generally

designed to protect small depositors; therefore, it may not avert the eruption of systemic crises. However, since the establishment of an explicit deposit insurance system is expected to alleviate the severity of crises, the analysis with the inclusion of systemic and nonsystemic crises should suggest the overall effectiveness of the system.

For the effect of deposit insurance on the fiscal costs of crises, the last column in table (4.4) indicates that an explicit deposit insurance system does not statistically significantly lower the fiscal costs of crisis resolution. However, this insignificance of deposit insurance coefficient may be due to the difficulty and inconsistency in measuring fiscal costs[27]. In the compilation of fiscal costs data, Caprio and Klingebiel (2003) note that in some cases, the fiscal costs are assessed from the costs of corporate restructuring, but include both restructuring and recapitalizing costs of the financial system in the other cases. As a result, "these estimates [fiscal costs] may not be strictly comparable across countries and should be treated with a degree of caution (Hoggarth, et al., 2002, p. 831)."

For the control variables, the significances of estimated coefficients vary across model specifications. The pre-crisis real GDP growth rate, the ratio of current account to GDP prior to crisis, the twin crisis dummy, and the systemic crisis dummy seem to be significant variables in explaining the costs of crises in most regressions. The significantly positive coefficient of pre-crisis real GDP growth rate and negative coefficient of the ratio of current account surplus to GDP indicate that the costs of crises will be larger if an economy experiences economic boom and/or current account deficit prior to a crisis. The significantly positive coefficients of the systemic crisis and twin crisis dummy variables suggests that the magnitude of output losses associated with a

[27] In addition, the fiscal cost data is not available for many crisis episodes. From 73 crisis episodes in the sample, 32 crisis episodes have missing data of fiscal costs.

systemic banking crisis is 3.7 percent of GDP higher that that of a nonsystemic crisis. In addition, for a banking crisis that is simultaneously accompanied by a currency crisis, the magnitude of output losses will be higher than if a banking crisis occurs alone by about 3 percent of GDP. For the overall fit of the model, the high significance of the likelihood ratio chi-squares (LR chi-square) at the 1 percent level in all output losses regressions (column 1-4, table 4.4) shows that the model as a whole is statistically significant[28].

4.6 Analyses from Empirical Findings

Empirical results in section 4.5 suggest that the establishment of an explicit deposit insurance system can make financial crises more likely, but can reduce the severity of a crisis once it occurs. Based on the sample of 49 industrial and emerging market countries during the period of 1975 to 2002, the change from an implicit to explicit deposit insurance system increases the probability of banking crises on average by 14.75 percent. However, the adoption of explicit deposit insurance reduces the total magnitude of absolute output losses associated with those crises by 2.4 percent of GDP, which is about the half of the averaged output costs of 4.9 percent of GDP from the sample. These marginal effects of deposit insurance are considerably smaller than those found by Hutchison and McDill (1998). By using the sample of 98 developed and developing countries 1975-1997, they find that the adoption of explicit deposit insurance increases the probability of financial crises by about 50 percent, but reduces the output costs by 5-6 percent of GDP, which is more than the double of the sample average of the output cost of 7.3 percent of GDP.

[28] The likelihood-ratio chi-square is defined as $2(L_1 - L_0)$, where L_1 is the log likelihood for the full model with constant and predictors and L_0 represents the log likelihood for the model with constant only.

To assess whether the benefit of having an explicit system in preventing financial panic dominates its adverse effect, the aggregate marginal effect of the change from an implicit to explicit deposit insurance system can be calculated from the following:

The aggregate marginal effect[29]

$$=\left[prob(FC \mid \mathbf{x}, DI=1)\cdot E(y^{FC} \mid FC, \mathbf{x}, DI=1)\right]-\left[prob(FC \mid \mathbf{x}, DI=0)\cdot E(y^{FC} \mid FC, \mathbf{x}, DI=0)\right]$$

The predicted probabilities of banking crises are estimated from the regression (1a), table (4.2) in part A, section 4.5, and the expected conditional magnitudes of output losses are estimated from the regression (1a), table (4.4) in part B. These predicted values are estimated for observations with (DI=1) and without (DI=0) an explicit deposit insurance system; these values are reported as follows:

	Types of DI Systems	Predicted Prob. of crises $[prob(FC \mid \mathbf{x}, DI)]$	Expected Output Losses (% of GDP) $[E(y^{FC} \mid FC, \mathbf{x}, DI)]$	Aggregate Marginal Effect
All countries	DI=1	0.3046	0.86%	-0.00256
	DI=0	0.1575	3.29%	
Industrial countries	DI=1	0.2396	0.85%	0.00133
	DI=0	0.0628	1.13%	
Emerging Market	DI=1	0.3376	1.41%	-0.00325
	DI=0	0.2092	3.83%	

The aggregate marginal effect of the change from the implicit to explicit deposit insurance system on the magnitude of output losses is close to zero for all groups of countries. The very small effect suggests that he benefit of deposit insurance in preventing financial panic only cancels out its adverse effect in increasing banks' risk-taking behaviors.

[29] See section 4.3.

The above findings reflect two important issues. First, they help explain the controversial debate about the role of deposit insurance in recent literatures. The findings in part A., section 4.5, support the opponents of the establishment of the explicit deposit insurance system, since it causes financial instability by increasing the likelihood of banking crises. The analysis from the same sample in part B. also provides evidence that supports the proponents of explicit deposit insurance, who believe in its efficiency in preventing financial panic and protecting the payment system. The output costs of financial crises are statistically significantly lower in countries with an explicit deposit insurance system. Based on these findings, policy makers will face the tradeoff between costs and benefits in adopting an explicit system. The policy choice is that if explicit deposit insurance is adopted, a country may experience banking crises frequently, but the cost of each crisis is small. On the other hand, if a country chooses to pursue implicit deposit guarantee, that country should be able to avoid the frequent eruption of crises, but a crisis can be very severe if it occurs. Second, this cost-benefit tradeoff disappears in countries with strong quality of domestic institutions, since the presence of explicit deposit insurance can reduce both the likelihood of banking crises and their severity. A strong institutional environment plays an important role in eliminating financial failures by increasing incentives to monitor banks' operations and reducing banks' risky projects.

While these empirical results point to the cost-benefit tradeoff of deposit insurance, particularly for countries with weak quality of domestic institutions, the analysis is based on a large sample of cross-section time-series data and may not predict each observation in the sample perfectly. Regression diagnostics from the Logit models (table 4.2) reveal the weak prediction of the incidence of crises in Indonesia, Malaysia,

and Thailand during the 1997-98 Asian financial crisis, and in Russia during 1998. The observations of these countries during crises have unusually large Standardized Pearson Residuals, which indicate the big difference between the observed and predicted values of the dependent variable (i.e. the crisis dummy) from the Logit model. Specifically, while a country is defined as having a banking crisis, the model predicts low probability for that country in experiencing a crisis in that period, causing a large residual from the estimation. Alternatively, these regression diagnostics imply that by holding other control variables constant, the system of deposit insurance in Indonesia, Malaysia, Thailand, and Russia performs poorly in predicting the occurrence of crises in these countries[30]. The implicit deposit guarantee system or the government's protection of depositors and creditors of financial institutions is one of the financial instruments pursued in these countries. In the analysis of the causes of the Asian financial crisis, Radelet and Sachs (1999) and Krugman (1998) suggest that banks' excessive risky investments resulting from the moral hazard of implicit guarantee combining with corruption and cronyism in Asia is one major source of the crisis. Similarly, Russia was also suffered from the moral hazard problem, particularly being generated by the IMF and too-big-to-fail policy.

On the other hand, the regression diagnostics of the output loss regressions (table 4.4) show that the models predict the costs of the Asian crisis well, as indicated by the small standard error of the prediction. Krugman (1999b) explains the severity of economic crisis in Asian as the result of a self-fulfilling panic of investors due to the lack

[30] From the regression diagnostics of the Logit model, 7 percent of observations are detected as having large unusual Standardized Pearson Residuals (the standard cutoff point is if it is less or larger than [-2, 2]). These observations include Greece and Norway during 1991-92, Costa Rica during 1994-95, the U.S. during 1985-89, Japan during 1993-94 and 1998-99.

of explicit deposit guarantee. In his analysis on the relationship between the recent world economic recessions and the U.S. economy, he notes that

> "Like so much of what has happened lately, the 1998 financial crisis was a blast from the past. Banking panics -- in which depositors lost confidence in the system, rushed for the exits, and produced a crisis that validated their panic -- were a common occurrence before the 1930s. But in modern economies banks are doubly protected from such panics, both by explicit government insurance of deposits and by the understood willingness of central banks to come to the rescue with as much cash as necessary. So, financial panics were supposed to be an outdated concern.", Krugman (1999b): p. 70.

The predicted absolute output losses from the Tobit model, separated for countries with and without explicit deposit insurance systems are reported in table (4.6). For crises which occurred during 1997-98, countries without explicit deposit insurance (Indonesia, Malaysia, Thailand, and Russia) experienced more severe crises than countries with the explicit system (the Philippines and South Korea). This finding is consistent with Krugman's analysis.

Beyond 0-1 dummy of deposit insurance

The empirical findings on a tradeoff between costs and benefits of deposit insurance have been analyzed based on using a 0-1 dummy, which only distinguishes the effect of an explicit deposit insurance system from implicit deposit guarantee. The use of 0-1 dummy may not take into account the effectiveness of explicit deposit insurance schemes, which are adopted differently across countries. For instance, by focusing on the timing of the payment of insurance claim, Kaufman and Seelig (2000) point out that the Federal Deposit Insurance Corporation (FDIC) of the United States is one of only a few explicit deposit insurance systems that provide full and immediate access to protected and unprotected depositors' claims on the insolvent banks during and after the resolution. The

delay of payment from freezing of deposit accounts can cause depositors' losses in liquidity and subsequently damage the economy.

Proper designs of explicit deposit insurance schemes are discussed in many studies. The limited deposit insurance coverage is particularly emphasized as the most common way to contain moral hazard incentives. In their empirical analysis, Demirgüç-Kunt and Detragiache (2002) and Cull, et al. (2004) show that the generosity of explicit deposit insurance causes bank fragility and slows down financial development[31]. On the other hand, empirical results reported in columns (1)-(3) in table (4.7) demonstrate the magnitude of output costs of crises on average is statistically significantly lower in countries where explicit deposit insurance systems provide higher coverage limits, including the protection of foreign currency and interbank deposits. The evidence of the comprehensive deposit insurance coverage in efficiently stopping depositor and creditor runs is also supported by the negative significance of the moral hazard index and deposit insurance funds-to-total bank assets in the output costs regressions. As discussed by Garcia (2000), an explicit deposit insurance system is in general designed to protect only small depositors, and it may not stop depositor and creditor runs when a systemic banking crisis arises. However, if the deposit insurance coverage is comprehensive, the system will be more efficient in alleviating financial runs. Alternatively, the tradeoff between the cost and benefit of deposit insurance is more apparent when considering the differentiation of coverage limit across countries with explicit deposit insurance schemes.

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[31] The variables of deposit insurance coverage in Demirgüç-Kunt and Detragiache (2002) include unlimited deposit insurance coverage, explicit coverage limit, foreign currency deposit covered, interbank deposits covered, and the moral hazard index. Cull et al. (2004) construct the generosity of deposit insurance index by using principal component analysis based on coverage per depositor, coverage of foreign currency deposits, coverage of interbank deposits, source of funding, the management of deposit insurance system, and whether the system requires co-insurance.

4.7 Policy Implications and Conclusions

The role of deposit insurance has been broadly debated in the literature for whether it stabilizes or destabilizes the stability of the financial system. While a number of publications place emphasis on the moral hazard problems created by deposit insurance, others support its role in preventing financial runs. Only a few studies contribute to the joint consideration of positive and negative effects of deposit insurance. This study uses a cross-sectional time-series analysis for the sample of 49 industrial and emerging market countries during the period of 1975 to 2002 to analyze the relationship between deposit insurance and financial crises. The estimates suggest that although a deposit insurance system may increase the likelihood of financial crises by increasing moral hazard incentives, it also substantially reduces the magnitude of output losses by preventing financial runs once crises occur. The latter impact is found to offset the former.

These findings provide important policy implications. During financial distress, the absence of extensive financial panic is essential for banks and financial institutions to continually function as financial intermediation. Bank runs, when they occur, can lead to large-scale bank failures, and subsequently can cause economic recession. According to the results, an explicit deposit insurance system appears to be an effective financial instrument that can maintain public confidence. Policy makers, however, may face the tradeoff between the short-run benefit and the long-run cost of deposit insurance, since the assurance on depositors' funds could reduce banks' market discipline leading to financial instability in the future. This cost-benefit tradeoff is more likely to exist in countries with weak domestic institutional environments. With prudential financial

regulations and supervisions, the banks' operations will be strictly monitored, and the incentives of banks' risk-taking behaviors induced by the presence of explicit deposit insurance can be contained. Furthermore, empirical results show that the cost-benefit tradeoff is even clear when considering different designs of deposit insurance schemes. The broader the coverage limit of insured deposits, the less output costs of financial crises, but the higher the probability of crises. The comprehensive deposit insurance coverage is more efficient in preventing financial runs, but it also raises the extent of moral hazard incentives.

Recently, financial crises and a high level of capital mobility internationally stimulate a certain number of countries to consider moving from implicit protection to other financial safety net instruments including explicit deposit insurance systems. The results from this study suggest that those countries need to pay particular attention to their institutional conditions such as the effectiveness of legal systems and financial regulations and supervisions. The setup of deposit insurance schemes, therefore, will be effective in both promoting public confidence and contributing to the stability of the financial system. However, we need to note that there are some countries that do not adopt a formal deposit insurance system and successfully avoid the severity of crises (see table 4.5). Studies on the specific characteristics of market and regulatory disciplines for those countries should be further performed.

Table (4.1) Descriptive Statistics

A. Descriptive Statistics from the Logit model

Variable	Obs	Mean	Std.Dev	Min	Max
Banking Crisis Dummy	1596	0.2011	0.4010	0	1
GDP Per Capita[†]	1554	110.4464	115.5832	2.16	468.95
GDP Growth Rate	1552	0.0339	0.0408	-0.15	0.24
M2 to Reserve	1416	13.0876	23.6505	0.00	334.31
Credit Growth $_{t-2}$	1489	-0.0486	0.4177	-3.72	9.17
Inflation	1549	0.3670	2.6051	-0.08	74.82
CA to GDP $_{t-1}$	1445	-1.5977	5.1448	-28.28	31.98
Developing Country Dummy	1596	0.6316	0.4825	0	1
Explicit Deposit Insurance	1596	0.3615	0.4806	0	1
Rule of Law	1539	4.0506	1.6197	0	6
Corruption	1539	3.8872	1.4486	0	6
Bureaucratic Quality	1539	2.7974	1.0530	0	4
Official Supervisory Power	1372	11.6939	2.7281	5	16
Capital Regulatory Index	1372	5.9388	1.5578	3	9

[†]GDP per capita is in thousand dollars

Table (4.1) Descriptive Statistics (Cont.)

B. Descriptive Statistics from the Togit model

Variable	Obs	Mean	Std.Dev	Min	Max
LEVELLOSS	73	0.0492	0.0574	0	0.2189
GROWTHLOSS	73	0.6387	1.4165	0	9.3937
Fiscal Cost	41	0.1353	0.1468	0.005	0.55
Explicit Deposit Insurance	73	0.3699	0.4861	0	1
GDP Per Capita $_{t-1}$	73	7.8186	9.3067	0.2561	39.8647
GDP Growth Rate $_{t-1}$	73	0.0312	0.0429	-0.1250	0.1002
M2 to Reserve $_{t-1}$	73	8.5953	8.3659	0.0010	47.6506
Credit Growth $_{t-2}$	73	-0.0742	0.2660	-0.8820	0.8951
CA to GDP $_{t-1}$	73	-0.0303	0.0398	-0.1058	0.1026
Twin Crisis Dummy	73	0.3973	0.4927	0	1
Systemic Crisis Dummy	73	0.6027	0.4927	0	1
Unlimited Coverage	73	0.0685	0.2543	0	1
Foreign Currency Deposits Covered	73	0.2877	0.4558	0	1
Interbank Deposits Covered	73	0.1370	0.3462	0	1
Coinsurance	73	0.0580	0.2292	0	1
Moral Hazard Index	37	0.9758	2.5478	-2.4907	3.9762
DI Funds-to-Total Bank Assets	31	0.7757	1.0195	0	5

Note: LEVELLOSS = the magnitude of losses in real GDP level and GROWTHLOSS = the magnitude of losses in real GDP growth rate.

Table (4.2) The Probability of Banking Crises and the Explicit Deposit Insurance System
Dependent Variable: Banking Crisis dummy; Estimation Method: Logit Model

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
	All Countries		Industrial Countries		Emerging Market Economies	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Constant	-0.8334*** (0.1450)		-2.5844 (0.6942)		-0.6177*** (0.1714)	
GDP per capita	-0.0036*** (0.0008)	-0.0006*** (0.0001)	0.0010 (0.0021)	0.0001 (0.0003)	-0.0049*** (0.0021)	-0.0009*** (0.0004)
GDP Growth Rate	-11.8589*** (1.8076)	-1.9597*** (0.2924)	-16.5838*** (6.2678)	-2.0344*** (0.7277)	-11.6496*** (1.8739)	-2.1467*** (0.3386)
CA to GDP $_{t-1}$	0.0216 (0.0153)	0.0036 (0.0025)	-0.0575 (0.0404)	-0.0071 (0.0050)	0.0313* (0.0165)	0.0058* (0.0030)
M2 to Reserve	-0.0025 (0.0028)	-0.0004 (0.0005)	-0.0006 (0.0037)	-0.0001 (0.0005)	-0.0061 (0.0049)	-0.0011 (0.0009)
Credit Growth $_{t-2}$	-0.3641 (0.2758)	-0.0602 (0.0455)	-0.8435 (0.7704)	-0.1035 (0.0931)	-0.2801 (0.2637)	-0.0516 (0.0485)
Inflation	0.0527* (0.0301)	0.0087* (0.0050)	1.1881 (1.5616)	0.1458 (0.1901)	0.0499 (0.0290)	0.0092* (0.0054)
Explicit DI	0.8511*** (0.1382)	0.1475*** (0.0248)	1.5483*** (0.3696)	0.1758*** (0.0338)	0.6558*** (0.1772)	0.1287*** (0.0365)
No. of observations	1288		450		838	
% correctly predicted	77.52 %		75.06%		82.67%	
Wald Chi-Square	107.1		29.24		70.90	
Prob > Chi-Square	0.0000		0.0001		0.0000	
Pseudo R2	0.0813		0.0887		0.0812	
Log-Likelihood	-642.7698		-189.1126		-445.1333	

*, **, *** indicate significance level of 10 percent, 5 percent, and 1 percent respectively.
The numbers in parentheses are robust standard errors of estimated coefficients. Subscripts t-1 and t-2 are indicated when the value of variable enters regression with one year and average two years preceding crisis year, respectively.

Table (4.3) The Probability of Banking Crises, the Explicit Deposit Insurance System, and Bank Regulations and Supervisions (Reported Marginal Effects)

Dependent Variable: Crisis dummy, Estimation Method: Logit Model

	(1)	(2)	(3)	(4)	(5)
Real GDP per capita				-0.0005***	-0.0005***
				(0.0001)	(0.0001)
Real GDP growth rate	-1.8452***	-1.8567***	-1.7775***	-1.9260***	-2.0465***
	(0.3063)	(0.3002)	(0.3047)	(0.2935)	(0.2957)
CA to GDP $_{t-1}$	0.0018	0.0007	0.0014	0.0033	0.0043
	(0.0025)	(0.0024)	(0.0025)	(0.0025)	(0.0027)
M2 to Reserve	-0.0009*	-0.0005	-0.0006	-0.0005	-0.0002
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Credit Growth $_{t-2}$	-0.0785	-0.0821*	-0.0898*	-0.0368	-0.0645
	(0.0480)	(0.0482)	(0.0486)	(0.0400)	(0.0490)
Inflation	0.0080	0.0096	0.0091	0.0091*	0.0126**
	(0.0052)	(0.0052)	(0.0058)	(0.0050)	(0.0064)
Explicit DI	0.0291	0.0579	-0.0367	0.0805	-0.2226***
	(0.0613)	(0.0669)	(0.0626)	(0.1006)	(0.0780)
Rule of Law	-0.0454***				
	(0.0095)				
Corrupt		-0.0573***			
		(0.0116)			
Bureaucratic Quality			-0.0796***		
			(0.0146)		
Official Supervision				0.0008	
				(0.0025)	
Bank Regulation					-0.0336***
					(0.0091)
Rule of Law*DI	0.0265*				
	(0.0138)				
Corrupt*DI		0.0197			
		(0.0161)			
Bureaucratic Quality*DI			0.0639***		
			(0.0212)		
Official Supervision*DI				0.0054	
				(0.0085)	
Bank Regulation*DI					0.0601***
					(0.0142)
No. of observations	1254	1254	1254	1265	1212
% correctly predicted	76.79%	76.95%	76.56%	78.26%	78.05%
Wald Chi-Square	93.79	101.69	103.31	103.21	104.86
Prob > Chi-Square	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0740	0.0828	0.0783	0.0770	0.0940
Log-Likelihood	-638.8642	-632.8430	-635.9342	-622.9347	-594.6093

*, **, *** indicate significance level of 10 percent, 5 percent, and 1 percent respectively.
The numbers in parentheses are standard errors of estimated coefficients (robust standard error for OLS estimation). Subscripts t-1 and t-2 are indicated when the value of variable enters regression with one year and average two years preceding crisis year, respectively.

Table (4.4) The Costs of Banking Crises and Explicit Deposit Insurance (All Countries)

	(1a)	(1b)	(2a)	(2b)	(3)	(4)	(5)
Dependent Variable	LEVELLOSS		GROWTHLOSS		LEVELLOSS	GROWTHLOSS	Fiscal Costs
Estimation Method	Tobit	Marginal Effect	Tobit	Marginal Effect	OLS	OLS	OLS
Constant	-0.0052 (0.0217)	-0.0036	-0.9958* (0.5158)	-0.6957*	0.0216 (0.0140)	-0.2896 (0.2879)	-0.0364 (0.0675)
GDP per capita $_{t-1}$	0.0011 (0.0009)	0.0008	0.0188 (0.0206)	0.0131	0.0008 (0.0006)	0.0154 (0.0095)	0.0002 (0.0020)
GDP Growth Rate $_{t-1}$	-0.1157 (0.1890)	-0.0808	15.4897*** (4.4996)	10.8216***	-0.0424 (0.1454)	11.4408*** (4.1831)	0.0109 (0.0782)
CA to GDP $_{t-1}$	-0.2254 (0.2320)	-0.1575	-10.6964* (5.4932)	-7.4728*	-0.2061 (0.1357)	-6.8860** (3.1203)	0.1547 (0.4840)
M2 to Reserve $_{t-1}$	-0.0006 (0.0009)	-0.0004	0.0068 (0.0207)	0.0048	-0.0007 (0.0007)	0.0068 (0.0128)	0.0003 (0.0013)
Credit Growth $_{t-2}$	0.0496 (0.0367)	0.0347	-0.0299 (0.8228)	-0.0209	0.0256 (0.0202)	-0.0110 (0.3723)	-0.0530 (0.1225)
Twin crisis dummy	0.0432*** (0.0163)	0.0302***	0.3248 (0.3647)	0.2269	0.0294** (0.0139)	0.0550 (0.3369)	0.0342 (0.0465)
Systemic Crisis Dummy	0.0534*** (0.0186)	0.0373***	0.6277 (0.4019)	0.4385	0.0365*** (0.0136)	0.4438 (0.3672)	0.1642*** (0.0514)
Explicit Deposit Insurance	-0.0348** (0.0174)	-0.0243**	-0.4332 (0.3961)	-0.3026	-0.0259** (0.0121)	-0.2867 (0.3056)	-0.0231 (0.0544)
No. of crises	73		73		73	73	41
LR Chi-Square (F statistic)†	25.84		24.22		3.14	2.17	1.50
Prob > Chi-Square (Prob > F)	0.0011		0.0021		0.0047	0.0418	0.1955
Pseudo R2 (R-squared)	-0.3216		0.0986		0.2819	0.2132	0.2730
Log-Likelihood (Root MSE)	53.0994		-110.6762		0.0516	1.3327	13.998

*, **, *** indicate significance level of 10%, 5%, and 1% respectively.

The numbers in parentheses are standard errors of estimated coefficients (robust standard error for OLS estimation). Subscripts t-1 and t-2 are indicated when the value of variable enters regression with one year and average two years preceding crisis year, respectively.

† The statistics in parentheses are for the OLS estimations

Table (4.5) The Output Costs of Banking Crises and Explicit Deposit Insurance (divided into developed and developing countries) Dependent Variable: The magnitude of absolute output losses, Estimation Method: Tobit Model

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
	Industrial Countries		Emerging Market Economies		Systemic Crises		Nonsystemic Crises	
Constant	-0.0191 (0.0488)	-0.0117	-0.0104 (0.0280)	-0.0075	0.0248 (0.0329)	0.0197	0.0298 (0.0329)	0.0164
GDP per capita $_{t-1}$	0.0011 (0.0016)	0.0007	0.0050** (0.0024)	0.0036**	0.0019 (0.0013)	0.0015	0.0001 (0.0012)	0.0000
GDP Growth Rate $_{t-1}$	0.0147 (0.4051)	0.0090	-0.2101 (0.2169)	-0.1528	-0.0254 (0.2390)	-0.0202	-0.4371 (0.3580)	-0.2411
CA to GDP $_{t-1}$	-0.0900 (0.4860)	-0.0550	-0.2013 (0.2588)	-0.1464	-0.5495 (0.3758)	-0.4371	-0.1575 (0.2598)	-0.0869
M2 to Reserve $_{t-1}$	-0.0005 (0.0014)	-0.0003	-0.0002 (0.0012)	-0.0001	-0.0009 (0.0011)	-0.0007	-0.0007 (0.0017)	-0.0004
Credit Growth $_{t-2}$	0.0557 (0.0825)	0.0340	0.0572 (0.0410)	0.0416	0.0224 (0.0550)	0.0178	0.0508 (0.0474)	0.0280
Twin crisis dummy	0.0033 (0.0487)	0.0020	0.0446** (0.0190)	0.0325**	0.0345 (0.0215)	0.0274	0.0548** (0.0241)	0.0302**
Systemic Crisis Dummy	0.0613 (0.0477)	0.0375	0.0476** (0.0232)	0.0346**				
Explicit Deposit Insurance	-0.0046 (0.0194)	-0.0028	-0.0333$^{15\%}$ (0.0218)	-0.0242$^{15\%}$	-0.0169 (0.0242)	-0.0134	-0.0577** (0.0242)	-0.0318**
No. of crises	18		55		44		29	
LR Chi-Square	13.97		18.46		9.47		11.36	
Prob > Chi-Square	0.0824		0.0180		0.2207		0.1236	
Pseudo R2	-0.6280		-0.2922		-0.1433		-0.4470	
Log-Likelihood	18.1141		40.8112		37.7817		18.3878	

*, **, *** indicate significance level of 10%, 5%, and 1% respectively.
The numbers in parentheses are standard errors of estimated coefficients (robust standard error for OLS estimation). Subscripts t-1 and t-2 are indicated when the value of variable enters regression with one year and average two years preceding crisis year, respectively.

Table (4.6) Predicted Absolute Output Losses for Countries With and Without the Explicit Deposit Insurance System

Countries with the Explicit Deposit Insurance System			**Countries without the Explicit Deposit Insurance System**					
Country	Banking Crisis	Estimated Output Loss (%GDP)	Country	Banking Crisis	Estimated Output Loss (%GDP)	Country	Banking Crisis	Estimated Output Loss (%GDP)
Argentina	1980	2.14 (7.99)	Australia	1989	3.53 (0)	Jamaica	1994	5.74 (5.83)
Argentina	1995	4.25 (9.94)	Botswana	1994	1.25 (2.12)	Jordan	1989	6.10 (15.57)
Argentina	2001	4.42 (14.9)	Brazil	1990	5.56 (4.96)	Malaysia	1985	5.10 (2.49)
Canada	1983	3.84 (0.3)	Brazil	1994	2.56 (0)	Malaysia	1997	10.09 (9.56)
Finland	1991	10.01 (14.10)	Chile	1976	4.95 (8.27)	Mexico	1981	9.03 (12.92)
Germany	1978	1.66 (0)	Chile	1981	6.00 (18.61)	Peru	1983	5.94 (9.86)
Iceland	1985	1.28 (0)	Colombia	1982	6.34 (3.53)	Portugal	1986	1.55 (0)
Iceland	1993	2.19 (0.42)	Costa Rica	1987	4.73 (0)	Russia	1995	4.12 (0)
India	1993	1.57 (0)	Costa Rica	1994	2.41 (0)	Russia	1998	8.70 (0)
Italy	1990	1.17 (3.64)	Denmark	1987	5.34 (5.42)	Senegal	1988	5.04 (1.13)
Japan	1991	3.64 (5.95)	Ecuador	1980	6.37 (5.24)	Singapore	1982	4.51 (0)
Kenya	1985	2.72 (0)	Ecuador	1996	6.09 (0)	South Africa	1977	2.44 (2.21)
Kenya	1992	2.80 (6.83)	Egypt	1980	10.94 (0.76)	South Africa	1989	1.77 (4.56)
Kenya	1996	2.68 (0)	Egypt	1991	2.20 (1.07)	Sweden	1991	12.44 (5.17)
Korea	1997	7.17 (5.97)	France	1994	2.86 (0.27)	Thailand	1983	4.93 (0)
Mexico	1994	7.51 (4.00)	Ghana	1982	10.25 (10.26)	Thailand	1997	10.72 (20.15)
Nigeria	1993	4.00 (5.81)	Ghana	1997	1.89 (0)	Turkey	1982	3.24 (0)
Nigeria	1997	0.73 (0)	Greece	1991	2.62 (0)	U.K.	1974	2.52 (5.00)
Norway	1987	10.49 (4.45)	Hong Kong	1998	7.26 (7.50)	Uruguay	1981	9.67 (21.89)
Philippines	1981	6.93 (1.21)	Hungary	1991	8.44 (12.33)	Uruguay	2002	6.43 (10.26)
Philippines	1998	7.54 (2.36)	Indonesia	1994	1.89 (0.04)	Venezuela	1978	3.28 (14.08)
Spain	1977	6.95 (5.27)	Indonesia	1997	8.85 (17.25)	Venezuela	1994	9.36 (5.86)
Sri Lanka	1989	3.44 (0.40)	Israel	1977	6.96 (16.80)	Zimbabwe	1995	5.81 (0)
Turkey	1994	1.83 (4.32)						
Turkey	2000	5.79 (4.21)						
U.K.	1984	0.89 (0)						
U.S.	1984	1.30 (0)						
All		4.03				All		5.60
Developed Countries		3.95				Developed Countries		4.41
Developing Countries		4.09				Developing Countries		5.82

The number is parenthesis is the magnitude of absolute output losses calculated based on the methodology described in section (4.3)

Table (4.7) The Costs of Banking Crises and Various Explicit Deposit Insurance Schemes
Dependent Variable: The magnitude of absolute output losses, Estimation Method: Tobit Model

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-0.0164	-0.0063	0.0027	-0.0080	-0.0151	-0.0521
	(0.0221)	(0.0220)	(0.0219)	(0.0221)	(0.0401)	(0.0398)
GDP per capita $_{t-1}$	0.0007	0.0009	0.0001	0.0010	0.0016	0.0003
	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0016)	(0.0010)
GDP Growth Rate $_{t-1}$	-0.1121	-0.1265	-0.1698	-0.1444	-0.1541	-0.7386**
	(0.1961)	(0.1915)	(0.1886)	(0.1948)	(0.2415)	(0.3364)
CA to GDP $_{t-1}$	-0.3334	-0.3194	-0.1566	-0.3414	-0.2020	-1.0692*
	(0.2317)	(0.2272)	(0.2340)	(0.2306)	(0.2847)	(0.5655)
M2 to Reserve $_{t-1}$	-0.0004	-0.0007	-0.0004	-0.0007	-0.0001	0.0014
	(0.0010)	(0.0009)	(0.0009)	(0.0010)	(0.0017)	(0.0015)
Credit Growth $_{t-2}$	0.0363	0.0452	0.0713*	0.0342	-0.0002	0.0360
	(0.0371)	(0.0368)	(0.0386)	(0.0368)	(0.0596)	(0.0474)
Twin Crisis Dummy	0.0417**	0.0413**	0.0456***	0.0372	0.0232	0.0218
	(0.0171)	(0.0164)	(0.0162)	(0.0166)	(0.0251)	(0.0214)
Systemic Crisis Dummy	0.0483**	0.0492***	0.0518***	0.0415**	0.0832***	0.0982***
	(0.0189)	(0.0185)	(0.0182)	(0.0190)	(0.0259)	(0.0298)
Unlimited Coverage	-0.0105					
	(0.0316)					
Foreign Currency Deposits Covered		-0.0307*				
		(0.0182)				
Interbank Deposits Covered			-0.0663**			
			(0.1886)			
Coinsurance				-0.0722 [15%]		
				(0.0497)		
Moral Hazard Index					-0.0097**	
					(0.0046)	
DI Funds-to-Total Bank Assets						-0.0238**
						(0.0117)
No. of crises	73	73	73	73	37	31
LR Chi-Square	22.03	24.76	28.26	24.28	20.24	19.38
Prob > Chi-Square	0.0049	0.0017	0.0004	0.0021	0.0095	0.0129
Pseudo R2	-0.2742	-0.3081	-0.3517	-3.022	-0.4249	-0.5155
Log-Likelihood	51.1932	52.5571	54.3091	52.3181	33.9298	28.4959

*, **, *** indicate significance level of 10 percent, 5 percent, and 1 percent respectively.

Table Appendix (A4.1) Empirical Studies on Deposit Insurance (DI) and Banking Crises

Authors	Primary Focus	The significance of DI as independent variable (IV)	Finding Details	Sample
1. Deposit Insurance and Probability of Crises [the dependent variable is *banking crisis dummy* and methodology is *a Logit/probit model*]				
Demirgüç-Kunt and Detragiache (2002)	Test the impact of the explicit DI system and DI designs on the probability of banking crises	Significant IV - the explicit DI dummy and various DI designs (+) - the interaction terms between DI variables and institutional quality (−)	1.) The explicit DI increases the probability of banking crises. The adverse impact is stronger if the system has extensive coverage, funded by members of financial institutions, and when it is run by government rather than private sector 2) With strong institutional environment (better role of law, corruption, and bureaucracy), the DI system reduces the probability of banking crises (tested by the interaction terms between the DI and institutional variable)	40 crisis episodes in 61 developed and developing countries, 1980-1997
Eichengreen and Arteta (2000)	Test the robustness of the determinants of banking crises when using different sources of banking crisis dates and different sample coverage	Significant IV - the explicit DI dummy (−) [but the significance is not robust]	1) Financial factors (including lending boom and large bank liabilities relative to reserves) and financial liberalization (proxied by deposit rate control) are robust as the determinants of banking crises regardless of sample coverage and the dating of banking crises 2) The lack of robustness is found for exchange rate regimes, deposit insurance, and institutional variables.	72 banking crisis episodes in 122 developing countries
Barth, Caprio, and Levine (2004)	Test the relationship between bank regulation and supervision and banking crises	Significant IV - moral hazard index (+) - interaction terms between moral hazard index and rule of law/political openness (−) Insignificant IV - interaction terms between moral hazard index and capital regulatory/official supervisory power index	1) The generosity of DI or the moral hazard index (measured from the principles of component analysis of various poor designs of DI schemes; the data is from Demirgüç-Kunt and Detragiache, 2002) significantly increase the probability of banking crises. 2) With the strong rule of law and political openness, the DI system reduces the probability of banking crises (tested by the interaction terms between the moral hazard index and the rule of law and political openness). Capital regulatory and official supervision powers are not significant either included independently or interactively.	107 countries. The date is averaged over 1997-99 period, cross-sectional analysis

Authors	Primary Focus	The significance of DI as independent variable (IV)	Finding Details	Sample
Rossi (1999)	Test the determinants of banking (and currency) crises with the focus on the impact of capital account liberalization, deposit safety nets, prudential regulation and supervision	Significant IV - the deposit safety nets (measured by combining the date of deposit insurance and lender-of-last-resort) (+)	Prudential regulations significantly decrease the probability of crises, while capital controls on capital outflows and deposit safety nets increase the probability of crises, however the results of deposit safety nets are not robust across specification	15 Developing countries, 1990-1997
2. Deposit Insurance and the Costs of Crises [Dependent variable (DI) is *fiscal costs or output costs*] and the common methodology is OLS]				
Demirgüç-Kunt and Detragiache (1997)	Test the impact of various macroeconomic variables on the probability and fiscal costs of crises	Significant IV - the explicit DI dummy (+)	**Low economic growth, poor quality of law and order, high real interest rate, high inflation, and high ratio of M2 to reserve significantly increase the probability of banking crises**	29 crises in 29 developed and developing countries, 1980-1994
Hutchison and McDill (1998)	Test the determinants of the probability and output cost associated with banking crises.	Significant IV - the explicit DI dummy (−)	- The factors including financial liberalization, explicit deposit insurance, central bank independence, expansionary credit growth, real GDP growth and an asset price bubble are significant in determining banking crises both for cross-section analysis and the prediction of Japanese banking crisis experience. - The output cost of banking crises is smaller with the existence of the explicit deposit insurance, the more quickly banking sector problems are resolved, and when exchange rate stability is maintained.	65 episodes of banking crises in 98 countries, 1975-1997
Hoggarth, et al. (2005)	Test the impact of the design of safety nets on the probability and the costs of crisis resolution	Significant IV (the prob. Of crisis regressions) - the unlimited deposit insurance (+) - explicit deposit insurance	- For the probability of crises regressions, countries with unlimited deposit insurance schemes (including both implicit and explicit systems) are more likely to experience a banking crisis, whereas a crisis is less likely in countries with explicit, but limited schemes.	29 developed and developing countries, 1994-2001

Authors	Primary Focus	The significance of DI as independent variable (IV)	Finding Details	Sample
(continue)		with limited coverage (-)	- For the fiscal and output costs of crises regressions, deposit insurance variables are not significant. However the signs of estimates show that explicit and limited deposit insurance schemes lead to the higher output costs, but the lower fiscal costs of crises.	
3. Unlimited Deposit Guarantee and the Costs of Crises [Dependent variable (DI) is *fiscal costs or output costs*]				
Hohohan and Klingebiel (2003)	Test the impact of crisis resolution policies on the fiscal and output costs of crises	Unlimited deposit guarantee is significant in fiscal costs regressions (−) but insignificant in output costs regressions.	1) Unlimited liquidity support, unlimited deposit guarantees, and regulator forbearance significantly increases the fiscal costs 2) Only unlimited liquidity support significantly increase the output costs of crises	40 crisis episodes in 33 developed and developing countries, 1980-2002
Claessens, et al. (2004)	Test the impact of crisis resolution policies and the quality of domestic institutions on the fiscal and output costs of crises	Unlimited deposit guarantee is significant in both fiscal costs and output costs regression (−)	Unlimited liquidity support, unlimited deposit guarantees, regulator forbearance, poor institutional quality (high corruption, lower law and order, weak bureaucratic quality, and less efficient judicial system) significantly increases both fiscal and output costs of banking crises	35 crisis episodes, 1980-2002
Bordo, et al. (2001)	Test the determinants of output costs of banking (and currency crises)		The unlimited liquidity support and pegged exchange rate regime increase the output costs of banking crises. Other policies such as capital support and unlimited guarantee are not found to significantly determine to output costs of crises.	56 developed and developing countries, 1973-1998

Authors	Primary Focus	The significance of DI as independent variable (IV)	Finding Details	Sample
4. Deposit Insurance and Financial Development				
Cull, et al. (2002)	Test the impact of the DI system and financial factors on short-run financial development	Significant IV - the explicit DI dummy (−) - the interaction term between the explicit DI dummy and financial instability (−) -the interaction between the explicit DI dummy and the rule of law (+)	1) The explicit deposit insurance is negatively associated with change in financial depth (measured by the average change of M2/GDP in 3 years after the explicit DI system is adopted). That is, countries will experience less growth in M2/GDP in the 3 years after adopting the explicit DI system. 2) The significantly negative interaction term between explicit DI dummy and financial instability (measured from the standard deviation of M2/GDP or the coefficient of variation) indicating that the adoption of the DI in instable financial environment may send a bad signal to the banking sector. 3) The significantly positive interaction term between DI and rule of law indicating that in a country with high level of rule of law, depositors will have higher credibility on explicit scheme and risk-taking by management can be limited.	1980-1995, 43 developed and developing countries
Cull, et al. (2003)	Examine the impact of the features and bank regulation/supervision on long-run financial development	Financial Volatility Significant IV -the generosity of DI (+) - the interaction terms between the generosity of DI and law/official supervisory power (−) Growth of Fin Development Significant IV -the generosity of DI (−) - the interaction terms between the generosity of DI and supervisory discretion/independence (+) Insignificant IV - the interaction terms between the generosity of DI and rule of law/supervisory power	In financial volatility regressions, - the generosity of DI (the principal component indices of coverage per deposit, coverage on foreign currency, etc) increase financial sector volatility but high quality of rule of law and official supervisory powers can mitigate the negative impact of deposit insurance on banking fragility In the growth rates of financial development regressions, - the generosity of DI decreases long-run financial development. High quality of supervisory powers and rule of law do not mitigate this effect. However, the significance of the interaction terms between the generosity of DI and supervisory discretion/independence indicate that some types of supervision may act as an adequate substitute for monitoring of banks by depositors.	119 countries (37 countries with explicit DI and 82 countries included as control countries), 1960-2001 (cross-section analysis, for countries with the explicit DI, the data is averaged over all years after each country's adoption of an explicit DI system)

CHAPTER FIVE

The Political Economy of Banking Crises in Emerging Economies: The Veto Player Framework

5.1 Introduction

Recent financial crises of the late 1990's evoked arguments and discussions concerning the consequences of crisis-mismanagement policies. Policies implemented by the government such as the provision of unlimited liquidity support and a blanket deposit guarantee to ailing financial institutions (Bordo et al, 2001 and Honohan and Klingebiel, 2003), or even pre-crisis economic conditions such as private capital inflows (Gupta et al, 2003) or corporate leverage level (Stone, 2000), have been empirically demonstrated to be associated with the increased costs of banking crises as measured in terms of the magnitude of output losses. However, far less attention has been given to the roles of domestic political institutions which directly influence a government's ability to implement these policy responses. Theoretically, the cross-national differentiation in political structures, particularly the political decision making processes and the number of political decision makers who control policy outcomes, should be expected to influence the severity of crises, and this relationship needs to be further studied.

The possible impact of different characteristics of the political structure on the extent of severity of financial crises can be analyzed using MacIntyre's (2001) applied veto player framework. In times of financial crises, the political institutions characterized by the number of veto players, i.e. policy decision makers who must agree to make a change, can determine policy credibility and policy flexibility, which significantly determine investors' confidence and economic reform in the aftermath of crises. If the

commitment of the government to its policy is credible, it should stop the spread of financial panic and reduce uncertainty about the future investment environment[1]. However, the benefits from increasing the extent of credibility are traded off against the losses of policy flexibility in responding promptly to exogenous shocks and allowing for the adjustment if any policy mistakes occur. In the political literature, the credibility and stability of a government's policy are underpinned by checks and balances or multiple veto players, since for political structure with many veto powers it may be difficulty in reaching a collective decision to implement or change policies due to the disagreement among these veto authorities (North and Weingast 1989; Tsebelis 2002).

MacIntyre (2001) proposes that during financial crises, countries with an intermediate level of concentration of veto authorities are more likely to be associated with a satisfactory investment environment according to benefits from both policy stability and policy flexibility[2]. For countries with a wide dispersal of veto authorities, the increasing extent of stability of implemented policies can also lead to the vulnerability of policy rigidity. On the other hand, the absence of veto players that create policy flexibility can also lead to the risk of policy volatility. Policy rigidity and policy volatility are two policies which cause investors to panic and hinder productive economic decisions. From this analysis, the degree of centralization of veto authority should have a U-shaped relationship with policy risks that affect investors' confidence. MacIntyre

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[1] During the Asian financial crises, the unlimited liquidity support and deposit guarantee policies cannot stop bank runs in most Asian crisis-hit countries due to incredibility of government in following financial reform plans that had publicly announced (see Lindgren et al 1999, pp. 18-21).

[2] MacIntyre (2001) applies Tsebelis (2002)'s veto player theory. In Tsebelis's model, the dependent variable of policy stability has linearly positive relationship with the number of veto players and their ideology distances. In MacIntyre's applied model, which focuses on policy risk as dependent variables, the relationship is examined to be U-shaped. Later in this chapter, the phase of "the number of veto players and their ideology distances" sometimes is shortened to "the number of veto players".

applies his theory to qualitative case studies of several of the Asian crisis countries, and found it consistent with the behaviors of the governments in those countries. This study makes use of the recent development of quantitative proxies for the number of veto players, and uses MacIntyre's applied veto player framework to investigate the relationship between the number of veto players and the magnitude of output losses associated with banking crises.

The evidence presented in this study covers 45 banking crisis episodes in 27 emerging market economies over the period of 1980 to 1999. It provides support for the U-shaped connection between the number of policy decision makers and the extent of the severity of crises. On average, a country with a relatively large numbers of veto players suffers from large output losses associated with a banking crisis due to delays in a government's response to financial sector problems. The difficulty in reaching a consensus to implement or change policies, such as which financial institutions need to be restructured and which institutions need to be closed due to insolvency, will prolong unresolved financial problems and intensify financial panic. Consequently, the real economy will be affected by output losses, which occur through the disruption in the payment systems or credit constraints on the private sector. The size of output losses can be magnified by the credit chain where the cutback of bank credit supply deteriorates non-bank firms' financial positions, and consequently firms' inability to repay debts exacerbates banks' illiquidity problem[3]. For a country with relatively few veto players, the policy responses are vulnerable to volatility since any policy reversal cannot be vetoed by other parties and according to Keefer (2001), the likelihood of policy reversal

[3] For the studies of credit cycles, see Kiyotaki and Moore (1997).

occurs during financial crises due to the influence of special interests on policy decision-makers. This volatility of policy responses can destroy public confidence in the times of crises and subsequently can increase the magnitude of output losses.

In addition, the test of a linear relationship between the veto players and the magnitude of output losses associated with crises is also performed in this study. Recent studies on the relationship between the veto players and long-run economic performances find that the higher the number of veto players, the higher the level of private investment (Stasavage, 2002) and long-run economic growth (Henisz, 2000). This is because the government with checks and balances will produce credible policies, which subsequently attract capital investment and economic growth. The linear relationship between the veto players and long-run economic performance can be established with the plausible assumption that in the long-run the benefits from policy credibility outweigh those of policy flexibility. However, for the magnitude of output costs of financial crises, which reflects the short-run adjustment of output, the empirical results in this chapter do not find evidence of a linear relationship with the number of veto players. In times of financial crises, a government with high levels of checks and balances may face the difficulty to reach an agreement in implementing or changing policy responses. The increasing costs of delay will magnify the severity of crises. This tradeoff between the ability of political actors to implement policy change (policy decisiveness) and to commit on a given policy (policy resoluteness) needs be considered for the choice of institutional arrangements (Cox and McCubbins, 2001), particularly during the vulnerable periods of domestic and international financial system.

The organization of chapter is as follows: the next section discusses the theory of veto players and its linkage with the magnitude of output losses associated with banking crises. Section 5.3 identifies model specification, the methodologies to measure the magnitude of output losses, and the data sources. The empirical results and sensitivity analysis are reported in section 5.4 and the conclusion is in the last section.

5.2 Political Institutions of Veto Players and the Real Economy

George Tsebelis (2002) defines a veto player as an individual or collective actor whose agreement is required for a change of status quo policy. In the theoretical analysis of the connections between veto players and policy stability, he illustrates that policy stability, i.e. the absence of significant changes of policy outcomes from the status quo, can be expected in a political system with multiple veto players and big ideological distances among them. The addition of a new veto player will increase the extent of policy stability by increasing the difficulty of an agreement among a certain number of policy decision-makers who have the power to veto a proposed change in policy. However, an additional veto player may not affect policy stability if the ideological and policy preferences of a new veto player are similar to the preferences of other existing veto players.

The theory of veto players is useful in analyzing the impact of different political structures on the stability of government policies since it analyzes different political characteristics of regime type, legislatures and/or party system through the identification of one variable, i.e. the political actor or veto player. For instance, the executive and chambers of a legislature in a presidential system or members of the coalition in

parliamentary system are counted as veto players who need to agree for any policy changes after taking into account the ideology of policy preferences among these players.

In recent literature, political institutions with checks and balances have been emphasized as playing necessary roles in improving economic performance. North and Weingast (1989) illustrate this connection from the evolution of checks and balances according to the constitutional arrangements of England in the 17th century. During that period, the creation of veto players was designed to exert control over the Crown's power to expropriate the property rights of private parties. By allowing the wealth holders' representatives in parliament with the rights to veto a major change in policies if there was a conflict of interests, the security of their property rights was then established. A politically independent judiciary together played a central role in assuring that governments commit to their agreements and thereby constrained their misuse of political power. These roles of veto players increased the credibility of government's commitment, which provided an incentive for long term capital investments, productive activity, and long-run economic growth.

Henisz (2000), Stasavage (2002) and Gariva et al (2000) provide empirical support for a positive relationship between the number of veto players and the level of real economic activities. Henisz (2000) studies the determinants of long-run economic growth by focusing on the role of political institutions that provide credibility commitment and the protection of private property rights. He constructs the index of political constraints to proxy for the extent of government's credible commitment[4]. These

[4] Henisz notes that the political constraint index should overcome the limitations of the variables of Law and Order, Corruption, and Bureaucracy compiled by International Country Risk Guide (ICRG), which are widely used in recent empirical research to proxy for institutional quality. ICRG's institutional variables

political constraint indices are closely related to the veto players concept since they take into account the number of independent veto points over policy outcomes and the distribution of these actors' policy preferences. By including the political constraint index in Barro's (1996) cross-sectional regression of long-run economic growth, Henisz finds that higher political constraints are significantly associated with higher long-run economic growth.

Stasavage (2002) and Gariva et al (2000) employ Henisz's political constraint index to proxy for checks and balances. By focusing on private investment, Stasavage (2002) finds that checks and balances, which establish the credibility of government's commitment, has a positively linear relationship with the level of private investment but has a negative linear relationship with the conditional variance of private investment[5]. These results indicate that on average a country with higher checks and balances will have a higher level of private investment, but it is not a necessary condition. In a country with the absence of checks and balances, the large conditional variance of private investment suggests the possibility of high levels of private investment since policy credibility may be established through other mechanisms. Gariva et al (2000) employ Henisz's political constraint index to test Rodrik's (1999) model, which studies the effect of political institutions and conflict management, mainly proxied by ICRG's variables, on the collapse of economic growth after the economic shocks of the mid-1970s. Their results show that the averaged political constraint index in 1970-75 has a significant

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may be subjected to endogeneity problem in regression analysis since these variables are subjectively measured and rated on the basis of private investment's decisions (see Henisz, 2000, pp. 2-5).

[5] Stasavage (2002) also tests non-linear impact of checks and balances by entering log(checks), which checks is the variable from the Database of Political Institution (DPI), into private investment regression. The positive significance of log(checks) indicates that higher checks lead to higher private investment but at the diminishing rate.

positive impact on the changes in growth rate, i.e. a country with higher political constraints will experience higher averaged growth rate in 1975-89 compared to the growth rate in 1960-75.

These findings of a positive linear relationship between political constraints and economic performances are established based on two assumptions. First, policy stability and credible commitment create certainty and the security of private property rights in investment environments, which attract higher capital investment and lead to long-run economic growth. Second, the gains from policy credibility outweigh the losses of policy flexibility. These two assumptions presume that the status quo policy is optimal so that policy change is not preferable. However, as mentioned in Henisz (2000), if policy stability locks-in a bad status quo policy, the increase in political constraint might not provide net gains to a country's economy and policy flexibility will become more desirable. Falaschetti (2003) shows that, if these assumptions are relaxed, a higher level of political constraints will not necessarily lead to higher levels of investment. In his study of 56 countries during the period of 1976-to-92, the estimates of a veto player variable, in the cubic functional form of total investment regression, are statistically significant, indicating that political constraints have a nonmonotonic relationship with investment. This result is robust regardless of whether a veto player variable is proxied by the political constraint index or checks variable from the database of political institutions (DPI). That is, in marginal terms, additional veto points will have a positive marginal effect on investment only in a country with an intermediate level of veto powers. This relationship becomes negative at the high and low level of political

constraints since a government's policy-making process can be disrupted by a marginal loss of responsiveness and a marginal loss of credibility, respectively[6].

A Veto Player Framework of Banking Crises

In the study of the determinants of long-run economic activity, policy stability (presumably that the status quo policy is optimal) is widely recognized as an important requirement for capital investment environment and long-run economic growth, and the gains from policy flexibility may be negligible. Unlike the study of long-run economy, in the study of policy response to financial crises, policy adaptability may be as important as policy stability, given that the duration of crises in emerging economies is on average around two or three years (see IMF 1998, Bordo et al 2001, and Mulder and Rocha 2001). As MacIntyre (2001) argues, "if the policy status quo were perfectly optimal, rigidity would be desirable–but almost by definition this is not the case when crisis strikes" (p. 84). According to MacIntyre (2001), the lack of policy credibility, or policy volatility, will destroy investors' confidence while the lack of policy flexibility, or policy rigidity, can delay policy adjustments for economic reform or if any policy mistakes occur. Policy volatility and policy rigidity are two policy syndromes that are determined by political structures that have too much centralization or too much dispersal of veto authority[7]. The relationship between the extent of concentration of veto authority and

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[6] According to Falaschetti's results, intermediate values of veto players when proxied by a political constraint index is between 0.2 and 0.6 (out of a 0-0.8 scale), and those when proxied by checks variable from DPI is between 4 and 12 (out of a 1-14 scale). The undesirably high and low level of veto powers are values outsides these ranges.

[7] The motive of government's delayed or oscillated policy response is plausibly influenced by special interests as examined by Keefer (2001). During financial sector weaknesses, the regulatory failures and financial authorities' imperfect information in distinguishing between illiquid but solvent and insolvent financial institutions could raise special interests' benefits from large fiscal transfers and banks' bailouts. Keefer performs empirical test by using 40 banking crises from 35 countries and finds that additional veto players can reduce the magnitude of fiscal transfers since the influence of special interests can be reduced

policy risks for investors, therefore, is suggested to be U-shaped rather than linear. This reflects that while adding one more veto player can reduce the risk of policy volatility, there is an inflexion point (minimum point of U-shaped curve) that an additional veto player becomes undesirable by only increasing the likelihood of policy rigidity.

Thailand and Indonesia are MacIntyre's polar cases when considering the policy responses–policy rigidity and policy volatility–of four Southeast Asian crisis-hit countries (Indonesia, Malaysia, the Philippines, and Thailand) in 1997. Thailand had a parliamentary system with the coalition government that is formed by factionalized parties (Hicken, 2004). Since each party is typically involved in the legislative process; therefore, all parties in the coalition government are effective veto players, which their votes are needed to sustain a majority. In 1997, the Thai government had six coalition parties. The possibility that any factions of each party could vote against government's proposed proposal led to policy rigidity according to the lack of government's ability brings about timely policy adjustment. This was likely to occur during economic and financial distress due to rent-seeking or pork-barrel opportunities[8]. While the severity of financial crises in Thailand was due to the delay of policy responses, the Indonesian financial crisis was exacerbated by the lack of credibility in the government's commitment to implemented policies. The dictatorship of Indonesia indicated one veto authority who had control over the policy process and any change in policy could not be

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due to the difficulty for multiple veto players with divergent preferences to agree on policy change for special interests to receive benefits. However, this effect is conditioned on special interests' costs from failures in financial institutions (measured from M2/GDP). If these costs are high, an increase in checks and balance can instead increase fiscal transfers.

[8] For instance, the rehabilitation criteria (by raising the capital) to resolve financial problem in ten of weakest financial companies at the beginning of 1997 was relaxed since "several senior members of government had interests in some of the 10 targeted institutions and used their leverage within the coalition to veto the actual implementation of the tough measures" (MacIntyre 2001, p. 98).

vetoed[9]. While MacIntyre applies his theory only to case studies of a few Asian countries we can use the recently developed quantitative measures of veto players to test the theory on a much large sample.

5.3 Model Specification and Data

The Tobit estimation using maximum likelihood methodology is employed to test the hypothesis that the impact of the numbers of veto players on the magnitude of output losses associated with banking crises is U-shaped. Since the dependent variable, the magnitude of output losses, is assigned a value of zero for those countries that the occurrence of banking crises is not accompanied by output contraction, Tobit regression is an appropriate estimation technique for these censored samples.

The model can be defined as

$$y^*_{i,t} = \alpha + \beta_k x_{i,t-1} + \sigma_1 Checks_{i,t} + \sigma_2 (Checks_{i,t})^2 + \varepsilon_{i,t}$$

$$y_{i,t} = y^*_{i,t} \qquad \text{if} \quad y^*_{i,t} > 0$$

$$y_{i,t} = 0 \qquad \text{if} \quad y^*_{i,t} \le 0 \qquad (1)$$

The dependent variable $y_{i,t}$ is the total observed magnitude of output losses associated with a crisis *i* in year *t* and $y^*_{i,t}$ is the latent dependent variable. The magnitude of output losses is calculated from both real GDP level (LEVELLOSS) and real GDP growth rate (GROWTHLOSS). For each observation, $y_{i,t}$ takes a specific magnitude or a

[9] The prompt decisiveness of closing 16 banks and other Suharto's related-businesses in Indonesia once financial sector problems appeared demonstrated the capability of centralization of government in implementing flexible policy response in the early stage of crises. However, within a short period after these closures, the news and rumors of the revisions of government decisions to bail out some corporate and banks, which later appeared to be well-connected to Suharto's relatives started to destroy public confidence.

value of zero, where zero corresponds to no economic contraction associated with the occurrence of banking crises[10].

To test for the U-shaped relationship hypothesis, the proxies for the number of veto players, or checks and balances in the crisis year (at period *t*), are entered output losses regressions in quadratic functional form. If there is evidence supporting the hypothesis of the U-shaped relationship, then the estimated coefficient of squared term (σ_2) should be positive and significant while the estimated coefficient of linear term (σ_1) should be negative and significant. According to the Tobit estimation, σ_1 and σ_2 are consistent and efficient estimates of the effects of checks on the latent dependent variable $y^*_{i,t}$.

For control variables, **X** is a *k*-element vector of economic and financial variables that have been frequently used in the literature, which includes real GDP per capita, real GDP growth rate, current account to GDP, the ratio of money supply to reserves, the ratio of private credit growth to GDP and twin crisis dummy. These control variables are entered into the output losses regressions with lags in order to avoid the endogeneity problem, or the feedback effects from the magnitude of output losses during crisis years to other economic and financial variables[11]. GDP per capita is included to control for the level of development. GDP growth rate and current account to GDP control for pre-crisis

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[10] When the dependent variable is censored, performing the OLS methodology yields biased and inconsistent parameter estimates while Tobit estimation produces consistent and asymptotically efficient parameter estimates. However, with the small proportion of zero values of the dependent variable such as when the magnitude of output losses is measured by GROWTHLOSS (see 'Output Costs of Banking Crises' under data section), both estimation techniques, OLS and Tobit regressions, yield similar values of estimated coefficients. The empirical tests in table (5.2) and (5.3) also report the estimated coefficients of OLS model. See Greene (1997) and Long (1997) for more discussions on Tobit estimation.

[11] The ratio of current account to GDP and the ratio of private credit growth to GDP are entered the regressions with averaged two-year pre-crisis periods while real GDP per capita, real GDP growth rate, and money supply to reserve are entered the regressions with one lag of the crisis year.

economic condition and government macroeconomic policy. The ratio of M2 to reserves and the rate of private credit growth control for the size of financial sector, and twin dummy is included with the value of one if there is currency crisis within two year before or after each banking crisis episode and zero otherwise.

Data

Dates of Banking Crises

Data on the episodes of banking crises are from Caprio and Klingebiel (2003). The information on bank insolvency is compiled from published financial sources and interviews with experts. Banking crises include both systemic and nonsystemic (i.e. smaller or borderline) events. The systemic banking crisis is defined when much or all of bank capital is exhausted, and the nonsystemic banking crisis is defined if there is evidence of significant banking problems. Based on the data of banking crisis episodes in emerging market economies and all available data for independent variables, the sample comprises 45 banking crisis episodes in 27 emerging market countries[12] during the period of 1980-to-1999.

Output Costs of Banking Crises

The magnitude of output loss associated with a banking crisis is estimated by annually summing up the difference between the actual output and the estimated potential output from a crisis year until a year that actual real GDP returns to its potential output trend. A banking crisis is identified as being accompanied by output loss if the actual output downwardly deviates from its potential trend within a crisis year or one year after

[12] Argentina, Bangladesh, Brazil, Chile, Colombia, Costa Rica, Ecuador, Egypt, Ghana, Hungary, Indonesia, Jordan, Kenya, S. Korea, Malaysia, Mexico, Nigeria, Paraguay, the Philippines, Russia, Singapore, Sri Lanka, South Africa, Thailand, Turkey, Venezuela, and Zimbabwe.

crisis year[13]. Since there is no consensus on techniques in calculating output losses (see Hoggarth et al, 2002; Mulder and Rocha, 2001; Angkinand and Hiro, 2004), both real GDP growth rate (GROWTHLOSS) and real GDP level (LEVELLOSS) are employed to estimate the output losses[14]. The output losses measured from the magnitude of growth contraction relative to its growth trend, which is calculated from averaged three-year pre-crisis growth rate[15], or GROWTHLOSS is used by many studies such as IMF (1998), Bordo et al (2001), Honohan and Klingebiel (2003), and Classens et al (2003). However, Hoggarth et al (2002) and Mulder and Rocha (2001) point out many biases from using the growth rate to approximate the severity of crises, particularly the underestimation of the magnitude of GROWTHLOSS, i.e. although the real GDP growth rate already returns to its growth trend, the real GDP level may not recover to its pre-crisis capacity. In order to estimate the magnitude of absolute output loss (LEVELLOSS), the Mulder and Rocha's methodology is adopted. The total absolute output losses in real GDP level is calculated from the sum of the deviation of real GDP level from its potential output level. For the estimates of potential output trend, HP filter is applied to the real GDP level from 1960 up to a crisis year, and the potential output level from the crisis year is projected from its past trend by assuming that the output would grow constantly at the averaged three-year pre-crisis growth rate (of the HP filter estimate). This estimated potential trend will reflect the level of GDP that would be if the crisis would not have occurred.

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[13] If the real GDP starts to slow down and lower than it trend in the year following crisis year, the starting point of output contraction is adjusted to begin at period $t+1$, where t is a crisis year. The year following the crisis year is included since occasionally the effect of crises to the real economy takes time for financial shocks to transfer to the real sector.

[14] See Angkinand (2005) for details of the estimation of output losses associated with cries.

[15] IMF (1998) uses averaged three-year pre-crisis growth rates while Bordo et al (2001) use five year average to calculated trend growth rate. According to Mulder and Rocha (2001), however, the use of different pre-crisis periods to calculate trend growth rate does not result in the significant difference in the calculated magnitude of output losses.

In the sample of 45 banking crises episodes, 64 percent of crisis episodes are accompanied by a decline in the real GDP level (LEVELLOSS>0) and 89 percent of crisis episodes are accompanied by a decline in GDP growth rate (GROWTHLOSS>0). Figure (5.1) presents the relationship between these two measurements of the magnitude of output losses[16]. The positive relationship indicates that the occurrence of banking crises in most countries induces both growth contraction (the decline in growth rate) and economic recession (the decline in real GDP level). However, there are some cases, which crises only affect the real economy by interrupting the process of high economic growth without causing the decline in level of GDP (i.e. the GDP growth rate declined but did not turn into a negative growth rate).[17][18] The descriptive statistics in table (5.1) report that on average, the total magnitude of absolute output losses is about 47 percent per crisis, but around 13 percent when output losses are measured from GDP growth rates. These magnitudes are higher when excluding crisis episodes that are not accompanied by output losses (i.e. when the magnitude of output losses is assigned the value of zero). Both LEVELLOSS and GROWTHLOSS are employed as the dependent variables in the model. The use of different methods of measuring output losses to test the

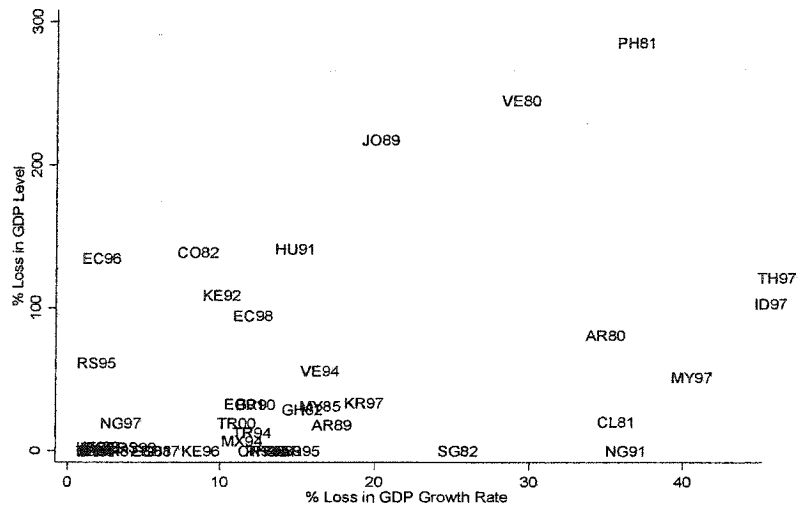
[16] The correlation between LEVELLOSS and GROWTHLOSS is 0.43.

[17] From figure (5.1), banking crisis episodes, which interrupt only the process of economic growth, are present along the x-axis (% loss in GDP growth rate). These episodes include, for example, Singapore (1982), Nigeria (1991), Argentina (1994), the Philippines (1998) (total numbers of crises in this category are 13 out of 45 crisis episodes).

[18] By construction of the estimates of output losses, it is possible for a crisis episode to be accompanied only by the decline in real GDP level without the decline in real GDP growth rate particularly if the occurrence of a crisis is preceded by negative growth rates. However, there are only few cases of episodes in this case. From the estimation of LEVELLOSS, the potential output trend is measured based on pre-crisis growth rates of the HP filter estimates. If averaged pre-crisis growth rate is negative, an economy is assumed to be growing at constant rate of zero, otherwise the potential output level trend will have downward slope and identifying economic recovery will mislead. With this assumption, a crisis with negative growth rate prior to crisis can be identified as having economic recession if the actual real GDP level is below the potential output trend (which is assumed to be at 0%). For GROWTHLOSS, the potential output trend is measured from averaged pre-crisis growth rates. If in crisis years a country has higher but negative growth rates than pre-crisis growth rates, that banking crisis will be identified as not being associated with losses in GDP growth rate measured relative to its pre-crisis growth trend.

effect of the veto players on the severity of crises will not only capture the different impact of political institutions on the magnitude of losses in real GDP level and in real GDP growth rate, but also strengthen the robustness of empirical results.

Figure (5.1) The Relationship Between Two Measurements of Output Losses



Data on Veto Players

The proxies of the number of veto players are from two datasets: the Database of Political Institutions (DPI) version 3.0 collected by Beck, et al (2001), and Political Constraints constructed by Henisz (2000)[19]. The variable from DPI, which is called "checks", is the number of checks and balances, adjusting for whether these veto players are independent of each other. The number of checks is counted based on the Legislative Index of Electoral Competitiveness (LIEC) or Executive Index of Electoral Competitiveness (EIEC), which ranged from 1-to-7 in the same dataset. The minimum score of checks is assigned to be equal to 1 when LIEC or EIEC is less than 5, which

[19] The details in measuring *checks* and data from the Database of Political Institutions versions 3.0 (May, 2001) can be downloaded from http://www.worldbank.org/research/bios/pkeefer.htm. For political constraints, the data and its descriptions are also downloadable from author's website http://www-management.wharton.upenn.edu/henisz/.

indicates the absences of competitive elections of legislatures, and the executive counts as one check. In presidential systems, the additional veto points stand for a chief executive, each chamber of the legislature, and each party coded as allied with the president's party. In parliamentary systems, the augmented points of veto players include a chief executive and every party in the government coalition (if that party is needed to maintain a majority or that party has a position on economic issues closer to the largest opposition party than to the party of the executive). Thus, these additional veto points are linearly increased by the numbers of veto players in the political system and by taking into account the policy preferences among these veto players.

For an alternative proxy of the veto players, the index of political constraints (the variable called "polconv") constructed by Henisz (2000) is used. This index derives from a simple spatial model of political interaction by taking into account both the number of veto players with veto powers over policy change and the distribution of their policy preferences. This index is constructed using a political science database for the number of independent branches of government, which is denoted by executive, lower and upper legislative chambers, judiciary, and sub-federal institutions. The initial measure is then modified to capture the distribution of policy preference among each independent branch of legislatures and executives. The political constraint index is distributed from 0-to-1 where higher score indicates the greater policy makers' constraints to change the economic policy. The spearman rank correlation coefficient between the political constraint index and checks for the sample in this chapter is 0.66.

The data for economic and financial variables are from World Development Indicators (WDI) and International Financial Statistics (IFS). Table (5.1) reports descriptive statistics for dependent and independent variables in the model.

Table (5.1) Descriptive Statistics

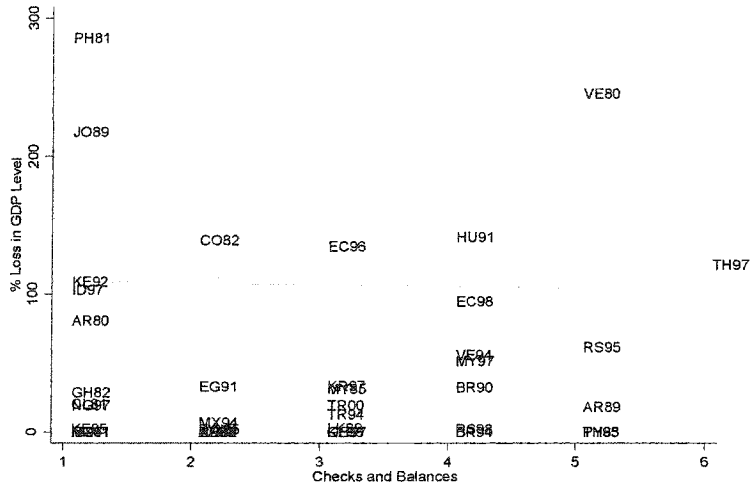
Variable	N	Mean	Std Dev	Minimum	Maximum
Magnitudes of output losses[20]					
LEVELLOSS	45	46.81	70.30	0.00	285.84
GROWTHLOSS	44	13.11	12.73	0.00	44.27
Magnitudes of output losses, only when output losses occur					
LEVELLOSS	29	72.64	76.30	1.70	285.84
GROWTHLOSS	39	14.79	12.57	0.28	44.27
The Veto Players					
Checks	45	2.64	1.43	1.00	6.00
Polconv	45	39.35	34.38	0.00	84.04
Control Variables					
GDP per capita $_{t-1}$ [†]	45	3.51	4.04	0.26	17.57
GDP growth rate $_{t-1}$	45	3.00	4.59	-12.57	10.22
CA to GDP $_{t-2}$	45	-2.87	3.73	-11.96	11.04
Private credit growth $_{t-1}$	45	9.66	23.33	-39.14	77.64
M2 to Reserve $_{t-1}$	45	8.90	12.25	1.27	62.56
Twin dummy	45	0.64	0.48	0.00	1.00

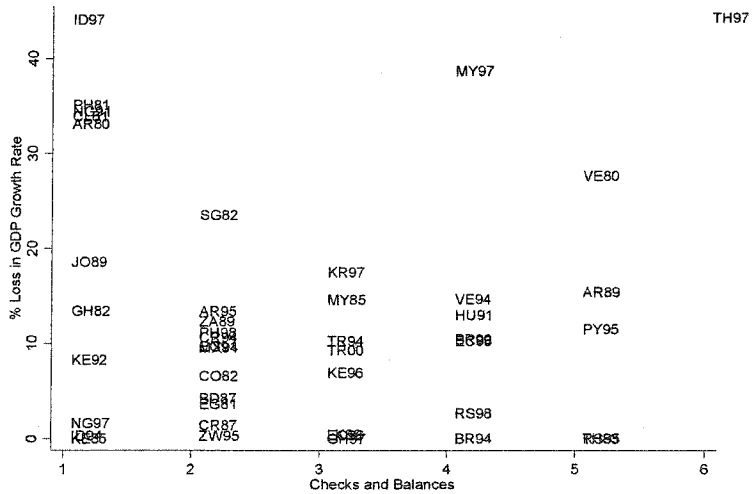
[†] GDP per capita is in 1,000 dollars

Figure (5.2) plots the relationship between the magnitude of output losses associated with crises (measured by both LEVELLOSS and GROWTHLOSS), and the veto player variables proxied by checks variable from DPI. The number of checks in Indonesia, the Philippines, and Thailand is consistent with MacIntryre's assigned number of veto players for Southeast Asian countries during the 1997-98 Asian financial crises. Indonesia and Thailand had one and six veto players, respectively. The Philippines had an intermediate number of veto players (three veto players in MacIntyre's and two veto players in 1997-98 and three veto players in 1999 according to DPI). The effective number of veto players in Malaysia, however, is counted in a different way. The

[20] For GROWTHLOSS, the Mexican crisis in 1981 is outlier observation and excluded in all regressions.

Figure (5.2) the Scatter Plots Between the Magnitude of Output Losses and the Veto Players





Malaysian government was formed by many ethnic parties. The DPI reports the number of government seats of Malaysia's three largest government parties equal to 144 out of 172 seats in legislature so the number of checks is assigned the value of four in 1997 and three in 1998. However, since Malaysia's cabinet is dominated by the largest party–the United Malays National Organization or UMNO[21]; therefore, MacIntyre argues that Malaysia has only one veto player, which is the collective veto player. The preliminary

[21] According to the Database of Political Institution, UMNO had 88 seats in the government in 1997-98.

examination of figure (5.2) suggests that the relationship should be U-shaped. The relationship between the magnitude of output losses and the polconv variable also provides a similar pattern.

5.4 Empirical Results

Tables (5.2) and (5.3) report results of the impact of the number of veto players on the magnitude of output losses associated with banking crises. The variables checks and polconv are used as alternatives to proxy for the number veto players and their ideological preferences. In each table, column (1)-(4) present results when the dependent variable is the magnitude of absolute output losses (LEVELLOSS) and column (5)-(8) present results for the losses in GDP growth rate (GROWTHLOSS). For each of these two dependent variables, the proxies of the veto players enter the Tobit regressions by three specifications: a linear form, a quadratic functional form, and a bivariate model of quadratic functional form. The model specification of quadratic functional form estimated by OLS methodology is also reported in both tables. When the proportion of zero values of dependent variable is small as in the case of GROWTHLOSS, the estimated coefficients obtained from OLS estimations are close to those from the Tobit models (e.g. column 7–8). However, for the sample with substantial censored values of the dependent variable, the estimated coefficients from OLS estimations will be biased downward, which is the case when the magnitude of output losses is measured in GDP level (e.g. column 3–4).

From tables(5.2) and (5.3), when the veto players variables enter the regressions in quadratic functional forms, the estimated coefficients both in linear and squared terms

are significant at any normal level of statistical significance[22]. The significantly negative sign of checks and significantly positive sign of $(checks)^2$ in table (5.2) and similarly for polconv and $(polconv)^2$ in table (5.3) provide evidence supporting the U-shaped relationship between the magnitude of output losses and the number of veto players. On average, countries with an absence or excessive veto powers in their political system would suffer from substantially larger output losses once crises occur according to the vulnerability of volatility or rigidity of implemented policies in responding unforeseen financial shocks. These magnitudes of losses will be lower for countries with intermediate levels in the concentration of veto players. On the other hand, the estimations in column 2 and column 6 show that the estimated coefficients of checks and polconv are all insignificant when they are entered in the regressions in linear form.

[22] In column 3 table 5.3 when the veto player variable is proxied by polconv, only linear term of polconv is significant at 10% level with p-value of 0.093 while the squared term of polconv has p-value of 0.126.

Table (5.2) The Impact of the Veto Players (Proxied by *checks*) on the Magnitude of Output Losses Associated with Banking Crises
Dependent Variable: The magnitude of output losses, Estimation Method: Tobit Regression

Dependent Variable	LEVEL LOSS	LEVEL LOSS	LEVEL LOSS	LEVEL LOSS	GROWTH LOSS	GROWTH LOSS	GROWTH LOSS	GROWTH LOSS
	TOBIT	TOBIT	TOBIT	OLS	TOBIT	TOBIT	TOBIT	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	108.8763*	-8.0561	99.0086	119.9183**	35.5424***	-1.2934	23.5915***	25.6371***
	(57.9307)	(50.3958)	(68.9109)	(52.9599)	(7.8688)	(6.8751)	(8.6051)	(8.6075)
GDP per capita $_{t-1}$		8.1972**	9.4736**	5.8261**		0.7031	0.9910**	0.8293*
		(3.6854)	(3.5426)	(2.7411)		(0.5099)	(0.4394)	(0.4453)
GDP Growth Rate $_{t-1}$		-11.2121 ***	-10.4282***	-5.4053**		0.9348*	0.9780**	0.8339*
		(3.7457)	(3.5193)	(2.5835)		(0.5226)	(0.4347)	(0.4228)
CA to GDP $_{t-2}$		-8.0178*	-6.8829	-4.0123		-0.4894	-0.4142	-0.3350
		(4.5716)	(4.1062)	(2.7540)		(0.5163)	(0.4369)	(0.4465)
M2 to Reserve $_{t-1}$		-0.4907	-0.7176	0.1444		0.0719	0.0459	0.0224
		(1.4629)	(1.4151)	(0.8976)		(0.1701)	(0.1438)	(0.1469)
Private Credit Growth $_{t-2}$		0.01223	-0.1219	-0.1330		-0.0458	-0.0472	-0.0239
		(0.6278)	(0.5892)	(0.4481)		(0.0868)	(0.0731)	(0.0726)
Checks	-82.0771*	9.7110	-94.9844**	-77.5021**	-18.9556***	-0.0626	-20.2509***	-20.0813***
	(44.8092)	(11.2035)	(42.8969)	(33.6414)	5.9900	(1.5390)	(5.4370)	(5.5219)
$(Checks)^2$	14.5746*		14.0175**	11.9163**	3.0137***		3.3217***	3.3438***
	(7.2948)		(6.7970)	(5.3710)	0.9682		(0.8655)	(0.8797)
Twin Dummy		75.8957**	64.8066**	22.1315		9.2944**	6.5471*	5.6045
		(33.1071)	(31.5177)	(22.0858)		(4.1459)	(3.5659)	(3.5830)
N	45	45	45	45	44	44	44	44
LR Chi-squared	4.09	15.64	19.65		8.84	11.37	23.75	
F-statistics				1.83				3.37
Pseudo R-squared	0.0110	0.0420	0.0528		0.0271	0.0349	0.0728	
R-squared				0.2894				0.4348
Log Likelihood	-184.1385	-178.3660	-176.35842		-158.57065	-157.30765	-151.11947	

*, **, *** indicate significance level of 10%, 5%, and 1% respectively. The numbers in parentheses are standard errors of estimated coefficients.

Table (5.3) The Impact of the Veto Players (Proxied by polconv) on the Magnitude of Output Losses Associated with Banking Crises
Dependent Variable: The magnitude of output losses, Estimation Method: Tobit Regression

Dependent Variable	LEVEL LOSS	LEVEL LOSS	LEVEL LOSS	LEVEL LOSS	GROWTH LOSS	GROWTH LOSS	GROWTH LOSS	GROWTH LOSS
	TOBIT	TOBIT	TOBIT	OLS	TOBIT	TOBIT	TOBIT	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	29.0301	-22.2656	-7.4779	31.6320	15.1673***	-0.0484	1.9209	5.7475
	(25.1692)	(39.6708)	(39.1196)	(28.2306)	(3.2806)	(5.5692)	(5.3979)	(5.0292)
GDP per capita $_{t-1}$		8.5025**	9.2279**	5.5209*		0.7710	0.9054*	0.7814
		(3.7181)	(3.6393)	(2.8517)		(0.5077)	(0.4893)	(0.5023)
GDP Growth Rate $_{t-1}$		-10.1731***	-11.3748***	-5.9150**		0.8922*	0.4753	0.4325
		(3.3514)	(3.4916)	(2.4582)		(0.4851)	(0.4753)	(0.4446)
CA to GDP $_{t-2}$		-7.6330*	-8.4603*	-4.4609		-0.4948	-0.5597	-0.4824
		(4.4579)	(4.4355)	(2.8374)		(0.5092)	(0.4871)	(0.4999)
M2 to Reserve $_{t-1}$		-0.4618	-0.7343	0.3731		0.0466	0.0610	0.0073**
		(1.4114)	(1.5471)	(0.9148)		(0.1678)	(0.1603)	(0.1628)
Private Credit Growth $_{t-2}$		0.0621	-0.0756	-0.1111		-0.0379	-0.0570	-0.0213
		(0.6213)	(0.6084)	(0.4682)		(0.0868)	(0.0837)	(0.0825)
Polconv	-1.2301	-0.4548	-4.0002*	-2.6924	-0.6663*	-0.0344	-0.6565**	-0.6181*
	(2.4719)	(0.4480)	(2.3166)	(1.7306)	(0.3396)	(6.1148)	(0.3104)	(0.3159)
$(Polconv)^2$	0.0154		0.0464	0.0321	85.6652*		0.0082**	0.0075*
	(0.0322)		(0.0296)	(0.0225)	(44.4141)		(0.0040)	(0.0041)
Twin Dummy		78.6116**	82.7107**	36.4510		9.3869**	9.8974**	9.0525**
		(33.2715)	(33.0488)	(22.5312)		(4.1125)	(3.9327)	(3.9775)
N	45	45	45	45	44	44	44	44
LR Chi-squared	0.25	15.91	18.44		3.70	11.68	15.67	
F-statistics				1.43				1.75
Pseudo R-squared	0.0007	0.0427	0.0495		0.0114	0.0358	0.0481	
R-squared				0.2411				0.2862
Log Likelihood	-186.05939	-178.22885	-176.96273		-161.14104	-157.15159	-155.15714	

*, **, *** indicate significance level of 10%, 5%, and 1% respectively. The numbers in parentheses are standard errors of estimated coefficients.

For control variables, the significance of the estimated coefficients varies across model specifications. The twin crisis dummy, pre-crisis GDP per capita, and pre-crisis growth rate have significant effects on the magnitude of output losses in most regressions. The substantive effects of these control variables on the magnitude of output losses can be compared from standardized coefficients. One-standard deviation change in each of these three control variables also has a relatively larger impact on the magnitude of output losses than that of any other control variables. However, other economic and financial variables such as pre-crisis credit growth rate and the ratio of money supply to reserve are included in a set of control variables although their individual coefficients are not significant. The F-test for whether these control variables have marginal contribution to the model is highly significant (p-value < 0.05), indicating that this set of control variables is jointly significant and enhance the model. Additionally, the significance of the likelihood ratio chi-squares (LR chi2) in the Tobit models in table (5.2)-(5.3) also shows that when a set of control variables is included, the model as a whole is statistically significant[23].

The estimated coefficients from Tobit regressions in table (5.2)–(5.3) are marginal effects of independent variables on the latent dependent variable ($y^*_{i,t}$), which is unobserved. Table (5.4) summarized the marginal effects of the veto players on the latent dependent variables (y^*) and the observed dependent variables (y)[24]. To compare the

[23] By comparing among Tobit models with specification of quadratic functional form in table (5.2)-(5.3), the likelihood ratio chi-squares are significant at 5% level in the models that include a set of control variables (column 3 & 7) but insignificant in bivariate models (column 1 & 5). The likelihood-ratio chi-square is defined as $2(L_1 - L_0)$, where L_1 is the log likelihood for the full model with constant and predictors and L_0 represents the log likelihood for the model with constant only. In addition, the pseudo-R2 is defined as $(1 - L_1)/ L_0$.

[24] The marginal effects of checks and polconv are obtained from the full models, which also include a set of control variables (column 3 and 7 from table 5.2–5.3).

impact of checks and polconv on the observed total magnitude of output losses per crisis, table (5.4) presents the effect of a one-standard deviation change in checks and in polconv on the observed dependent variables in percentage point terms, which is shown under the column of y (x-std coeff). A one-standard deviation change in checks and in polconv has a more or less equivalent impact on the magnitude of output losses with stronger impact on losses in GDP level than on losses in the GDP growth rate.

Table (5.4) Marginal Effects of checks and polconv on the Magnitude of Output Losses

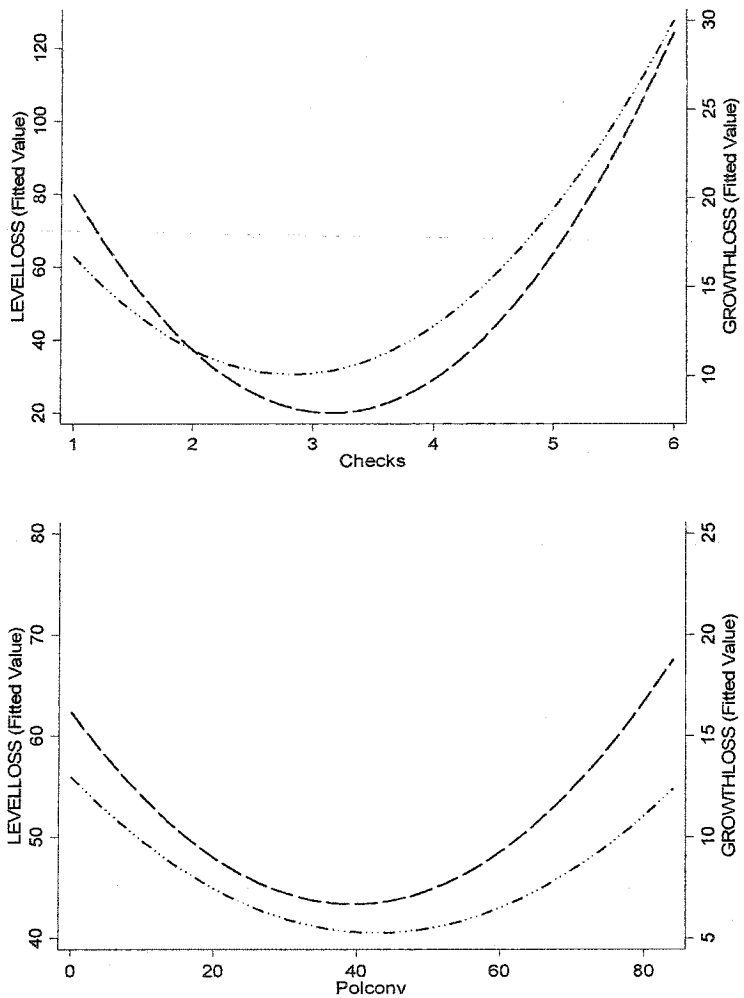
	LEVELLOSS			GROWTHLOSS		
	y*	y	y (x-std coeff)	y*	y	y (x-std coeff)
Checks	-94.984	-61.212	-87.697	-20.251	-18.001	-25.789
$(Checks)^2$	14.015	9.032	12.939	3.322	2.957	4.230
Polconv	-4.000	-2.578	-88.623	-0.657	-0.584	-20.062
$(Polconv)^2$	0.046	0.030	1.028	0.008	0.007	0.251
Proportion of no output contraction	0.64			0.89		

Note: y^* and y are unobserved (latent dependent variable) and observed magnitude of output losses. y(x-std coeff) is the observed magnitude of output losses with standardized independent variables. According to equation (1) in section 5.3, the marginal effects of check and balance variables (and other control variables) on the observed total magnitude of output losses $y_{i,t}$ are calculated from

$$\frac{\partial E[y|\mathbf{X}, Checks]}{\partial (Checks)} = \sigma \times \text{Prob}[y^*_{i,t} > 0]$$

Figure (5.3) shows the fitted values of the expected magnitude of output losses (y) with the different values of checks and polconv, which are estimated from the quadratic specifications of the Tobit models (column 3 and column 7 in table 5.2-5.3). The left-axis shows the scale of the magnitude of output losses in GDP level and the right-axis for the losses in GDP growth rate.

Figure (5.3) The Fitted Values of the Expected Magnitude of Output Losses with Different Values of Checks and Polconv from Tobit Estimations.



Note: ····· LEVELLOSS ———— GROWTHLOSS. The expected dependent variables of LEVELLOSS and GROWTHLOSS are observed magnitudes of output losses ($y_{i,t}$) for the values of checks and polconv that are not standardized.

The fitted values of predicted magnitude of output losses with the different values of *checks* show the U-shaped relationship with the inflection point of three checks. That is, when the number of veto players is proxied by checks, additional veto points, up to approximately three veto players, bring declines in the magnitude of output losses; beyond three veto players, the higher veto points the larger output losses associated with

banking crises. Similar analysis can be performed for polconv variable. The inflection point of the U-shaped curve can be calculated by taking the first derivative of regression (3) and (7) in table (5.3) with respect to polconv and setting the slopes equal to zero. From this calculation, the inflection point of the U-shaped curve is where polconv equals to 43.10 for the dependent variable of the losses in GDP level and equals to 39.87 for the losses in GDP growth rate.

The significance of estimated coefficients in quadratic terms indicates that the marginal effect of the veto players on the magnitude of output losses is not constant, and depends on the values of the independent variables. The marginal effects for the different values of checks on the magnitude of output losses can be simply calculated by taking the first derivative of the magnitude of output losses with respect to checks.[25]. The predicted marginal effects for different values of checks, reported in table (5.5), suggest that when the value of checks is greater than three, the magnitude of output losses will increase at increasing rates for additional checks. Similarly, when the value of checks is less than three, the reduction in the value of checks will increase the magnitude of output losses at an increasing rate[26].

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[25] For example, the predicted change in the magnitude of output losses in GDP level for a change in the number of checks from 1 to 2 is $-61.212 + (2 \times 9.032) \times 1.5 = -34.12$.

[26] From tables (5.2)-(5.3) and the robustness of these empirical results in the next section, the veto players variables has more significant impact on GROWTHLOSS than LEVELLOSS. Similarly, the prediction of the effect of changes in number of veto players on output losses is also more accurate for GROWTHLOSS than LEVELLOSS. These can be partly due to the methodology in measuring LEVELLOSS. As noted by Mulder and Rocha (2001), from the methodology in measuring output trend, the actual output is less likely to return to its trend and the magnitude of output losses will be truncated when the next crisis occurs.

Table (5.5) Marginal Effects of Different Values of *checks* on the Magnitude of Output Losses

Change in the values of *checks*	LEVELLOSS	GROWTHLOSS
from 1 to 2	-34.12	-10.29
from 2 to 3	-16.05	-3.64
from 3 to 4	2.01	3.00
from 4 to 5	20.07	9.64
from 5 to 6	38.14	16.29

This empirical evidence suggests that after controlling for economic and financial factors, countries with intermediate numbers of veto players in times of financial crises will benefit from the tradeoff between a government's ability to maintain policy credibility and a government's ability to adjust policies flexibly, to respond to crises appropriately, and subsequently to minimize the severity of crises. From the sample of the political structures in 27 emerging market economies in this study, South Korea is the example of countries that have intermediate numbers of veto players, which is equal to three checks or at the inflexion point of the U-shaped curve, in the year of financial crises. In the 1997-98 Asian financial crises, the Korean coalition government, formed by two parties with diversified preferences, had brought the country to a stronger and faster recovery than the recoveries of the rest of the Asian crisis-hit countries. The government's commitment to the IMF program required extensive reforms in the financial and business sectors as well as in the labor market (Heo, 2001) and the prompt reforms, which led to business recovery and a heavily growing export sector, had quickly restored the investors' confidence in the post-crisis periods.

The economic consequence of increasing or decreasing the number of veto players in most countries is consistent with the model prediction reported in table (5.5). For instance, the differences in policy responses, and the degree of severity of the

banking crises in 1981 and 1998 in the Philippines were due to the change in the political structure. In the first half of the1980s, policy reactions to the major financial crisis under the authoritarian leadership of Ferdinand Marcos were aimed to provide massive financial assistances to financial institutions and public corporations (Nascimento, 1991). Similar to the case of Indonesia under Suharto, the implemented policies that could not be vetoed were aimed to support well-connected businesses resulted in the deepened severity of the crises. The magnitude of the losses in growth rates of 35 percent associated with banking crisis in 1981 and 11 percent in 1998 indicates that the increasing number of veto players of the Philippines from one checks in 1981 to two checks in 1998 and three checks in 1999[27] contributes to the decrease in the magnitude of losses in growth rate by about 24 percent. Another example is Ghana, which the increase in checks values from one to three is associated with the decrease in the magnitude of growth losses by about 29 percent.

On the other hand, when checks are larger than three, increasing the number of veto players can cause the increase in the magnitude of output losses. The example of crisis episodes that support this finding is the occurrence of banking crises in Thailand in 1983 and 1997. The increase in the number of veto players to six checks in 1997 from five checks in 1983 is associated with the larger magnitude of losses in the growth rate in 1997 than that in 1983 by about 44 percent. This magnified severity of crisis in 1997-98 was notably the result of the delay of policy changes in dealing with financial sector problems, which was apparent in the delayed process of passing the new bankruptcy laws since the a number of governments could lose their stake in failing financial institutions

[27] Polconv of the Philippines reduces from 0 in 1981 to 0.7 in 1998, where 0 out of 0-1 scale indicates no political constraints.

(Vatikiotis, 1998). Venezuela is another example where the magnitude of losses in the growth rate is lower by about 13 percent when the checks value changes from five checks in the 1980 banking crisis to four checks in the 1994 banking crisis.

Robustness of the Results

The tests for the robustness of empirical results are performed by the analysis of outliers and the sensitivity tests of control variables. The purpose of the outlier analysis is to test for the robustness of the U-shaped relationship against the linear relationship between the number of veto players and the magnitude of output losses, since the significance of estimates in quadratic terms can be influenced by outlying and influential observations. If an observation is detected as an outlier or influential observation[28], it will be excluded before the Tobit regressions are re-estimated. The re-estimations of the model specifications in table (5.2)–(5.3) illustrate that, after excluding some outlying and/or influential observations, the estimated coefficients in quadratic specifications (column 3 and 7) remain significant, while the insignificance of estimated coefficients from the linear specification (column 2 and 6) are not improved, indicating the robustness of the U-shaped relationship. This finding of a U-shaped relationship between the magnitude of output losses and the concentration of veto authorities is stronger when output losses are measured from the losses in GDP growth rate (GROWTHLESS). The exclusion of any outlying and/or influential observations does not impact the significant and substantive effect of estimated coefficients. One exception is the re-estimation of

[28] The statistics for identifying outliers or observations with large discrepancy are Studentized Residuals and for identifying influential observations are DFBeta, which measures the change in individual coefficient caused by dropping a single observation. Cook's Distance (Cook's D) is statistics for detecting outlying observation that has influence on the coefficients since it is composed of a discrepancy and a leverage term.

LEVELLOSS regression in column 3 table 5.2. The exclusion of these three observations (the Philippines 81, Venezuela 80, and Jordan 89) that was detected by Cook's Distance statistics as having a large influence, and this discrepancy reduces the significances of the coefficients of checks and $(checks)^2$ from 5 percent to a 10-15 percent level of significance.

The results in tables (5.2)-(5.3) are further examined by using different lag(s) of control variables, including a one year lag, averaged two-year lags, and averaged three-year lags of the crisis year. With the changes of the lags of control variables, the estimated coefficients of the veto player variables in quadratic terms (both linear and squared terms) remain significant. However, the F-statistics of the set of control variables that are used in table (5.2)–(5.3) yield the highest significant level. Furthermore, the sensitivity of control variables is also tested by including the lag(s) of other economic and financial variables such as the world economic growth rate, the total (private plus public) credit growth rate, and the inflation rate. These variables are not only insignificant for individual effects, but the F-statistics for the test of overall significance of the model is also lower compared to that of the set of control variables used in table (5.2)–(5.3). In addition, since the impact of the veto players on the magnitude of output losses might vary across the regions and the types of banking crises, the sensitivity analysis is also performed by controlling for these specific factors. The regional dummies (separated into four regions: Africa, Central and Latin America, East and Southeast Asia, and other region) and the dummies of banking crisis types (separated into systemic and nonsystemic banking crises) do not have a significant effect as well as do not improve the F-statistics of the overall fit of the model.

5.5 Conclusion

The empirical findings in this chapter suggest the importance of domestic political institutions in alleviating the severity of financial crises. In times of unforeseen financial shocks, the implementation of policy responses must be credible in order to stop financial panic as well as be flexible for any adjustment if any policy mistakes occur. One fruitful method of characterizing the political institutions underlying the governments' ability to produce policies with credibility and flexibility is the concept of veto players. Political institutions with checks and balances will allow the government to produce credible and stable policies, since a change in any policies according to political benefits can be vetoed by other parties. However, the political institutions with excessive veto players can be vulnerable to the delay and inflexibility of policy responses. On the other hand, in the absence of any veto players, political institutions become vulnerable to policy volatility since any changes in policies can be processed without the veto by other parties. In the consideration of the choice of institutional arrangements, particularly when there are changes in global financial environments, political authorities need to rely on this tradeoff between policy credibility and policy flexibility.

The number of veto players and their ideological distance significantly influences the magnitude of output loses associated with banking crises. From the sample of 45 banking crisis episodes in 27 emerging market economies, the numbers of veto players has a U-shaped relationship with the magnitude of output losses, and this finding is robust regardless of the measures of output losses and the measures of the veto players. The inflexion points of the U-shaped curve is equal to three for the checks variable from DPI (from 1-to-6 of min-to-max scales in the sample) and equal to approximately 40 for

the polconv variable constructed by Henisz (from 0-84 of min-to-max scales in the sample). The decrease in the values of veto players from the inflexion points will increase the magnitude of output losses at an increasing rate according to the increasing vulnerability of policy volatility. Similarly, the increase in the values of veto players from the inflexion points will increase the magnitude of output losses at an increasing rate due to the increasing risk of policy rigidity.

Nonetheless, it is not a necessary condition that political institutions with an absence or excessive number of veto players will produce policy volatility or policy rigidity or, on the other hand, political institutions with intermediate numbers of veto players can always escape from the severity of financial crises. Policy makers in a country with small numbers of veto players, coupled with the awareness that the credibly commitment can be threatened, can employ other mechanisms to signal their commitment; similarly for policy makers in a country with many vetoes. Further research should examine what policies governments in these countries should pursue in order to safeguard their economies in these periods of financial vulnerability.

Appendix Table (A5.1) The Recent Empirical Studies of the Relationship Between the Veto Players and Economic Performances

Authors	Primary Focus	The Model[f]	Primary Findings	Other Findings	Sample
Henisz (2000)	Constructing political constraint indexes to proxy for the extent of government's credible commitment and test whether these indexes have significant impact on long run economic growth.	DV: growth rate of real GDP per capita IV: political constraint indexes, law and order, democracy	Political constraint indexes have significantly positive impact on long run economic growth in all estimation techniques (OLS, GLS and GMM).	For other proxies of institutional environments, law and order index is significant while democracy index is not significant in determining long run economic growth	More than 100 countries during the period of 1965-90.
Stasavage (2002)	Testing North and Weingast (1989)'s hypothesis that checks and balances, which establish credibility of government's commitment, lead to higher private investment.	DV: private Investment as a percentage of GDP IV: political constraint index and checks (from DPI version 1.0)	The higher checks and balances, the higher private investment and the lower the conditional variance of investment. The latter relationship indicates that countries without checks and balances may also establish credibility through other mechanism.	These results are robust for heteroskedastic regression and quantile regression.	74 developing countries, 1971-994
Falaschetti (2003)	Studying the relationship of how checks on opportunistic abilities influence investment	DV: Investment as a percentage of GDP IV: political constraint index and checks	The relationship between investment and veto players is nonmonotonic. That is, only intermediate level of checks has positive marginal effect on investment, otherwise checks has negative marginal effect on investment.	The linear relationship between checks and investment is also significant with the higher checks, the higher level of investment.	56 countries, 1976-92

[f]Note: DV is dependent variable(s) and IV are independent variables, which show only the veto players variables and other political variables (the control variables included in the model in each study are not shown here).

Appendix Table (A5.1) Cont.

Authors	Primary Focus	The Model[f]	Primary Findings	Other Findings	Sample
Gaviria et al (2000)	Testing Rodrik (1999)'s hypothesis that conflict management institutions determine growth collapses after the economic shocks of the mid 1970s by using political constraint index to proxy for institutions.	DV: averaged per capita growth rate 1975-89 minus averaged per capita growth rate 1960-75 IV: political constraint index and political particularism	The results support Rodrik's findings that the level of political constraints has positive relationship with the change in growth rate. This indicates that a country with higher political constraint experienced higher growth rate in 1975-89 compare to the growth rate in 1960-75, or had quicker recovery from economic shocks in the mid 1970s.	The political particularism has the quadratic relationship with the change in growth rate, that is, a country with intermediate levels of political particularism experienced quicker recovery from economic shocks.	80 countries, 1975-1989
Keefer (2001)	The effects of checks and balances on policy responses to banking crises. The channel of the effects is that checks and balances can reduce political incentives to cater special interests. The focuses of policy responses are fiscal transfers and the policy decision of forbearance.	DV: fiscal costs of crises as a percentage of GDP and the dummy of policy decision of forbearance IV: checks (checks2a)	The increase in the number of checks reduces the magnitude of fiscal transfers. This effect decline as the rents from special interests to the veto players rise. In addition, the effect of checks on fiscal transfers is nonlinear, that is the increase in checks reduces fiscal costs of crises at diminishing rates.	The effect of checks on the decision of forbearance is similar to the effect of checks on fiscal transfer but the effect is much weaker for the forbearance.	40 crises in 35 developed and developing countries

[f]Note: DV is dependent variable(s) and IV are independent variables, which show only the veto players variables and other political variables (the control variables included in the model in each study are not shown here).

CONCLUDING REMARKS

Currency and financial crises, which have emerged repeatedly, particularly from 1980s until recently, resulted in severe economic recession in many countries. This dissertation studies the connection between crises and the real economy by aiming to investigate the factors or policy responses that could explain the differentiation of the severity of crises across crisis-hit countries. The crisis severity is assessed from the magnitude of output losses, or the deviation of the real GDP from its potential trend. Two important factors are found to have significant explanatory powers on the output costs of crises. These are the system of deposit insurance and the structure of domestic political institutions.

An explicit deposit insurance system plays an important role in preventing financial panic in times of financial distress. It increases public confidence by guaranteeing the safety of depositors' funds in times of financial vulnerability. With an absence of extensive financial runs, banks and financial institutions are allowed to continue their functions as financial intermediations. This prevention of the disruption of the payment system could reduce the extent of economic recessions associated with financial crises. However, the benefit of deposit insurance in reducing the output costs of crises is traded off with its cost in creating a moral hazard. The existence of explicit deposit insurance could induce bank managements' perverse incentives in engaging in additional risky projects under the assurance that depositors' funds are guaranteed.

The empirical results based on a sample of 73 banking crisis episodes in 48 industrial and emerging market countries between 1975-2002 show that the system of

deposit insurance has a significant impact on both the incidence and severity of crises. The presence of an explicit deposit insurance system is found to reduce the output costs of crises on average by 2.4 percent of GDP. With the averaged magnitude of output losses in the sample of 4.9 percent of GDP, the effect of explicit deposit insurance in alleviating output costs of crises is substantial. However, by using the same sample, the existence of explicit deposit insurance significantly increases the probability of crises on average by 14.5 percent. This adverse effect of deposit insurance in increasing banks' risk-taking behaviors cancels out its benefit in preventing financial panic.

These empirical findings suggest that policy makers would face the cost-benefit tradeoff in establishing a system of deposit insurance. For countries that adopt an explicit system, financial crises may occur more frequently, but each crisis would be small. On the other hand, for countries without an explicit system, the recurring crises may be relatively less likely. However, if financial shocks were unavoidable and crises occurred, those crises could be very severe. This cost-benefit tradeoff is more apparent when considering the coverage limit of deposit protection. While the comprehensive coverage, including the protection of foreign currency and interbank deposits, is more effective in containing financial panic, it tends to generate the higher extent of moral hazard incentives. To avoid this cost-benefit tradeoff of deposit insurance, the analysis in this dissertation suggests that a country needs to have a strong institutional quality as well as prudential financial regulation and supervision in order to cope with banks' reckless behavior generated by explicit deposit insurance.

The structure of political institutions is also essential in influencing the speediness and the credibility of policy responses to crises, which significantly determine the

severity of crises. This dissertation extends MacIntyre (2001)'s case studies of the relationship between veto players and policy risks in the Asian financial crisis to analyze the impact of domestic institutions on the output costs of crises for a sample of 27 emerging market economies between 1980-1999. A veto player is an individual or collective actor whose agreement is required for a change of status quo policy. By using cross-sectional time-series analysis, the results show that crisis-hit countries with an absence or too many veto players would suffer from the relatively larger output costs of crises. This is consistent with MacIntyre's argument on a U-shaped relationship between the number of veto players and the degree of policy risks. In times of financial crises, a government with high levels of checks and balances may face the difficulty to reach an agreement in implementing or changing policy responses. This increases the costs of delay and could magnify the severity of crises. On the other hand, a government with an absence of checks and balances would be subjected to policy volatility, since a change of policy responses could not be vetoed by other parties. As a result, the lack of credible commitment in implemented policies could lead to the loss of investor confidence and spread of financial panic.

The empirical analysis employs two proxies of the veto players: the variable called "checks" from the Database of Political Institutions or DPI and the Political Constraint Index (which is so-called "polconv") constructed by Henisz (2000). The regression models predict that when the number of veto players is proxied by checks (which ranges from 1 to 6 checks), additional veto points up to approximately three veto players bring declines in the magnitude of output losses. When the number of veto players is beyond three, the higher the veto points the larger the output losses associated

with banking crises. Similarily, the inflection point of the U-shaped curve is where polconv (which ranges from 0 to 84) equals to 43. These predictions on average could explain the relationship between the structure of domestic political institutions and the severity of crises well in many countries. For instance, during the 1997-98 Asian financial crisis, the South Korea economy, with its political structure that had three checks, was relatively less affected by financial crisis. On the other hand, Thailand had five checks and Indonesia had only one check. These two countries experienced a very severe economic recession associated with the 1997 crisis.

This dissertation hopes to signal policy makers, particularly in emerging market economies to pay more attention to the quality of domestic institutions. In the period of increasing capital mobility internationally, a growing economy needs to be safeguarded from both internal and external financial shocks. Not only do macroeconomic and financial policies need to be pursued appropriately, the strong quality of domestic institutions and proper institutional arrangements are also essential. Financial safety net instruments such as explicit deposit insurance will promote financial stability by preventing financial panic without causing moral hazard incentives in countries with strong institutional environments. In addition, the structure of domestic institutions should also allow policy decision makers to make a credible commitment on an implemented policy as well as allow them to have policy decisiveness during the period of financial vulnerability.

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