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Shocks, Financial Soundness and Currency Crisis in Emerging Market Economies

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ABSTRACT

A currency crisis is identified as a significant decline in a currency's exchange rate within a short time. Every time the crisis emerges, it severely affects the economic stability and well-being of larger populations, not only for the affected country but across the world. A currency crisis is mainly initiated by weak macroeconomic conditions and speculative attacks that depreciate the domestic exchange rate. Moreover, an economy's exchange rate is sensitive to a country's external and internal economic conditions; therefore, its stability is of significant concern for monetary authorities. They are compelled to switch exchange rate regimes to stabilize the currency's value. Several economies have suffered from a currency crisis. However, its negative consequences are more frequent and prolonged for emerging market economies. This research analyzes the nature and mechanism of currency crises in the backdrop of shocks, financial instability, foreign liabilities, and capital controls. Annual data for the period of 2000 to 2017 for a panel of 43 emerging economies is used for analysis. It is found that countries with high liabilities are more likely to experience depreciation in currencies. In this context, an overvalued exchange rate creates speculative pressure and sudden currency depreciation. The shocks to productivity and risk premium of a country also amplify the chances of depreciation. In emerging economies, capital controls do not significantly reduce the chances of a currency crisis. However, the financial soundness is likely to keep the currency value stable.
Effects of global shocks on the exchange rate depreciation are mixed subject to the fact that a country is a major importer or exporter of oil. The findings of this study are consistent with existing literature on emerging economies and currency crisis models. Given these empirical results, it is recommended that authorities focus on managing the size of foreign liabilities, export growth, and productivity levels. Monetary authorities should manage policy rates only to attract investors and must not overvalue the exchange rates and abandon the managed float to avoid speculative pressure.

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Introduction

Evidence of the macro-level financial turmoil across economies dates to the inception of capitalism (Kindleberger, 1978; Schwartz, 1987). However, these crises have been more frequently observed during the last century. Some of those have been severe in nature and consequences, such as the 1960s sterling and frank crises, the collapse of the Breton Wood System in the 1970s, Latin American economies crises, and the breakdown of the Exchange Rate Mechanism (ERM, henceforth) of European monetary system during 1990s, in late 2000s East Asian economic crises and Russian financial crisis and more recently in 2007-08 the Global Financial Crisis (GFC, henceforth).

The financial crisis is supposed to have several forms categorized according to two conceptual domains (Antczak, 2000), narrow and broad. The narrow definition of crisis is developed on monetary grounds. It suggests that the emergence of a crisis is subject to changes in the money supply and problems in the banking sector (Friedman & Schwartz, 1963). The second description is relatively broad (Kindleberger, 1978; Minsky, 1972) and considers problems in the real sector, financial institutions' structure, exchange markets, and information flow among agents to play an active role in setting the ground for the crisis.

Given these explanations, a financial crisis is categorized as a balance of payments (BOP, henceforth) or currency crisis, banking crisis, debt crisis, stock market crash, and liquidity crisis (Djebbar, 2009). This study focuses on the first type of financial crisis, i.e., BOP or currency crisis. The exchange rate is used to identify this type of crisis. The exchange rate provides a broad picture of the financial stability of an economy as it is susceptible to internal and external economic conditions, responds to domestic and foreign relationships in economic and strategic terms, and represents the overall state of fundamentals. Therefore, it is sometimes argued that a currency crisis is vitally important to identify the evidence for the other types of the financial crisis (Antczak, 2000).

A currency crisis is defined as a significant decline in the value of a currency within a short time interval (Burnside et al., 2011). The rate of decline is sometimes quantified by a threshold such as (Frankel & Rose, 1996) has defined the incidence of currency crisis when the nominal exchange rate declines by at least 25 percent within a month and the rate of currency devaluation is at least 10 percent greater than the previous month's depreciation. (Eichengreen et al., 1995) It has attributed the currency crisis to substantial depreciation with a successful speculative attack that leads to the government's change in the exchange rate policy. For example, a crisis emerges in economies that follow exchange rate parity if authorities have shifted from the parity given a speculative attack. This creates a circular situation where speculators expect that the value of a currency will decline, and the currency will depreciate because agents have speculated it.

It is argued that the exchange rate depreciates when a speculative attack occurs. For domestic currency's stability, monetary authorities either increase the interest rate or sell the foreign reserves. Exchange Market Pressure (EMP) index value defines the risk of an impending crisis. If EMP has a value outside some standard deviations, three as per Kaminsky & Reinhart (1999) of the sample average, there is evidence of a crisis. It is important to note that the value of the EMP index and the benchmark criteria vary from country to country.

Causes of Currency Crisis

Initially, the currency crisis has been considered an outcome of weak macroeconomic conditions and government policies, remarkably following the exchange rate peg. The level of financial reserves of an economy is supposed to have a significant contribution to its growth. Reserves support reducing the volatility and risk of domestic capital assets and enable the economy to defend against financial and economic crises. During deficits, it is challenging for the central bank to maintain sufficient reserves, so devaluation is inevitable (Krugman, 1979).

Later, studies suggest that the economy may have multiple equilibria due to self-fulfilling speculations (Obstfeld, 1996). In addition, speculators' herding behavior (Calvo & Mendoza, 1997) and the contagion effect (Masson, 1998) are crucial reasons for initiating the crisis. Post-Asian crisis, studies have observed the importance of including micro factors and macro fundamentals, particularly from the financial sector. Such as problems in the balance sheet, illiquidity, and credit risk due to moral hazards that may outbreak the twin crises, i.e., banking with currency crisis (Burnside et al., 2007).

Policy trilemma is also used as an explanation for the currency crisis. It states that free capital mobility limits governments' choice between the conduct of independent monetary policy and a managed exchange rate system. It is argued that the liberalization of capital assets and a fixed exchange rate connect the domestic interest rate to the foreign. This puts a constraint on achieving the monetary goals by conducting policy. For example, the decision for tight monetary policy requires the government to set a higher domestic rate of interest than the foreign rate. However, the free capital regime induces inflows and import demand, resulting in the decline of the domestic interest rate.

Glick & Hutchison (2013) explained real-world currency crises such as the ERM crisis, the Mexican crisis, and the Asian economic crisis by trilemma or impossible trinity. It has been observed that during the first of these crises, Germany adopted a tight monetary policy to manage the problem of inflation and kept its interest rate higher. However, other economies could not keep up with this higher interest rate, and significant capital inflows led them to collapse. Given this situation, speculative pressure forced countries to shift from the pegged exchange rate, and their interest rates and currency values dropped substantially, bringing to recession.

Given the evidence, it is concluded that managing the exchange rate parity is always tricky for economies over long periods because it requires withdrawing from the independent monetary policy. However, in the real world, countries are often reluctant to act passively in their monetary policy and end up paying a high cost in the form of recession. It is also argued that the crisis risk is more for the currencies that follow rigid or intermediate rates without association with a single currency (Ghosh et al., 2011). In this context, economies that follow a floating exchange rate must not experience currency crises. However, (Calvo & Reinhart, 2002) maintains that most countries avoid the floating behavior and practice the peg with the label of floating.

Several researchers (Chang & Velasco, 2001) have argued that a currency crisis may emerge due to other crises. Therefore, it is necessary to understand the mechanism and the link with those crises.

Problem Statement

Economic crises in general and currency crises specifically have been distinctive attributes of international monetary setup. From the breakdown of Bretton Woods in the 1970s to the Latin American, Mexican, European, and Asian currency crises and the GFC of 2008, several economies have gone through the adverse effects of crises (Balakrishnan, 2009). It is observed that crisis

affects developed and developing economies differently, so it is necessary to understand the potential outcomes of crisis for these heterogeneous economies and suggest the appropriate economic strategy.

The nature and consequences of crisis vary from country to country, given the volatility in their currencies and macroeconomic conditions. However, emerging economies are at higher risk of being affected by a financial breakdown. As for now Nomura index in the following figure shows.

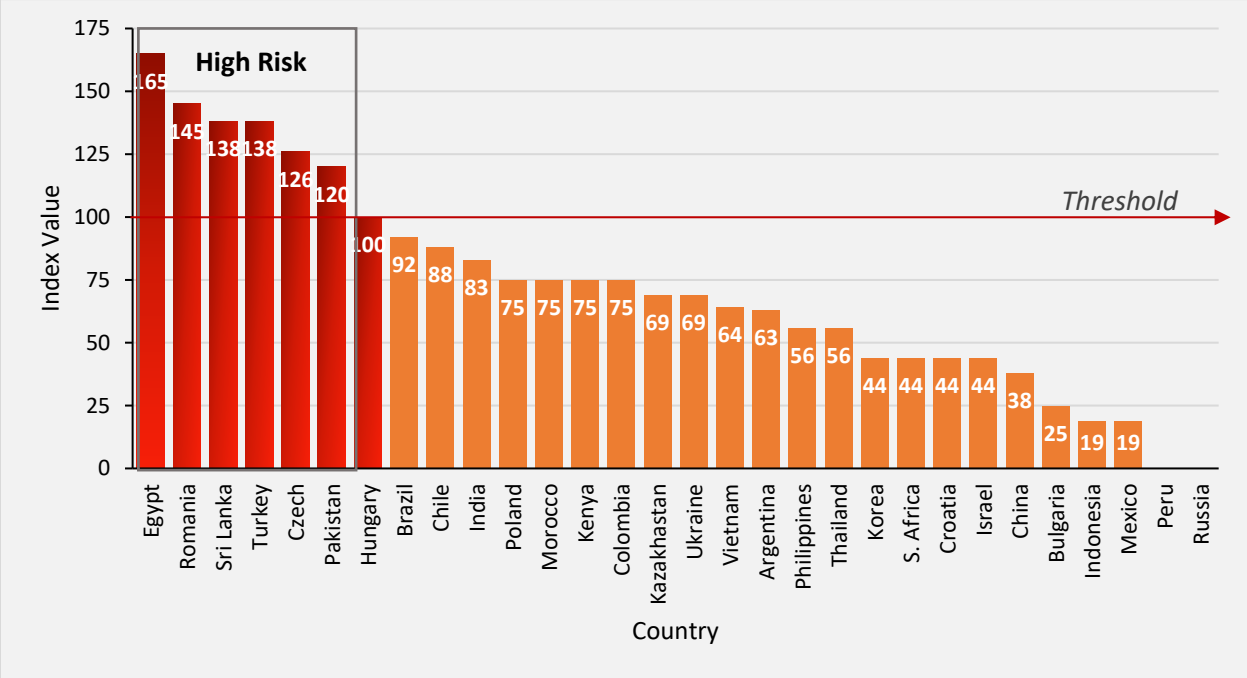

Figure 1. Early Warning Indicator of Exchange Rate Crisis for Emerging Markets.

The Nomura index provides early warning about the currency crisis. This index has successfully predicted the pressure on currencies in the past. Currently, seven developing economies are at the top of the risk for a currency crisis, i.e., Egypt, Romania, Sri Lanka, Turkey, Czech, and Pakistan, respectively. These economies have more than 100 scores in the early warning index Damocles. This index measures the likelihood of a crisis within 12 months. If a country's score breaches 100, there is a 64% chance that it will experience an exchange rate crisis. Recently, several other economies have faced similar risks but at a bit lower level. Among those two countries, i.e., Egypt and Romania from the emerging market economies, are at the highest risk of experiencing a currency crisis.

There are varying arguments regarding the economic issues and consequences of the currency crisis of a country. Initially, it was supposed that the currency's depreciation was purely a monetary phenomenon that did not affect the real economy. Nevertheless, Kaminsky (2006) has argued that the extent of a crisis can be estimated through productivity slowdown. There is a considerable loss of output in the economy and a slowdown in growth. Cross-country comparisons (Basistha & Teimouri, 2015; Nakatani, 2018) have also shown at least a 4 percent or more reduction in the growth of economies during the currency crisis.

This situation brings difficulties in implementing and making the optimal choice among the conflicting policy goals. Moreover, inherent financial constraints and factors like sovereign debts, higher deficits in the current account, and low foreign reserves increase the risk of crisis in developing economies. Output loss due to currency depreciation furthers the potential means of trade openness for such economies to recover from the recession.

Significance and Contribution of the Study

Despite extensive theoretical and empirical research on the causes and consequences of the currency crisis, it is the most frequently occurring financial turmoil in recent times that contagiously spreads across the global economy. Therefore, exploring the potential measures to face such challenges is a preferred policy goal in most countries (Gurtner & Bruno, 2010; Nakatani, 2018). Due to the constant crisis risk, it is necessary to investigate the conditions and mechanisms that may collapse domestic currencies.

Several studies have explored the crisis mechanisms theoretically and empirically. In theoretical work, inconsistencies in economic fundamentals and policies with speculative pressure are more prominent. At the same time, the empirical focus is more on developing some system to measure the likelihood of upcoming recessions. There is very little attention given to the real and financial sector issues that lead to the breakdown of a currency (Nakatani, 2018).

Due to structural differences among economies, currency crisis, and its risk varies across countries in terms of factors and consequences. So, it is vitally important to analyze the nature of currency crises and their effect on heterogeneous economies. Besides this (Candelon et al., 2014) have argued that existing empirical models are not dynamic. Therefore, identifying an upcoming issue is very difficult and requires dynamic analysis by including the previous periods' information. Given these problems, it is argued that the existing theoretical and econometric methods may have prevented experts from recognizing the GFC even during the suffering (Bezemer, 2009).

Given these issues, this study contributes to the crisis literature by addressing the abovementioned issues. The first contribution is to develop a model that identifies the nature of a looming crisis and the potential mechanisms that may bring turmoil by analyzing the structural heterogeneity among economies. This enables the developed framework to study the varying nature of a crisis. Secondly, the model includes economic shocks and financial stability with macroeconomic economic indicators. This is a significant contribution as existing econometric frameworks have yet to empirically explore the role of financial stability in detail so far, particularly for currency crises. This study has also focused on analyzing the crisis framework using the dynamic probit model. That is supposed to predict upcoming crises by including information on past turmoil. Another contribution of this research is to observe the potential policy for countries that may be adopted to avoid the crisis or to reduce the adverse effects and pave the way for economic wellbeing.

Objectives of the Study

This research aims to assess the role of shocks and financial stability in the economy during a currency crisis. It also evaluates the nature of a currency crisis to determine if it is fundamentals driven. The analysis is carried out for a diversified emerging economies group. Given the findings, appropriate policy suggestion for emerging economies is an essential study objective.

The study is organized as given. Section two briefly reviews the literature on theoretical and empirical models of the currency crisis. Section three discusses the empirical methodology, framework of the model, and data sources used for analysis. Section four presents the result discussion. The conclusion about each hypothesis is discussed with policy implications in the next section. References to the cited works are given in the last section.

Literature Review

Various episodes of turmoil across the world after the 1970s, such as currency collapse in Latin American, European, and Asian economies, have stimulated the considerable interest of researchers in this context. It is necessary to review existing literature from all fronts of theory and empirics to identify the risk and scale of the currency crisis in emerging economies. A substantial

amount of literature is devoted to analyzing the nature and dynamics of currency crises experienced in different episodes. In this section, a brief overview of theoretical and empirical models, along with recent development in literature, is presented.

Theoretical Framework of Currency Crisis

Pre and post-crisis characteristics of economies are observed in different models categorized as model generations. These models focus on sources, signals, forecasts, consequences, and crisis measurement. Theoretical models of currency crisis have three mainstream generations extended up to the fourth and fifth levels. All these models try to explain the financial turmoil experienced in different countries at different times.

The 'first-generation' crisis models are based on the philosophy that growth in domestic credit and weak macroeconomic conditions put downward pressure on the domestic currency and force monetary authorities to quit the fixed exchange rate regime. Thus, currency depreciation is unavoidable for developing countries (Krugman, 1979). The crisis results from poor economic variables such as high fiscal deficits, inflation, current account deficit, trade deficit, and excessive monetary expansions (Agénor, 1991; Blackburn & Sola, 1993; Dooley, 2000).

These models focus on the relationship between weak macroeconomic environments with speculations about government policies to manage the exchange rate. It is argued that inconsistencies in policy conduct lead to speculative attacks on the domestic currency. This happens because the government finances the deficit in times of high fiscal spending by reducing reserves or taking debt. However, the government can borrow only up to a specific limit, and under pegged exchange rate, it is impossible to deplete the reserves, so the deficit is financed through seigniorage. Printing money brings inflation in the economy that is inconsistent with the exchange rate peg. Moreover, excessive credit creation harms the reliability of monetary authorities to maintain a sufficient level of real balances, and investors start selling domestic assets to adjust their portfolios. This speculative attack further reduced the reserves, and the fixed exchange rate system collapsed (Flood & Garber, 1984; Krugman, 1979; Salant & Henderson, 1978).

Evidence from several economies that experienced currency crises in the 1970s and late 1980s is consistent with the first-generation models. There has been a high fiscal deficit and inflation in many Latin American countries, such as Brazil, Chile, and Argentina. The rapid expansion of domestic credit to stabilize these economies led to the drain of foreign reserves and the collapse of the exchange rate peg (Blackburn & Sola, 1993). That is why (Krugman, 1996) has referred to these models as 'seignorage-driven,' where crisis is predictable to a large extent.

The collapse of the European Exchange Rate Mechanism (ERM) in 1992-93 highlighted the role of speculative perceptions about government policies and suggests that crisis always is not due to unfavorable economic fundamentals or expansionary public policies (Eichengreen et al., 1995; Obstfeld, 1996). Most of the economies facing the crisis were found to have sound economic fundamentals and consistent fiscal and exchange rate policies that made it challenging to understand the reasons for the crisis from the first-generation model setting.

In this context, the 'second-generation' studies (Eichengreen et al., 1995; Obstfeld, 1996) suggest that government policies are conditional to one kind of situation, and investors behave speculatively; thus, multiple equilibria emerge in the economy. Krugman (1999) and Esquivel & Larrain (1998) have described these second-generation models as a circular process creating multiple equilibria by combining various factors like incentives, reasons, and costs, including agents' perceptions of government to pursue parity. Some studies (Banerjee, 1992; Calvo &

Mendoza, 1997) have argued that agents follow herd behavior instead of individual expectations about some positive signal.

It is observed that currency crisis often coexists with deteriorations in the financial sector of economies (Diaz-Alejandro, 1985; Kaminsky & Reinhart, 1999). Insights from the Asian crisis have given a new perspective to evaluate the crisis evolution. In this line, most studies have focused on the presence and significance of an association between devaluation and deficiencies in the banking sector. Theoretical literature in this line has discussed two mainstream approaches, i.e., moral hazard (Krugman, 1999) and liquidity problem (Chang & Velasco, 2001), that bring issues in the system of banks and financing firms and then in the exchange rate.

Most third-generation models have elements of previous models, such as indicators of economic fundamentals and the role of speculation to bring successful attacks with moral hazard and liquidity. Some researchers (Burnside et al., 2001; Flood & Garber, 1984) suggest developing a model setting that combines the element across previous generations. However, the absence of a sound relationship between economic conditions with crises experienced in east Asia implies that it is difficult to accurately predict the crisis in the previous framework (Jeanne, 1997).

The prediction problem about the quick spread of crisis from one country to another has motivated researchers to consider the contagion effect. Generally, contagion refers to some economic shock that diffuses from one market or economy to others (Masson, 1998). These effects are due to some standard external shock, trade of financial interdependence among countries, and change in agents' sentiment about an economy's condition (Drazen, 2000; Eichengreen et al., 1995; Gerlach & Smets, 1995; Masson, 1998; Sell, 2001). In this context, trade linkages, global shocks, and competition among countries in foreign markets play an essential role.

An overview of third-generation models suggests inefficient financial markets (Mishkin, 1996), irregularities in the balance sheet (Krugman, 1999), and weak systems of domestic banks (Kaminsky & Reinhart, 1999) create the basis for currency problems. The quick spread of crisis across countries is due to the contagion effect (Eichengreen et al., 1998; Gerlach & Smets, 1995) and the herding behavior (Mendoza & Calvo, 1997; Chari & Kehoe, 2000) of investors.

Krugman (2001) initiated the fourth generation of theoretical models by suggesting the analysis of financial turmoil beyond currency value and emphasized considering the role of asset prices. It is argued that the poor state of financial institutes leads to inflation, over-borrowing in foreign currencies, and the conduct of conflicting public policies (Breuer, 2004). Bussiere & Mulder (2000) have included the political factors to explain the crisis mechanism. Some researchers (Ghosh & Ghosh, 2003) have highlighted the role of the market and other agents in creating and expanding financial uncertainty through their unanticipated actions.

Leading indicators in these models include the quality of the economic environment, political stability, legal and cultural rights for assets' ownership, depositors' trust, and credibility of financial and other public policies. These can potentially bring ambiguity among decision-makers by affecting their efficiency and information handling (Agénor & Aizenman, 1999; Alesina et al., 2003; Das et al., 2004).

In brief, the fourth generation of crisis studies has explored the role of future expectations based on market price information (Tularam & Subramanian, 2013). It is argued to consider the role of asset prices (Krugman, 2001), political factors (Bussiere & Mulder, 2000), standards of financial policies, the role of stakeholders (Ghosh & Ghosh, 2003) along with other institutional and

macroeconomic factors and socio-economic environment (Arteta & Eichengreen, 2000; Breuer, 2004).

Empirical Models of Currency Crisis

The ongoing theoretical debate about leading indicators of crises has induced to model and forecast of the episodes of devaluation on empirical grounds. These models were initiated to test the significance and relevance of the proposed theoretical mechanisms. Empirical testing is statistically developed with a focus on leading indicators. These studies endeavor to define the variables used as crisis indicators, their thresholds, and other methods to identify the risk of an upcoming turmoil. Another objective of these models is to rank the countries according to the risk of developing a crisis. For this purpose, data and information is used for samples of different countries and groups.

In empirical literature (Derkach, 2010; Kaminsky & Reinhart, 1998), various approaches are proposed to evaluate the crisis, and most of these have focused on assessing the potential indicators as determinants of crisis. According to the methodology of analysis, these studies are categorized into three (Chui, 2002) to four (Kaminsky & Reinhart, 1998) types. These are named discrete choice, signaling, and structural approaches and are classified to identify currency pressure as a crisis. The common feature of these models is using the index for exchange rate pressure as a proxy for measuring a crisis for a panel of countries that have experienced some financial turmoil. In addition to these three approaches, Kaminsky & Reinhart (1998) have identified another method, the qualitative approach, as it uses no formal testing of theoretical models. Only graphical analysis and other factors are used to recognize a crisis.

The qualitative method is based on detecting the common factors among countries that have gone through some currency crisis. For this purpose, before and after crisis patterns and the state of these economies are investigated in an exploratory manner (Derkach, 2010). These models also focus on understanding how the response to some external shocks varies across countries (Goldstein, 1997). However, the graphical analysis does not suffix the complicated structure of currency depreciation in a global world.

Since the crisis is a latent variable, there is a considerable variation in defining it by some observed variable or index. Most studies have used exchange rate pressure (Goldman Sachs GS-WATCH, 1998; JP Morgan;(Frankel & Rose, 1996) and depreciation in currency (Kumar et al., 2003) to define the crisis. Some (Eichengreen et al., 1996) have used the average index of interest rate and reserves with the exchange rate, and others (Sachs et al., 1996) have used the level of reserves with devaluation. Given the data availability for relevant variables, most of the studies (GS-WATCH; (Kumar et al., 2003; Morgan, 1998; Ötker & Pazarbaşioğlu, 1997)) have used monthly data, and(Frankel & Rose, 1996) have used annual data for various groups of countries. Here, crisis indicators are selected from the theoretical literature according to some major categories.

Empirical models indicate the presence of a strong link between poor economic conditions with speculative pressure. In these conditions, expansionary policies, excessive credit creation, deficits, and inadequate foreign reserves (Kruger et al., 2000; Ötker & Pazarbaşioğlu, 1997) are supposed to intensify the crisis probability. However, it is suggested that currency devaluation is not purely a consequence of macroeconomic weaknesses or regional contagion, but investors' behavior is also required for appropriate assessment.

Empirical analysis based on academic settings has also exposed several relevant factors present endogenously and exogenously in economies that initiate and boost economic collapse. These approaches can be categorized into three types, i.e., discrete choice, signaling, and structural

models. The precision and accuracy of these models vary subject to several methodological problems and data availability. However, a fascinating insight from the empirical literature refers to some specific indicators that are beneficial to identify a future crisis. These include exchange rate valuation, banking and financial sector inconsistencies, excessive lending, and contagion.

Gap in Literature

Existing studies have conflicting evidence based on different models, as those models are primarily static and unable to provide a sufficient understanding of the dynamics of devaluation. Moreover, the literature contributes to the issue of the currency crisis. It typically focuses on the factors optimal for currency areas and regimes, like the size of economies, trade openness, and macroeconomic fundamentals. Little attention was paid to the implications of financial stability and the exchange rate fluctuations until the Global Financial Crisis (GFC, henceforth) in 2007-08. Therefore, it is maintained that despite the extensive investigation of the crisis, several issues and sources emerge with each episode of turmoil and must be included in the analysis of emerging economies.

Data and Methodology

Currency depreciation is subject to various elements, including macroeconomic fundamentals, financial stability, capital control, external liabilities, and economic shocks. Given the varying nature of fundamentals and other conditions in different countries, this analysis requires including country specific heterogeneity and preconditions. This framework is conceptualized in figure 2.

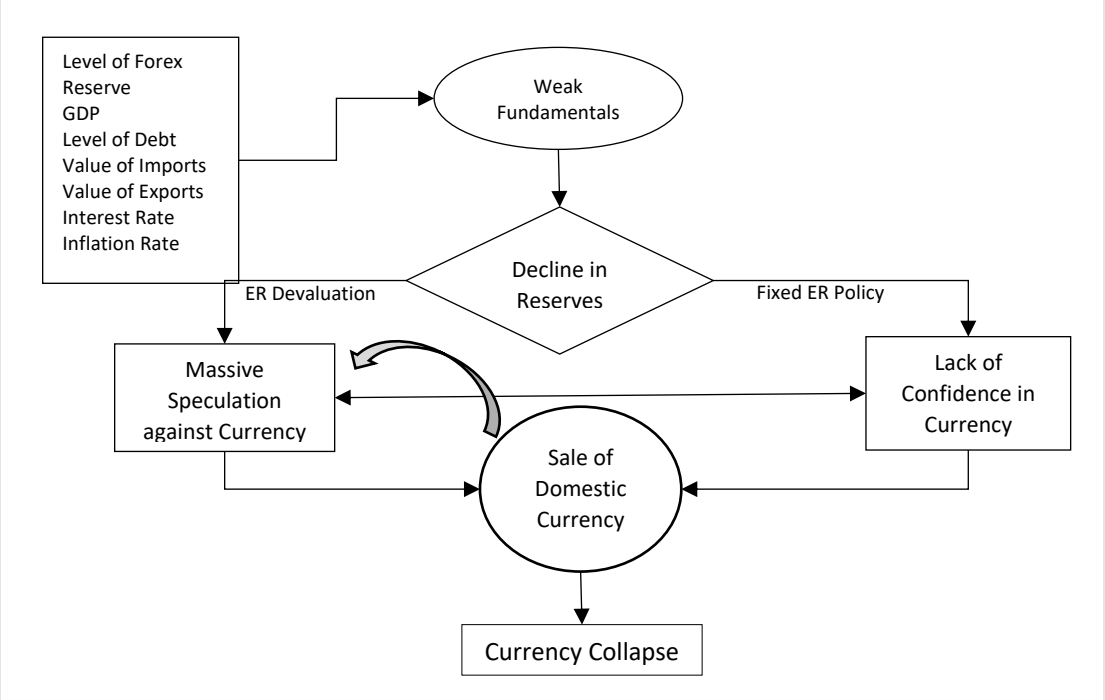

Figure 2. Conceptual Framework of Currency Crisis.

Model Specification

To assess the role of shocks in the exchange rate, this study uses the proposed (Nakatani, 2018) modified "ABB" model (Aghion et al., 2000) that includes the effects of shocks for predicting the changes in the exchange rate of an economy. This model has established that the nominal exchange rate of the currency is determined from the interaction of the Interest Parity-LM (IPLM) with the wealth or output curve. The model for the exchange rate used in this study is conceptualized in equation (1).

$$\Delta e_{i,t} = \beta_0 + \beta_1 \Delta e_{i,t-1} + \beta_2 \Delta i_{i,t} + \beta_3 \frac{l^*_{i,t}}{GDP_{i,t}} + \beta_4 \eta_{i,t} + \beta_5 WSh_{i,t} + \beta_6 WSh_{i,t} WSl_{i,t} + \beta_7 FS_{i,t} + \beta_8 GSh_t + \gamma_m Z_{i,t} + v_i + \varepsilon_{i,t}$$

Here, $\Delta e_{i,t}$ represents change in the nominal exchange rate for ith country in t time period, $\Delta e_{i,t-1}$ is change in exchange rate for the previous time period, $\Delta i_{i,t}$ is change in policy interest rate that represents monetary policy of country i, $\frac{l^*_{i,t}}{GDP_{i,t}}$ is ratio of external debt to GDP, $Z_{i,t}$ is the vector of control variables that includes GDP growth, overvaluation of exchange rate and reserves to import ratio in the country. $FS_{i,t}$ represents the financial stability that is measured by the proxy of bank credit to bank deposit ratio. v_i is the fixed effect of country and $\varepsilon_{i,t}$ is error term. In addition to these, oil prices are used as a proxy of global shocks i.e., GSh_t.

$\eta_{i,t}$ is shock to domestic risk premium. To account for this, IPLM shock is estimated from the equation (2).

$$\delta_{i,t} = \gamma_{1,i} + \gamma_{2,i} HPtrend_{i,t} + \gamma_{3,i} \text{Ƙ}_{i,t} + \eta_{i,t} \quad (2)$$

Here, $\delta_{i,t}$ measures the risk premium for the country i in period t. It is obtained by the domestic interest rate change from the anchored currency i.e., US interest rate as: $\delta_{i,t} = i_{i,t} - i^f_t$. To measure the trend for the risk we use the Hodrick–Prescott filter and estimate $HPtrend^i_t$. Ƙ^i_t is the set of control variables that includes the effect of monetary policy in the economy. These variables are selected to account effects of the monetary policy, government activities, and state of development in the banking sector (Nakatani, 2018). The monetary policy effect is measured by differencing the domestic policy rate with US policy rate. Bank assets to GDP and ratio of public sector credit to GDP is used to capture the development of banking sector and government activities respectively. $\eta_{i,t}$ is the IPLM shock that measures the financial market shock by a shift in the risk premium of a country is estimated as an error term of the model given in equation (2). To avoid the endogeneity problem, lag of policy rate differential is used.

The productivity shock is represented by $WSh_{i,t}$. It is measured by the growth in productivity of an economy.

The panel study provides a deeper and more comprehensive examination of macroeconomic issues like currency depreciation. Longitudinal analysis is particularly of great use for macro panel of countries as it enables to observe the country specific characteristics by controlling the heterogeneity among the cross sections over time. Therefore, a group of emerging markets is selected in this study to understand the dynamic relationship of exchange rate with different variables.

Technique of Analysis

In practice, it is difficult for many economic models to establish the homogeneity of explanatory variables. Similarly, the unobserved individual heterogeneity is likely to exist and correlate with both the stimulates and response variables. To deal with the problem of endogeneity, it is recommended to use the instrumental variable (IV) approach (Anderson & Hsiao, 1981) or the Generalized Method of Moments (GMM) (Arellano & Bond, 1991) for analysis. For estimation of the exchange rate depreciation model discussed in equation (1), this research uses the GMM model to avoid the problem of endogeneity and evaluate the exchange rate dynamics for heterogenous economies.

Results from the panel data estimators could be more efficient if variables are non-stationary. Therefore, panel unit root tests are used to ascertain whether the data series is stationary. The panel unit root equation is given as.

$$\Delta x_{it} = \alpha_i + \rho x_{it-1} + \phi_i \Delta x_{it} + \delta_i t + v_t + \varepsilon_{it} \quad (5)$$

Here, the null hypothesis assumes that $\rho < 1$ and xit series is stationary, against the alternative hypothesis that xit series is nonstationary with $\rho \geq 1$.

Data and Variables

The study uses the annual data of 43 emerging market economies. The data on several variables is collected from various sources for the period of 2000 to 2017 including, world Development Indicators (WDI) , International Financial Statistics (IFS) , Direction of Trade Statistics (DOTS) etc. The data for currency exchange rates for policy rates is obtained from the International Monetary Fund (IMF) data base. The time frame for panel analysis is selected as per data availability and changes in the exchange rate management policy. A brief description of the variables with the source of data is discussed here in detail.

Change in the Exchange Rate (Δe): The change in exchange rate is used as dependent variable in the study of currency crisis. It is measured as the percentage change in value of domestic currency in terms of foreign currency i.e., U.S dollar. The data for change in the exchange rate is taken from IFS database.

Monetary Policy Rate (pr): The policy rate is used as the annual percentage change in the rate of interest set by the monetary authorities of the economies. Data of central bank rates of selected economies is taken from IFS where available and from the official websites of the central banks of the rest of countries.

Foreign Liabilities (l): Foreign liabilities are accounted for as the ratio of external debt to GDP. These liabilities are measured as the ratio of the external debt to GDP. The data on liabilities is taken from world bank's WDI database, World Economic Outlook (WEO) , IMF, and Joint External Debt Hub (JEDH) databases.

Total Factor Productivity (TFP): The data of TFP is accessed from the Penn World Table (PWT), version 10.0 based on Feenstra et al., (2015).

Export Value and volume: The export level is measured in the US dollar value of annual exports and volume is the annual total exports from a country. Data is taken from DOTS database.

Interest Rate Spread (i-i*): Deposit rate is used as the nominal interest rate and is taken from the IFS.

Bank assets to GDP ratio is used as the control variable in computation of IPLM shock. This data is taken in annual frequency from the Global Financial Development Database (GFDD), world bank.

Credit to Public Sector to GDP: The ratio of credit to public sector including government and State-Owned Enterprises (SOEs) to GDP is used as control variable in IMPL shock calculation. The data is obtained from the GFDD in annual frequency.

Real Effective Exchange Rate (REER): Data on the real effective exchange rate indices is accessed from Bank of International Settlements (BIS) .

Foreign Interest Rate (i*): Data of the foreign interest rate i.e., US rate is taken from IFS in annual series.

Exchange Rate Overvaluation (erov): The exchange rate overvaluation is calculated as the deviation of the real effective exchange rate from the five-year moving average of effective exchange rate. This series is computed in annual percentage form and is taken from BIS and IFS databases.

Reserves to Imports Ratio (r/m): Data on the value of imports is taken from DTOS and the annual reserves over in excess of gold in a country is taken from IFS.

Financial Soundness: Two indicators are used to account for the financial soundness in an economy. These are bank credit to deposit and bank z score taken from GFDD.

Capital Controls: The data is taken from various annual reports on Exchange Arrangements and Exchange Restrictions (EAER) by IMF.

Global Shocks: To measure the global shocks, global oil prices are taken for crude oil WTI annual prices. This data is taken from International Energy Agency (IEA) database.

Results and Discussion

This section presents the results of the estimated model of the nominal exchange rate depreciation. There is a great fluctuation in the real effective exchange rate of the economies in past decades. These fluctuations are quite high for the advance economies and other emerging economies.

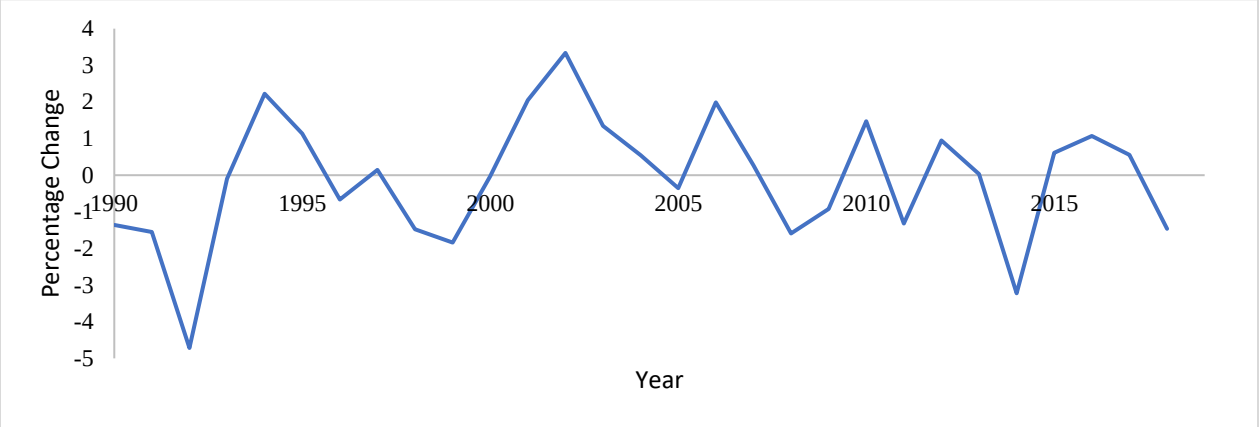

Figure 4. Fluctuations in Exchange Rate of Emerging economies.

The descriptive statistics of all variables is given as in table 1. These summaries are estimated for overall panel, between the cross-section units and within cross sections for emerging economies.

Table 1
Descriptive Statistics

Variable	Sample	Mean	Standard Deviation	Minimum	Maximum
Nominal Exchange Rate	Overall	4.648	18.097	-28.233	293.791
	Between		6.438	-1.137	27.699
	Within		16.940	-31.174	270.740
Policy Rate	Overall	-0.645	14.601	-269.743	244.350
	Between		1.599	-10.350	0.979
	Within		14.515	-268.784	245.309
IPLM	Overall	12.409	8.539	-167.823	35.110
	Between		4.318	-7.626	17.299
	Within		7.394	-147.788	55.145
Wealth Shock	Overall	0.949	7.094	-41.723	76.469
	Between		1.982	-2.474	6.289
	Within		6.818	-41.737	76.455
GDP Deviation (from trend)	Overall	0.198	4.338	-40.310	24.085

	Between		0.475	-0.430	1.402
	Within		4.313	-39.863	24.022
Exchange Rate Overvaluation	Overall	0.149	9.570	-52.162	140.585
	Between		1.075	-1.990	3.893
	Within		9.511	-55.906	136.841
Reserves to import ratio	Overall	0.589	0.420	0.000	2.528
	Between		0.356	0.016	1.572
	Within		0.229	-0.251	1.793
Financial Stability	Overall	11.857	7.334	0.423	44.362
	Between		6.982	4.229	38.900
	Within		2.472	3.254	36.779
Ratio of external debt to GDP	Overall	45.573	32.307	0.000	202.624
	Between		23.515	4.944	115.368
	Within		22.427	-69.795	179.122
Global Shocks	Overall	6.258	23.712	-47.659	37.687

Source: Author's Calculations

The findings of various unit root tests for the selected panel are given in table 2. These indicate that all the series are stationary at moderate level of significance i.e., 5%.

Table 2
Results of Panel Unit Root Test

Variables	IPS	LLC	Fisher-PP
Nominal Exchange Rate	-3.19***	-15.63***	387.75***
	(0.0000)	(0.0000)	(0.0000)
	(0.0000)	(0.0000)	(0.0000)
Policy rate	-4.62***	-11.003***	759.70***
	(0.0000)	(0.0000)	(0.0000)
IPLM	-3.23***	-4.20***	423.54***
	(0.0000)	(0.0000)	(0.0000)
Wealth Shock	-3.36***	-12.34***	419.48***
	(0.0000)	(0.0000)	(0.0000)
GDP Deviation (from trend)	-3.06***	-8.86***	338.67***
	(0.0000)	(0.0000)	(0.0000)
Exchange Rate Overvaluation	-3.24***	-22.25***	404.17***
	(0.0000)	(0.0000)	(0.0000)
Reserves to Import Ratio	-22.30***	-3.70***	249.78***
	(0.0026)	(0.0001)	(0.0000)
Financial Stability	-4.88***	-7.45***	133.99***
	(0.0000)	(0.0000)	(0.0007)
Ratio of external debt to GDP	-2.89***	-6.24***	139.42***
	(0.0019)	(0.0000)	(0.0002)
Global Shock	-13.53***	-6.04***	406.81***
	(0.0000)	(0.0000)	(0.0000)

Note: The level of significance is shown by narrow *(10%), moderate **(5%), and broad ***(1%) criteria. Values in the parentheses represents the p-values of the test.

The results from the model of the nominal exchange rate fluctuations are given in table 3. The model 1 evaluates the effect of risk premium in relation to the monetary policy and exchange rate change, model 2 estimates the impact of output shock. Model 3 is the last one that includes both shocks for the economies.

Variables	1	2	3
Lag of Change in exchange rate	0.201* (0.061)	0.204 ** (0.016)	0.21** (0.018)
Ratio of external debt to GDP	1.62** (0.02)	2.16*** (0.003)	3.706*** (0.008)
Bank Policy rate	-0.227** (0.004)	-0.348** (0.031)	-0.306** (0.012)
Estimate of risk premium	0.198** (0.017)		0.253** (0.041)
Wealth Shock		-3.48** (0.034)	-3.15*** (0.002)
GDP Deviation (from trend)	-2.89** (0.045)	0.541* (0.078)	0.376 (0.671)
Overvaluation of exchange rate	-0.43** (0.046)	-1.18*** (0.003)	-0.16** (0.039)
Reserves to import ratio	-9.102*** (0.006)	-12.34*** (0.0044)	-7.12*** (0.0083)
Global shock	2.64 (0.192)	1.451 (0.1820)	1.487 (0.1561)
Financial stability	-8.601** (0.064)	-5.186* (0.0841)	-5.508** (0.048)
Capital Restrictions	5.14** (0.073)	3.16** (0.062)	2.28** (0.051)
Groups	43	32	32
Observations	688	510	510
Arellano-Bond AR (2) test	0.115	0.242	0.186
Hansen Test	0.103	0.182	0.132

Note: The level of significance is shown by narrow *(10%), moderate **(5%), and broad ***(1%) criteria. Values in the parentheses represents the p-values of the test.

To focus on the effect of monetary policy, we observe the coefficient of the monetary policy rate. This is a negative and significant variable and means that an increase in the monetary policy rate will result in currency appreciation. A one percent increase in the central bank rate increases domestic currency's value by 0.2 to 0.3 percent in emerging economies. This finding matches the expected theoretical sign of the policy rate relationship with currency value.

The ratio of short-term external debt to GDP has a positive and significant relationship with the exchange rate. It means that one point change in the ratio depreciates the nominal exchange rate between 1.6 to approximately four percent. It is implied that higher levels of foreign debt could be better for domestic currency value. This is also validated in all model scenarios. Lagged dependent variable captures the dynamic effect and is also positive and significant, which validates the theoretical perspective that a past depreciation will further depreciate the currency value and vice versa. Similarly, the IPLM shock has a significant positive value in all models. This refers to an increase in the risk premium for a country's financial state that leads to the depreciation of its currency value.

Given the shock of productivity, risk in the economy's structure is observed. A positive productivity shock is always good for the economy's competitiveness and exchange rate. The

coefficient of wealth shock is negative and significant, meaning that an increase in output will appreciate the domestic currency valuation. This finding is significant for all models. Moreover, the change's size is also more significant than other variables that may appreciate the exchange rate.

Control variables for the model are also indicative of notable implications. Deviation of output shows a business cycle phenomenon, as the model without productivity shock shows a negative relationship that is altered to a positive one in the presence of shocks. So, there is more chance of a currency devaluation during periods of higher economic productivity. The exchange rate overvaluation is always negative and significantly related to currency depreciation. An overvalued domestic real exchange rate appreciates the nominal value of the currency.

Financial stability is also highly associated with currency appreciation. Its coefficient ranges between 4 to 8 percent change in the nominal currency exchange rate. Oil prices have a positive but insignificant relationship with the nominal devaluation of the domestic currency. This relationship can be positive or negative, given the country-specific nature of oil export and imports. If a country exports oil, an increase in global price will appreciate its currency, and if it is the main importer of the economy, its value will depreciate. The capital flow restrictions have a positive and significant relation with currency depreciation. There is approximately a 5 % higher chance of experiencing depreciation if we follow the policy of controlling the capital flow as per model 1. This chance remains significant, with a value of around 3% for models 2 and 3. The model's Diagnostic is provided by the Arellano-Bond test with no serial autocorrelation AR (2). In this estimate, all models' presence of serial autocorrelation is not validated. The Hansen test refers to the joint validity of restriction in the model.

Conclusion

The incidence of the currency crisis has been quite common in the recent past. Several economies have experienced various financial crises of varying natures and intensities. Such crises have become more frequent in the past century by following the varying exchange rate regimes. Every time a crisis emerges, it severely affects the economic stability and well-being of larger populations, not only for the affected country but across the world. In this research, several channels of a currency crisis are explored for emerging economies. A third-generation modified model is adopted for empirical analysis to observe how much change in a fundamental variable brings variation in the domestic currency's value. To observe the dynamics of currency value, a sophisticated model is used. It is observed that foreign liabilities have a significant role in determining the currency devaluation of various countries. Countries with high due loans are more likely to observe pressure on their currencies. This model is consistent with first-generation empirical studies.

Moreover, an overvalued real exchange rate also becomes a reason for depreciation in currency value. This happens due to the speculative pressure on the currency. Additionally, the shock or risk premium productivity and weak economic structure are significant factors for depreciation. A positive relationship of the output shock is a potential implication for many countries to set the optimal strategy to avoid the negative consequences of a crisis. In addition to these, financial stability is another critical variable. If the countries have a higher level of stability, they are less likely to face depreciation. Oil prices have a mixed effect on the economies. It may be positive or negative, given that a country is a significant exporter or oil importer.

Given the empirical results, it is recommended that countries should focus on reducing and managing the size of their foreign liabilities. Monetary authorities must not overvalue the exchange rates and abandon the managed float to avoid speculative pressure. Similarly, the policy for interest

rates should be investor friendly so that potential depreciation can be avoided. Emerging economies can work on improving their export sector as a strong export sector can benefit in the situation of crisis instead of loss. Governments and firms should focus on exploring and improving output production in the economies. As the positive productivity shocks have a long-lasting benefit for the economies.

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Appendix

Table A.1
Indicators of Currency Crisis According to Theoretical Model Generations

Model	Indicators
First generation	Fiscal deficit/ GDP Excess real M1 balances
Second generation	Exports Imports Real exch. rate Terms of trade Output Dom. Real int. Rate
Third generation	Dom. Credit/ GDP M2/ foreign exch. Reserves M2 multiplier Bank deposits Stock prices Banking crises
Sovereign debt	Foreign debt/ exports S-T foreign debt/ exch. Reserves
Sudden stops	World real int. Rates Foreign exch. reserves

Source: (Kaminsky, 2006; Nakatani, 2018)

Table A.2
List of Selected Economies

Emerging Market Economies		
Argentina	Egypt	Peru
Armenia	Gabon	Philippines
Bangladesh	Guatemala	Romania
Bolivia	Hungary	Russian Federation
Brazil	India	Sierra Leone
Burundi	Indonesia	South Africa
Cameroon	Iran	Sri Lanka
Central African Republic	Jamaica	Thailand
Chile	Kazakhstan	Togo
China, P.R.: Mainland	Malaysia	Turkey
Colombia	Mexico	Ukraine
Costa Rica	Moldova	Uruguay
Côte d'Ivoire	Morocco	Venezuela
Croatia	Nigeria	
Dominican Rep.	Pakistan	