

# INVESTIGATING THE INFLUENCE OF COUNTRY CREDIBILITY ON THE CHANCE OF CURRENCY CRISIS

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## ABSTRACT

*This paper deals with the relationship between country credibility and currency crises by using cross-country pooled data with a multinomial logit model. We use Corruption Perception Index (CPI) published by Transparency International, which is a global non-governmental organization devoted to combating corruption, as a proxy for country credibility. The main findings from the multinomial logit models indicate that country credibility has a significant influence on currency crisis. The applied corruption index is statistically significant. Negative coefficients on this index prove a relationship between country corruption and the likelihood of currency crisis. Moreover, marginal effects of corruption index are high in relation to marginal effects of other explanatory variables. These results suggest that approaching currency crisis should capture country corruption itself or any other proxy of country prestige.*

**JEL:** E51,F31, G18

## INTRODUCTION

The Asian Crisis confirms that currency crises occur when macroeconomic as well as microeconomic fundamentals experience vulnerabilities. As Radelet and Sachs (1998a:26) stated; in the aftermath of the Asian crisis, many observers have decried widespread corruption and crony capitalism as an underlying cause of the financial crisis. Mc Kinnon and Phil (1997,1999) view the problem in the Asian Crisis as the “over borrowing syndrome” and emphasized the role of moral hazard driven by unregulated banks and financial institutes. Corruption, cronyism and lack of transparency were thought to be the ultimate causes of the large open positions banks took and over borrowing throughout the economy. Wei and Wu (2001) note that crony capitalism and self fulfilling expectations by international creditors are tow frequently mentioned opposing explanations for currency crises. They propose corruption as a linkage between these two alternative explanations. Their main argument is that corruption may affect a country’s composition of capital inflows in a way that makes it more likely to experience a currency crisis that is triggered by a sudden reversal of international capital flows.

Ghosh and Ghosh (2002) examined the role of corporate sector vulnerabilities in currency crises by using a methodology called binary recursive tree. Their findings suggest that, countries with poor public sector governance, as proxied by public sector corruption index, are much more likely to have a crisis. Eichengreen and Rose (1999) consider the impact of corruption. Their argument is that it is bad for both international direct investors and creditors but direct investment suffers more and hence the composition of capital inflows favors financial over direct investment. Countries with this problem are more likely to default on bank loans, or to nationalize the assets of foreign direct investors. The need for international investors to pay bribery and deal with extortion by corrupted bureaucrats tends to increase with the frequency and the extent of their interaction with local bureaucrats. A country with high levels of corruption receives substantially less foreign direct investment.

This study intends to investigate the influence of country credibility on probability of currency crises by using cross-country pooled data with the multinomial logit model. Corruption Perception Index (CPI) published by Transparency International, which is a global non-governmental organization devoted to

combating corruption, is used as a proxy for country credibility in this study. High levels of corruption are expected to increase the chance of currency crisis. The impact is not direct though, as it affects the currency stability through its impact on Foreign Direct Investments. Moreover, membership in international financial and trade organizations might have a reasonable impact on country credibility. However, when checking for the sample countries membership, each country is found to be a member of some international organization. Nevertheless, membership in the European Union was included in to this study in order to analyze the impacts of being an international organization member on country credibility. The remainder of the paper is organized as follows: The following section provides a review of the related literature. Section three discusses the methodological issues and section four presents the empirical results. Finally, section five includes some final remarks and future extension proposals.

## A BRIEF REVIEW OF RELATED LITERATURE

The beginning of the currency crisis literature is attributed to Krugman's (1979) classic paper. Krugman's (1979) work was later simplified and extended by Flood and Garber (1984) and surveyed in Agenor et al. (1992). The so called *first generation* crisis models are based on the exhaustible resource literature. The first generation crisis occurs because of an unfavorable macroeconomic policy incompatible with a fixed exchange rate. In this framework, currency crises are essentially caused by excessive credit expansion, which leads to a gradual but persistent loss of international reserves. Under a virtually fixed exchange-rate regime, economic agents anticipate that the authorities will eventually abandon the parity with the depletion of international reserves.

Flood and Garber (1984) showed that the abandonment of the currency peg typically will be enforced by a speculative attack of rationally acting market participants. As soon as the shadow flexible exchange rate, i.e. the exchange rate that would prevail in the absence of the currency peg, is above the fixed parity, domestic speculators can make a profit in an attack by purchasing foreign exchange from the central bank at the fixed price and reselling it at the market-determined price. However, competition between speculators will ensure that the exchange-rate peg will collapse as soon as the shadow exchange rate equals the currency peg. This kind of currency crisis is often called a "fundamental crisis" since it is a fundamental reason that makes it impossible for the central bank to further stabilize the exchange rate. Without such a fundamental reason no currency crisis will occur in these models (Berlemann et al. 2002).

The understanding of a currency crisis based on first generation models is questioned after 1992 due to their inability to explain the crisis of the European Monetary System (EMS) that happened in the same year. To capture the features of the crises in the European Monetary System (EMS) and in Mexico in the 1990s, a *second-generation* of currency crises models was developed (Obstfeld 1986, 1994). These models studied what happened when government policy reacts to change in private behavior or when the government faces an explicit trade-off between the fixed exchange rate policy and other objectives. In Ozkan and Sutherland (1998), for instance, one benefit derived from maintenance of the peg is to obtain credibility in the fight against inflation.

However, an increase in foreign interest rates will lead to an increase in domestic interest rates, which causes a lower level of output. If foreign interest rates rise beyond a certain level, the cost of maintaining the peg becomes larger than the benefits and policymakers will abandon the peg. Therefore, it is changes in important economic variables, due to certain shocks either domestic or external, that make policymakers abandon the peg. Self-fulfilling expectations and multiple equilibria play an important role in these models. The economy can move from one state of equilibrium to another without any noticeable change in the fundamentals and crisis may develop without changes in economic fundamentals.

Obstfeld (1996) presented some mechanisms through which currency crises with self-fulfilling features, or self-fulfilling crises, erupt. One such mechanism is when expectations of a currency depreciation drive

up domestic interest rates in a country with a high public debt. In this case, out of concern for the higher cost of servicing the public debt, the government will abandon the peg. Another mechanism is based on expectations of depreciation, which lead to higher domestic interest rates. In this case, rather than face a possible costly bailout of banks, the government will abandon the peg.

The Asian crises of 1997-98 motivated the development of *third generation* currency crises models with financial issues from both banks' and firms' side being the key elements. As Radelet and Sachs (1998b:2) have argued; the Asian Crisis in 'one sense can be understood as a "crisis of success." By conventional fiscal measures the governments of the afflicted economies were in quite good shape at the beginning of 1997; while growth had slowed and some signs of excess capacity appeared in 1996, none of them faced the kind of clear tradeoff between employment and exchange stability. Krugman (1999) suggested that there are two major approaches dominated in the post-1997 theoretical literature. The first, so called "moral hazard approach" represented Krugman (1998, 1999) as well as Mc Kinnon and Phil (1997,1999) modeled "over borrowing syndrome" and emphasized the role of moral hazard driven by unregulated banks and financial institutes.

Corruption, cronyism and lack of transparency were thought to be the ultimate causes of the large open positions banks took and over borrowing throughout the economy. Krugman (1998) argued that the collapse of a fixed exchange rate regime might occur as the result of moral hazard due to governmental guarantees to the financial sector without an adequate system of banking regulation and supervision. Krugman considered a case of over-guaranteed and under-regulated financial intermediaries. Since these institutions do not have to put any capital up-front, and have the liberty to walk away at no personal cost in case of bankruptcy, they engage in excessive lending.

In the alternative view, the so called "financial fragility approach", represented by Chang and Velasco (1998) and Radelet and Sachs(1998a, 1998b), a self-fulfilling pessimism of international lenders caused financial fragility of the Asian countries. A typical model of this kind was presented in Chang and Velasco (1998). This model is based the bank runs work of Diamond and Dybvig (1983). Chang and Velasco (1998) added currency demand to the utility function, which makes a distinction among different exchange rate-monetary regimes necessary. They provide a detailed account of interactions between bank fragility and exchange rates under different monetary regimes.

According to Radelet and Sachs (1998a:2); East Asia had exposed itself to financial chaos because its financial systems were riddled by insider dealing, corruption, and weak corporate governance, which in turn had caused inefficient investment spending and had weakened the stability of the banking system. Wei and Wu (2001) noted that crony capitalism and self fulfilling expectations by international creditors are often suggested as two opposing explanations for currency crises. They proposed corruption as a linkage between these two alternative explanations. Their main argument is that corruption may affect a country's composition of capital inflows in a way that makes it more likely to experience a currency crisis that is triggered by a sudden reversal of international capital flows.

## METHODOLOGICAL ISSUES

### Data Description and Transformation

Data were collected from the International Financial Statistics (IFS: CD-ROM Version) of the International Money Fund (IMF) for International Reserves, M2 Money Supply and Domestic Credit series. Real Effective Exchange Rate series data were obtained from JP Morgan. Data about corruption comes from Transparency International. Because of data availability, the sample contains 33 countries listed in Table1. This limited number is mostly a result of data availability. It includes a panel of emerging economies of the period 1991-2002.

The following standard definition of currency crises defines Exchange Market Pressure (EMP) as:

$$EMP = \frac{\Delta e}{e} - \frac{\sigma e}{\sigma R} \cdot \frac{\Delta R}{R} \tag{1}$$

This is a weighted average of the rate of change of the exchange rate,  $\frac{\Delta e}{e}$ , and of reserves,  $\frac{\Delta R}{R}$ , with weights such that the two components of the index have equal sample volatilities, that  $\sigma e$  is the standard deviation of the rate of change of the exchange rate and  $\sigma R$  is the standard deviation of the rate of change of reserves. This way of defining currency crises has an advantage of including instances where a currency came under severe pressure but the authorities successfully defend it. Another advantage of using this definition is that, it can be used to analyze speculative attacks under both fixed and flexible exchange rate regimes. It is worth noting that in order to construct an exchange market pressure index, some researchers employ the difference between domestic and foreign interest rates, or percentage changes in domestic interest rates, while many others avoid using it because many developing countries do not have reliable interest-rate data.

Table 1: Countries in the Sample

Country	Country	Country	Country	Country	Country	Country	Country
Argentina	Bangladesh	Bolivia	Brazil	Bulgaria	Chile	China	Colombia
Croatia	Cyprus	Czech Rep.	Dominican	Ecuador	Egypt	Estonia	Ghana
Hungary	India	Indonesia	Israel	Korea	Latvia	Lithuania	Malaysia
Mexico	Peru	Philippines	Poland	Slovenia	Russia	Thailand	Turkey
Tunisia							

Kaminsky et.al (1997) listed 103 variables used in various studies to explain the likelihood of a crisis occurring and they accepted 16 out of 103 variables as most useful indicators of currency crises. Then in World Economic Outlook of May 1998 IMF, this list is reduced further to three: the real exchange rate, credit growth and M2/Reserves. Corruption Perception Index is used to reflect country prestige as an exogenous variable and to be consistent with the related studies three explanatory variables that might affect currency crises; M2 money supply/net international reserves (denoted M2/NIR), domestic credit (denoted Dcred), and real effective exchange rates (denoted REER), are taken into account as the other exogenous variables. For real effective exchange rates, using the percentage change would be improper as not all real appreciations indicate greater depreciation pressure. Therefore, a trend was estimated by using Hodrick-Prescot (H-P) filter and deviations from the trend are used. A Hodrick-Prescott filter applied to a time series  $\{y_t\}$  produces the filtered series  $\{\hat{y}_t\}$  which solves the following minimization:

$$\min \sum_{t=1}^T (y_t - \hat{y}_t)^2 + \lambda \sum_{t=2}^{T-1} ((\hat{y}_{t+1} - \hat{y}_t) - (\hat{y}_t - \hat{y}_{t-1}))^2 \tag{2}$$

The first term is the standard sum of squared residuals; the second term is a penalty factor for changing the slope of  $\{\hat{y}_t\}$  too much.  $\lambda$  controls the importance given to the penalty. If  $\lambda = 0$  then  $\hat{y}_t = y_t$  for all  $t$ ; as  $\lambda \rightarrow \infty$  the H-P filter becomes a simple least squares linear regression. The other two exogenous variables; domestic credit and M2/Reserves are calculated as 12 months percentage changes. Avoiding any seasonality that could be incorporated into the data and keeping away from the risk of deriving misleading interpretations are the reasons for the use of the 12 months percentage change.

Method of Estimation

In order to examine how the probability of currency crisis is affected by country credibility, a maximum – likelihood multinomial logit model is used in this study. Eichengreen, Rose, Wyplosz (1994, 1996), Frankel, and Rose (1996) have used the logit approach in estimating models of currency crises. Recently, Berg and Pattillo (1998) and Kumar et al. (2003) have also analyzed the emerging market currency crises by using probit/logit models. The decision to use Logit or Probit (normal distribution) is purely arbitrary as the logistic and normal distributions are quite similar except that the tails are thicker in the logistic case. This approach defines a crisis indicator equal to one or zero depending on whether a currency crisis does, or does not occur within the specified time. In addition, it considers all variables together and looks only at the marginal contributions of each indicator; it disregards variables that do not contribute information that is not already captured in the other variables (Abiad, 2002).

According to this approach, one can write the probability of having crisis as;

$$P(y = 1) = f(\beta'x) \tag{3}$$

where  $f(\bullet)$  is a probability distribution function. If we assume a logistic distribution, then;

$$(Y_t = 1) = \frac{\exp(\beta' X_t)}{1 + \sum \exp(\beta' X)} , \quad (Y_t = 0) = \frac{1}{1 + \sum \exp(\beta' X_t)} \tag{4}$$

where,

$$Y_t = \begin{cases} 1, & \text{if } EMP_t > \mu_{EMP} + 1.75\sigma_{EMP} \\ 0, & \text{otherwise} \end{cases} \tag{5}$$

the parameter vector  $\beta$  is estimated by maximum likelihood and the regression is a standard logit one.  $\mu_{EMP}$  and  $\sigma_{EMP}$  are the sample mean and the standard deviation of the exchange market pressure index for each country.

For the logit model, the estimated coefficients do not have a direct economic interpretation. Measures that are familiar to economists are marginal effects and elasticities. The marginal effect of the  $k^{th}$  explanatory variable on the response probability is obtained from the following formula;

$$\frac{\partial P(Y_t = 1|X_t)}{\partial X_{kt}} = scale.\beta_k \quad \text{where,} \quad scale = \frac{\exp(X_t\beta)}{[1 + \exp(X_t\beta)]} \tag{6}$$

**ESTIMATION RESULTS**

The first step is to estimate the impact of corruption on the probability of currency crisis. I estimate a logit model with the dependent variable being an indicator whether a currency crisis has occurred. The explanatory variable is expressed by the Transparency International corruption index (CPI) that varies from zero to 10. The higher the value of the CPI index, the less corrupted a country is. The result from this model are reported in the first column of Table 2. The model gives a log likelihood of -64, 37. As we can see from the table below, corruption is significant at the 5% level. The negative sign of the coefficient on CPI is in line with the common intuition that the more corrupted country, the less stable the country is and the more likely a currency crisis.

However, we have to remember that the estimation above does not capture the influence of all significant explanatory variables. Since there are omitted variables, the estimation is inconsistent. Therefore, I estimate the baseline model by taking into account all basic explanatory variables. The basic explanatory variables that are included in the logit model are; deviations from real effective exchange rates (denoted REER), M2 money supply/net international reserves (denoted M2/NIR) and domestic credit (denoted DCred). The result is reported in column 2 of Table 2. The baseline model has a better fit to the data. The log likelihood from the baseline model is -60,33, higher than that from the previous one. The *CPI* remains statistically significant and negative. The coefficients on the other explanatory variables except deviations from real effective exchange rate are statistically insignificant at the 5% significance level, as p-values on them are greater than 0.05. Although there are no omitted variables, there are still inconsistent estimates due to the correlation between explanatory variables. Because of this, we should be careful in interpretation of statistical significance.

I also analyze the marginal effects as opposed to simple coefficients because I want to see the effect of corruption on the probability of currency crisis. For instance, the marginal effect would show us by how much the probability of currency crisis increases when there is a one-unit rise in an independent variable *x*, i.e. Corruption Perception Index. The third column of the Table 2 shows the marginal effects of each variable on the probability of currency crisis. As can be seen from the table, the marginal effect of the *CPI* is relatively high among all others. We can expect that the probability of currency crises in an average country will decrease by 0.046, if the *CPI* rises by 1 point. We should remember that the change by 1 in *CPI* stands a substantial shift, as *CPI* varies from 0 to 10. Such strong changes do occur often in the unstable countries with low *CPI* values, and are less likely in those with high *CPI* scores.

Table 2: Results for Multinomial Logit Models <sup>a</sup>

Variables	(1) <i>Introducing Model</i>	(2) <i>Baseline Model</i>	(3) <i>Marginal Effects</i>	(4) <i>CPI Mean</i>	(5) <i>EU Membership</i>	(6) <i>GCI Model</i>	(7) <i>Mar. Effects GCI</i>
<b>CPI</b>	-0.2653* (0.1052)	-0.2941* (0.1221)	-0.0467* (0.1952)	-0.2182* (0.1129)	-0.0951* (0.5433)	-3.2746** (1.1444)	-0.0584* (0.0446)
<b>REER</b>	-	0.0478* (0.0787)	0.0235* (0.0765)	0.0056* (0.0035)	0.0037 (0.0038)	0.2014* (0.1398)	0.0617* (0.0084)
<b>M2/NIR</b>	-	-0.0347 (0.0007)	-0.01873 (0.0023)	-0.0083 (0.0072)	-0.2141 (0.0092)	0.0098* (0.2971)	-0.0217* (0.0061)
<b>DCred</b>	-	-0.0065 (0.0006)	-0.0081 (0.0002)	-0.0769 (0.0702)	-0.0064 (0.0087)	0.0081 (0.0027)	0.0094 (0.8010)
<b>Cons</b>	-0.3321 0.3750	-0.2602 (0.0089)	-	-0.6192 (0.4189)	-1.2761 (0.1972)	-2.3947 (0.7944)	-
<b>Num. of Obs.</b>	194	194	194	193	306	113	113
<b>Prob&gt;chi2</b>	0.0024	0.0198	-	0.0934	0.0221	0.0004	-
<b>Pseudo R2</b>	0.0714	0.0989	-	0.601	0.0572	0.3971	-
<b>LogLikelihood</b>	-64.3725	-60.3321	-	-67.2392	-99.2612	-23.5235	-

\* 5% and \*\* 1% indicates level of significance. <sup>a</sup>This table shows the results of the Logit regressions on the probability of currency crises. The dependent variable is Exchange Market Pressure Index that is defined in Eqn (1). The independent variables are Corruption Perception Index (*CPI*), Real Effective Exchange Rate (*REER*), M2 Money Supply/Net International Reserves (*M2/NIR*), Domestic Credit (*DCred*), Global Competitiveness Index (*GCI*) and European Union (*EU*) Membership. Columns 1 through 7 report the results of the regression using seven different models of currency crises. The first figure reported in each cell is the regression coefficient and the second is the standard error.

Country prestige tends to be smoothened along time and even if there is an improvement in reliability, a country can suffer from the previous low place in the Transparency International rank. In order to capture this mechanism, I use an average *CPI<sub>t</sub>*, instead of pure *CPI<sub>t</sub>*. The fourth column of Table 2 shows the results of the model that is analyzed with the average *CPI*. The results are disappointing. In the *CPI<sub>mean</sub>* estimation only deviations from the real effective exchange rate is statistically significant. The corruption index coefficient is once again negative. The p-value on *CPI<sub>mean</sub>* is the lowest; although the other explanatory variables (except *REER*) are statistically insignificant. This can be the result of the autocorrelation. We define *CPI<sub>mean</sub>* as an average of *CPI* from all previous periods and we know that

the corruption is correlated with other explanatory variables. Thus, the random term from period  $t$  is correlated with the previous random terms.

Moreover, membership in international financial and trade organizations might have a reasonable impact on country credibility. However, when checking for the sample countries membership I found that each country is a member of some international organization that could not been treated in the same way. Nonetheless, I decide to include membership in the European Union. The sample consists of developing countries and some countries from the new Member States are included. According to this, it is reasonable to check the influence of EU membership on the probability of currency crises. I show the results of this estimation even though the data is based on the years 1990-2002 and in these years, none of the countries from the sample was a member of the EU.

However, since joining the EU means that a country must satisfy particular criteria and changes in politics for a number of years, I assume that the political climate of those countries must have been decent long before the actual accession. In the fourth model, we use *EU* dummy, which is a variable equal to one for all EU Member States and zero for the others, instead of *CPI*. The results obtained from the fourth model, which is reported in the fifth column of Table 2, confirm that membership in the EU has a statistically significant impact on currency crisis probability. The log likelihood from this model is -99,26, lower than that from the all other models. *EU* dummy is statistically significant at the %5 level and there is a negative relationship between EU membership and currency crisis, as the sign of coefficient on the *EU* dummy is negative.

The Transparency International corruption index is one of the most popular measures of corruption. However, there are some other measures of corruption. Global Competitiveness Index (*GCI*) published by the World Bank Group is included in this study as another corruption index (of different methodology) and the results from two corruption definitions are compared. Here, it is worth noting that the *CPI* index is based on experts' opinions whereas the *GCI* index is based on firms' records

The sixth column of the Table 2 shows the results from the model conducted with the *GCI* index, while the seventh column of the Table 2 presents the marginal effect of *GCI* index on the probability of currency crisis. The relationship between corruption and currency crisis is positive, as the sign of coefficient on *GCI* is negative. As can be seen from the sixth column of the Table 2, corruption measured in another way is still statistically significant at the 5% and 1% levels. Besides, the marginal effect of *GCI* is again relatively high and negative. The results of this model show that a unit change in *GCI* increases the probability of a currency crisis by 5.8% in the sample countries.

When considering marginal effects it is important to note that currency crises are rare events and even marginal effects of 5% would be notable. This confirms our thesis that corruption does matter regardless of the measure we use to reflect it. *GCI* can be a better measure of corruption because in such a specified model the pseudo  $R^2$  is much higher. Although, the pseudo  $R^2$  estimated for a multinomial logit model cannot be interpreted as it is in a regular linear model, it still gives an indication of the fit since the crisis definition is not dichotomous. The limitation of using pseudo  $R^2$  as a goodness-of-fit measure for usual logit models is due to binary characteristics of the dependent variable rather than its boundaries. In addition, the fit of the model is relatively high, although our results were obtained from a 113 observation sample.

## CONCLUSIONS

Empirical research on corruption is quite a new field of interests to economists. Cross-country analyses aim at finding causes and consequences of corruption. There are number of problems arising from the

modeling point of view, mostly connected with the methodology of corruption indicator creation. Such indices are mostly based on subjective opinions of the real level of corruption that is country specific. Understanding of corruption varies across cultures. Nevertheless, there are still forms of power abusing behaviors that fall under the 'corruption' definition regardless of the culture. Due to this, researchers commonly agree to rely on some commonly approved corruption indices and conduct many projects in the field of corruption impact on different economic and social characteristics.

This research examines unobserved country credibility. Such a defined explanatory variable is difficult to measure, as there is no standard index of country reliability. Corruption Perception Index is used as a proxy for the unobserved credibility in this study. The estimation results confirm the main intuition. The applied corruption index is statistically significant and negative coefficients on this index prove that the higher corruption, the more likely a currency crisis will occur. Moreover, marginal effects of corruption index are high in relation to marginal effects of other explanatory variables. These results suggest that approaching currency crisis should capture country corruption itself or any other proxy of country prestige. In order to make the proposal of using membership in international trade and financial organizations as a proxy for country credibility useful, I encourage new studies to more detailed analysis of different organizations structure to capture only significant elements and enlarge the sample of countries used in the estimation.

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<http://www.transparency.org/> - data for CPI index

<http://publications.worldbank.org/WDI/> - data for GCI index

## **BIOGRAPHY**

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