# SENIOR RESEARCH

**Topic:** Does increasing the policy rate help to prevent currency crises?

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## Introduction

A currency crisis is defined by Claessens and Kose (2013) as involving a speculative attack on the currency leading to one or more of the following outcomes: (1) a devaluation or sharp depreciation, (2) the depletion of international reserves (to defend the currency), (3) a sharp rise in interest rates, and (4) the imposition of capital controls. Whereas much of the currency crisis literature have been focused on explaining its causes or coming up with an early warning system to predict its occurrence, less efforts have been spent on how a central bank should wield the policy rate once a currency crisis has already occurred.

There are two sides to this issue. The conventional view suggests that increasing the policy rate helps to deter speculative attacks by making shorts more expensive and by signaling the commitment of the central bank. However, this approach as recommended by the IMF has come under fire for worsening speculative pressures in South Korea and Thailand during the 1997 Asian Financial Crisis. The contrarian view, meanwhile, argues that the conventional view has been misguided. Higher borrowing costs, they reason, would cause a liquidity crunch for domestic firms as well (especially those with short-term debt obligations) and may result in foreign investors letting go of claims on the domestic economy which is the cause for even more depreciation (Montiel (2003)). Furthermore, whether a rise in the interest rates signals commitment or not depends on the judgment of market participants. What looks to be commitment to one may seem like panic to others and signal weak fundamentals or low levels of reserves instead. As recent as December 2014, articles from the Economist and the Guardian still cited the Russian central bank for having raised the policy rate by 6.5 percentage points to defend the rouble (Elliott (2014)). This suggests that the debate is far from over and that it is still as relevant today as ever before. This paper aims to answer whether or not increasing the policy rate has helped to prevent currency crises by looking at the empirical evidence.

In attempting to answer our question, two issues immediately arise. Firstly how do we define currency crises. Secondly, how do we measure the effectiveness of increases in the policy rate in preventing currency crises.

Currency crises have long been a subject of interest. As Kaminsky et al. (1998) puts it, “financial market participants are interested […] because they want to make money, policymakers because they wish to avoid the crisis, and academics because they have a long fascination with financial crises.” Three main types of indicators have been used to define a currency crisis (Perez (2005)). The first type, also known as the exchange market pressure index (from here on ‘EMP’), calculates a composite index of variables such as the exchange rate and international reserves. A period is defined as a currency crisis when this EMP index crosses some threshold. The second type establishes the necessary conditions in the behavior of each variable instead of calculating a single aggregate index. The third type focuses solely on sudden variations in the exchange rate.

For this paper, we will be using a variation of the EMP as proposed by Kaminsky et al. (1998), which take into account changes in the exchange rates and international reserves. The EMP is more complicated than the other two types but it also has its merits. For example, it is able to capture episodes of speculative pressures, absorbed by changes in international reserves, which would otherwise be labeled a normal period by the third type of indicator. At the same time, more questions are asked as well regarding the selection of the crisis threshold. Thresholds of 1.5, 2, and 3 SD above the mean have been used (see Perez (2005) for a survey). Pozo and Dorantes (2003), in particular, challenge the assumption that the EMP has a normal standard distribution and proposes using extreme value analysis (EVA) instead. As there is yet to be a consensus on one crisis identification method, this paper will employ all the thresholds mentioned.

The question that remains is measuring the effectiveness of policy rate increases on crisis prevention. The probit model, which transforms crisis values into binary variables to evaluate its probability, seems to be an appropriate method. Glick and Hutchison (2011) have used it to study the effectiveness of capital controls in currency stabilization. Works similar in topic to ours such as Kraay (2003) and Goderis and Ioannidou (2008) have also favored the probit model.

The remainder of this paper will look at the methodology, the data involved, the results, and finish off with the conclusion.

**Methodology**

1. Defining crises

Sample Period: Jan 1981 to Dec 2010

Data Frequency: Monthly

Following Kaminsky et al. (1998), we define pressure in the currency market as
$EMP_{i,t} = a\%\Delta e_{i,t} - b\%\Delta res_{i,t}$
where $EMP_{i,t}$ indicates the EMP index for country i at month t, $e_{i,t}$ represents the price of US$1 in i's currency, $res_{i,t}$ stands for the ratio of USD reserves to M2 in country i; Weights a and b are used to equalize the volatilities of each component and are defined as the inverse of the SD of each country's series.
Alternately, some studies use the SD of the entire pool. I run and show both in the result table. The real choice between individual country and pooled weights comes down to whether or not you want a period to be considered a crisis relative to its own currency market volatility or to the volatility of the entire pool.

Hyperinflation episodes are dealt with as in Kaminsky et al. (1998). The annual inflation rate is computed as $\Delta p_{t,12} = \ln p_t - \ln p_{t-12}$, where $p_t$ is the consumer price index at time t.
If any month t-1, …, t-6 has an annual inflation rate higher than 150%, the month t has hyperinflation. Data for $\%\Delta e_{i,t}$ and $\%\Delta res_{i,t}$ is grouped into hyperinflation and normal periods. EMP is then constructed separately using its group's weights.
Period t is considered as going through a crisis ($C_{i,t} = 1$) when

$EMP_{i,t} > c\sigma_{EMP} + \mu_{EMP}$ ; $c = 1.5, 2, 3$ ($\sigma_{EMP}$ and $\mu_{EMP}$ are pooled)

A separate threshold calculated with EVA is also used.

Following Comelli (2014), we next convert $C_{i,t}$ into a forward-looking variable $Y_{i,t}$ defined as 1 if C = 1 within k months. (I use k = 12). This allows us to see the effect of changes in the policy rate on crisis probability over a certain amount of periods that follow.

We then plug it into the probit model

$$P(Y_{i,t} = 1) = F(\beta_0 + \beta_1 POL_{i,\, t-k} + \beta_2 Z_{i,\, t-k}) + \varepsilon_{i,\, t}$$

Where F(.) is the standard normal distribution , $POL_{i,t-k}$ is an indicator that capture changes in the policy rate, and Matrix $Z_{i,\, t-k}$ are the episode-specific fundamentals.

2. Changes in the policy rate

$POL_{i,t-k}$ is the percentage change in the spread between the end-of-the-month key policy rate of country i over the US's federal funds rate. When the policy rate is not available, we use either the discount rate or the money market rate as a substitute depending on which series is more complete.

This method is somewhat crude but is good enough for our purpose. For a finer selection of the relevant rates involved, look to Goderis and Ioannidou (2008) for a start.

3. Control variables

For our control variables, we use the real exchange rate and the production index (as a proxy for GDP) due to its availability in monthly frequency and its consistent significance in previous studies as noted by Frankel and Saravelos (2010).

Cumperayot and Kouwenberg (2013) provide a detailed rationale on the relationship between these two variables and a currency crisis. In brief, excessive real appreciation points to misalignment of the domestic currency and eventually leads to current account deterioration, one of the theoretical causes of a currency crisis. Since a decrease in the real exchange rate is equal to a real appreciation, we expect the relationship between the real exchange rate and crisis measures to be negative. The RER variable is the monthly rate of change of the real exchange rate.

The production index is a real sector indicator, and its decline usually spells trouble. Thus, we also expect a negative relationship between the production index and currency crisis measures. The production index variable 'PI' uses the year-on-year percentage change in order to remove seasonality.

**Data**

Crisis measure $Y_{i,t}$ is renamed to specifically reflect the weighting scheme and the threshold level used in each case. The first four measures are derived using individual country weights and denoted with 'C'. Those with pooled weights begin with 'CP'. 1.5, 2, 3 and EVT refer to the threshold level.

Table 1. Descriptive statistics

| Variable | Obs | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| *Dependent variables* | | | | | |
| C15 | 20156 | 0.313 | 0.464 | 0 | 1 |
| C2 | 20156 | 0.195 | 0.396 | 0 | 1 |
| C3 | 20156 | 0.083 | 0.276 | 0 | 1 |
| CEVT | 20156 | 0.029 | 0.167 | 0 | 1 |
| CP15 | 20156 | 0.076 | 0.265 | 0 | 1 |
| CP2 | 20156 | 0.057 | 0.232 | 0 | 1 |
| CP3 | 20156 | 0.039 | 0.193 | 0 | 1 |
| *Independent variables* | | | | | |
| POL | 17575 | 0.224 | 20.788 | -185.601 | 2548.66 |
| RER | 18734 | -0.03 | 0.386 | -34.489 | 0.497 |
| PI | 7556 | 0.044 | 0.09 | -0.419 | 0.622 |

Table 2. Regression results

| | | C1.5 | C2 | C3 | CEVT |
|---|---|---|---|---|---|
| POL | Coefficient | -0.001649 | -0.0018098 | 0.0002542 | 0.0051059 |
| | SE | 0.004 | 0.004 | 0.005 | 0.007 |
| | P>\|z\| | 0.669 | 0.656 | 0.962 | 0.492 |
| RER | Coefficient | -0.064939 | -0.0635671 | -0.0578249 | -0.0243422 |
| | SE | 0.029 | 0.029 | 0.032 | 0.043 |
| | P>\|z\| | 0.024 | 0.031 | 0.077 | 0.569 |
| | dy/dx | -0.023 | -0.017 | -0.005 | |
| PI | Coefficient | 0.4261463 | 0.224577 | -0.2795092 | -0.4721648 |
| | SE | 0.188 | 0.201 | 0.263 | 0.367 |
| | P>\|z\| | 0.024 | 0.263 | 0.288 | 0.199 |
| | dy/dx | 0.148 | | | |

| | | CP1.5 | CP2 | CP3 |
|---|---|---|---|---|
| POL | Coefficient | 0.0052079 | 0.0036878 | 0.0052418 |
| | SE | 0.009 | 0.011 | 0.011 |
| | P>\|z\| | 0.542 | 0.742 | 0.632 |
| RER | Coefficient | -0.2135772 | -0.2218003 | -0.0362376 |
| | SE | 0.068 | 0.069 | 0.041 |
| | P>\|z\| | 0.002 | 0.001 | 0.376 |
| | dy/dx | -0.002 | -0.0003 | |
| PI | Coefficient | 1.270742 | 1.333174 | 0.576732 |
| | SE | 0.367 | 0.402 | 0.500 |
| | P>\|z\| | 0.001 | 0.001 | 0.249 |
| | dy/dx | 0.009 | 0.0004 | |

Note: I've included the marginal effects only for variables which show a significant p-value.

**Results**

Our results show no evidence that changes in the policy rate have a significant effect on crisis probability. We are particularly fortunate that this result is unanimous for all types of crisis measures.

The results for our controls are less conclusive. The real exchange rate is consistently negative but is significant only for the lower threshold levels.

The least can be said about the production index. Signs are a curious mix of positive and negative, but show only positive when it is significant.

**Conclusion**

In conclusion, I find no evidence that increasing the policy helps prevent currency crises or that it worsens it either. Central banks should stick to responding to measures of inflation and output where the policy rate is relevant. In the case of a currency crisis where poor economic conditions are a cause, this would imply that the policy rate be reduced in line with its standard countercyclical role.

There are two issues to keep in mind though. Firstly, our sample size is somewhat constrained by the data we found available for the production index. The final number of observations amount to a little more than 7000 covering only 27 countries. There is no guarantee that this result would hold for a larger dataset.

Secondly, the choice of weighting schemes and threshold levels do matter as seen in the case of the real exchange rate. Whereas many previous papers would choose only one type of weighting scheme to deal with, it may actually make more sense to have both for consideration. After all, there is a significant overlap between periods judged as a crisis relative to the whole pool and relative to its own market. Around 70% of the crisis periods called by the pooled weights (CP1.5, CP2, CP3) are captured by the individual weights C1.5 and C2. This overlap decreases to 50% for weight C3.

Therefore, it may be more helpful to think of the crisis periods computed using pooled weights roughly as a narrower version of the individual weights ones. This kind of interpretation is potentially important because it would suggest that the real exchange rate works better as a control (and a predictor) for milder crises (from C1.5 to CP2).

Although theoretical causes to currency crises have only been touched on tangentially in our paper, the two drivers can broadly be said to be (1) weakness in economic fundamentals and (2) the uncertainty about this weakness itself, which quickly turns into panic in the currency market. My suspicion is that the second driver plays a bigger role in more severe crises. This would offer an explanation as to why indicators such as the real exchange rate may work for milder crises and stop working in more severe ones. This is only speculation and would require a different paper to prove. At this point, the potency of the real exchange rate as a control should be taken with a grain of salt.

**List of Countries**

| | | | |
|---|---|---|---|
| Bangladesh | India | Norway | South Korea |
| Brazil | Indonesia | Pakistan | Sweden |
| Canada | Israel | Peru | Tunisia |
| Chile | Japan | Philippines | Turkey |
| Colombia | Jordan | Romania | United Kingdom |
| Denmark | Malaysia | Singapore | Uruguay |
| Iceland | Mexico | South Africa | |

**Data Source**

The CEIC database is my go-to source. Most of the data, in turn, comes from the IMF's International Financial Statistics.
For the numerator of the reserves ratio, I used 'international liquidity: total reserves minus gold.' For the denominator, I used the direct figure for M2. When it is not available, I used values recorded for 'Money and quasi money' from the Monetary, Depository Corporations, or Banking surveys as a proxy.

Production index data is somewhat limited in CEIC. I used data from the OECD for Canada, Denmark, Indonesia, Sweden, Brazil, and South Africa.

For Tunisia, data for the policy rate exists up to 1997. However, especially after 1988 (to 1997), the ratio between the policy rate and the money market rate (PR/MM) is quite consistent (average: 1.01, SD: 0.04). Therefore, post-1997, I estimate the policy rate by multiplying 1.01 to the money market rate.

**Bibliography**


Claessens, Stijin, and M. Ayhan Kose. 2013. Financial crises: explanations, types, and implications. IMF Working paper.

Comelli, Fabio. 2014. Comparing the performance of logit and probit early warning systems for currency crises in emerging market economies. IMF Working Paper.

Cumperayot, Phornchanok, and Roy Kouwenberg. 2013. Early warning systems for currency crises: a multivariate extreme value approach. *Journal of International Money and Finance* 36: 151-71.

Elliott, Larry. 2014. Russian central bank raises interest rate to 17% to prevent rouble's collapse. *The Guardian.* 15 December.

Frankel, Jeffrey A., and George Saravelos. 2010. Are leading indicators of financial crises useful for assessing country vulnerability? Evidence from the 2008-09 global crisis. NBER Working Paper 16047.

Glick, Reuven, and Michael Hutchison. 2011. The illusive quest: Do international capital controls contribute to currency stability? *International Review of Economics and Finance* 20: 59-70.

Goderis, Benedikt, and Vasso P. Ioannidou. 2008. Do high interest rates defend currencies during speculative attacks? New evidence. *Journal of International Economics* 74: 158-69.

Kaminsky, Graciela, Saul Lizondo, and Carmen M. Reinhart. 1998. Leading indicators of currency crises. International Monetary Fund Staff Paper 45(1): 1-48.

Kraay, Aart. 2003. Do high interest rates defend currencies during speculative attacks? *Journal of International Economics* 59: 297-321.

Montiel, Peter J. 2003. Tight money in a post-crisis defense of the exchange rate: what have we learned? *The World Bank Research Observer* 18(1): 1-23.

Perez, J. 2005. Empirical identification of currency crises: differences and similarities between indicators. *Applied Financial Economics Letters* (1): 41-46.

Pozo, Suzan, and Catalina Amuedo-Dorantes. 2003. Statistical distributions and the identification of currency crises. *Journal of International Money and Finance* 22: 591-609.