



## Exchange rate volatility across financial crises

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### ABSTRACT

This paper studies the impact of global financial turmoil on the exchange rate policies in emerging countries. Spillovers from advanced financial markets to currencies in emerging countries are likely to be exacerbated during crisis periods. To test this hypothesis, we assess the exchange rate policies by currencies' volatility and investigate their relationship to a global financial stress indicator, measured by the volatility on global markets. We introduce the possibility of nonlinearities by running smooth transition regressions over a sample of 21 emerging countries from January 1994 to September 2009. The results confirm that exchange rate volatility does increase more than proportionally with the global financial stress, for most countries in the sample. We also evidence regional contagion effects spreading from one emerging currency to other currencies in the neighboring area.

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### 1. Introduction

Despite the long-lasting prevalence of the USD as an anchor currency, its key role in the international monetary system has been more and more challenged for several years and some evolution has begun to take shape, especially since the start of the present financial crisis. Many countries have indeed loosened the link of their currency to the USD in the global financial turmoil that started in July 2007, either because they have been pushed into this strategy by market pressures, or for tactical reasons. In this paper, we try to address this evolution by answering the following questions: (i) Are exchange rates characterized by greater volatility since the start of the financial turmoil in July 2007? (ii) Is this evolution in line with what happened during previous crises? All the rationales that can be found in the literature on contagion across markets point to a positive answer to these questions (see e.g. Corsetti et al., 1999; Kaminsky and Reinhart, 2000). More generally, we aim at investigating the linkages between currency markets in emerging countries and financial market strains in the global economy. We expect that the co-movements between these two types of markets are exacerbated in episodes of financial turmoil.

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To check these hypotheses more precisely, we start by considering that the exchange rate regimes can be proxied by the exchange rate volatility; in this respect, we follow the spirit of the works done by Reinhart and Rogoff (2004) and Ilzetzki et al. (2008). Then, we study the relationships between currency volatility for a sample of emerging countries and various proxies for stress on global financial markets. This comes down to testing the volatility spillovers from advanced financial markets to emerging currency markets. The transmission of volatility may be a normal phenomenon in globalized markets, but can also take on abnormal turns during episodes of financial stress, which is a typical symptom of “contagion.” Contagion effects can be evidenced empirically by different methods (for a survey see Dungey et al., 2005), although it is difficult to disentangle the precise channels at stake. Forbes and Rigobon (2002) insist on the rupture in the usual interdependence mechanisms between markets during a crisis. These disrupted links can be captured by different ways and most of them involve acknowledging nonlinearities in the transmission channels. Favero and Giavazzi (2000) introduce dummy variables for outliers in a VAR model. Eichengreen et al. (1996a,b) also rely on dummy variables linked to the pressures on the exchange market. Some works focus on co-movements when asset returns are extreme (Bae et al., 2003; Hartman et al., 2004). Here, we aim at testing the hypothesis that strains in global financial markets are likely to affect exchange rates in emerging markets more badly when they reached high degrees. To this end, we run smooth transition regressions (STR) and

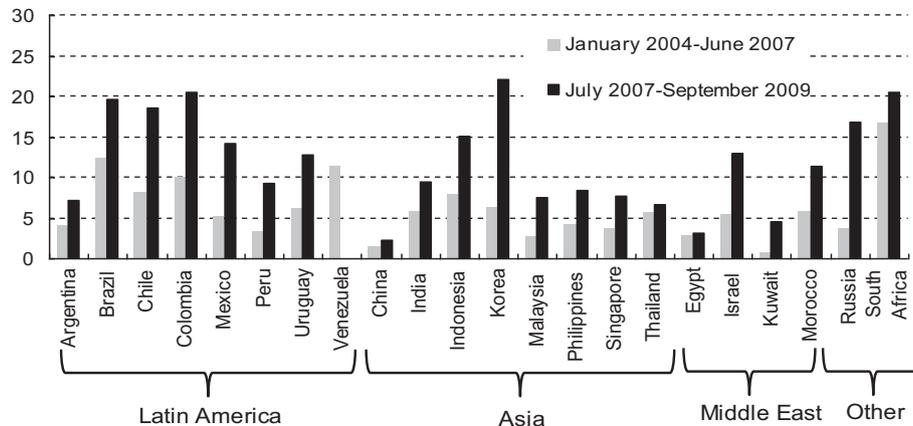


Fig. 1. Exchange rate volatility around the subprime crisis, annualized in %.

test for nonlinearities over a sample of 21 emerging countries during the period from January 1994 to September 2009.

The rest of the paper is organized as follows. Section 2 presents the data and compares exchange rate and financial market volatilities around crisis episodes. Relying on the estimation of STR models, Section 3 assesses the relationships between global financial stress and emerging currency volatility. Section 4 is devoted to the study of regional contagion effects within the emerging countries by testing whether the intensity of such effects differs across crisis and noncrisis periods. Section 5 concludes.

## 2. Data for assessing currency volatility and global financial stress

### 2.1. Exchange rate volatility

The sample period spans from January 1994 to September 2009, on a monthly periodicity. It includes 21 currencies of emerging countries; in Latin America: those of Argentina (ARS), Brazil (BRL), Chile (CLP), Colombia (COP), Mexico (MXN), Peru (PEN), Uruguay (UYU), Venezuela (VEB); in Asia: those of China (CNY), Indonesia (IDR), India (INR), Korea (KRW), Malaysia (MYR), Philippines (PHP), Singapore (SGD), Thailand (THB); in the Middle East: those of Israel (ILS), Kuwait (KWD), Morocco (MAD). We also add the Russian ruble (RUB) and the South African rand (ZAR).

This set of currencies matches the main emerging countries in the traditional dollar zones of influence, which are Latin America, Asia and the Middle East. We deliberately leave out emerging Europe and North Africa, as the link of their currencies to the euro could disturb the interpretation of the results. Consequently, all the currencies in the sample are more or less linked to the USD over the period under review, at least for some time (for a complete description of the exchange rate regimes of these countries, see Ilzetzki et al., 2008). This justifies our calculations on exchange rates against USD. The later are taken from Bloomberg. We alternatively consider real exchange rates to account for exchange rate regimes aimed at stabilizing real exchange rates, such as crawling pegs and some managed floats.<sup>1</sup> Note that exchange rate volatility is a good gauge for assessing exchange rate regimes, as shown by a number of empirical works (Reinhart, 2000; Calvo and Reinhart,

2002; Levy Yeyati and Sturzenegger, 2003, 2005; Reinhart and Rogoff, 2004; Ilzetzki et al., 2008).

We measure the volatility of exchange rates ( $\sigma_i^2$ ) against USD by two ways: the squared monthly returns of exchange rates (in logarithms) and through the estimation of a GARCH model (the mean equation including only a constant term). We only retain the squared returns in all the following results for several reasons: (i) results are very close for the two measures of volatility; (ii) they are more straightforward to interpret; (iii) they do not require any prior calculations of parameters, which may increase the uncertainty on the coefficients estimated in regressions.<sup>2</sup> In the next section, volatility figures are annualized and expressed in percentages.

### 2.2. Exchange rate volatility during the crisis periods

We now take a look at the data on exchange rate volatility in order to check their evolution around several crisis episodes. Firstly, we check that major turmoils in advanced financial markets give rise to more exchange rate volatility in emerging countries.<sup>3</sup> To do that, we compare the currency volatility before and after the subprime crisis that burst in July 2007 (Fig. 1). We take a large window both (i) before the crisis—January 2004–June 2007—as this period is often considered as a tranquil episode on financial markets, characterized by low volatility and low spreads, and (ii) after it—July 2007–September 2009—as when we wrote the paper, the crisis was not over. Results show that this crisis triggers a surge in currency volatility for all countries but one (Venezuela). Indeed, most countries loose the link of their currencies to the USD after the crisis, especially Brazil, Chile, Korea, Mexico and Russia. Note that the depreciation that hit some of these currencies at the start of the crisis, subsequently reversed to an appreciation in a number of cases (such as Brazil); so the surge in volatility does not necessarily mean depreciation. Venezuela manages to keep its hard peg to the USD throughout the crisis, thanks to its tight capital controls. China also tightens its currency peg to the USD, fearing that a depreciation of the dollar would yield losses in its huge forex reserves as well as a loss in its export competitiveness.

Secondly, we consider the effects of two major currency crises that occurred over the period: the 1997 Asian and the 2002 Argentinean crises. We select these particular episodes, because each of them brought about strains on world financial markets across the

<sup>1</sup> Real exchange rates are calculated by deflating the exchange rate by the consumer price index (CPI), extracted from the IMF's International Financial Statistics database. To save space, we only report throughout this paper the results dealing with series in nominal terms. Results obtained with series expressed in real terms are very similar and are available in the working paper version of the article (see Coudert et al., 2010).

<sup>2</sup> Note that all our series of volatility are stationary, as indicated by the results of standard unit root tests (available upon request to the authors).

<sup>3</sup> Our aim in this section is not to identify all crises, but just to provide some stylized facts. For instance, we do not study the LTCM or the Dot-com crises, which are very near the Asian and Argentinean crises, respectively.

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