Did QE Unleash a Monetary Tsunami?

An Exchange Market Pressure Approach

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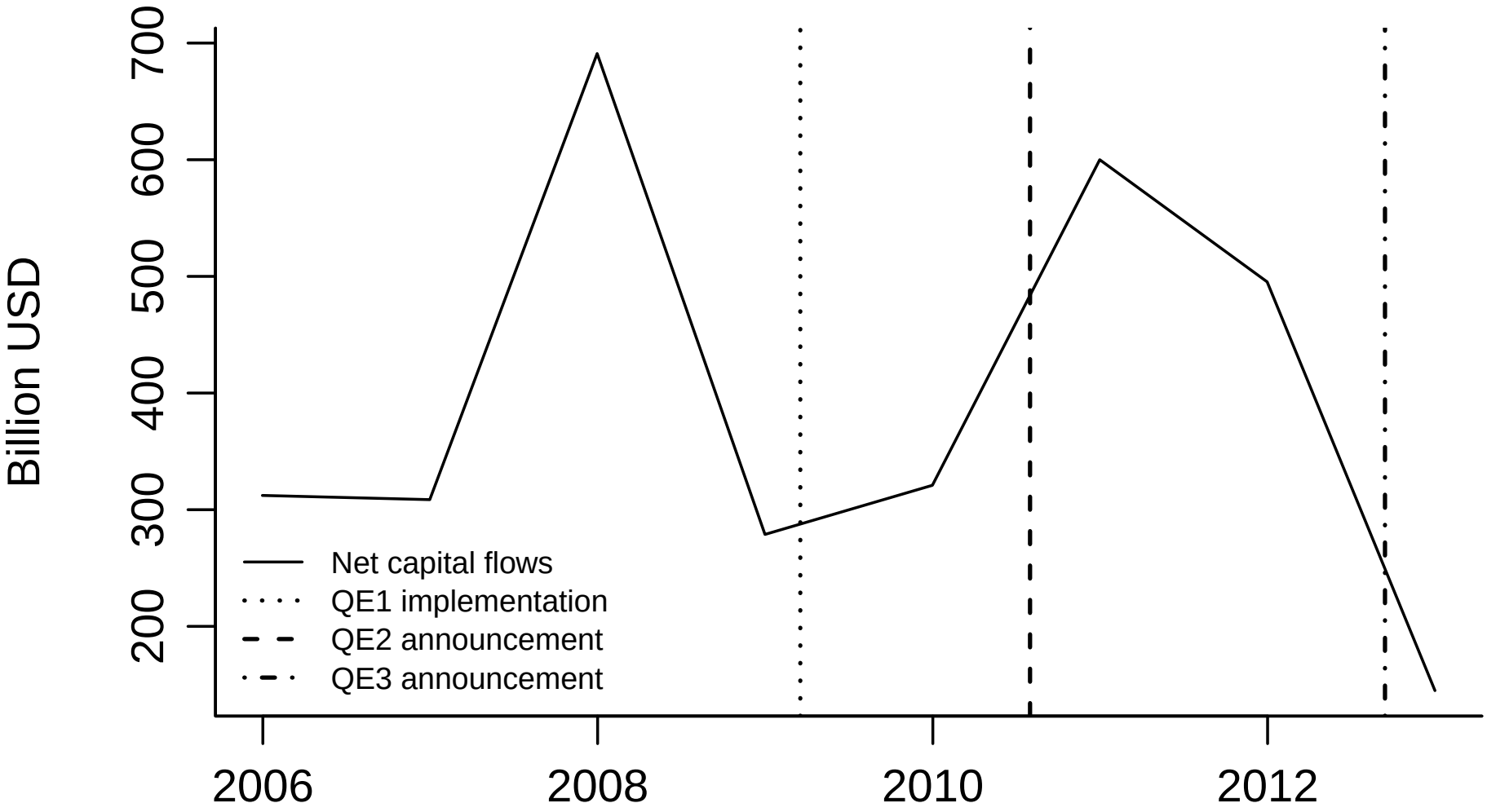
Net capital flows to EM's



Studying the impact of capital flows

- QE has led to sharp inflows and and outlfows of capital
- How can we study the impact of capital flows and the response of countries?
- We need a measure that combines the effect on exchange rates, reserves and interest rates.
- This paper proposes a measure of exchange market pressure (EMP) that can be used for comparisons across countries and across time
- We find that QE induced unusual EMP for the first two months.

EM response

Main channels of adjustment:

1. Exchange rate movement, Δe_t
2. Central bank intervention, I_t
3. Interest rate changes, $\Delta(i_t - i_t^*)$
4. Capital controls

Unit consistent exchange market pressure measure

- EMP measures the change in the exchange rate that takes place, or would have taken place (counter-factual), had it not been for intervention or interest rate changes.
- Units: Change in the exchange rate.
- Challenge: Measuring the change in the exchange rate that was prevented by intervention.
- Effectiveness of intervention on the exchange rate market depends on the size of its foreign exchange market.
- The impact of interest rate changes on the exchange rate depends on the openness of asset markets.
- Challenge: Measuring the change in the exchange rate that was prevented by the change in interest rates.

Measuring exchange market pressure

- The EMP is measured as:

$$\mathrm{EMP}_t = \Delta e_t + \rho_t I_t + \eta_t \Delta(i_t - i_t^*)$$

- where Δe_t is the *the percentage change in the exchange rate*
- I_t is the intervention measured in billion dollars
- where ρ is the *the change in the exchange rate associated with $ 1 billion of intervention*
- η_t is the percentage change in exchange rates caused by a one percent change in the interest differential
- $\Delta(i_t - i_t^*)$ is the change in the interest differential between domestic and foreign interest rates
- All quantities on the right hand side are measured in units of percentage change of the exchange rate.

How to combine Δe_t and I_t?

- These are in two different units
- $$\mathrm{EMP}_t = \Delta e_t + \rho I_t$$
- Meaningful if we interpret ρ as *the change in the exchange rate associated with $ 1 billion of intervention*
- In this case, EMP is interpreted in the units of percentage change of the exchange rate. It is the exchange rate change of the month if there had been no intervention.

What is ρ?

- If India's central bank buys \$ 1 billion, what is the price change obtained on the currency market?
- This will vary by country, by time, by size of the market. As the characteristics of the currency market change, ρ will change. We will need a ρ_t time-series for each country to measure EMP

Estimating ρ_t: Assumptions

$$\begin{aligned} \text{EMP}_t &= \Delta e_t + \rho_t I_t \\ \text{EMP}_{\text{float}} &= \Delta e_t \\ \text{EMP}_{\text{fixed}} &= \rho_t I_t \end{aligned}$$

1. Suppose we observe a country with both fixed and float periods
2. Separately observe Δe_t in float periods and I_t in fixed periods
3. Assume country characteristics are unchanged; macroeconomic volatility is unchanged.
4. If there has been no large external shock we can assume that EMP volatility is stable across these periods. Then:

$$\rho_t = \left(\frac{Var(\Delta e_t)}{Var(I_t)} \right)^{\frac{1}{2}}$$

Obtaining a dataset of countries observed with both fixed and float periods

- Zeileis, Shah, Patnaik (2010): a method for obtaining dates of structural change in the *de facto* exchange rate regime, and a measure of exchange rate flexibility: the R^2 of the Frankel-Wei regression
- We define :

  Fixed $R^2 > 0.95$
  Float $R^2 < 0.66$

- Minimum period of the regime: 12 months.

Obtaining a dataset of countries observed with both fixed and float periods

- We get a set of 106 country-periods with 60 fixed to floating transitions and 46 floating to fixed transitions
- Drop from dataset crisis country periods (Tequila, AFC, GFC, country specific events) where the assumption of equal volatility would not hold.
- Drop country periods which are defined as freely-falling periods by Reinhart & Rogoff (2004).

ρ_t example: Kenya

- The ZSP (2010) methodology of structural breaks detects a *float to fix* regime shift in Jan 2001 for the Kenyan Shilling
- From April 1997 to July 2001, the Kenyan Shilling was floating. This is followed by a period from July 2001 till Dec 2002 when the Kenyan Shilling was pegged to the USD and the Kenyan central bank was intervening in the currency market
- Kenya mainly used intervention to keep the exchange rate pegged.

Kenya: Exchange rate regime

Figure : Kenya: Exchange rate regime transition

	Start date	End date	R^2	R&R Classification
Period 1	1997-04-11	2001-07-20	0.54	2
Period 2	2001-07-20	2002-12-27	0.97	2

Estimating ρ_t for Kenya

- We can assume the transition occurred during a relatively stable period and so the shocks to EMP in the full period were roughly the same. Equality of macroeconomic shocks implies:

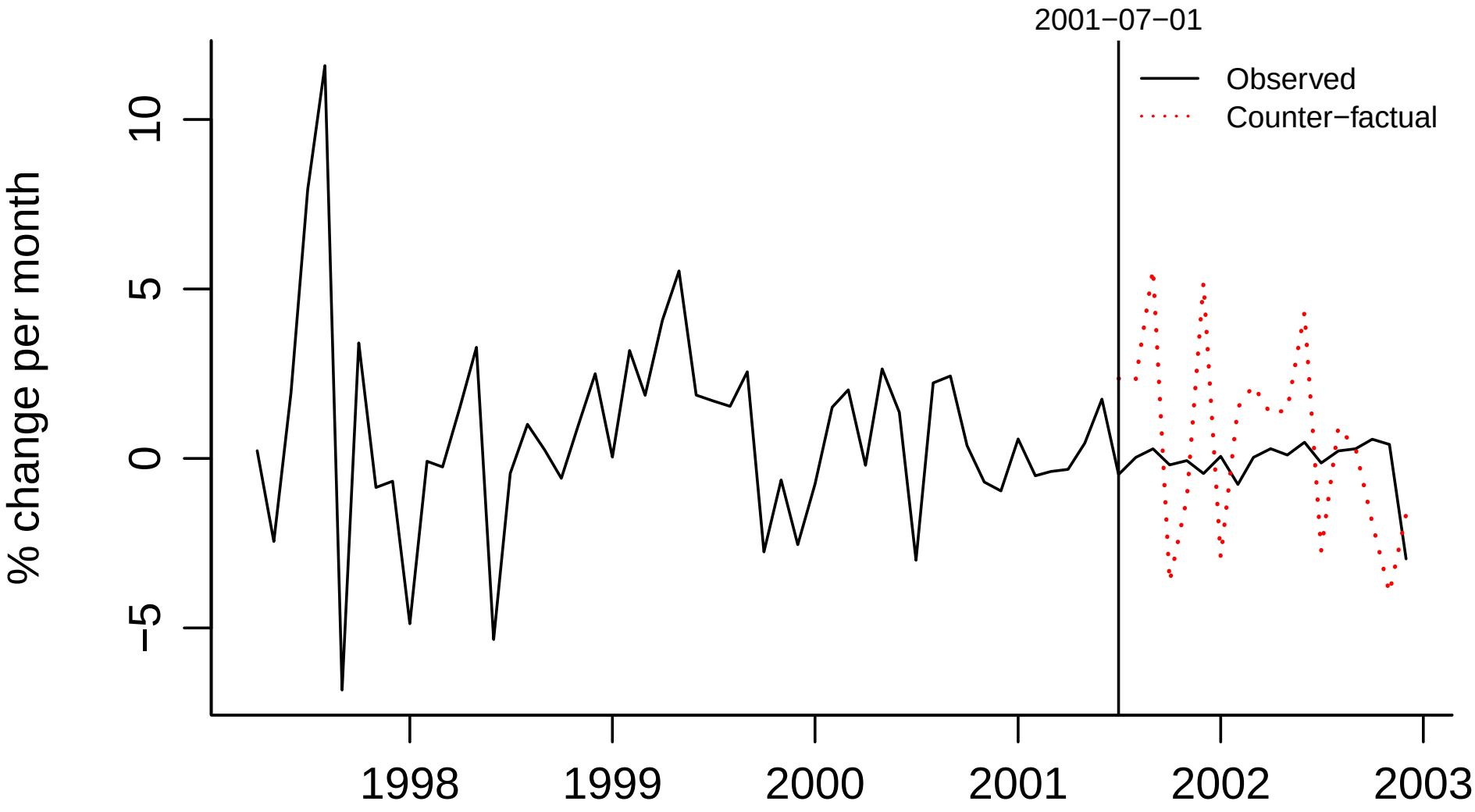
$$Var(\text{EMP}_{\text{Apr 1997-Jul 2001}}) = Var(\text{EMP}_{\text{Jul 2001-Dec 2002}}) \tag{1}$$

$$\rho_t = \left(\frac{Var(\Delta e_{\text{float}})}{Var(I_{\text{fixed}})} \right)^{\frac{1}{2}} \tag{2}$$

$$\rho_{t\ Kenya} = 105$$

- A million dollars of intervention by the Central Bank of Kenya in currency markets would have prevented a 0.105% change in the exchange rate in the period Jul 2001 to Dec 2002

Kenya: Exchange market pressure



ρ_t estimates: some examples

Country	1995	1996	1997	1998	1999	2000	2001	2002	..	..	2010
India	..	..	..	..	..	..	1.55	..	..	..	..
Angola	..	151	..	..	..	..	..	..	..	..	..
Belarus	..	..	..	..	..	..	..	..	..	..	5.41
Kenya	..	..	..	..	..	..	..	105.64	..	..	..
Sri Lanka	..	..	..	..	..	..	28.20	..	..	..	..
Gambia	..	..	691.35	..	..	..	..	..	..	..	..
Brazil	..	..	1.97	..	..	..	..	..	..	..	..
Romania	..	..	..	..	..	43.98	..	..	..	..	..
Turkey	..	..	..	..	..	..	..	4.42	..	..	..
Vietnam	..	..	..	..	..	..	6.41		..	..	..
Malaysia	..	..	..	..	..	..	5.35	..	..	..	..

Source: Author's calculations

Do these ρ_t estimates make sense?

- ρ_t should depend on the size of the currency market.
- Estimates of the impact of intervention in the scant literature on it lie within 0 to 10 per cent. These are for advanced economies and for relatively big markets among EMs.
- It should be higher if the market is smaller i.e a billion dollars of intervention should impact the exchange rate more if the market is small. In a very large market a billion dollars may have little or no impact.

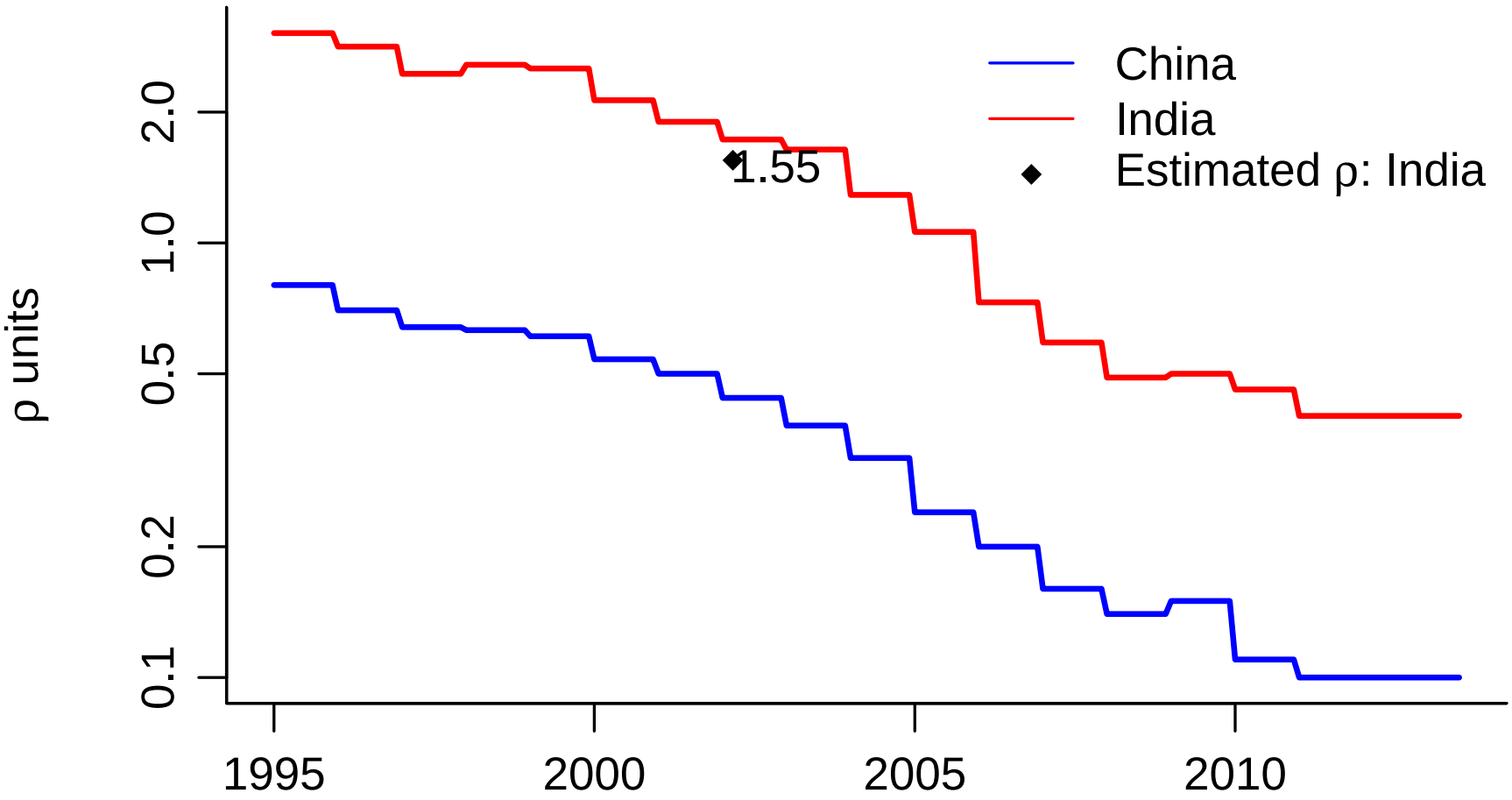
Estimated ρ_t and FX market turnover

Country	Year	ρ_t	FX market daily turnover ($ Billion)
Brazil	1997	1.97	5*
India	2001	1.55	3
Malaysia	2002	5.35	1**

Data for size of market missing

- We get forex market size data from the BIS triennial survey
- For most countries and most years, forex market size data is not available. Size of the market may depend on:
  1. Level of production
  2. Level of trade
  3. Financial openness
  4. Monetary policy framework.
- Annual values of ρ_t for 172 countries for the years 1995 to 2010 are imputed using GDP, trade, financial integration, Lane-Milesi-Ferreti measure.

Imputed ρ: India and China



Determinants of η_t

- The effectiveness of an interest rate change on exchange rate depends on the level of openness of the economy
- If interest rates rise in a country and capital cannot flow in to buy bonds, the impact of the interest rate rise will be small.
- Countries will less capital controls need small changes in interest rates to do currency defence.

A measure of η_t

- To measure η_t we need a measure of degree of capital controls.
- We rescale the Chinn-Ito index of capital account openness between 0-1 for a measure of η_t.
- ci_{it} : Total capital account openness

  Open : $\eta_t \approx 1$

  Closed : $\eta_t \approx 0$

Examples of η_t values

η_t : Selected countries

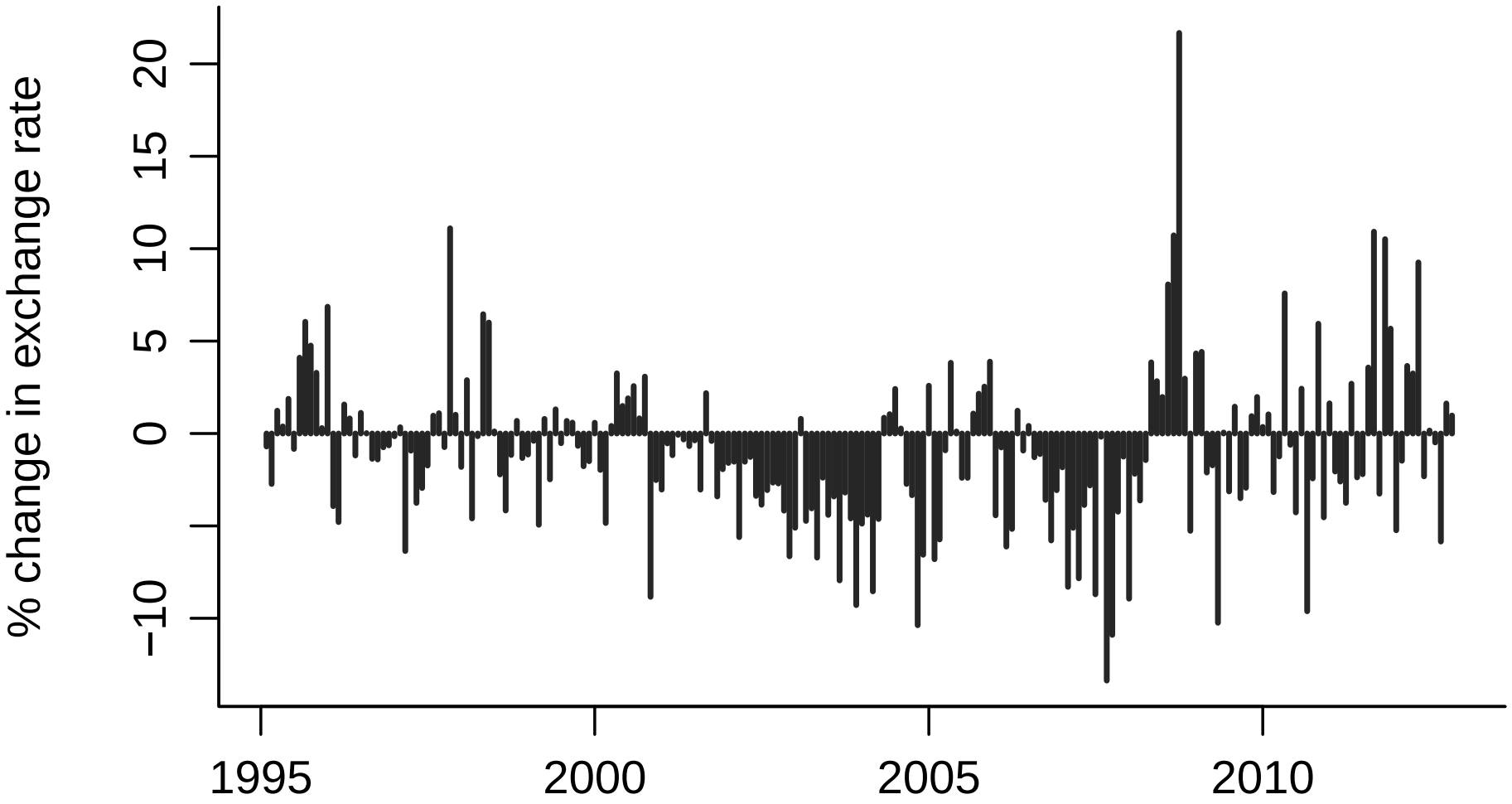
	1995	1997	1999	2001	2003	2005	2007
Romania	0.17	0.17	0.17	0.17	0.454	0.81	0.93
Uganda	0.40	0.40	0.81	0.93	1	1	1
China	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Indonesia	1	0.93	0.66	0.69	0.69	0.69	0.69
Hong Kong	1	1	1	1	1	1	1
Egypt	0.29	0.59	0.72	0.84	1	1	1
Cyprus	0.4	0.17	0.17	0.17	0.17	0.75	0.87

Source: Author's calculations

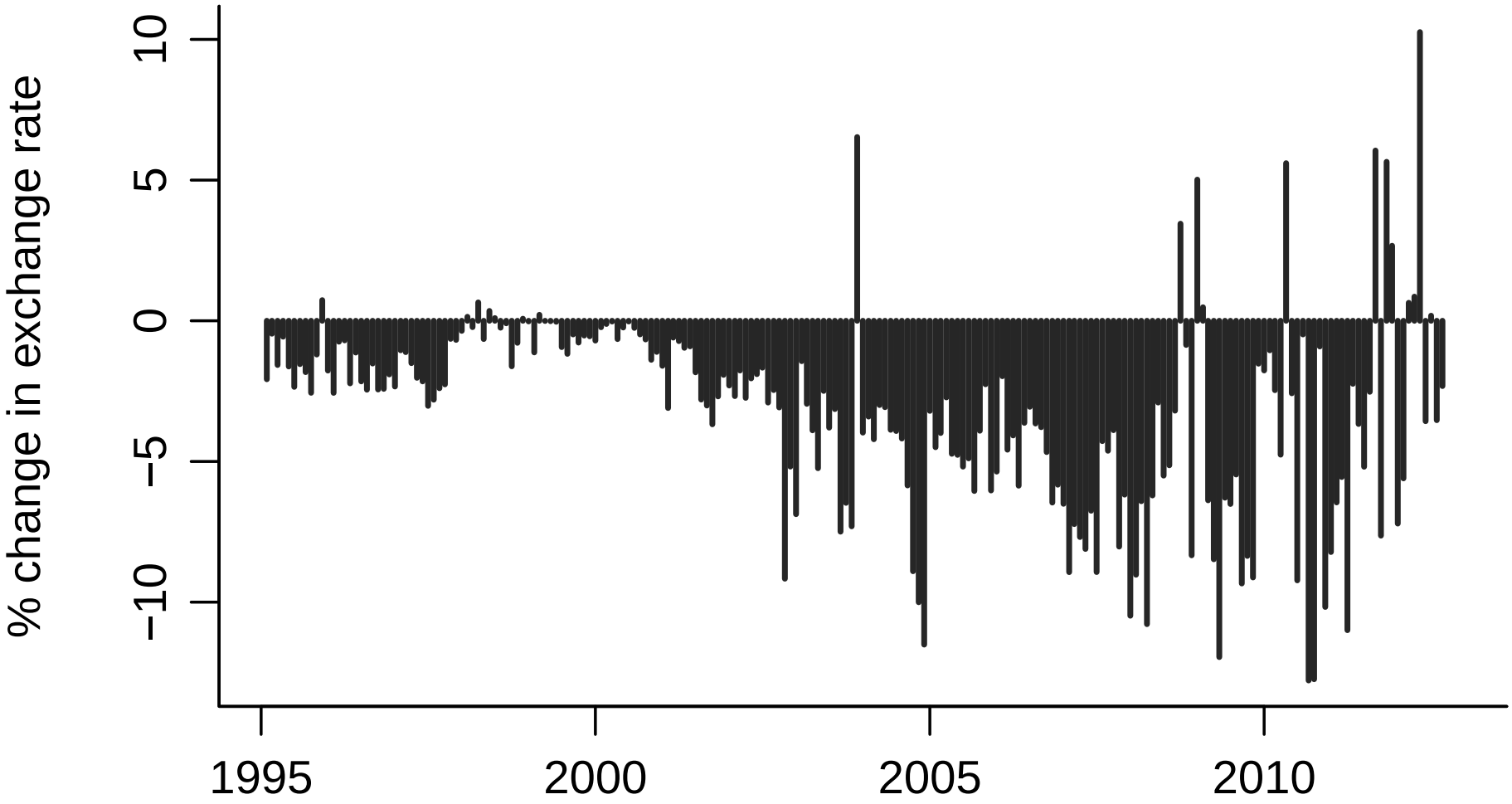
A multi-country EMP database

- We now have an annual multi-country dataset of the two parameters, ρ_t and η_t required for measuring EMP
- For a monthly EMP dataset we assume that the values of the two parameters remain the same over each year
- We calculate monthly EMP for all countries in the database (excluding Euro zone countries) for the period January 1995 to May 2013

EMP: India



EMP: China



Using EMP to study QE

A set of 26 EM's

- We study 26 EM's across Emerging Asia, Europe, Africa and Latam to understand the impact of QE on individual countries, regional groupings as well as the whole set

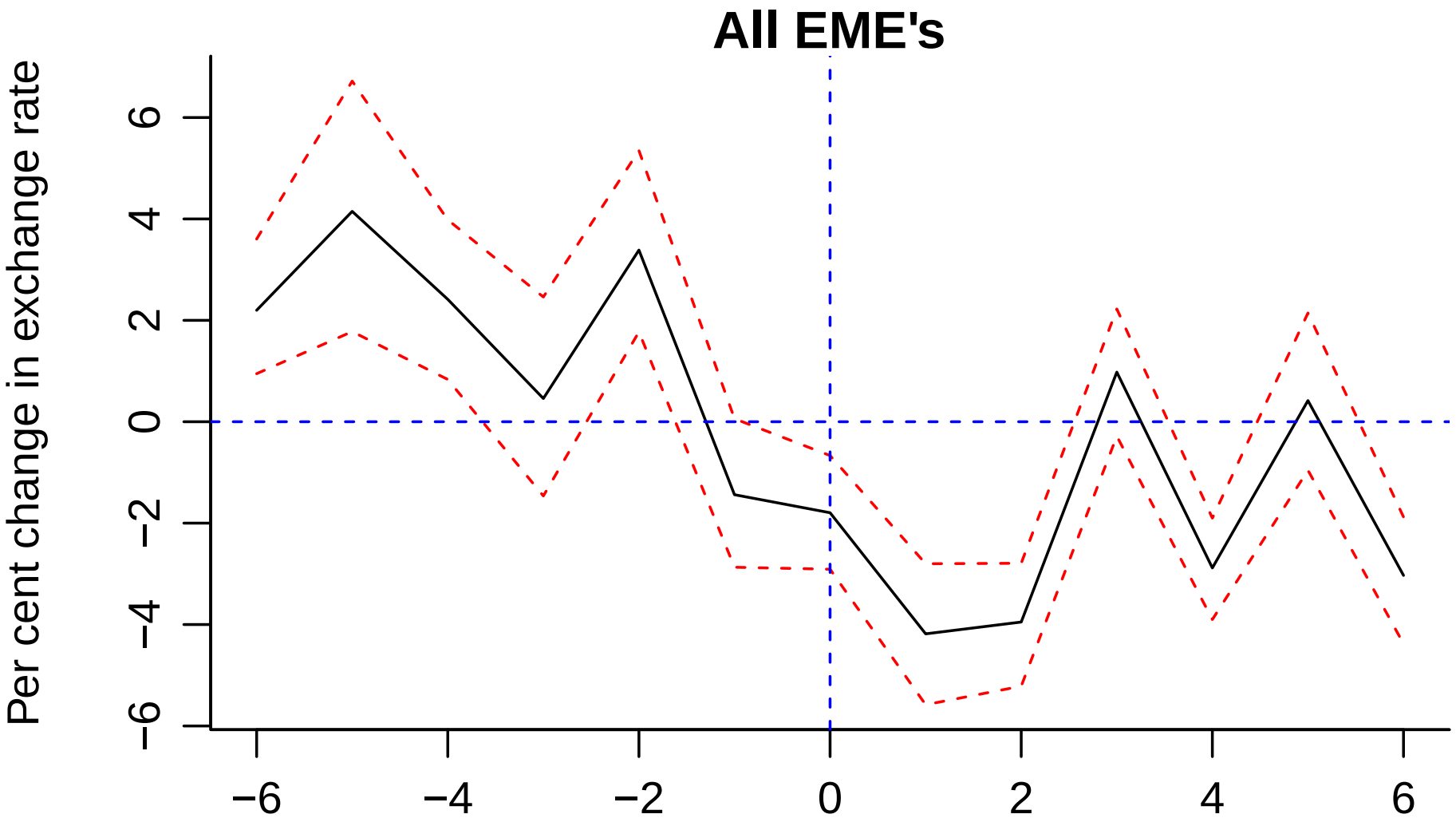
Emerging Asia	Emerging Africa & Middle East	Emerging Latam	Emerging Europe
China	Morocco	Mexico	Ukraine
India	Egypt	Argentina	Czech Republic
Malaysia	South Africa	Brazil	Hungary
Indonesia	Lebanon	Chile	Russia
Philippines	Saudi Arabia	Colombia	Turkey
South Korea	South Africa	Peru	Romania
Thailand		Venezuela	

Event study methodology

- We use an event study to analyse the impact of QE on EM EMP (as in IMF (2010), Broner (2013), Moore et al. (2013), Morgan (2011) and Krishnamurthy, Vissing-Jorgensen (2010, 2011)).
- The dates for the easing constitute the event. The event comprises of dates for QE1 (implementation date) and QE2 and QE3 (announcement date), which are lined up as time t=0

Impact of QE on EM EMP

Appreciation pressure after QE



Differential impact of QE

Did all regions feel a similar impact?

- Asia and Europe saw pressure to appreciate for two months after QE
- Latam faced appreciation pressure for one month after QE
- On average, Africa did not see an impact

Differential impact of QE

Was the impact of different episodes of QE different?

- EM's faced significant appreciation pressure after QE1. QE1 is different from other episodes as we see a reversal in EMP from significant depreciation pressure to appreciation pressure
- EM's faced maximum pressure to appreciate during QE2 as they faced appreciation pressure two months before and after QE2
- There seems to be no significant impact of QE3

Conclusions and further research

- The key contribution of this paper is a new measure of EMP.
- The proposed measure of EMP has consistent units and suitable for comparison across time and countries.
- The database of EMP for 125 countries from 1995 to May 2013 offers scope for answering questions about the impact of capital flows and the responses of countries.
- QE induced a pressure to appreciate for 2 months.