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International Portfolio Flows And Exchange Rate Volatility for Emerging Markets

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The deregulation of …nancial markets and the increase in cross-border capital ‡ows are widely believed to be an important factor behind the recently observed excess volatility of major currencies. A case in point is the US dollar, which was relatively stable in the 1970s but became highly volatile in the early 1980s. Gross cross-border portfolio (equity and bond) ‡ows were only 4% of GDP in 1975, but this percentage surged to 100% in the early 1990s and had reached 245% by 2000 (Hau and Rey, 2006). As a comparison, global capital ‡ows increased from about 2% of world GDP in 1975 to over 20% in 2007. However, they declined sharply at the time of the collapse of Lehman Brothers in September 2008, before starting to rise again in 2009 (see Milesi-Ferretti and Tille, 2011).

Most previous empirical papers only consider the relationship between portfolio ‡ows and exchange rate changes (appreciation or depreciation) (e.g., Brooks et al., 2004; Hau and Rey, 2006; Kodongo and Ojah, 2012; Menla Ali et al., 2014). In contrast, the present study examines their volatility linkages as well. For this purpose we use monthly bilateral data for the US *vis-à-vis* eight Asian developing and emerging countries, namely India, Indonesia, South Korea, Hong Kong, Thailand, Pakistan, the Philippines, and Taiwan over the period 1993:01-2012:11. This focus on emerging countries is another distinctive feature of our analysis: to the best of our knowledge, ours is the …rst empirical study investigating the impact of international equity and bond portfolio ‡ows on exchange rate dynamics for this group of countries. The existing literature provides plenty of evidence for the developed countries; examples of such studies are Brooks et al. (2004) for the US vis-a-vis the euro area and Japan; Hau and Rey (2006) for the US vis-a-vis 17 OECD countries; Siourounis (2004) for four developed economies (the UK, Japan, Germany, and Switzerland) vis-a-vis the US; Chaban (2009) for three oil-exporting countries (Canada, Australia, and New Zealand) vis-a-vis the US. The few papers considering instead developing and emerging countries include Kodongo and Ojah

rates and their volatility (see, e.g., Jeanne and Masson, 2000 and Chen, 2006); investors react differently in different states of the market (see, e.g., Jeanne and Rose, 2002 and Lovcha and Perez-Laborda, 2013). There is now evidence that equity and bond portfolio flows change with the degree of uncertainty of the foreign exchange market. For example, Fidora et al. (2007) found that exchange rate volatility is a key factor leading to bilateral portfolio home bias in a number of industrialised and emerging economies. Bayoumi (1990) concluded that net capital flows as a percentage of GDP were much larger during the gold standard (1880-1913) than during the floating exchange rate period (1965-1986). Bacchetta and van Wincoop (2000) showed, in the context of a two-period general equilibrium model, that exchange rate uncertainty dampens net international capital flows. Recent studies by Mishra (2011) and Caporale et al. (2015) also found evidence of a home bias for various countries. Batten and Vo (2010) and Daly and Vo (2013) reported instead that exchange rate volatility reduces equity home bias in Australia. In the emerging and developing countries, capital inflows turned into outflows following the Mexican crisis of 1994 and the Asian financial crisis of 1997-1998 (Baek, 2006). Eichengreen and Mody (1998) found evidence that emerging bond markets are primarily driven by shifts in market sentiment rather than changes in economic fundamentals, whilst Baek (2006) showed that portfolio investment flows to Asia are pushed by investors' appetite towards risk. Nonlinearities in the relationship between portfolio flows and exchange rate dynamics have only been investigated in the paper by Menla Ali et al. (2013) using constant transition probability Markov-switching specifications. However, they examine state-dependent linkages in the *first moments* for the US *vis-à-vis* the UK, Japan, the euro area, and Canada. By contrast, the present study considers different *volatility* regimes and provides evidence for emerging (instead of developed) economies.

The remainder of the paper is organised as follows. Section 2 outlines the econometric model. Section 3 describes the data. Section 4 discusses the empirical results, and finally Section 5 offers some concluding remarks.

We investigate the linkages between net equity and bond portfolio flows and exchange rate volatility using a regime-switching model allowing for volatility shifts, i.e. for periods of both high and low exchange rate volatility. The specification is the following:

$$r_t = \mu(s_t) + \sum_{i=1}^{12} \phi_i r_{t-i} + \sigma(s_t)\varepsilon_t; \qquad \varepsilon_t \sim N(0;1) \tag{1}$$

$$\mu(s_t) = \sum_{i=1}^{2} \mu^{(i)} 1\{s_t = i\}; \quad \sigma(s_t) = \sum_{i=1}^{2} \sigma^{(i)} 1\{s_t = i\}; \quad (t \in T)$$

where r_t = (exchange rate changes), $\{\varepsilon_t\}$ are i.i.d. errors with $E(\varepsilon_t) = 0$ and $E(\varepsilon_t^2) = 1$, and $\{s_t\}$ are random variables in $S = \{1;2\}$ that indicate the unobserved state of the system at date t. Throughout, the regime indicators $\{s_t\}$ are assumed to form a Markov chain on S with a transition probability matrix $P = [p_{ij}]_{2\times 2}$, where:

$$p_{ij} = \Pr(s_t = j | s_{t-1} = i); \qquad i;j \in S; \tag{2}$$

and $p_{i1} = 1 \quad p_{i2}$ (i 2 S); with each column adding up to unity and all elements being non-negative. We also allow for a time-varying conditional mean ((s_t)): To capture the dynamics of r_t adequately autoregressive terms (up to 12 lags) are considered. Therefore, the parameters vector of the mean equation (1) is de…ned by the autoregressive terms $\sum_{i=1}^{12}{}_i$, up to twelve lags; $^{(i)}$ (i = 1; 2) and $^{(i)}$ (i = 1; 2); which are real constants (where 1 stays for low and 2 for high).

Net equity and bond portfolio ‡ows enter the model through the time-varying transition probabilities as in the speci…cation by Filardo (1994). In particular, each conditional volatility (where $^{(1)}$ stands for low volatility and $^{(2)}$ for high volatility) follows a regime-shift process and the transition mechanism governing fs_tg is given by:

$$p_t^l = \frac{\exp\{ {}_0 + {}_1 nbf_{t-1} + {}_2 nef_{t-1}\}}{1 + \exp\{ {}_0 + {}_1 nbf_{t-1} + {}_2 nef_{t-1}\}};$$

$$p_t^h = \frac{\exp\{ {}_0 + {}_1 nbf_{t-1} + {}_2 nef_{t-1}\}}{1 + \exp\{ {}_0 + {}_1 nbf_{t-1} + {}_2 nef_{t-1}\}};$$

where nbf_{t-1} and nef_{t-1} refer to net bond and net equity in‡ows respectively. Note that, since p_t^h/nbf_{t-1} (p_t^h/nef_{t-1}) has the same sign as $_1$ ($_2$); $_1 > 0$ ($_2 > 0$) implies that an increase in nbf_{t-1} (nef_{t-1}) increases the probability of remaining in the state characterised by high exchange rate volatility. Similarly, $_1 > 0$ ($_2 > 0$) implies that an increase in nbf_{t-1} (nef_{t-1}) increases the probability of remaining in the state characterised by low exchange rate volatility. The maximum likelihood estimation is performed using the EM algorithm described by Hamilton (1989, 1990).

For comparison purposes, the following linear model commonly used in the literature (e.g., Brooks et al., 2004; Hau and Rey, 2006; among others) is also estimated:

$$r_t = + \sum_{i=1}^{12} {}_i r_{t-k} + {}_1 nbf_{t-1} + {}_2 nef_{t-1} + "_t:$$

More details on the estimation are provided in Section 4.

We examine the impact of net equity and bond portfolio ‡ows on exchange rate dynamics for the US vis-à-vis eight Asian developing and emerging countries, namely India, Indonesia, Hong Kong, South Korea, Pakistan, Philippines, Thailand, and Taiwan. China and Malaysia were excluded because their currencies were …xed vis-a-vis the US dollar for some time during the sample period considered.[1] Throughout, the US is treated as the domestic economy. We use monthly data on equity and bond portfolio ‡ows and period average exchange rates de…ned as US dollars per unit of foreign currency for the period 1993:01 to 2012:11. The data source for exchange rates is the IMF's International Financial Statistics (IFS), whilst portfolio ‡ows were obtained from the US Treasury International Capital (TIC) System.[2] As

[1] China's exchange rate was …xed to the US dollar until 2005, whilst Malaysia pegged its currency to the US dollar for the period following the Asian …nancial crisis till the middle of 2005.

[2]

pointed out by Edison and Warnock (2008), the US TIC data have three main limitations. First, they only cover transactions involving US residents, i.e. they represent bilateral US portfolio in‡ows and out‡ows and do not include other cross-border portfolio ‡ows. Second, transactions taking place via third countries lead to a …nancial centre bias in the bilateral ‡ows data as they are recorded against the foreign intermediary rather than where the issuer of the foreign security resides. Third, …nancing of cross-border mergers through stock swaps makes the analysis of equity ‡ows rather di¢ cult. Despite these limitations, the TIC data have been widely used in the empirical literature because they are still informative about bilateral portfolio investments between the US and the rest of the world. Moreover, the latter two issues are likely to be trivial in the context of emerging and developing countries.

Log changes of exchange rates are calculated as $r_t = 100 \quad (E_t/E_{t-1})$; where E_t is the log of the exchange rate at time t. Net portfolio ‡ows are constructed as the di¤erence between portfolio in‡ows and out‡ows. While in‡ows are measured as net purchases and sales of domestic assets (equities and bonds) by foreign residents, out‡ows are de…ned as net purchases and sales of foreign assets (equities and bonds) by domestic residents. Therefore, positive numbers indicate net equity and net bond portfolio in‡ows towards the US or out‡ows from the Asian countries. Following Brennan and Cao (1997), Hau and Rey (2006), and Chaban (2009) among others, the ‡ows are normalised using their past 12-month average.

A wide range of descriptive statistics is presented in Table 1. The mean monthly changes of exchange rates are negative, suggesting a US dollar appreciation against all Asian currencies over the sample period. The biggest one occurred vis-a-vis the Indonesian currency (-0.644), followed by the Pakistani one (-0.552), whilst the smallest occurred vis-a-vis the Hong Kong dollar (-0.001), the Taiwanese dollar (-0.056), and the Thai baht (-0.078). Net bond ‡ows are positive for all countries but Pakistan and the Philippines, the latter two experiencing bond in‡ows vis-a-vis the US. On the contrary, net equity ‡ows are negative in all cases. Exchange rate volatility ranges from 0.10 for Hong Kong to 7.02 for Indonesia. The volatility of net bond ‡ows ranges instead from 10.14 (highest) for Pakistan to 1.12 (lowest) for Hong Kong, with the corresponding volatility for net equity ‡ows ranging from 2.09, 2.08, and 2.07 (highest) respectively for the Philippines, India, and Indonesia to 1.43 and 1.44 (lowest) for Thailand and South Korea respectively. All series exhibit strong skewness and excess kurtosis. Finally, the Jarque-Bera (JB) test statistics reject the null hypothesis of normality in all cases except that of net equity ‡ows in Thailand.

First we report the estimates of the linear model, Eq. (3), where net (equity and bond) ‡ows are regressors in a standard OLS setting. The results, displayed in Tables 2 and 3, indicate that neither has a statistically signi…cant e¤ect on exchange rate changes. The only exceptions are net bond ‡ows in the case of the Philippines and South Korea. This general pattern may suggest that the simple linear model fails to capture the relationship between ‡ows and exchange rates. In fact the residuals exhibit high heteroscedasticity, especially in the case of Indonesia, the Philippines and Thailand.

The null hypothesis of linearity against the alternative of Markov regime-switching cannot be tested directly using a standard likelihood ratio (LR) test. Therefore we test for multi-

ple equilibria (more than one regime) against linearity using Hansen (1992)'s standardised likelihood ratio test. Testing requires the evaluation of the likelihood function across a grid of di¤erent values for the transition probabilities and for each state-dependent parameter.[3] The standardised likelihood ratio statistics (Table 4) provide strong evidence in favour of a two-state Markov switching speci…cation. We also test for the presence of a third state, but this is rejected for all countries.

The maximum likelihood estimates are reported in Tables 5 and 6. The standardised residuals show no sign of either linear or nonlinear dependence. The periods of high and low volatility seem to be identi…ed accurately by the smoothed probabilities. The Markov process is driven by switching in the variance rather than the mean. Statistically signi…cant low and high levels of the variances are identi…ed for all countries considered. The mean appears to be signi…cant only in the cases of Pakistan in both states, Hong Kong in the high volatility state, and Thailand in the low volatility state.

Figures 1 to 8 show plots of exchange rate changes, r_t; the estimated smoothed probabilities (SP), net bond ‡ows, nbf_t, net equity ‡ows, nef_t, and the time-varying transition probabilities (TVTP) for India, Indonesia, South Korea, Pakistan, Hong Kong, the Philippines, Thailand, and Taiwan, respectively.

The smoothed probabilities indicate that switches are not very frequent. The process is in the high volatility state for 117 months (49.36%) in India, 61 months (25.74%) in Pakistan, 54 months (22.79%) in Indonesia, 16 months (6.81%) in Thailand, 29 months (12.34%) in South Korea, 38 months (16.10%) in the Philippines, 97 months (41.10%) in Taiwan, and 121 months (51.27%) in Hong Kong. Exchange rate changes are characterised by low volatility for the remainder of the sample.

Furthermore, the time-varying transition probabilities suggest that net equity and net bond portfolio in‡ows drive the switches between the two states for a selected number of countries. In particular, the estimated value of $_1$ is positive in the case of Indonesia and negative in the case of Pakistan and the Philippines. This implies that net bond in‡ows result in an increase in the probability of staying in the high volatility regime in Indonesia, and an increase in the probability of switching from the high to the low volatility regime in Pakistan and the Philippines. Also, the positive and signi…cant value of $_1$ in the case of Thailand suggests that net bond in‡ows from Thailand towards the US increase the probability of remaining in the low volatility regime.

The estimated value of $_2$ is instead positive and signi…cant only in India, which indicates that net equity in‡ows from India towards the US lead to an increase in the probability of staying in the high volatility regime. This …nding is also supported by the estimate of $_2$, which is negative and signi…cant. This also holds for Indonesia, South Korea, Hong Kong and Taiwan, which suggests that net equity in‡ows from these countries towards the US lead to a decrease in the probability of remaining in the low volatility state.

[3]

In this paper we have investigated the e¤ects of equity and bond portfolio in‡ows on exchange rate volatility, using monthly bilateral data for the US vis-a-vis eight Asian developing and emerging countries, namely India, Indonesia, South Korea, Pakistan, Hong Kong, Thailand, the Philippines, and Taiwan over the period 1993:01-2012:11. A time-varying transition probability Markov-switching speci…cation has been employed to model the volatility of exchange rates as well as the switching between high and low volatility regimes as a function of stochastic information arrivals in the form of simple portfolio (bond and equity) shifts.

The empirical results suggest that net equity and bond portfolio in‡ows a¤ect signi…cantly the transition probabilities and the switches from high to low volatility states. In brief, net equity (bond) in‡ows drive the exchange rate to the high (low) volatility state. Speci…cally, net bond in‡ows increase the probability of remaining in the low volatility state in the case of Pakistan, Thailand, and the Philippines, whilst they increase the probability of staying in the high volatility state in the case of Indonesia. Finally, net equity in‡ows from India, Indonesia, South Korea, Hong Kong, and Taiwan towards the US also increase the probability of staying in the high volatility state.

The impact of equity ‡ows can be plausibly interpreted in terms of the "return-chasing" hypothesis of Bohn and Tesar (1996), according to which investors tend to move to markets where returns are expected to be high, which leads to more volatile exchange rates. The empirical validity of this hypothesis has also been con…rmed by Bekaert et al. (2003), who found, using data from twenty emerging countries, that positive return shocks lead to an increase in short-term equity ‡ows. As for net bond ‡ows, cross-border bond acquisitions are usually driven by changes in bond yields, which, in turn, drive exchange rate movements. Finally, our …ndings have important policy implications: since it appears that net equity and bond protfolio ‡ows a¤ect exchange rate volatility, credit controls imposed on them could be an e¤ective tool for policy-makers and …nancial regulators aiming to stabilise the foreign exchange market.

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Table 1
Descriptive Statistics

		Mean	St. Dev	Skewness	Ex. Kurtosis	JB
India	r_t	0:308	1:977	3:112	28:04	6629:3[a]
	nbf_t	0:168	2:142	1:836	18:95	2668:3[a]
	nef_t	0:897	2:083	2:527	14:81	1645:5[a]
Indonesia	r_t	0:644	7:023	4:187	43:25	16046:[a]
	nbf_t	0:023	1:765	0:115	6:106	96:65[a]
	nef_t	0:405	2:071	1:029	10:52	606:3[a]
Hong Kong	r_t	0:0003	0:100	0:660	8:093	275:7[a]
	nbf_t	0:869	1:126	0:058	4:930	37:25[a]
	nef_t	0:288	1:504	0:437	4:430	27:98[a]
Korea	r_t	0:134	3:562	5:1103	51:09	24074:[a]
	nbf_t	0:351	1:692	1:497	11:23	765:2[a]
	nef_t	0:722	1:4443	0:800	4:730	55:33[a]
Pakistan	r_t	0:552	1:425	2:644	10:82	885:1[a]
	nbf_t	0:776	10:14	5:793	46:89	20441:[a]
	nef_t	0:230	1:761	7:144	86:69	71494:[a]
Philippines	r_t	0:202	2:155	1:562	11:77	859:6[a]
	nbf_t	0:046	1:793	1:612	8:344	386:4[a]
	nef_t	0:270	2:096	5:170	66:54	41098:[a]
Thailand	r_t	0:078	2:780	1:694	20:30	3096:1[a]
	nbf_t	0:436	5:004	12:48	181:7	3201[a]
	nef_t	0:248	1:431	0:072	3:540	3:116
Taiwan	r_t	0:056	1:328	0:506	6:543	134:7[a]
	nbf_t	0:390	1:463	1:953	10:67	736:1[a]
	nef_t	0:406	1:795	0:091	8:403	289:8[a]

Note: r_t; nbf_t; and nef_t indicate exchange rate changes, net bond ‡ows and net equity ‡ows, respectively; JB is the Jarque-Bera test for normality. [a] indicates signi…cance at the 1% level.

Table 2

Estimated Linear Models: India, Indonesia, Korea, and Pakistan

	India	Indonesia	S. Korea	Pakistan
	0:316[b] (0:139)	0:575 (0:459)	0:329 (0:220)	0:321[a] (0:093)
1	0:024 (0:069)	0:090 (0:258)	0:397[a] (0:119)	0:0008 (0:008)
2	0:077 (0:062)	0:212 (0:216)	0:127 (0:134)	0:036 (0:048)
1	0:200[a] (0:108)	0:242[a] (0:063)	0:565[a] (0:066)	0:391[a] (0:060)
2			0:352[a] (0:072)	
3			0:053[c] (0:031)	
	1:948	6:900	2:973	1:329
Log Lik	494:4	788:6	589:0	400:0
Q(6)	5:913 [0:432]	1:994 [0:849]	1:529 [0:957]	7:920 [0:244]
Q(12)	8:197 [0:769]	13:52 [0:195]	11:49 [0:486]	10:60 [0:563]
Q^2(6)	0:411 [0:998]	63:17 [0:000]	3:034 [0:804]	0:447 [0:998]
Q^2(12)	0:467 [0:999]	78:06 [0:000]	3:645 [0:989]	0:516 [0:999]

Notes: Autocorrelation and heteroscedasticity-consistent standard errors are reported in brackets (.). $_1$ and $_2$ measure the e¤ects of net bond and net equity in‡ows respectively on exchange rate changes. Q(.) and Q^2(.) are respectively the Ljung-Box test (1978) of signi…cance of autocorrelations in the standardised and squared standardised residuals, p-values are reported in square brackets [.]. [a],[b]; and [c] indicate signi…cance levels at the 1%, 5%, and 10%, respectively.

Table 3

Estimated Linear Models: Hong Kong, Philippines, Thailand and Taiwan

	Hong Kong	Philippines	Thailand	Taiwan
	0:002 (0:007)	0:139 (0:129)	0:066 (0:174)	0:065 (0:085)
1	0:002 (0:005)	0:183[b] (0:071)	0:005 (0:034)	0:058 (0:056)
2	0:0001 (0:004)	0:039 (0:061)	0:034 (0:122)	0:024 (0:045)
1	0:283[a] (0:064)	0:426[a] (0:064)	0:387[a] (0:066)	0:415[a] (0:066)
2	0:288[a] (0:063)	0:107[c] (0:064)	0:094[b] (0:041)	0:108[c] (0:063)
3			0:038[c] (0:023)	
	0:095	1:962	2:629	1:228
Log Lik	222:2	493:4	560:0	380:8
$Q(6)$	0:362 [0:999]	7:272 [0:296]	6:038 [0:418]	3:372 [0:760]
$Q(12)$	0:382 [0:999]	14:66 [0:260]	19:46 [0:077]	6:597 [0:883]
$Q^2(6)$	0:001 [1:000]	90:92 [0:000]	81:48 [0:000]	0:035 [0:999]
$Q^2(12)$	0:00 [1:000]	94:85 [0:000]	115:9 [0:000]	0:064 [1:000]

Notes: See notes to Table 2.

Table 4

Markov-Switching State Dimension: Hansen Test		
Country	Linearity vs two-states	Two states vs three-states
India	4:231	0:316
Indonesia	3:998	0:354
Hong Kong	4:292	0:871
Pakistan	4:446	0:332
Philippines	4:852	0:491
South Korea	3:759	0:667
Thailand	3:476	0:883
Taiwan	4:006	0:129

Note: Hansen's standardised Likelihood Ratio test (LR) statistics. The test results for the presence of a third state are also reported.

Table 5

Estimated Markov-Switching Models: India, Indonesia, Korea, and Pakistan

	India	Indonesia	S. Korea	Pakistan
1	0:306 (0:235)	2:192 (1:772)	2:729 (2:562)	3:174[a] (0:331)
2	0:013 (0:045)	0:114 (0:109)	0:099	

Table 6

Estimated Markov-Switching Models: Hong Kong, Philippines, Thailand, and Taiwan.

	Hong Kong	Philippines	Thailand	Taiwan
1	0:009	1:575	5:762[b]	0:233
	(0:016)	(1:132)	(2:431)	(0:229)
2	0:007[a]	0:014	0:085	0:079
	(0:003)	(0:152)	(0:122)	(0:088)
0	2:002[a]	1:933[c]	2:868[c]	2:238[a]
	(0:434)	(1:113)	(1:524)	(0:528)
1	0:562	2:062[c]	0:191	0:034
	(0:653)	(1:258)	(0:895)	(0:364)
2	0:047	0:901	1:767	0:014
	(0:247)	(1:034)	(1:513)	(0:412)
0	2:406[a]	3:397[a]	5:057[a]	3:045[a]
	(0:450)	(0:619)	(1:023)	(0:857)
1	0:383	0:102	0:360[c]	0:367
	(0:329)	(0:275)	(0:214)	(0:320)
2	0:563[b]	0:062	0:297	0:656[b]
	(0:284)	(0:139)	(0:552)	(0:312)
1	0:298[a]	0:446[a]	0:445[a]	0:397[a]
	(0:044)	(0:059)	(0:040)	(0:061)
2	0:119[b]	0:092[c]	0:066[c]	0:134[b]
	(0:046)	(0:056)	(0:040)	(0:055)
3			0:041[c]	
			(0:021)	
1	0:019[a]	18:60[b]	88:74[a]	2:967[a]
	(0:002)	(7:284)	(26:21)	(0:505)
2	0:0004[a]	1:462[a]	1:421[a]	0:441[a]
	(0:00008)	(0:194)	(0:128)	(0:074)
Log Lik	311:4	438:0	417:6	354:3
$Q(6)$	5:528	6:340	4:049	5:683
	[0:478]	[0:386]	[0:669]	[0:459]
$Q(12)$	11:22	12:22	16:41	14:79
	[0:509]	[0:427]	[0:172]	[0:253]
$Q^2(6)$	1:037	6:337	0:240	2:896
	[0:984]	[0:386]	[0:999]	[0:821]
$Q^2(12)$	2:968	13:18	11:48	6:177
	[0:995]	[0:355]	[0:488]	[0:906]

Notes: See notes of Table 5.

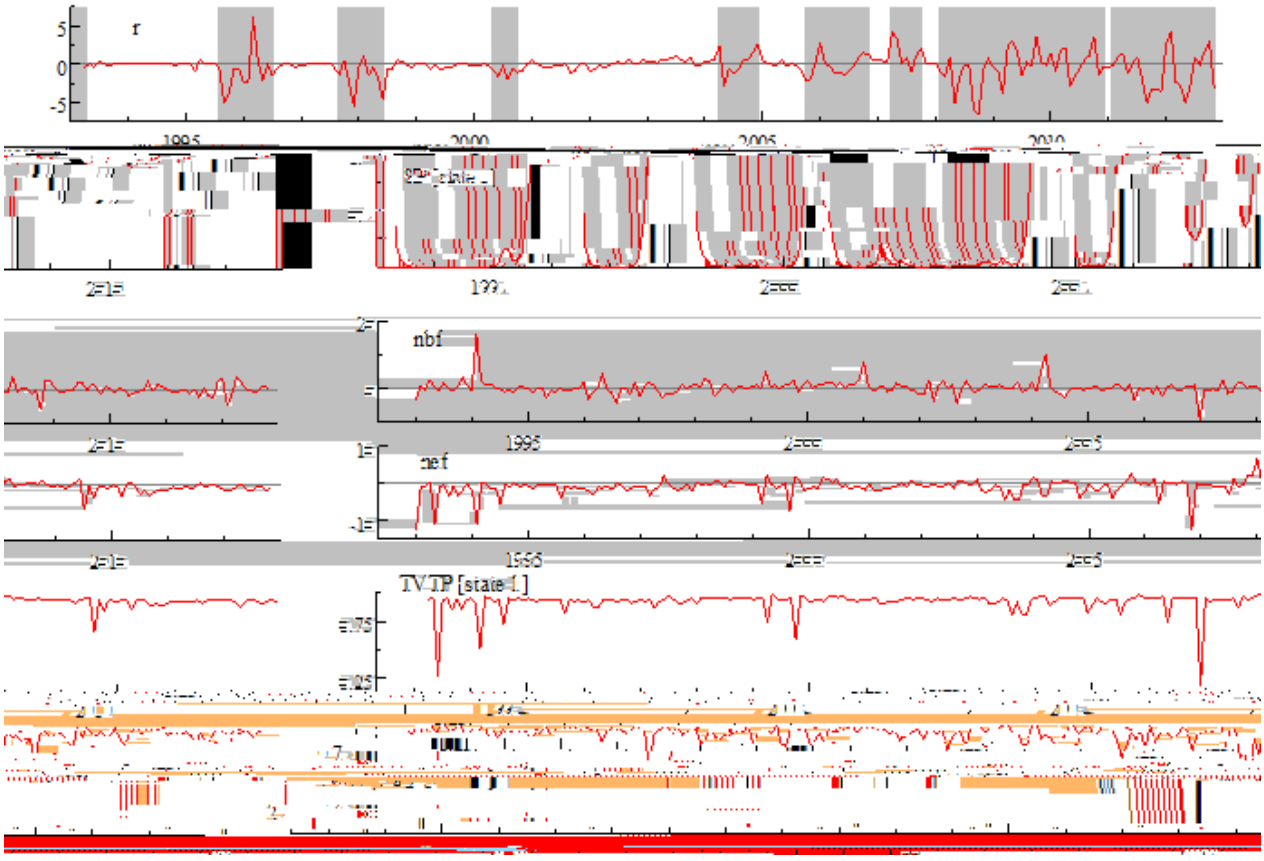

Figure 1: Exchange rate changes (r_t), smoothed probabilities (SP), net bond flows (nbf_t), net equity flows (nef_t), and time-varying transition probabilities (TVTP) for India.

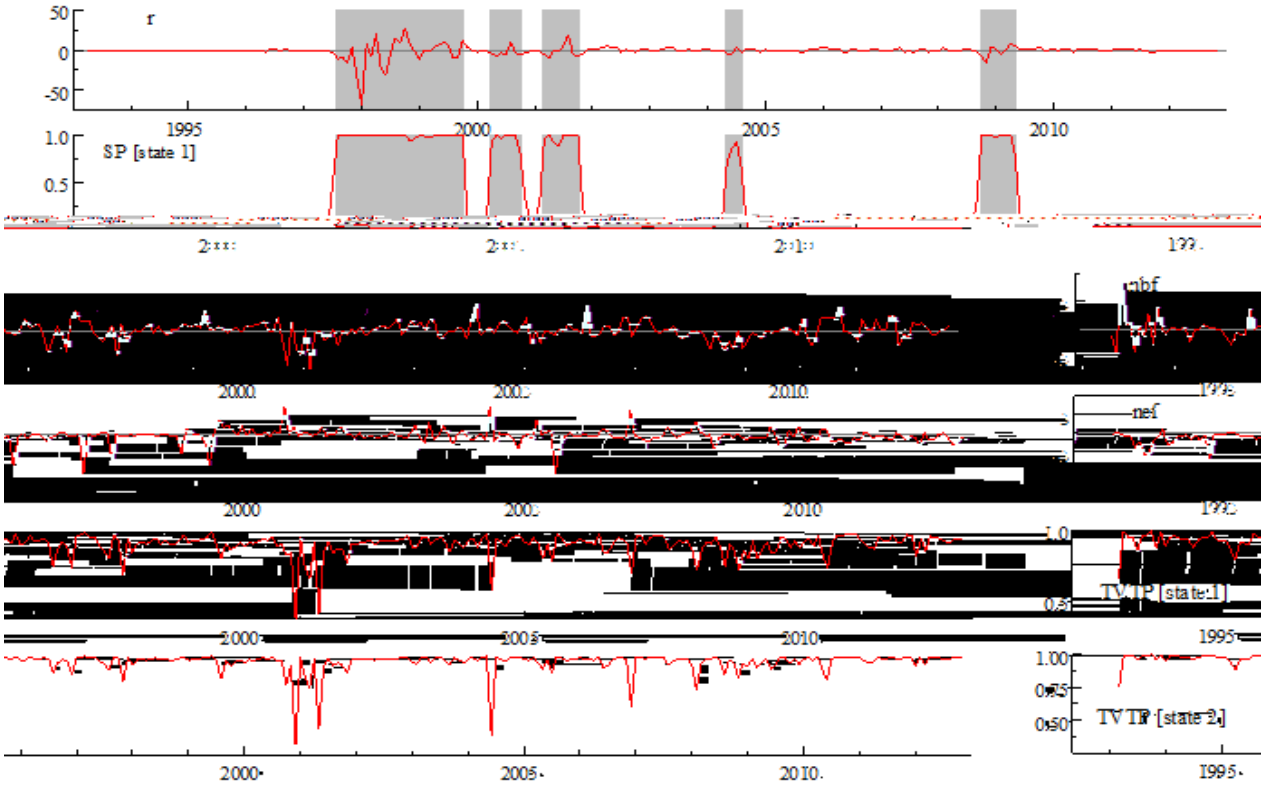

Figure 2: Exchange rate changes (r_t), smoothed probabilities (SP), net bond flows (r

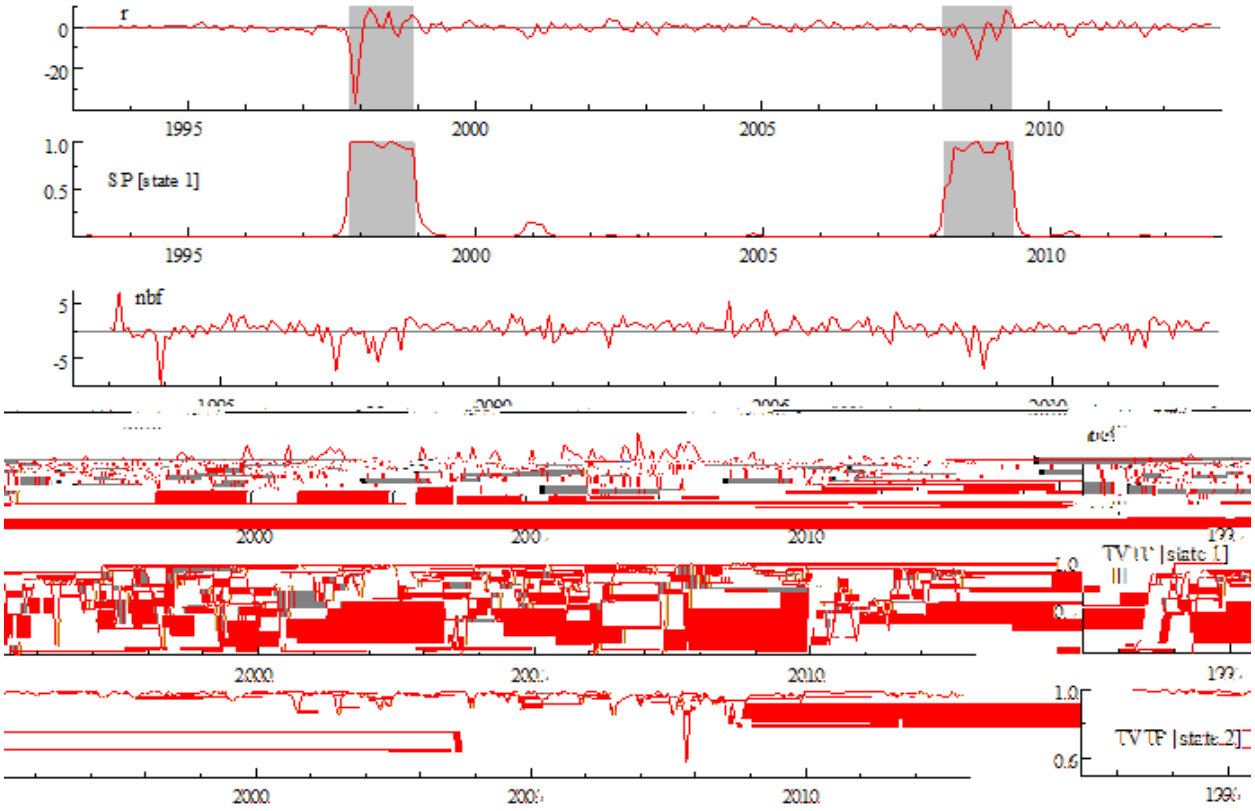

Figure 3: Exchange rate changes (r_t), smoothed probabilities (SP), net bond ‡ows (nbf_t), net equity ‡ows (nef_t), and time-varying transition probabilities (TVTP) for South Korea.

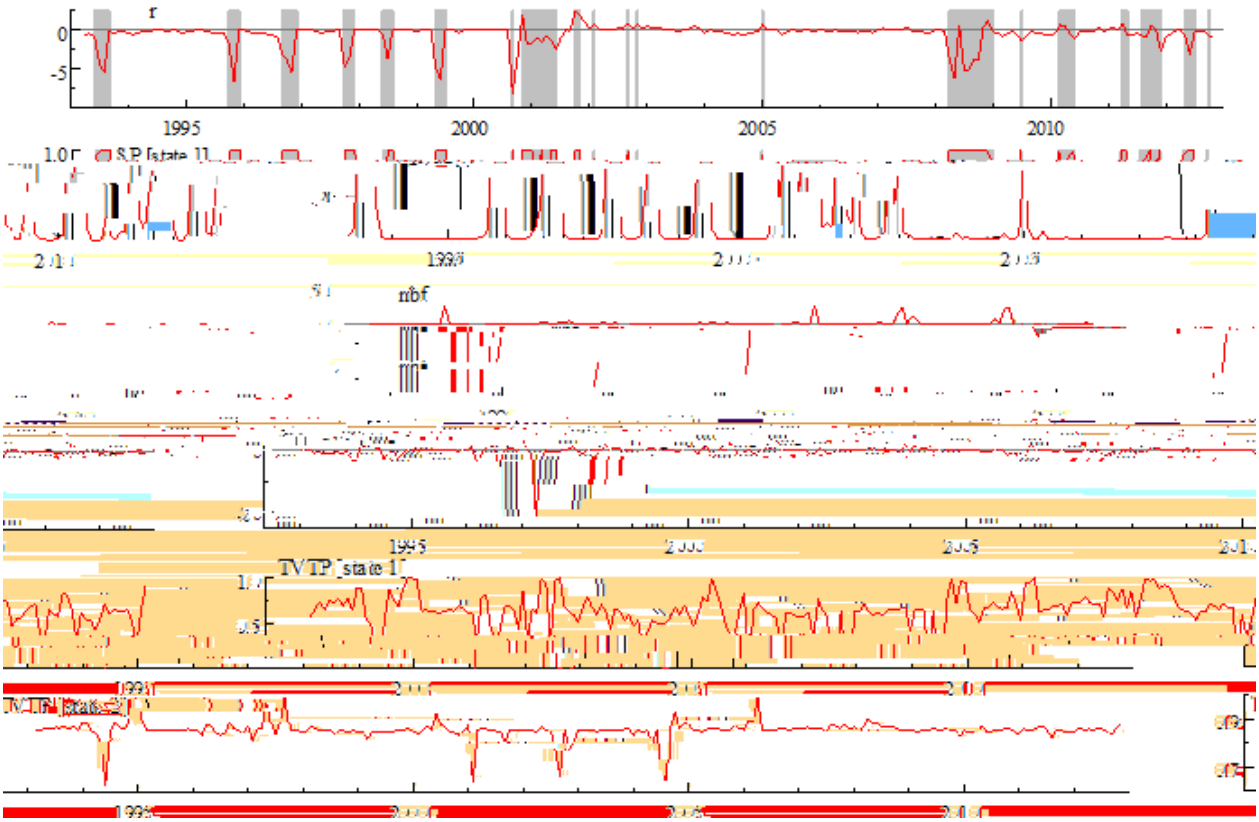

Figure 4: Exchange rate changes (r_t), smoothed probabilities (SP), net bond flows (nbf_t), net equity flows (nef_t), and time-varying transition probabilities (TVTP) for Pakistan.

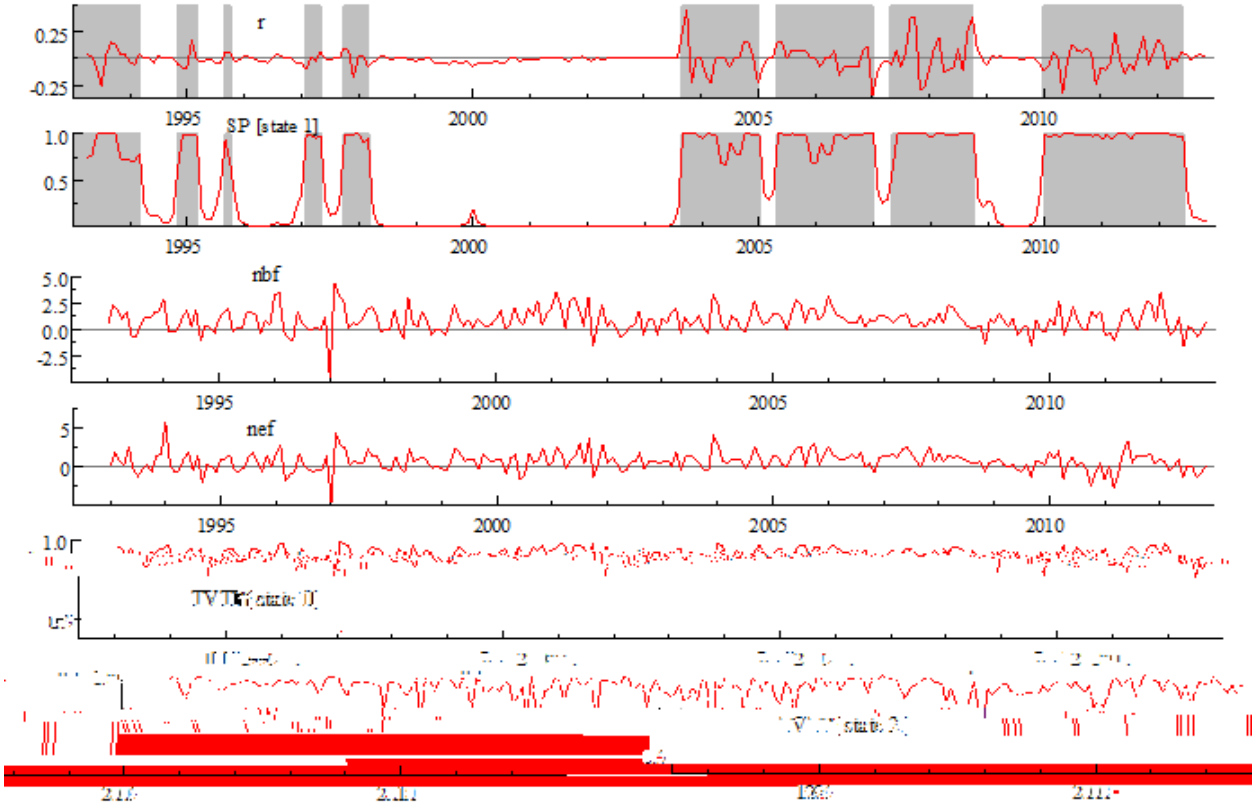

Figure 5: Exchange rate changes (r_t), smoothed probabilities (SP), net bond ‡ows (nbf_t), net equity ‡ows (nef_t), and time-varying transition probabilities (TVTP) for Hong Kong.

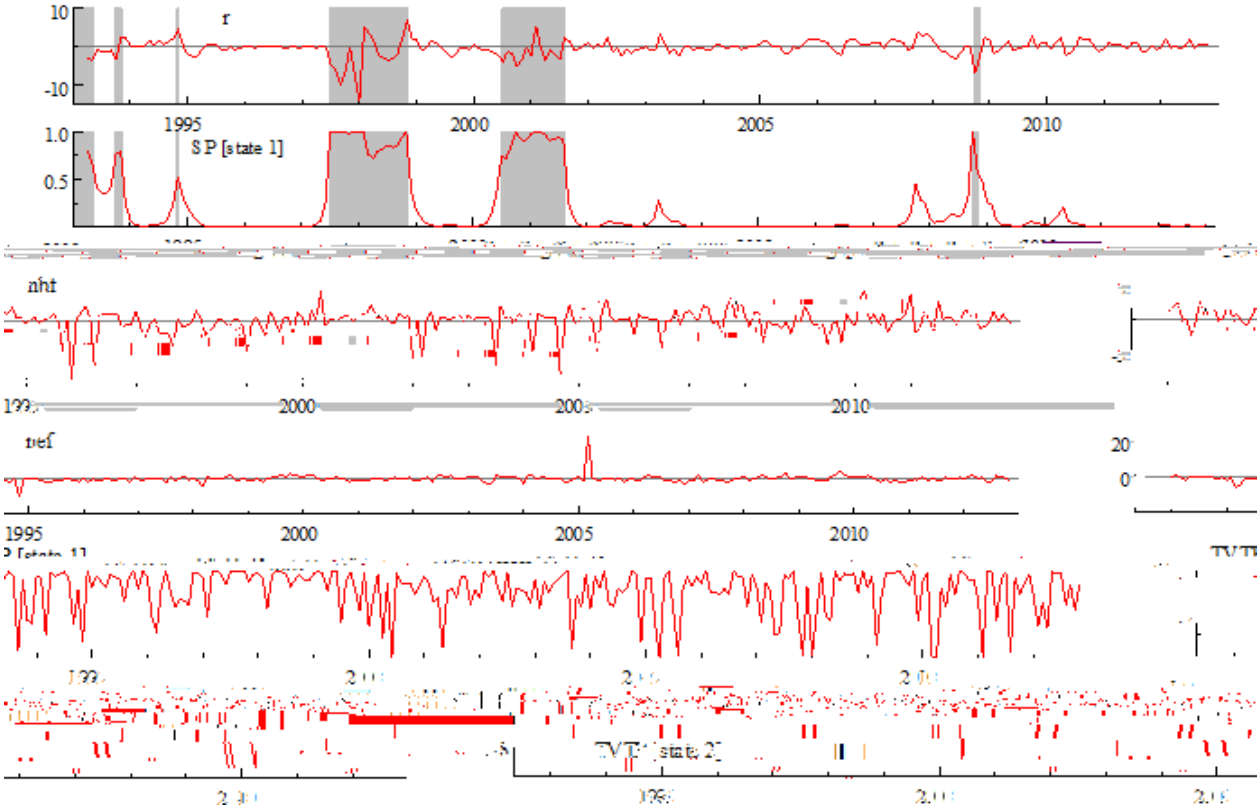

Figure 6: Exchange rate changes (r_t), smoothed probabilities (SP), net bond ‡ows (nbf_t), net equity ‡ows (nef_t), and time-varying transition probabilities (TVTP) for the Philippines.

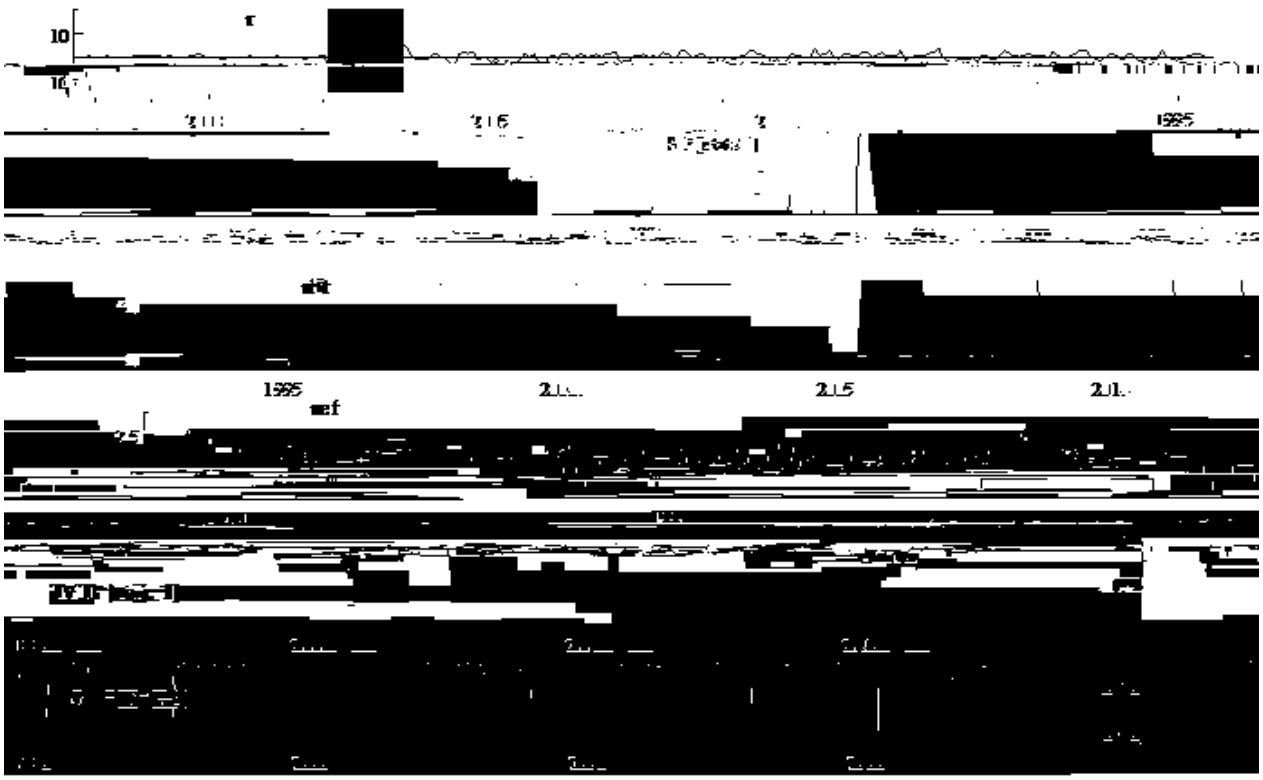

Figure 7: Exchange rate changes (r_t), smoothed probabilities (SP), net bond flows (nbf_t), net equity flows (nef_t), and time-varying transition probabilities (TVTP) for Thailand.

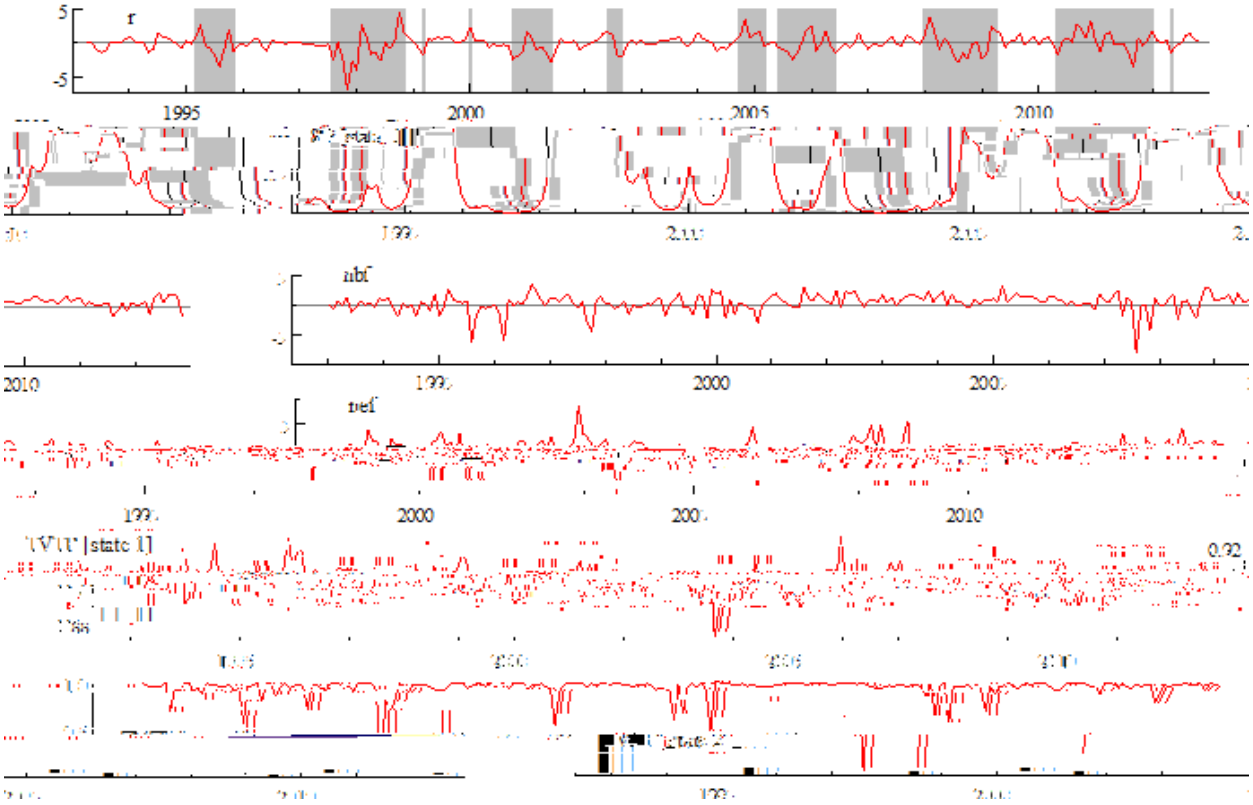

Figure 8: Exchange rate changes (r_t), smoothed probabilities (SP), net bond flows (nbf_t), net equity flows (nef_t), and time-varying transition probabilities (TVTP) for Taiwan.