Department of
Economics and Finance

International Portfolio Flows And Exchange Rate Volatility for Emerging Markets

Guglielmo Maria Caporale[a;b;c,×], Faek Menla Ali[a]

The deregulation of financial markets and the increase in cross-border capital flows 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) flows 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 flows 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 flows 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 first empirical study investigating the impact of international equity and bond portfolio flows 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 $p_{i1} = 1 - p_{i2}$ $(i \in S)$, with each column adding up to unity and all elements being non-negative. We also allow for a time-varying conditional mean $(\mu(s_t))$. 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 defined by the autoregressive terms $\sum_{i=1}^{12} \phi_i$, up to twelve lags; $\mu^{(i)}$ $(i = 1, 2)$ and $\sigma^{(i)}$ $(i = 1, 2)$, which are real constants (where 1 stays for low and 2 for high).

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

$$
\begin{aligned}
p_t^l &= \frac{\exp\{\alpha_0 + \alpha_1 nbf_{t-1} + \alpha_2 nef_{t-1}\}}{1 + \exp\{\alpha_0 + \alpha_1 nbf_{t-1} + \alpha_2 nef_{t-1}\}}, \\
p_t^h &= \frac{\exp\{\beta_0 + \beta_1 nbf_{t-1} + \beta_2 nef_{t-1}\}}{1 + \exp\{\beta_0 + \beta_1 nbf_{t-1} + \beta_2 nef_{t-1}\}},
\end{aligned}
$$

where nbf_{t-1} and nef_{t-1} refer to net bond and net equity inflows respectively. Note that, since $\partial p_t^h / \partial nbf_{t-1}$ $(\partial p_t^h / \partial nef_{t-1})$ has the same sign as β_1 (β_2), $\beta_1 > 0$ $(\beta_2 > 0)$ 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, $\alpha_1 > 0$ $(\alpha_2 > 0)$ 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:

$$
r_t = \mu + \sum_{i=1}^{12} \phi_i r_{t-k} + \beta_1 nbf_{t-1} + \beta_2 nef_{t-1} + \varepsilon_t.
$$

More details on the estimation are provided in Section 4.

We examine the impact of net equity and bond portfolio flows 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 fixed 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 flows and period average exchange rates defined 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 flows were obtained from the US Treasury International Capital (TIC) System.[2] As

---

[1] China's exchange rate was fixed to the US dollar until 2005, whilst Malaysia pegged its currency to the US dollar for the period following the Asian financial 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 inflows and outflows and do not include other cross-border portfolio flows. Second, transactions taking place via third countries lead to a financial centre bias in the bilateral flows data as they are recorded against the foreign intermediary rather than where the issuer of the foreign security resides. Third, financing of cross-border mergers through stock swaps makes the analysis of equity flows rather difficult. 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 $r_t = 100 \ (E_t/E_{t-1});$ where E_t is the log of the exchange rate at time t. Net portfolio flows are constructed as the difference between portfolio inflows and outflows. While inflows are measured as net purchases and sales of domestic assets (equities and bonds) by foreign residents, outflows are defined as net purchases and sales of foreign assets (equities and bonds) by domestic residents. Therefore, positive numbers indicate net equity and net bond portfolio inflows towards the US or outflows from the Asian countries. Following Brennan and Cao (1997), Hau and Rey (2006), and Chaban (2009) among others, the flows 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 flows are positive for all countries but Pakistan and the Philippines, the latter two experiencing bond inflows vis-a-vis the US. On the contrary, net equity flows 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 flows ranges instead from 10.14 (highest) for Pakistan to 1.12 (lowest) for Hong Kong, with the corresponding volatility for net equity flows 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 flows in Thailand.

First we report the estimates of the linear model, Eq. (3), where net (equity and bond) flows are regressors in a standard OLS setting. The results, displayed in Tables 2 and 3, indicate that neither has a statistically significant effect on exchange rate changes. The only exceptions are net bond flows 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 flows 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 multiple 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 different 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 specification. 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 identified accurately by the smoothed probabilities. The Markov process is driven by switching in the variance rather than the mean. Statistically significant low and high levels of the variances are identified for all countries considered. The mean appears to be significant 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 flows, nbf_t, net equity flows, 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 inflows 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 inflows 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 significant value of $_1$ in the case of Thailand suggests that net bond inflows from Thailand towards the US increase the probability of remaining in the low volatility regime.

The estimated value of $_2$ is instead positive and significant only in India, which indicates that net equity inflows from India towards the US lead to an increase in the probability of staying in the high volatility regime. This finding is also supported by the estimate of $_2$, which is negative and significant. This also holds for Indonesia, South Korea, Hong Kong and Taiwan, which suggests that net equity inflows 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 effects of equity and bond portfolio inflows 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 specification 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 inflows affect significantly the transition probabilities and the switches from high to low volatility states. In brief, net equity (bond) inflows drive the exchange rate to the high (low) volatility state. Specifically, net bond inflows 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 inflows 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 flows 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 confirmed 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 flows. As for net bond flows, cross-border bond acquisitions are usually driven by changes in bond yields, which, in turn, drive exchange rate movements. Finally, our findings have important policy implications: since it appears that net equity and bond protfolio flows affect exchange rate volatility, credit controls imposed on them could be an effective tool for policy-makers and financial regulators aiming to stabilise the foreign exchange market.

[1] Baek, I.M., 2006. Portfolio Investment Flows to Asia and Latin America: Pull, Push, or Market Sentiment. *Journal of Asian Economics*, 17, 363–373.

[2] Bacchetta, P., and van Wincoop, E., 2000. Trade in Nominal Assets and Net International Capital Flows. *Journal of International Money and Finance*, 19, 55-72.

[3] Batten, J.A., and Vo, X.V., 2010. The Determinants of Equity Portfolio Holdings. *Applied Financial Economics*, 20 (14), 1125–1132.

[17] Edison, H.J., and Warnock, F.E., 2008. Cross-Border Listings, Capital Controls, and Equity Flows to Emerging Markets. *Journal of International Money and Finance*, 27, 1013–1027.

[18] Eichengreen, B., and Mody, A. (February 1998). What Explains Changing Spreads on Emerging-Market Debt: Fundamentals or Market Sentiment? In NBER working paper, No. 6408. National Bureau of Economic Research.

[19] Engle, C., 1994. Can the Markov Switching Model Forecast Exchange Rates? *Journal of International Economics*, 36, 151- 165.

[20] Engle, C., and Hamilton, J.D., 1990. Long Swings in the Dollar: Are They in the Data and Do Markets Know It? *The American Economic Review*, 80 (4), 689-713.

[21] Fidora, M., Fratzscher, M., and Thimann, C., 2007. Home Bias in Global Bond and Equity Markets: The Role of Real Exchange Rate Volatility. *Journal of International Money and Finance*, 26, 631-655.

[22] Filardo, A.J., 1994. Business-Cycle Phases and Their Transitional Dynamics. *Journal of Business & Economic Statistics*, 12(3), 299-308.

[23] Frömmel, M., MacDonald, R., and Menkho¤, L., 2005. Markov Switching Regimes in a Monetary Exchange Rate Model. *Economic Modelling*, 22, 485-502.

[24] Hamilton, J.D., 1989. A New Approach to the Economic Analysis of Non-Stationary Time Series and the Business Cycle. *Econometrica*, 57, 357 – 384.

[25] Hamilton, J.D., 1990. Analysis of Time Series Subject to Changes in Regime. *Journal of Econometrics,* 45, 39-70.

[26] Hansen, B.E., 1992. The Likelihood Ratio Test Under Nonstandard Conditions: Testing the Markov Switching Model of GNP. *Journal of Applied Econometrics*, 7, 61-82.

[27] Hau, H., and Rey, H., 2006. Exchange Rates, Equity Prices, and Capital Flows. *The Review of Financial Studies*, 19, 273-317.

[28] Ibarra, C.A., 2011. Capital Flows and Real Exchange Rate Appreciation in Mexico. *World Development*, 39, 2080–2090.

[29] Jeanne, O., and Masson, P., 2000. Currency Crises, Sunspots and Markov-Switching Regimes. *Journal of International Economics*, 50, 327–350.

[30] Jeanne, O., and Rose, A.K., 2002. Noise Trading and Exchange Rate Regimes. *Quarterly Journal of Economics*, 117 (2), 537-569.

[31] Kaminsky, G., 1993. Is There a Peso Problem? Evidence from the Dollar/Pound Exchange Rate, 1976-1987. *The American Economic Review*, 83 (3), 450-472.

[32] Kodongo, O., and Ojah, K., 2012. The Dynamic Relation between Foreign Exchange Rates and International Portfolio Flows: Evidence from Africa’s Capital Markets. *International Review of Economics and Finance*, 24, 71-87.

[33] Ljung, G.M., and Box, G.E.P. 1978. On a Measure of Lack of Fit in Time Series Models. *Biometrika*, 65, 297–303.

[34] Lovcha, Y., and Perez-Laborda, A., 2013. Is Exchange Rate Customer Order Flow Relationship Linear? Evidence from the Hungarian FX Market. *Journal of International Money and Finance*, 35, 20-35.

[35] Menla Ali, F., Spagnolo, F., and Spagnolo, N., 2014. Exchange Rates and Net Portfolio Flows: A Markov-Switching Approach. In: Hidden Markov Models in Finance: Volume II (Further Developments and Applications), US Springer's International Series in Operations Research and Management Science, 117-132.

[36] Milesi-Ferretti, G-M., and Tille, C., 2011. The Great Retrenchment: International Capital Flows During the Global Financial Crisis. *Economic Policy*, 26, 289–346.

[37] Mishra, A.V., 2011. Australia's Equity Home Bias and Real Exchange Rate Volatility. *Review of Quantitative Finance and Accounting*, 37 (2), 223–244.

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]	0.575	0.329	0.321[a]
	(0.139)	(0.459)	(0.220)	(0.093)
$_1$	0.024	0.090	0.397[a]	0.0008
	(0.069)	(0.258)	(0.119)	(0.008)
$_2$	0.077	0.212	0.127	0.036
	(0.062)	(0.216)	(0.134)	(0.048)
$_1$	0.200[a]	0.242[a]	0.565[a]	0.391[a]
	(0.108)	(0.063)	(0.066)	(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	1.994	1.529	7.920
	[0.432]	[0.849]	[0.957]	[0.244]
$Q(12)$	8.197	13.52	11.49	10.60
	[0.769]	[0.195]	[0.486]	[0.563]
$Q^2(6)$	0.411	63.17	3.034	0.447
	[0.998]	[0.000]	[0.804]	[0.998]
$Q^2(12)$	0.467	78.06	3.645	0.516
	[0.999]	[0.000]	[0.989]	[0.999]

Notes: Autocorrelation and heteroscedasticity-consistent standard errors are reported in brackets (.). $_1$ and $_2$ measure the effects of net bond and net equity inflows respectively on exchange rate changes. Q(.) and Q^2(.) are respectively the Ljung-Box test (1978) of significance of autocorrelations in the standardised and squared standardised residuals, p-values are reported in square brackets [.]. ^{a,b}, and ^{c} indicate significance 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
$\boldsymbol{Q}(6)$	0:362 [0:999]	7:272 [0:296]	6:038 [0:418]	3:372 [0:760]
$\boldsymbol{Q}(12)$	0:382 [0:999]	14:66 [0:260]	19:46 [0:077]	6:597 [0:883]
$\boldsymbol{Q}^2(6)$	0:001 [1:000]	90:92 [0:000]	81:48 [0:000]	0:035 [0:999]
$\boldsymbol{Q}^2(12)$	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	2:192	2:729	3:174[a]
	(0:235)	(1:772)	(2:562)	(0:331)
2	0:013	0:114	0:099	
	(0:045)	(0:109)		

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.

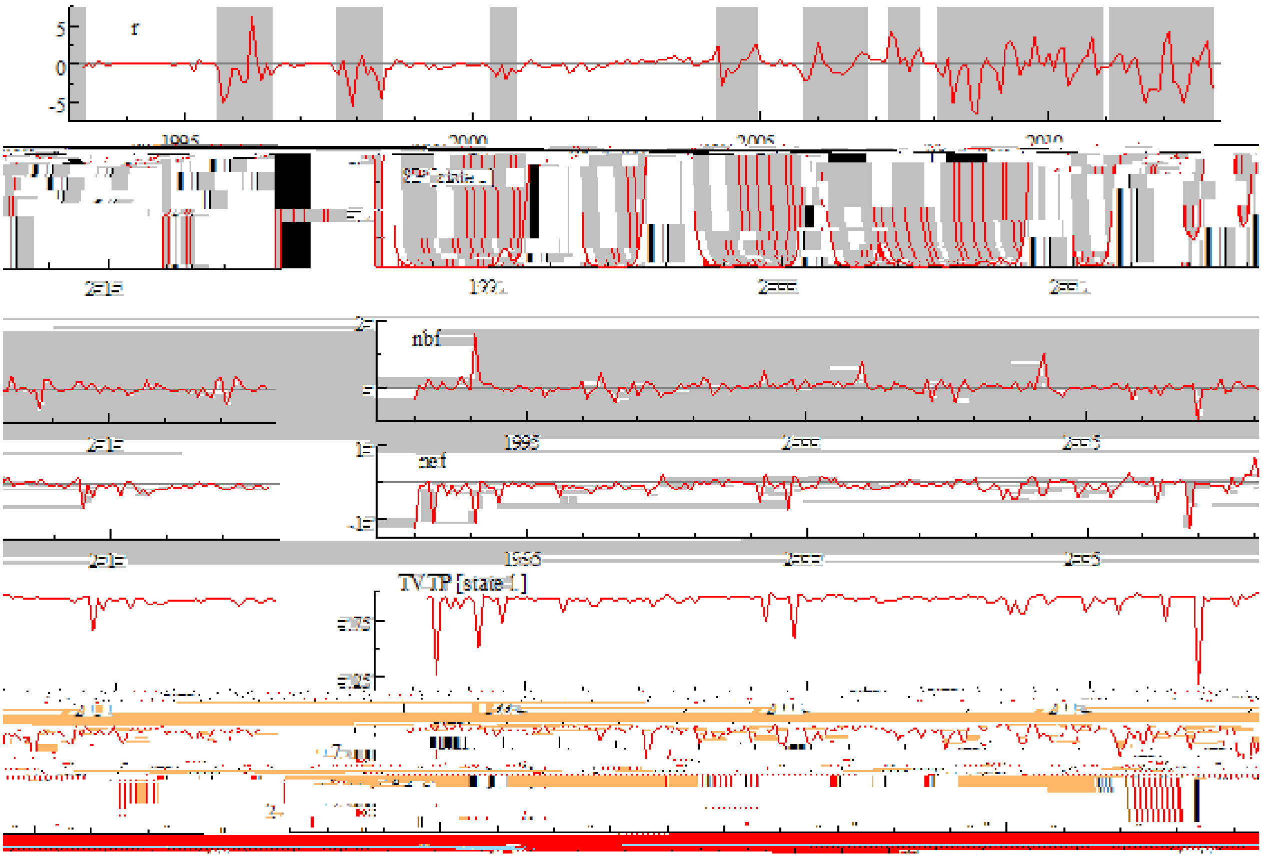

Figure 1: Exchange rate changes (r_t), smoothed probabilities (SP), net bond ‡ows (nbf_t), net equity ‡ows (nef_t), and time-varying transition probabilities (TVTP) for India.

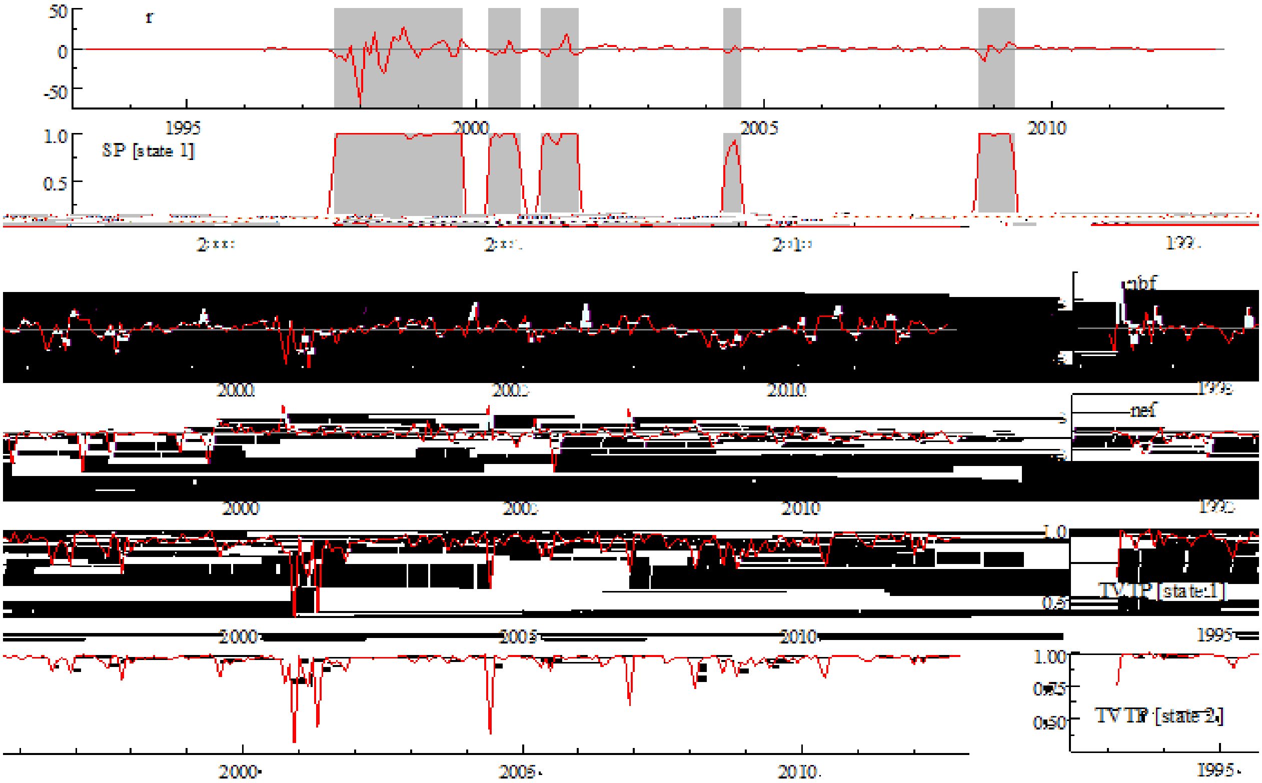

Figure 2: Exchange rate changes (r_t), smoothed probabilities (SP), net bond ‡ows (r

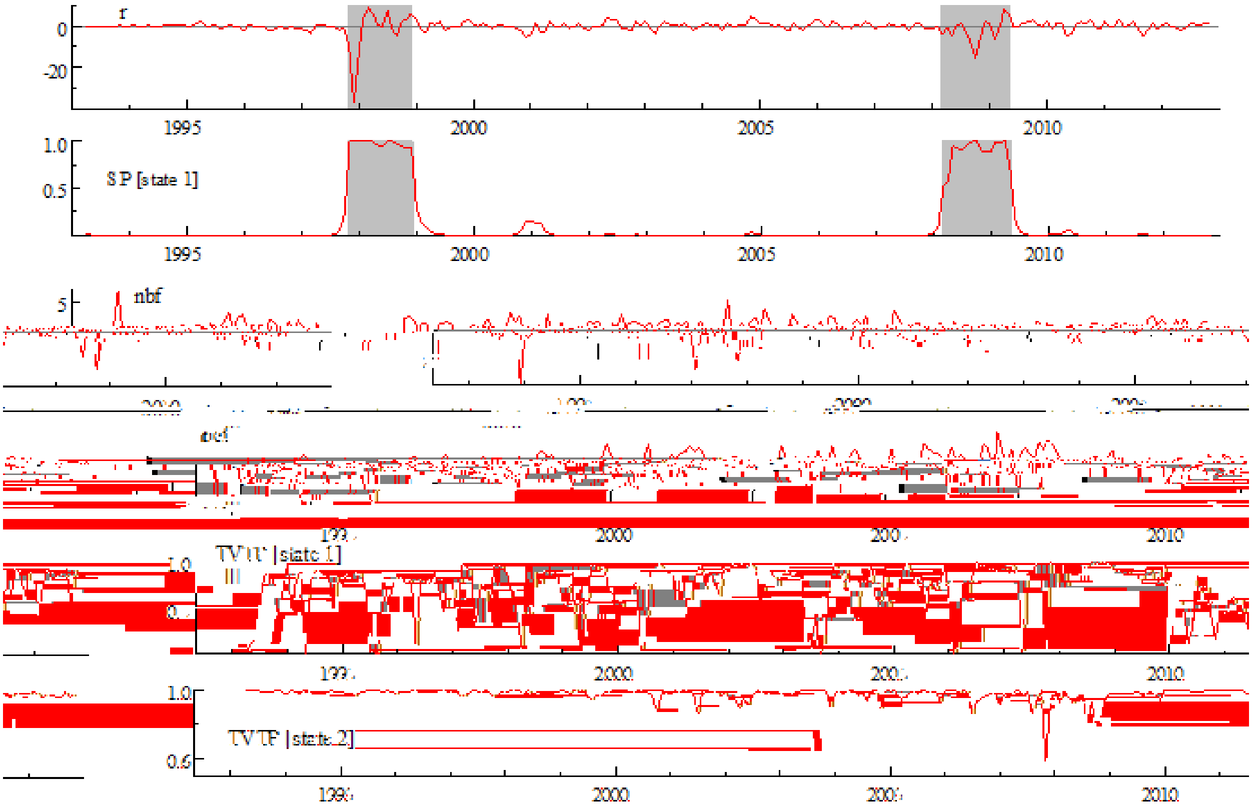

Figure 3: Exchange rate changes (r_t), smoothed probabilities (SP), net bond ‡ows (nbf_t), net equity ‡ows (nef_t), and time-varying transition probabilities (TVTP) for South Korea.

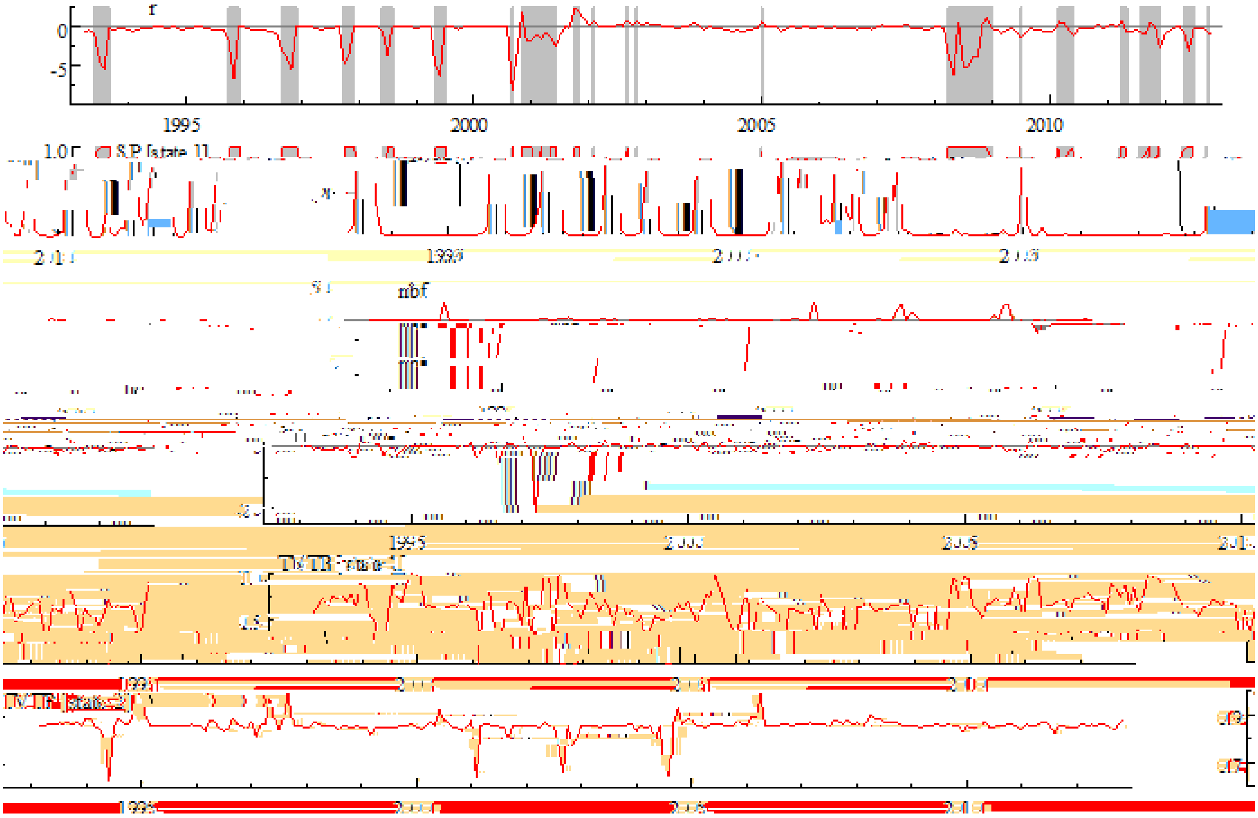

Figure 4: Exchange rate changes (r_t), smoothed probabilities (SP), net bond ‡ows (nbf_t), net equity ‡ows (nef_t), and time-varying transition probabilities (TVTP) for Pakistan.

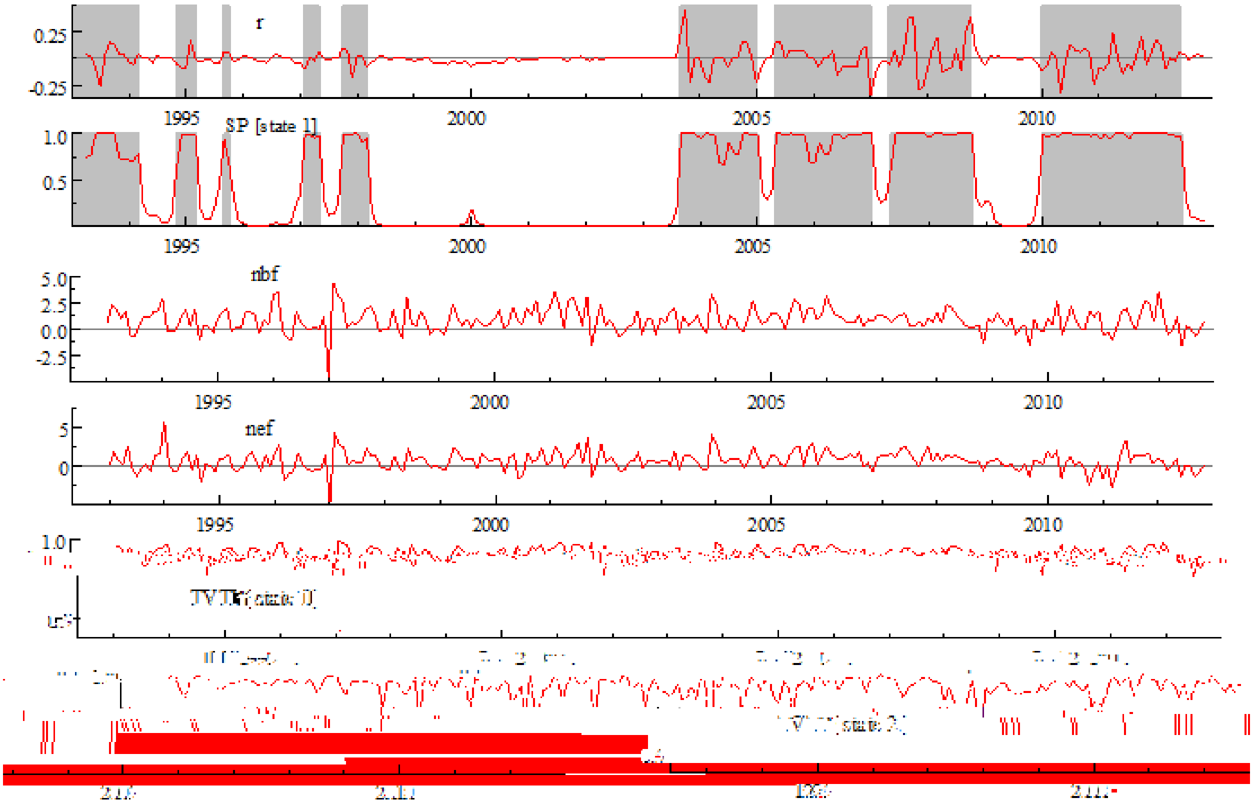

Figure 5: Exchange rate changes ($\boldsymbol{r_t}$), smoothed probabilities (SP), net bond ‡ows ($\boldsymbol{nbf_t}$), net equity ‡ows ($\boldsymbol{nef_t}$), and time-varying transition probabilities (TVTP) for Hong Kong.

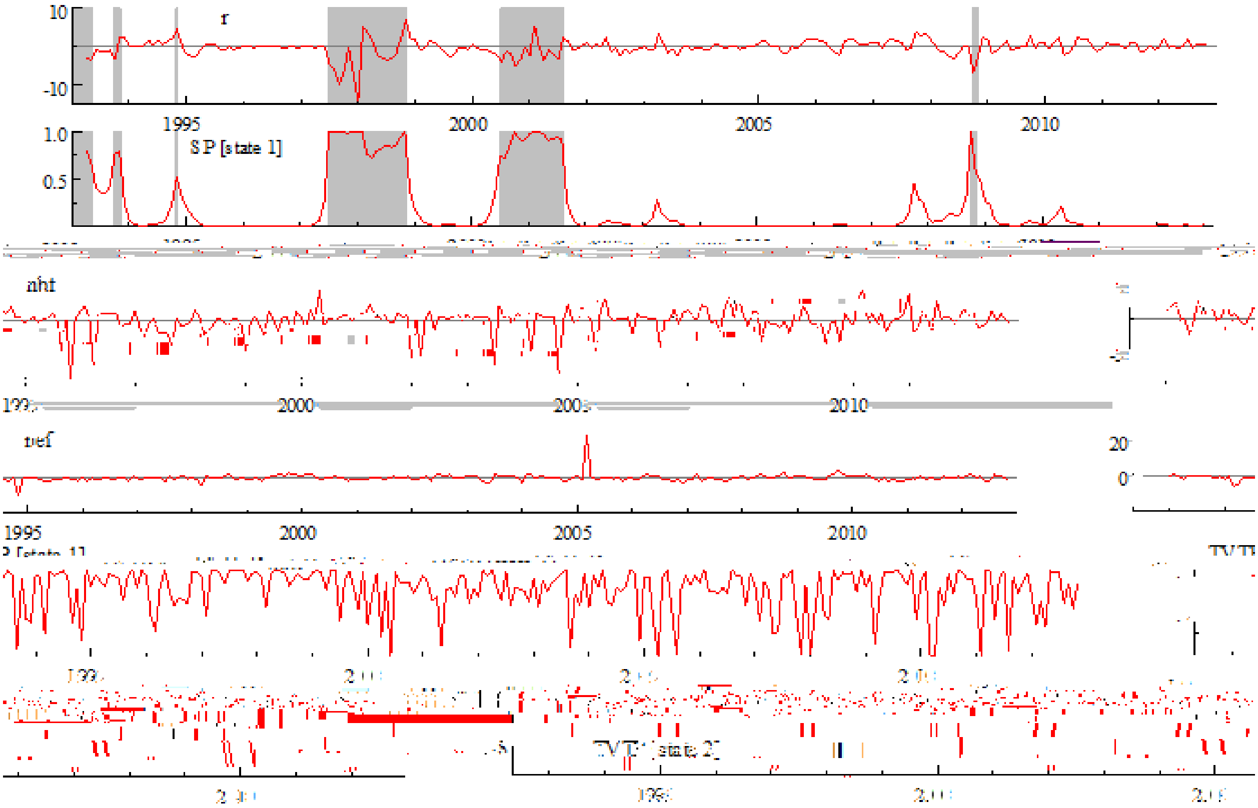

Figure 6: Exchange rate changes (r_t), smoothed probabilities (SP), net bond flows (nbf_t), net equity flows (nef_t), and time-varying transition probabilities (TVTP) for the Philippines.

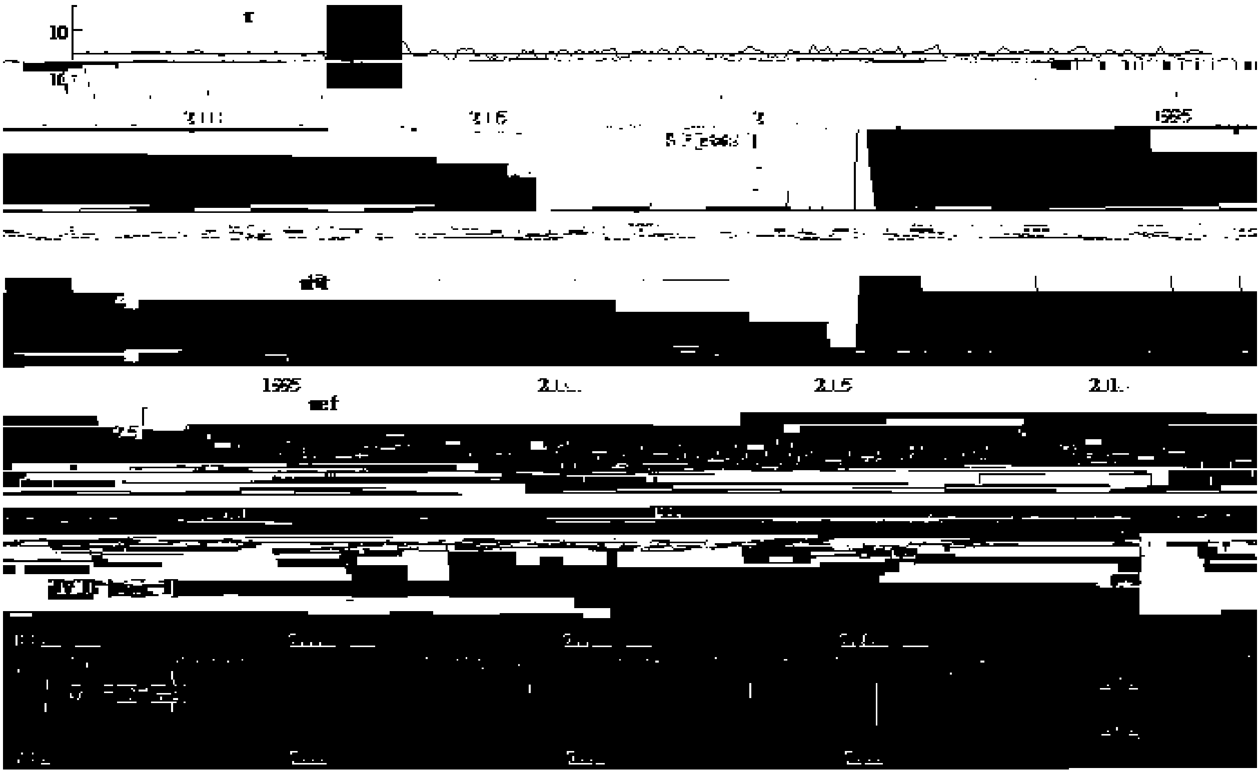

Figure 7: Exchange rate changes (r_t), smoothed probabilities (SP), net bond ‡ows ($\boldsymbol{nbf_t}$), net equity ‡ows ($\boldsymbol{nef_t}$), and time-varying transition probabilities (TVTP) for Thailand.

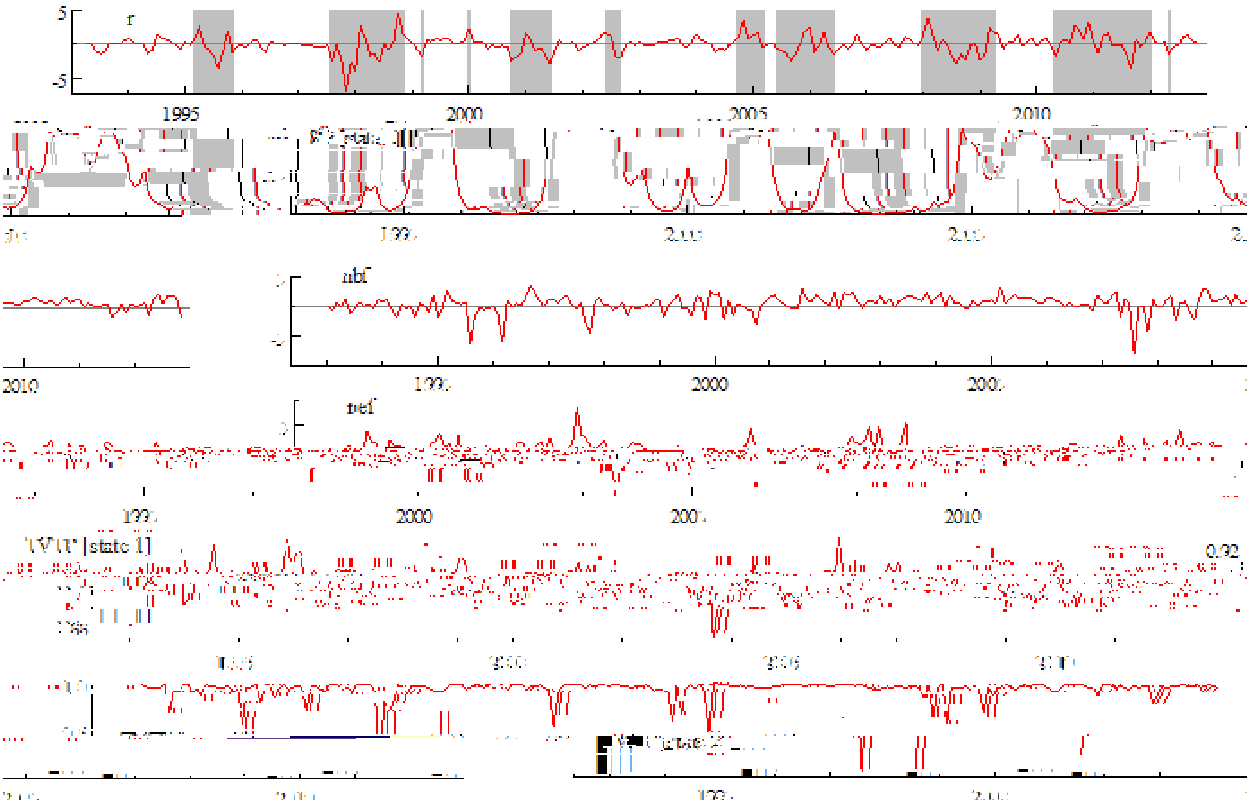

Figure 8: Exchange rate changes (r_t), smoothed probabilities (SP), net bond ‡ows (nbf_t), net equity ‡ows (nef_t), and time-varying transition probabilities (TVTP) for Taiwan.