

Financial Integration in Emerging Market Economies

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- Modified market efficiency conditions

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- How far does CIP hold?
 - Self-Exciting Threshold Autoregressive Model (SETAR)
 - Ordinal Index of de-facto Integration

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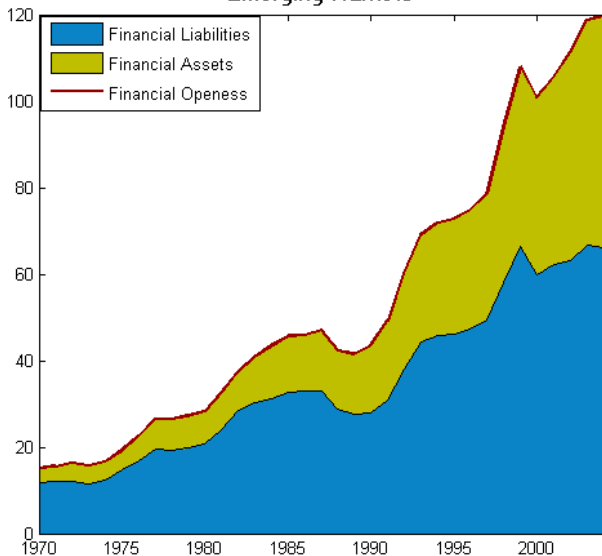
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 - Financial integration has implications for efficacy of domestic fiscal, monetary and exchange rate policies
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- Inform debate over regulation and control. Eg: India
 - Concerns over fluidity of capital
 - Financial integration has implications for efficacy of domestic fiscal, monetary and exchange rate policies
- CIP and UIP cornerstones of exchange rate models.
- Bulk of research in this area on Industrialized countries (Obstfeld and Taylor (2004), Peel and Taylor(2002), Viera(2003), Balke and Wohar (1998)).

Foreign Assets and Liabilities as % of GDP Emerging Markets



- New markets for forward transactions and financial instruments in EMEs \Rightarrow New data.
- Chinn (2006) survey, Branson and Taylor (2004) Russia.

- Estimated Thresholds non-trivial, asymmetric.
- Thresholds conform to expectations:
 - Larger negative thresholds for known outflow restrictors (eg. Malaysia).
 - Narrower and enclose more observations for developed markets.
 - Wider during crisis periods.

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- Correlation of Integration Index with de-jure index of Chinn-Ito (2006) is high, with Lane-Milesi-Ferretti(2006) is low.
- Rankings robust to alternative model specifications, estimation methodologies.

In a model world, market efficiency means:

$$\delta_t = P\left(\frac{F_{t+k} - S_t}{S_t}\right) - (i_{t+k} - i_{t+k}^*) = 0 \quad (1)$$

With transaction costs, bid and ask rates differ. CIP requires:

$$\delta_p = \frac{F_b - S_a}{S_a} - (i - i^*) \leq 0 \quad (2)$$

$$\delta_n = \frac{F_a - S_b}{S_b} - (i - i^*) \geq 0 \quad (3)$$

Complication: Measuring average of Bid and Ask rates

$$\hat{\delta} = \frac{F - S}{S} - (i - i^*) \quad (4)$$

$$\Rightarrow \hat{\delta} = \delta_p + C_1 \quad (5)$$

$$\text{where } C_1 = \left(\frac{F_b - S_a}{S_a} \right) \frac{\zeta_S}{2S_a} + \frac{\zeta_F + \zeta_S}{2S_a - \zeta_S}.$$

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Similarly,

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CIP condition:

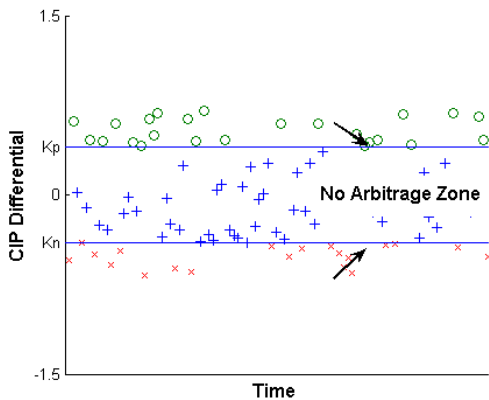
$$\delta_p \leq 0 \quad \& \quad \delta_n \geq 0$$

modifies to:

$$-C_2 \leq \hat{\delta} \leq C_1$$

\Rightarrow *Thresholds*

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- Assume a tax τ on inflows into the EME.

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Tax on outflows similarly pushes down negative threshold.

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- Suppose $u\%$ of every USD of inflows to be kept as unremunerated reserves, paid back at time $h \geq 1$.

$$\text{CIP requires: } -C_2 \leq \hat{\delta} \leq X + C_1$$

X positive and increases with h and u .

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Limited supply of capital probably reduces the reversion speed.

- Self-Exciting Threshold Autoregressive Model (SETAR)

$$\delta_t = \rho_i \delta_{t-1} + \epsilon_{it} \quad \text{for } \kappa_n < \delta_{t-1} < \kappa_p \quad (8)$$

$$\delta_t - \kappa_n = \rho_n (\delta_{t-1} - \kappa_n) + \epsilon_{nt} \quad \text{for } \delta_{t-1} \leq \kappa_n \quad (9)$$

$$\delta_t - \kappa_p = \rho_p (\delta_{t-1} - \kappa_p) + \epsilon_{pt} \quad \text{for } \delta_{t-1} \geq \kappa_p \quad (10)$$

where $\epsilon_{jt} \sim N(0, \sigma_j^2)$, $j = i, n, p$; κ_n and κ_p are the negative and positive thresholds respectively.

- Efficient arbitrage hypothesis: AR(1) process outside the bands is stationary.

Choose κ_n and κ_p that maximize the likelihood function:

$$\mathcal{L} = -\frac{1}{2} \sum_{\delta_{t-1} \in (\kappa_1, \kappa_2)} \left[\ln \sigma_i^2 + \frac{\epsilon_{it}^2}{\sigma_i^2} \right] - \frac{1}{2} \sum_{\delta_{t-1} \geq \kappa_p} \left[\ln \sigma_p^2 + \frac{\epsilon_{pt}^2}{\sigma_p^2} \right] \quad (11)$$

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- Non-Crisis periods.

- Daily frequency: Datastream, GFD, database of Federal Reserve Board.

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- Only Countries for which at least 5 years of data available.
- Stationarity tests, Tsay Tests.

Table 1: CIP Deviations: 1-Month Interbank Rates, Non-Crisis Periods

Country	Threshold Estimates		Data Range	
	Negative	Positive	Begin Date	End Date
Emerging Markets				
Hungary	-1.16	0.01	28 Oct 97	03 Oct 02
India	-1.85	0.12	02 Dec 98	29 Dec 06
Philippines	-3.56	0.21	01 Jun 97	30 Jun 98
Poland	-0.80	0.05	12 Feb 02	11 Jan 07
Malaysia	-3.42	1.65	01 Jan 97	31 Aug 99
Singapore	-0.91	0.02	01 Jun 97	30 Nov 98
South Africa	-2.40	0.20	02 Apr 97	29 Dec 06
Thailand	-6.06	0.02	01 Jan 97	31 Jul 98

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South Africa	-2.40	0.20	02 Apr 97	29 Dec 06
Thailand	-6.06	0.02	01 Jan 97	31 Jul 98
Developed Markets				
Australia	-0.37	0.73	01 Jan 95	25 Jan 07
Canada	-0.13	0.33	01 Jan 95	25 Jan 07
Denmark	-0.20	0.10	01 Jan 95	25 Jan 07
Euro Area	-0.04	0.16	05 Jan 99	25 Jan 07
Hong Kong	-0.60	0.19	01 Jan 95	11 Jan 07
Japan	-0.78	0.29	01 Jan 95	25 Jan 07
Norway	-0.38	0.39	01 Jun 97	30 Jun 98
Sweden	-0.15	0.35	01 Jan 95	25 Jan 07
Switzerland	-0.007	0.49	01 Jan 95	25 Jan 07
United Kingdom	-0.11	0.22	01 Jan 95	25 Jan 07

Note. — USA is assumed to be home country. Deviations expressed as per cent per annum. Crisis periods are 6 month windows around crisis months.

Table 2: CIP Deviations: 3-Month Interbank Rates, Non-Crisis Periods

Country	Threshold Estimates		Data Range	
	Negative	Positive	Begin Date	End Date
Emerging Markets				
Hungary	-0.05	0.01	28 Oct 97	03 Oct 02
India	-0.97	1.52	02 Dec 98	29 Dec 06
Mexico	-0.12	0.003	18 Jul 01	29 Dec 06
Philippines	-1.23	0.75	03 Jan 97	30 Jun 98
Poland	-0.21	0.001	12 Feb 02	11 Jan 07
Singapore	-0.26	0.0002	01 Jun 97	30 Nov 98
South Africa	-0.41	1.72	02 Apr 97	17 Jan 07

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South Africa	-0.41	1.72	02 Apr 97	17 Jan 07
Developed Markets				
Australia	-0.09	0.26	01 Jan 95	25 Jan 07
Canada	-0.05	0.20	01 Jan 95	25 Jan 07
Denmark	-0.01	0.10	01 Jan 95	25 Jan 07
Euro Area	-0.12	0.09	05 Jan 99	25 Jan 07
Hong Kong	-0.31	0.29	01 Jan 95	11 Jan 07
Japan	-0.08	0.10	01 Jan 95	25 Jan 07
Norway	-0.10	0.35	01 Jun 97	30 Jun 98
Sweden	-0.01	0.28	01 Jan 95	25 Jan 07
Switzerland	-0.17	0.15	01 Jan 95	25 Jan 07
United Kingdom	-0.04	0.21	01 Jan 95	25 Jan 07

Table 3: Measures of Financial Openness, Non-Crisis Periods

Country	Percent Obs. in Outer Regimes	1-Month CIP				Longest Run	Median Run	3 rd Quartile
		Average Deviation Negative	Deviation Positive	Median Deviation Negative	Deviation Positive			
Emerging Markets								
Hungary	85	-2.97	2.52	-2.27	1.72	10	1	2
India	49	-1.19	1.63	-0.80	1.05	69	1	2
Malaysia	32	-0.19	0.23	-0.07	0.28	369	2	14
Philippines	21	-1.70	2.02	-0.97	0.65	16	1	1
Poland	90	-2.78	2.64	-2.25	1.77	13	1	3
Singapore	89	-1.81	1.86	-1.60	1.68	12	1	3
South Africa	71	-4.35	3.11	-3.13	1.81	17	1	2
Thailand	22	-3.40	0.87	-1.78	0.61	15	1	2

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India	49	-1.19	1.63	-0.80	1.05	69	1	2
Malaysia	32	-0.19	0.23	-0.07	0.28	369	2	14
Philippines	21	-1.70	2.02	-0.97	0.65	16	1	1
Poland	90	-2.78	2.64	-2.25	1.77	13	1	3
Singapore	89	-1.81	1.86	-1.60	1.68	12	1	3
South Africa	71	-4.35	3.11	-3.13	1.81	17	1	2
Thailand	22	-3.40	0.87	-1.78	0.61	15	1	2
Developed Markets								
Australia	12	-1.79	2.39	-0.54	0.99	5	1	1
Canada	12	-1.79	1.30	-0.98	0.54	7	1	1
Denmark	52	-3.31	0.38	-1.49	0.09	58	1	3
Euro Area	28	-0.93	1.13	-0.06	0.10	19	1	2
Hong Kong	41	-0.56	0.25	-0.15	0.19	29	1	3
Japan	38	-3.88	1.26	-2.01	0.25	25	1	2
Norway	14	-2.76	2.63	-1.40	0.34	20	1	1
Sweden	13	-2.41	1.87	-1.55	0.30	4	1	1
Switzerland	24	-0.99	1.04	-0.11	0.19	26	1	2
United Kingdom	15	-1.00	1.18	-0.16	0.11	18	1	1

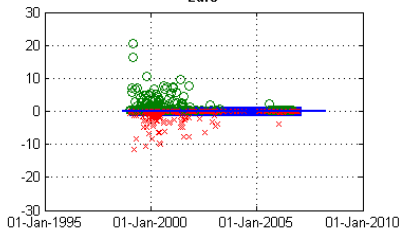
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Country	Percent Obs. in Outer Regimes	3-Month CIP				Longest Run	Median Run	3 rd Quartile
		Average Deviation Negative	Average Deviation Positive	Median Deviation Negative	Median Deviation Positive			
Emerging Markets								
Hungary	98	-1.07	0.96	-0.83	0.74	24	1	2
India	21	-0.50	1.45	-0.33	1.35	170	1	2
Mexico	96	-1.05	1.13	-0.84	0.79	12	1	2
Philippines	10	-0.93	1.30	-0.46	0.47	17	1	1
Poland	93	-0.94	0.87	-0.77	0.61	13	1	3
Singapore	90	-0.68	0.62	-0.61	0.56	16	1	3
South Africa	55	-1.55	1.42	-1.21	0.83	35	1	3

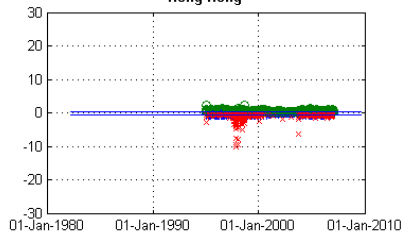
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India	21	-0.50	1.45	-0.33	1.35	170	1	2
Mexico	96	-1.05	1.13	-0.84	0.79	12	1	2
Philippines	10	-0.93	1.30	-0.46	0.47	17	1	1
Poland	93	-0.94	0.87	-0.77	0.61	13	1	3
Singapore	90	-0.68	0.62	-0.61	0.56	16	1	3
South Africa	55	-1.55	1.42	-1.21	0.83	35	1	3
Developed Markets								
Australia	22	-1.10	0.29	-0.49	0.05	46	1	2
Canada	11	-0.56	0.50	-0.26	0.19	4	1	1
Denmark	51	-0.92	0.17	-0.40	0.05	76	1	3
Euro Area	24	-0.98	0.32	-0.61	0.04	19	1	2
Hong Kong	10	-0.48	0.39	-0.17	0.06	17	1	2
Japan	83	-0.88	0.18	-0.48	0.10	214	2	5
Norway	10	-1.12	1.62	-0.65	0.77	6	1	1
Sweden	10	-0.95	1.13	-0.58	0.68	4	1	1
Switzerland	22	-0.36	0.62	-0.07	0.16	32	1	2
United Kingdom	10	-0.51	0.52	-0.24	0.15	5	1	1

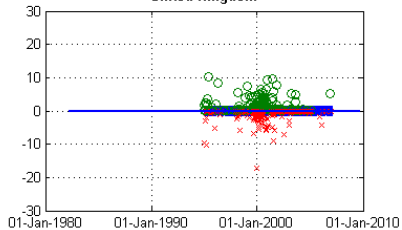
Euro



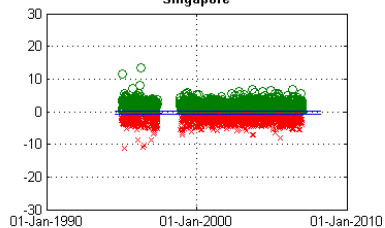
Hong Kong



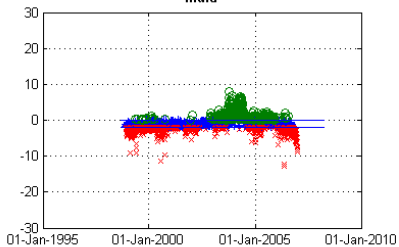
United Kingdom



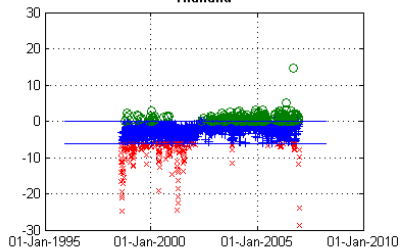
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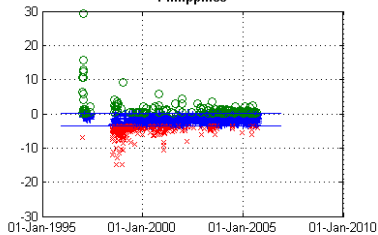
India



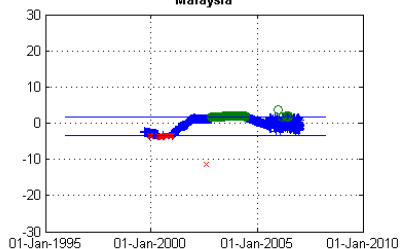
Thailand



Philippines



Malaysia



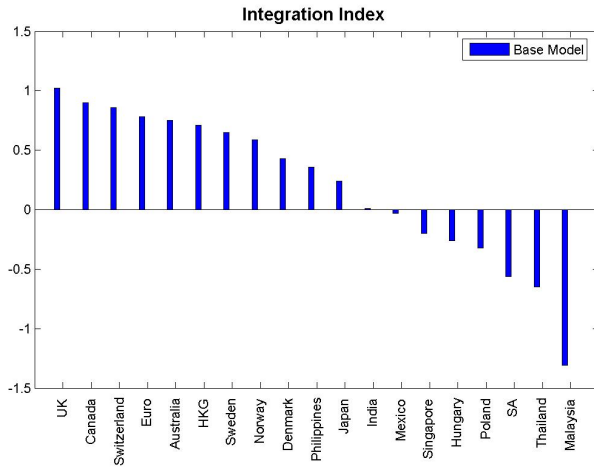
- Normalize, following variables using inter-country mean and standard deviations:
 - Bandwidth
 - Percent Observations in Outer Regimes
 - Median deviations (+ and -) outside thresholds
 - Third Quartile of continuous runs outside thresholds

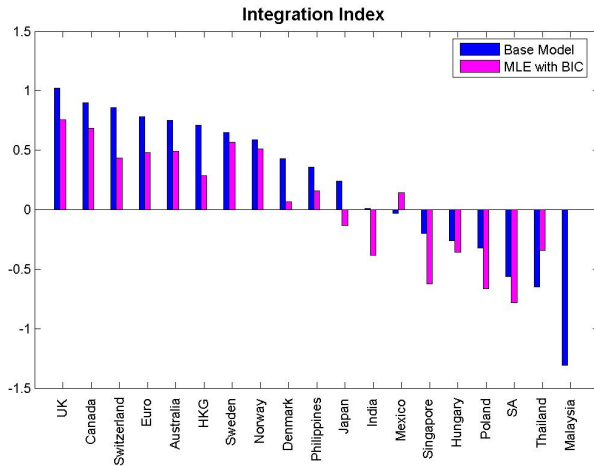
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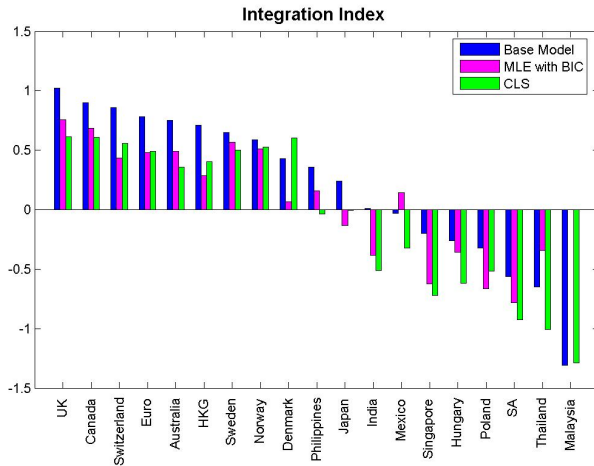
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- Malaysia, Mexico, Thailand.







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- Further work:
 - Theoretical implications of limited supply of capital
 - Non-neutrality towards risk
 - Does a modified UIP hold?
 - Volatility and flight to quality

Table 5: Integration Index

Country	Integration Index	Ranking	Chinn-Ito Measure	LMF Measure
United Kingdom	1.02	1	2.62	5.96
Canada	0.90	2	2.62	2.07
Switzerland	0.86	3	2.62	8.55
Euro	0.78	4
Australia	0.75	5	1.66	1.79
Hong Kong	0.71	6	2.62	11.93
Sweden	0.65	7	2.54	3.79
Norway	0.59	8	2.35	2.29
Denmark	0.43	9	2.62	3.04
Philippines	0.36	10	0.20	1.43
Japan	0.24	11	2.49	1.14
India	0.01	12	-0.95	0.47
Mexico	-0.03	13	0.72	0.79
Singapore	-0.20	14	2.42	8.04
Hungary	-0.26	15	1.08	1.50
Poland	-0.32	16	0.20	1.03
South Africa	-0.56	17	-1.09	1.25
Thailand	-0.65	18	-0.05	1.43
Malaysia	-1.31	19	-0.01	2.05
Correlation	0.73	0.40

- Correlation between Base Estimates and MLE with BIC Selection: 0.95
- Correlation between Base Estimates and VCLS with BIC selection: 0.96
- Correlation between MLE and VCLS (both with BIC selection): 0.90