International Financial Integration
The Effects of Liquidity and Capital Controls

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Outline

1. What we do in the paper
2. Cross-market premium
3. Liquidity
4. Capital controls
5. Conclusion

Outline

- What we do in the paper
- Cross-market premium
- Liquidity
- Capital controls
- Conclusion

1. What we do

- Take advantage of migration of stocks abroad
  - Two identical assets with many advantages
- Price divergence from LOOP as new measure of IFI
- Under full integration, LOOP should hold

- Extent of integration
- Effects of liquidity
  - Trading frequency and trading activity
- Effects of capital controls
  - Controls on outflows
  - Controls on inflows

1. What we do

- Structure of the paper

1. Introduction
2. Data
3. Methodology
4. The Cross-Market Premium and Financial Integration
   - AR and TAR Estimates
   - Integration and Liquidity
5. Time-Varying Financial Integration: Capital Controls
   - Capital Controls and the Cross-Market Premium
   - Capital Controls: What and When?
   - Summary Statistics
   - Case Study: Argentina 2000-2007
6. Conclusions

Outline

- What we do in the paper
- Cross-market premium
- Liquidity
- Capital controls
- Conclusion

2. Cross-market premium: Definition

- *Cross-market premium*
  - Measure of international financial integration
  - Law of One Price needs to hold when markets are integrated
  - % price difference between their (underlying) shares at home and DRs in NY
  - Underlying stock can be transformed into DR and vice versa, so arbitrage pressure when prices diverge

2. Cross-market premium: Definition

- *Cross-market premium*: Difference between the home market price of the stock and its NY price:

$$\pi_t = \frac{S_t r P_t^{und} - P_t^{dr}}{P_t^{dr}}$$

π_t = premium at time t

S_t = spot exchange rate

r = number of underlying stocks per DR

P_t^{und} = price of underlying stock in local currency

P_t^{dr} = price of the DR in NY in U.S. dollars

2. Cross-market premium: Some advantages

- Two truly identical assets, avoiding index composition
- Free from the idiosyncratic risk related to default risk
  - Same issuer, same legal rights
- Market-based measure, no empirical model imposed
- Continuous measure, between complete segmentation and complete integration
- Amenable to the use of TAR models; linear models understate convergence speed
- Avoids potential aggregation bias

2. Cross-market premium: Data

- Analysis
  - 98 stocks
  2. Argentina
  3. Brazil
  4. Chile
  5. Indonesia
  6. Mexico
  7. Russia
  8. South Africa
  9. South Korea
  10. Venezuela

2. Cross-market premium: Methodology

1. Summary statistics
   - Mean
   - Median
   - Standard deviation

2. AR estimates
   - Convergence speed

3. TAR estimates
   - No-arbitrage bands
   - Convergence speed

2. Cross-market premium: Methodology

- TAR estimates

$$\Delta x_t = I_{in}\,\beta_{in} x_{t-1} + I_{out}\,\beta_{out}\Phi\left(x_{t-1}, c\right) + \sum_{j=1}^{k}\varphi_j \Delta x_{t-j} + \varepsilon_t,$$

$$\sigma_t^2 = \alpha_0 + \sum_{j=1}^{p}\alpha_j \varepsilon_{t-j}^2 + \sum_{j=1}^{q}\lambda_j \sigma_{t-j}^2,$$

$$\Phi\left(x_{t-1}, c^{up}\right) = x_{t-1} - c^{up} \text{ if } x_{t-1} > c^{up},$$

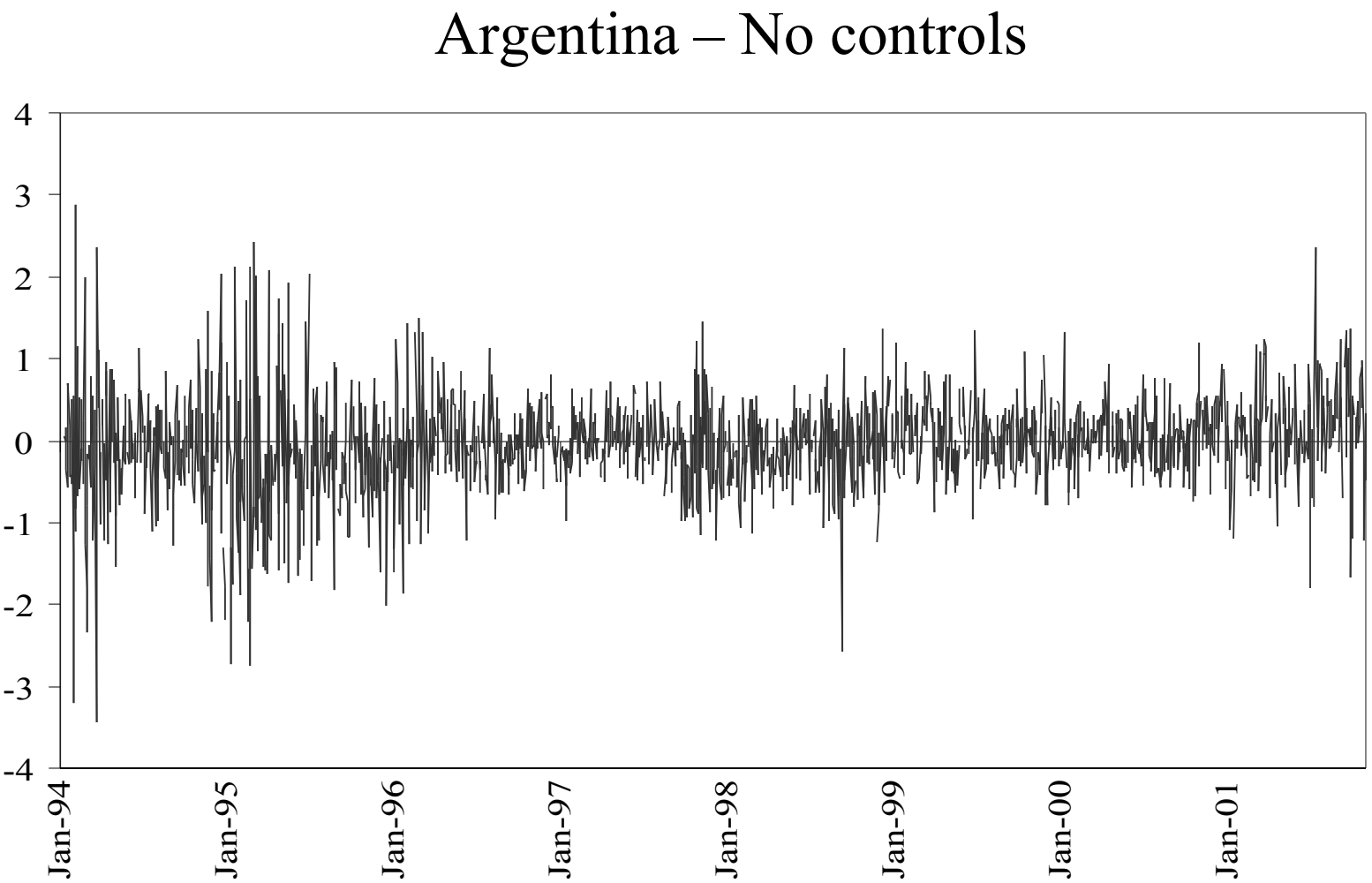
$$\Phi\left(x_{t-1}, c^{low}\right) = x_{t-1} - c^{low} \text{ if } x_{t-1} < c^{low},$$

$$c^{up} > 0 \text{ and } c^{low} < 0,$$

$$I_{out} = 1 \text{ if } x_{t-1} > c^{up} \text{ or } x_{t-1} < c^{low}; \text{ zero otherwise,}$$

$$I_{in} = 1 \text{ if } c^{low} \le x_{t-1} \le c^{up}; \text{ zero otherwise.}$$

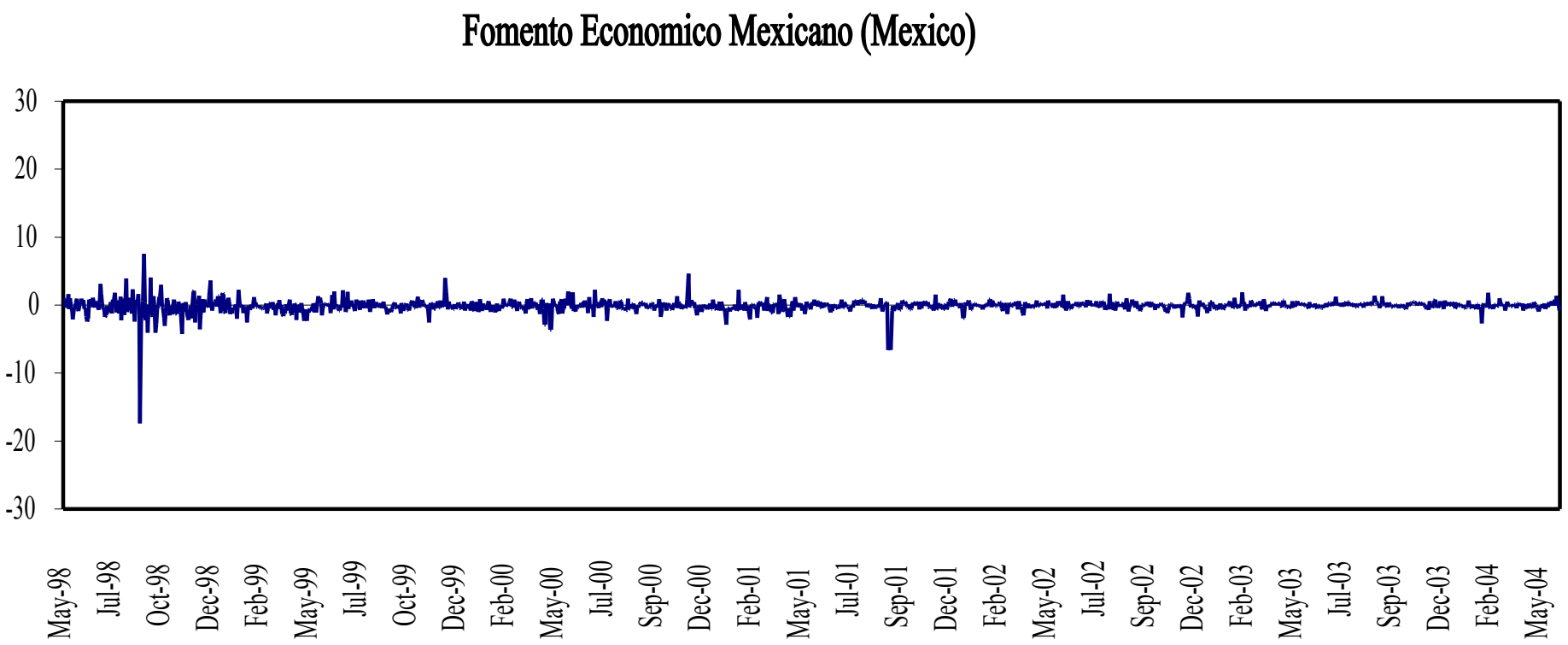
2. Cross-market premium



Outline

- What we do in the paper
- Cross-market premium
- Liquidity
- Capital controls
- Conclusion

3. Liquidity


Fomento Economico Mexicano (Mexico)
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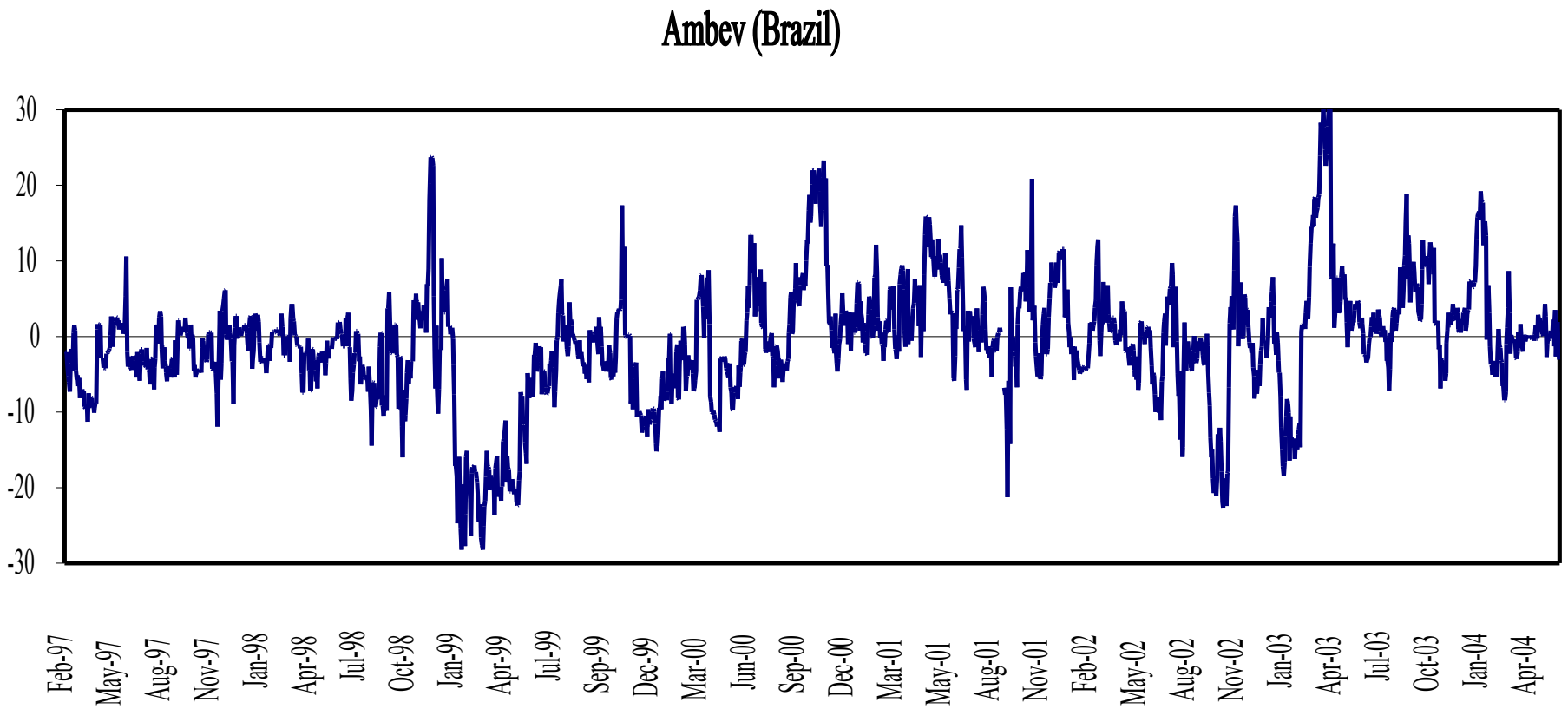
3. Liquidity


Ambev (Brazil)
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Jun-00
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Dec-00
Mar-01
May-01
Aug-01
Nov-01
Feb-02
May-02
Aug-02
Nov-02
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04

3. Liquidity

Summary statistics

All Days

Country	Mean	Median	Std. Dev.	5th Pctile	95th Pctile	Obs.
Argentina	0.07	0.01	0.81	-1.05	1.43	2,296
Brazil	0.45	0.18	1.85	-1.84	3.62	2,503
Chile	0.41	0.36	0.90	-0.84	1.86	1,705
Indonesia	0.63	0.56	1.93	-2.35	3.98	1,447
Korea	1.69	1.40	3.92	-3.93	8.19	1,082
Mexico	1.23	1.20	1.65	-1.34	3.97	2,540
Russia	0.05	0.14	1.92	-3.27	3.04	1,504
South Africa	-0.24	-0.17	1.28	-2.40	1.66	2,187
Venezuela	-0.09	-0.15	3.23	-5.14	5.76	1,630
All Stocks	0.53	0.46	0.74	-0.52	1.82	2,716

3. Liquidity

Summary statistics

Contemporaneous Tradi ng Days

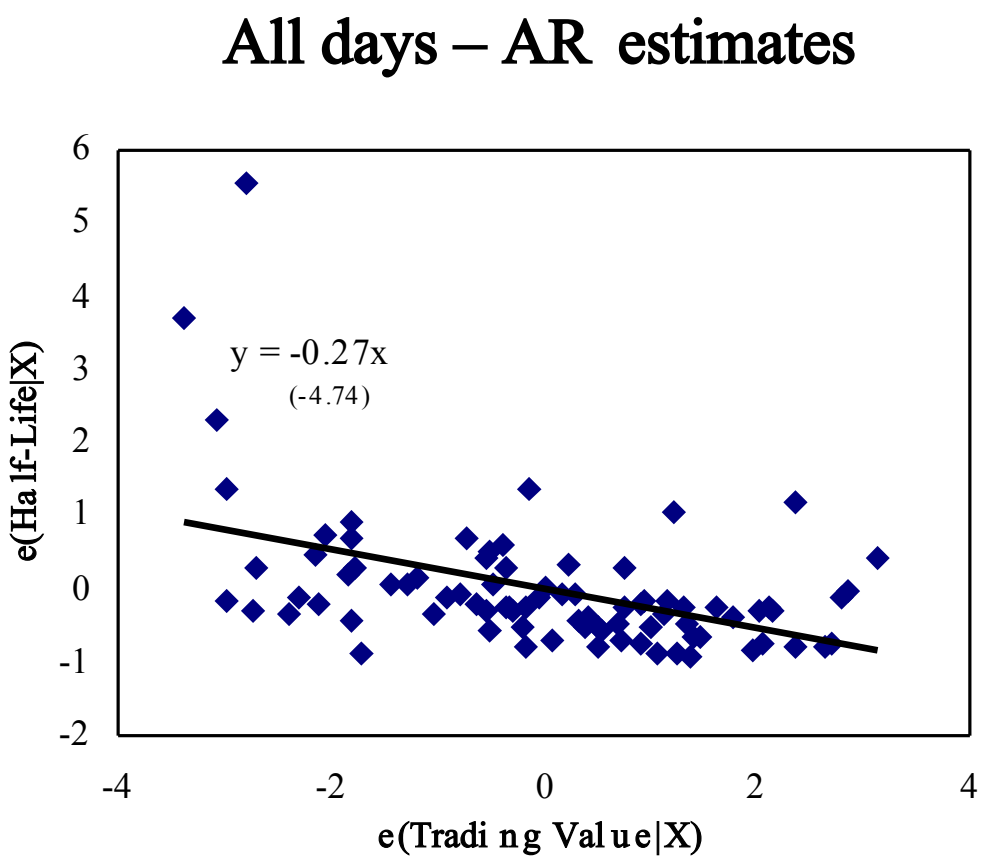
Country	Mean	Median	Std. Dev.	5th Pctile	95th Pctile	Obs.
Argentina	0.06	0.00	0.72	-0.97	1.35	2,138
Brazil	0.11	0.03	1.27	-1.76	2.15	2,301
Chile	0.29	0.25	0.73	-0.82	1.54	1,617
Indonesia	0.58	0.53	1.89	-2.32	3.88	1,315
Korea	1.59	1.17	3.80	-3.76	7.87	972
Mexico	0.19	0.16	0.81	-1.05	1.55	2,379
Russia	0.11	0.23	1.52	-2.50	2.30	1,371
South Africa	-0.09	-0.13	1.45	-2.33	2.45	2,032
Venezuela	0.00	-0.06	2.84	-4.43	4.95	1,440
All Stocks	0.12	0.12	0.73	-0.74	0.96	2,618

3. Liquidity

AR estimates

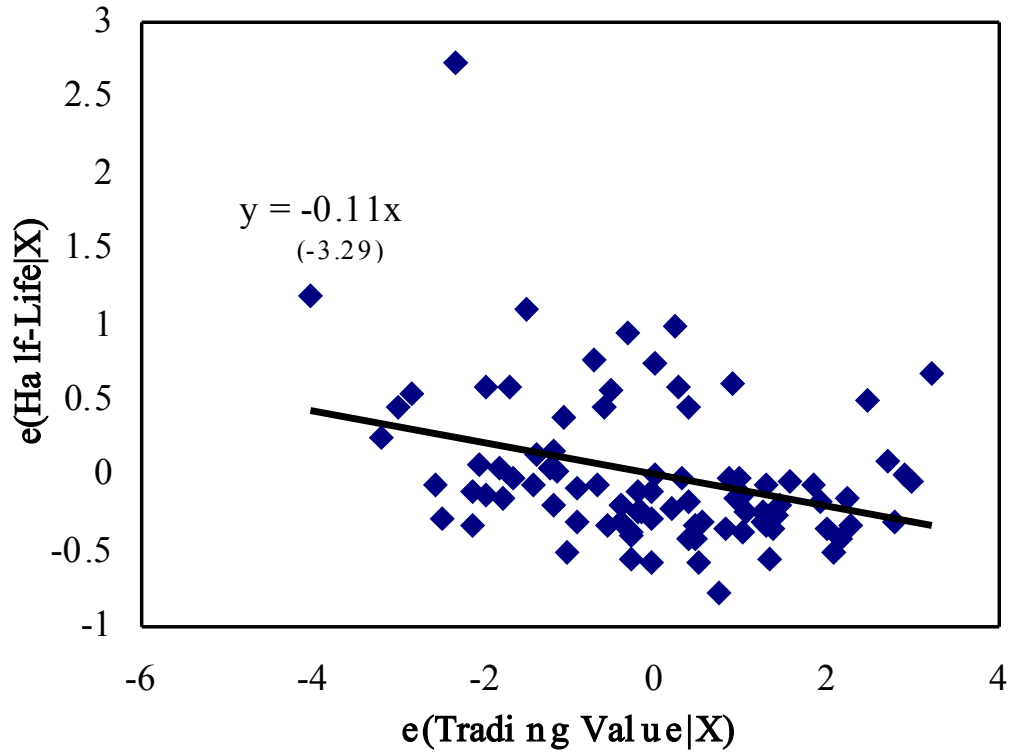
Country	AR Half-Life	
	All Days	Contemporaneous Trading Days
Argentina	0.73	0.73
Brazil	0.92	0.77
Chile	1.55	1.07
Indonesia	1.64	1.64
Korea	1.34	1.22
Mexico	2.70	1.43
Russia	0.80	0.89
South Africa	1.67	1.06
Venezuela	2.13	1.05
All Stocks	1.54	1.05

3. Liquidity: Liquidity proxies



3. Liquidity: Liquidity proxies

Contemporaneous trading days – AR estimates



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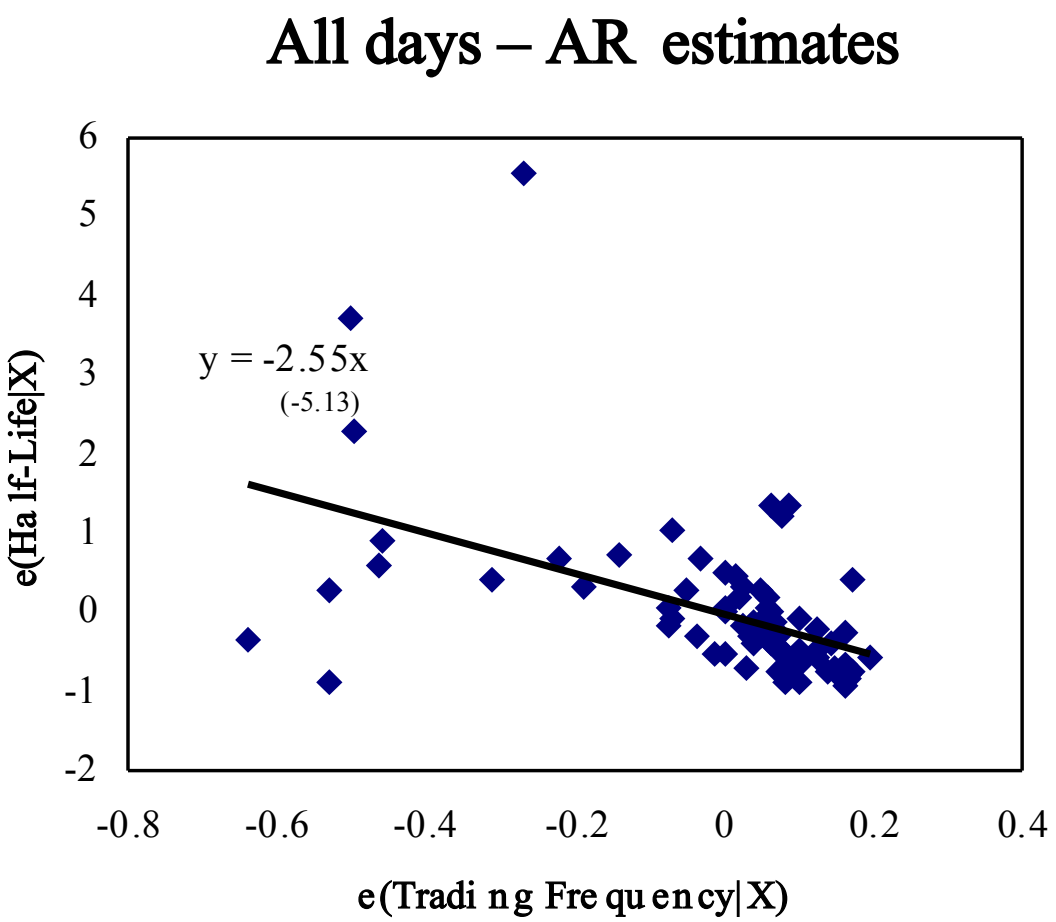
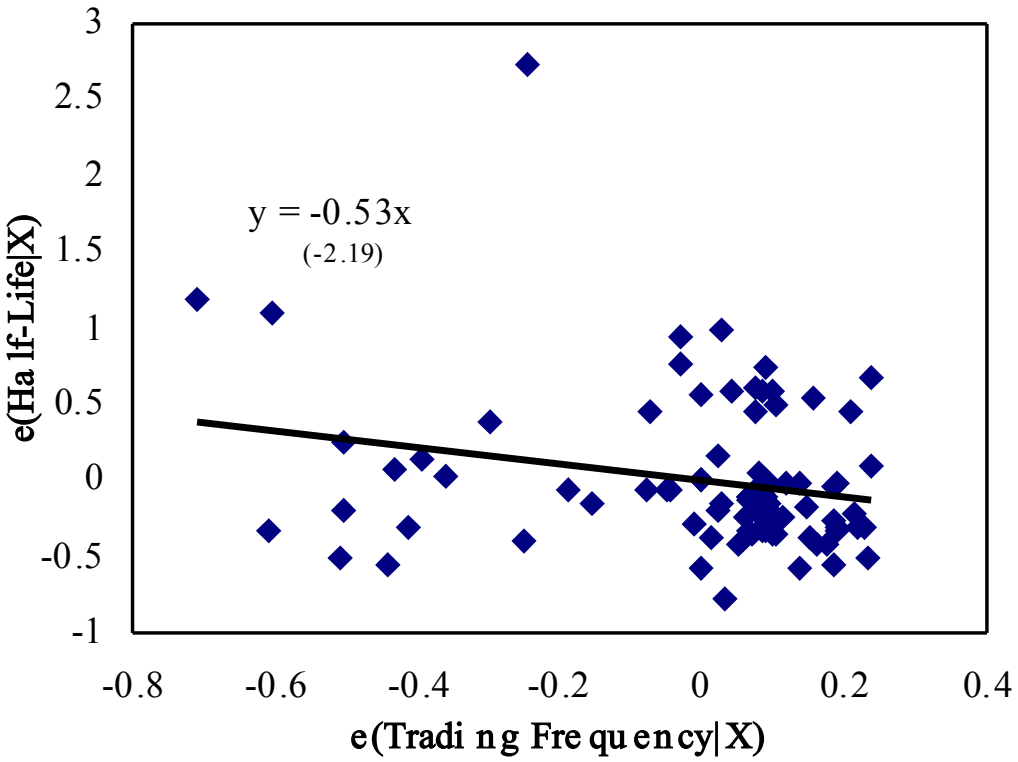


3. Liquidity: Liquidity proxies

Contemporaneous trading days – AR estimates

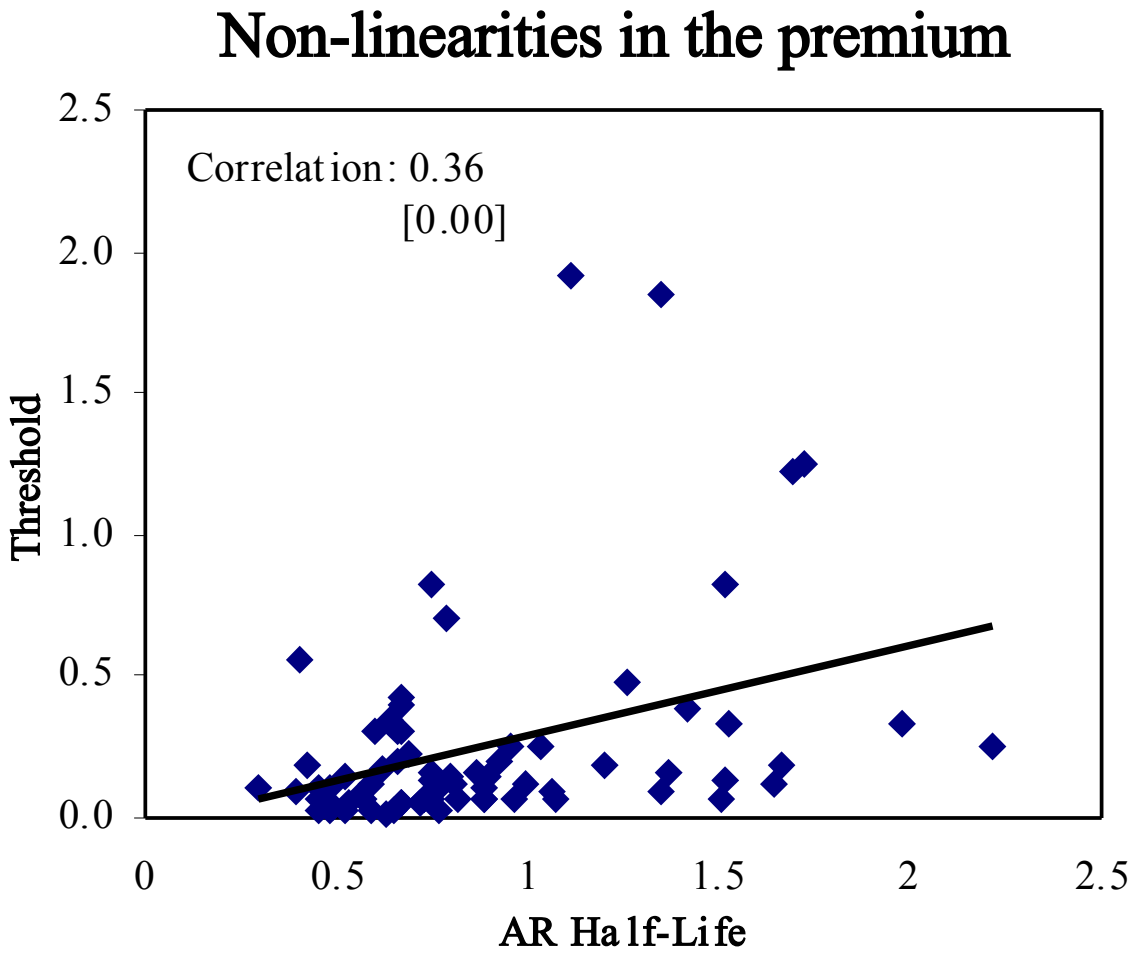


3. Liquidity: AR vs. TAR

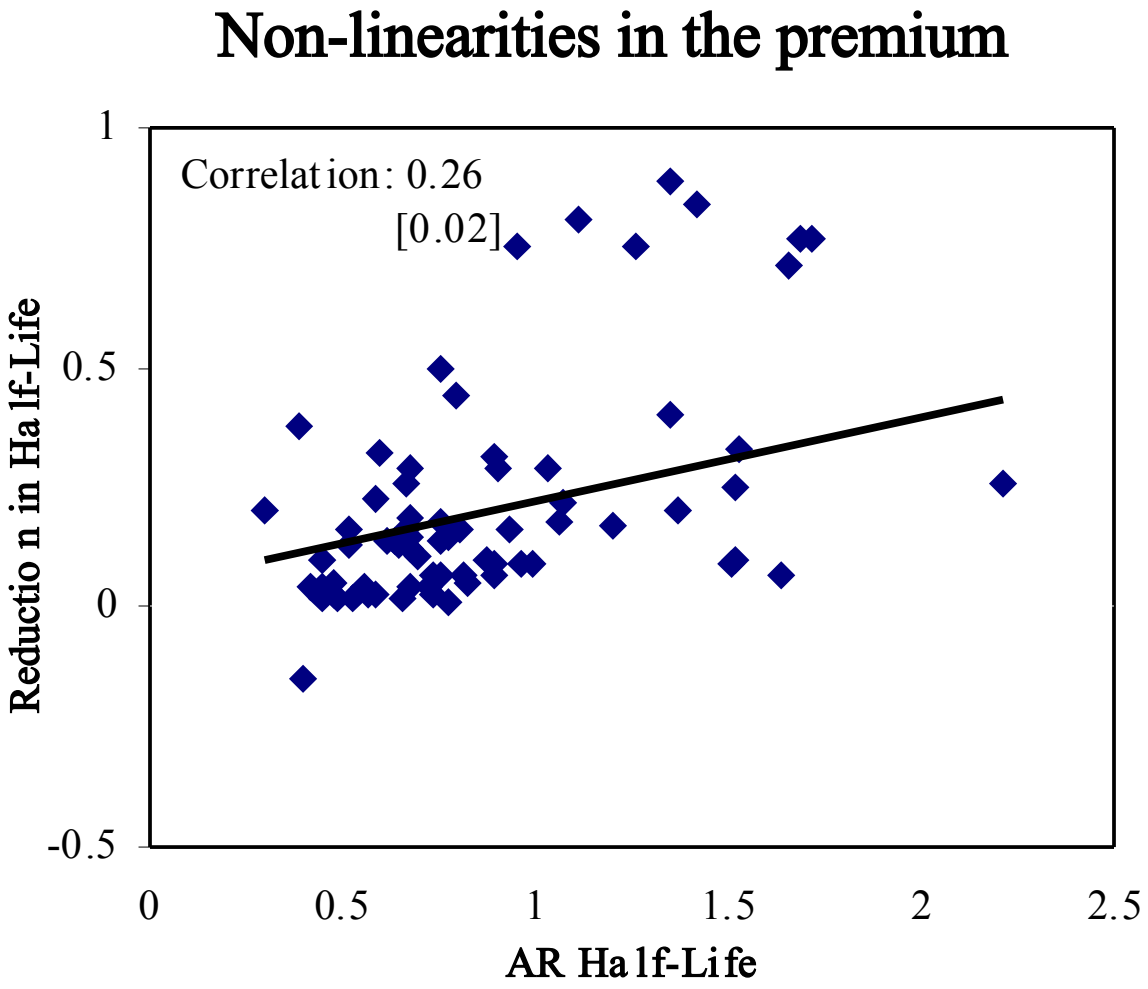
AR and TAR – Contemporaneous trading

Country	AR Half-Life	TAR Thres	TAR Half-Life
Argentina	0.73	0.25	0.50
Brazil	0.77	0.24	0.59
Chile	1.07	0.35	0.64
Indonesia	1.64	0.17	1.42
Korea	1.22	0.22	1.65
Mexico	1.43	0.20	0.63
Russia	0.89	0.11	0.60
South Africa	1.06	0.22	0.93
Venezuela	1.05	0.68	0.91
All Stocks	1.05	0.26	0.69

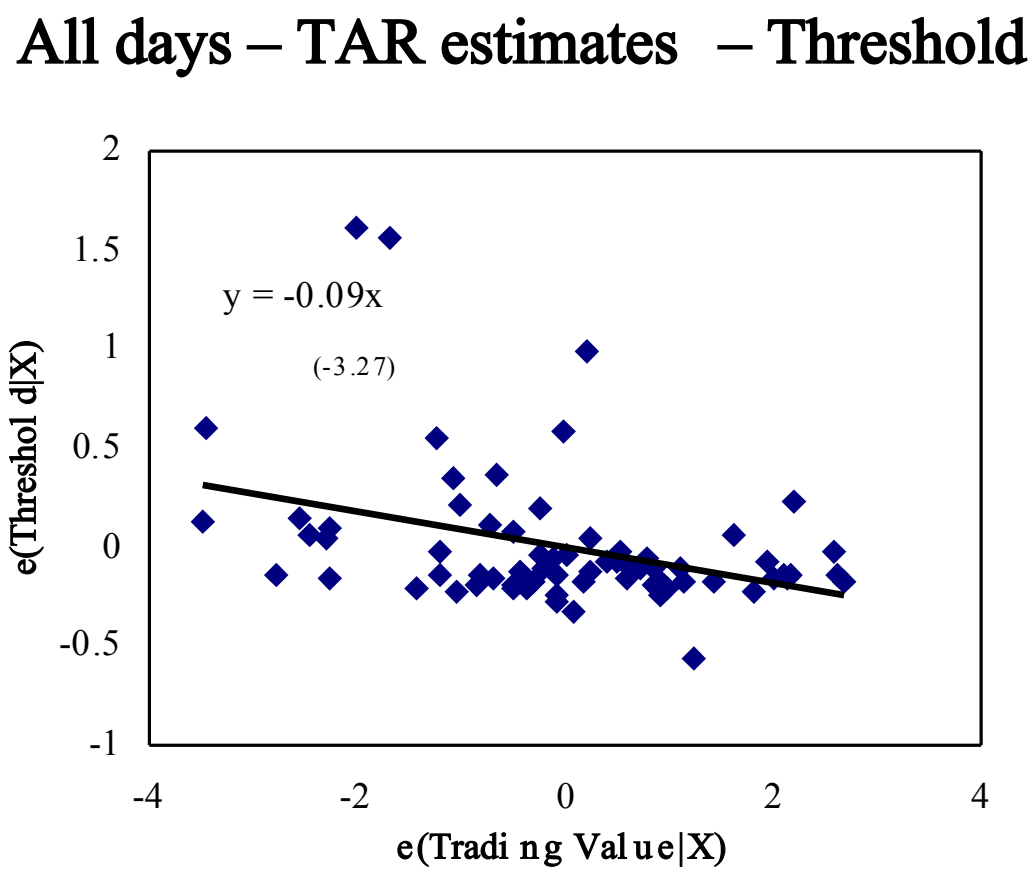
3. Liquidity: AR vs. TAR



2. Liquidity: AR vs. TAR

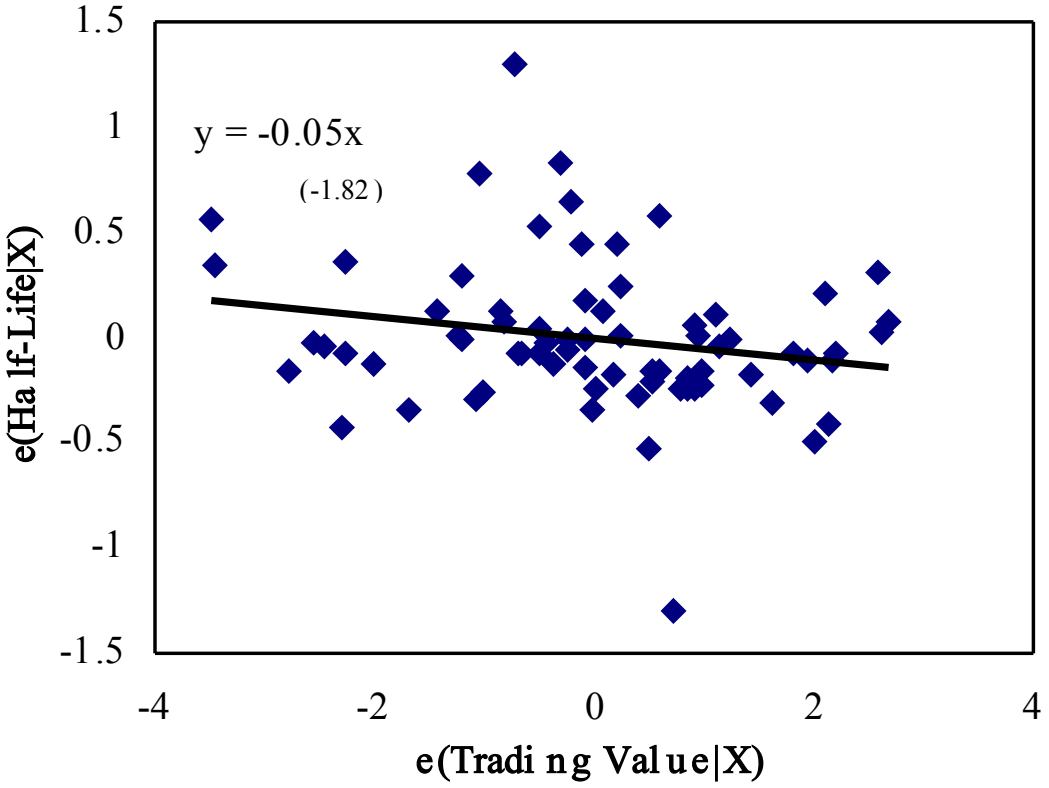


3. Liquidity: Liquidity proxies



3. Liquidity: Liquidity proxies

Contemporaneous trading days – TAR estimates – Half-life



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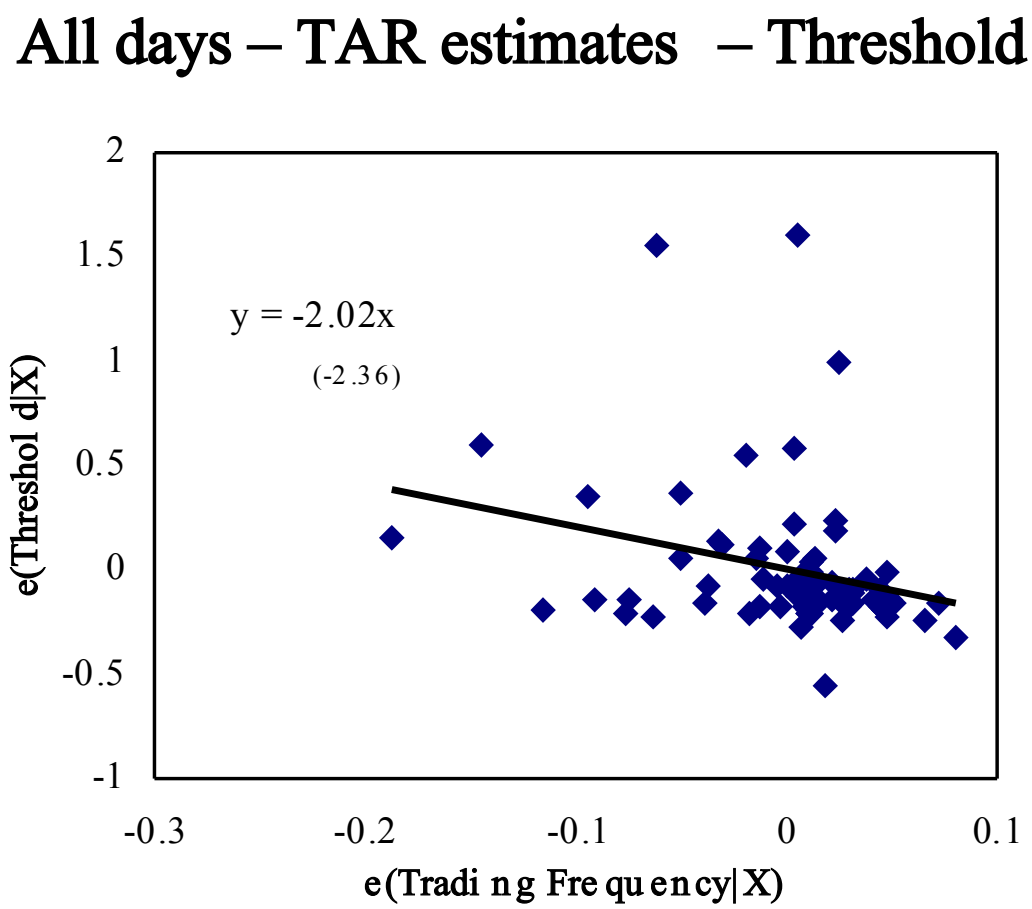

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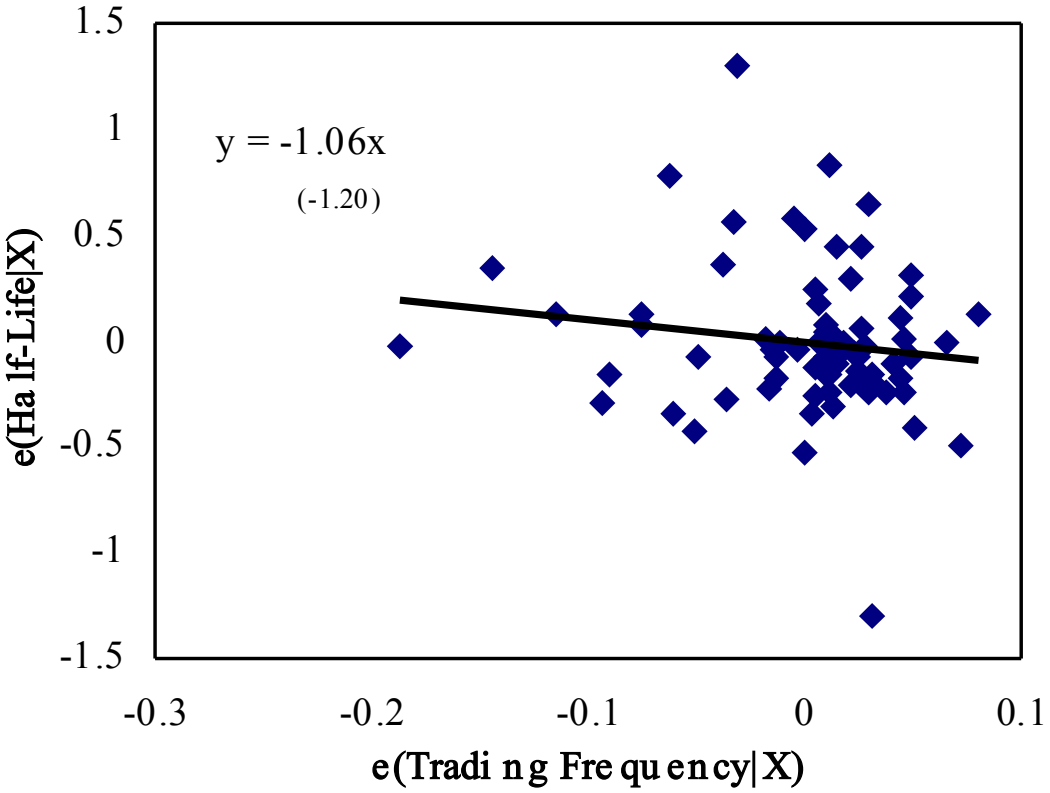

Outline

- What we do in the paper
- Cross-market premium
- Liquidity
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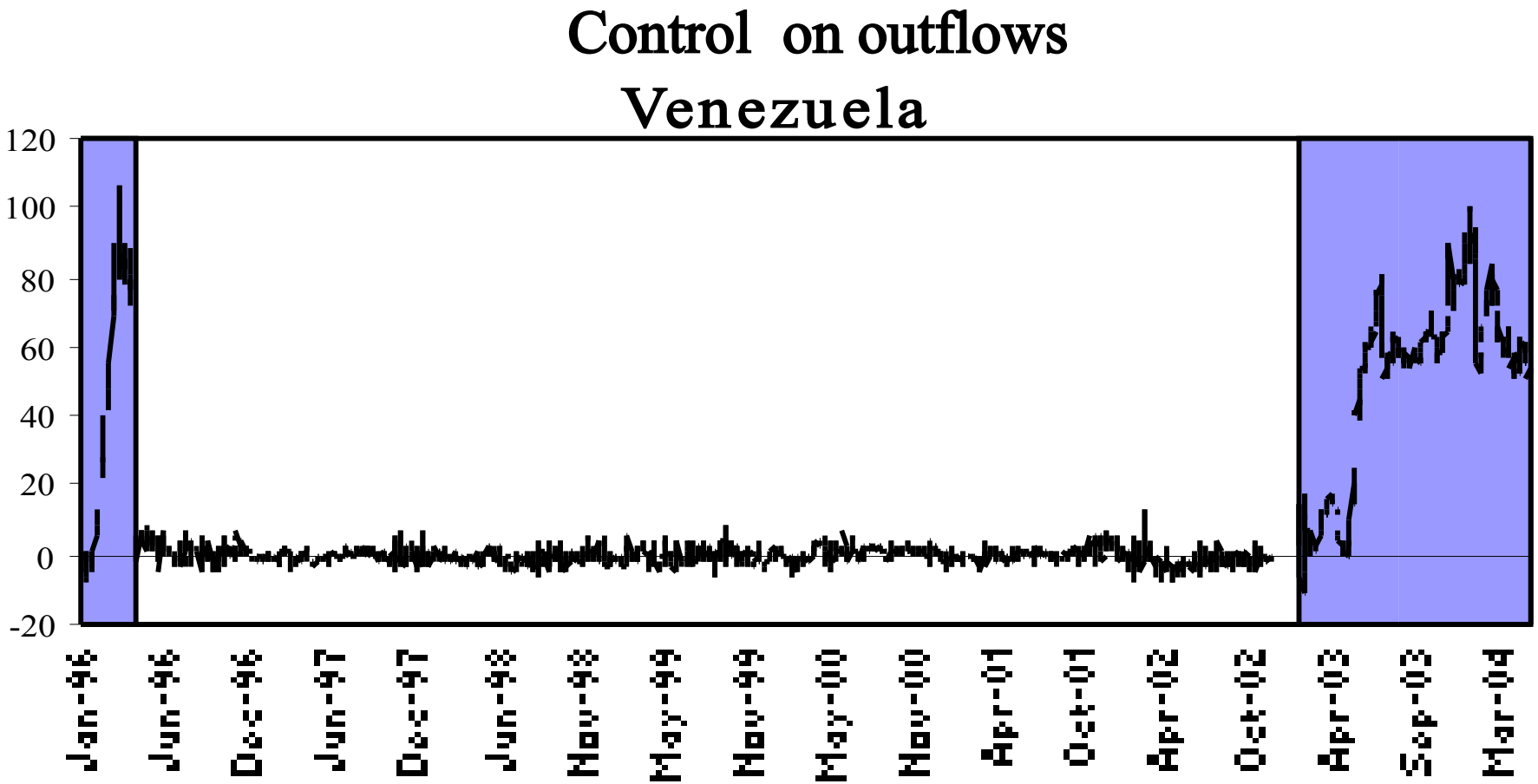
4. Capital controls

- Capital controls increase transaction costs
- Controls on outflows: positive premium
  - Arbitrage not possible when local price > NY price
  - Arbitrage possible when NY price > local price
- Controls on inflows: negative premium
  - Arbitrage not possible when NY price > local price
  - Arbitrage possible when local price > NY price
- Cross-market premium measures effective intensity of controls
  - More capital flows, larger premium

4. Capital controls



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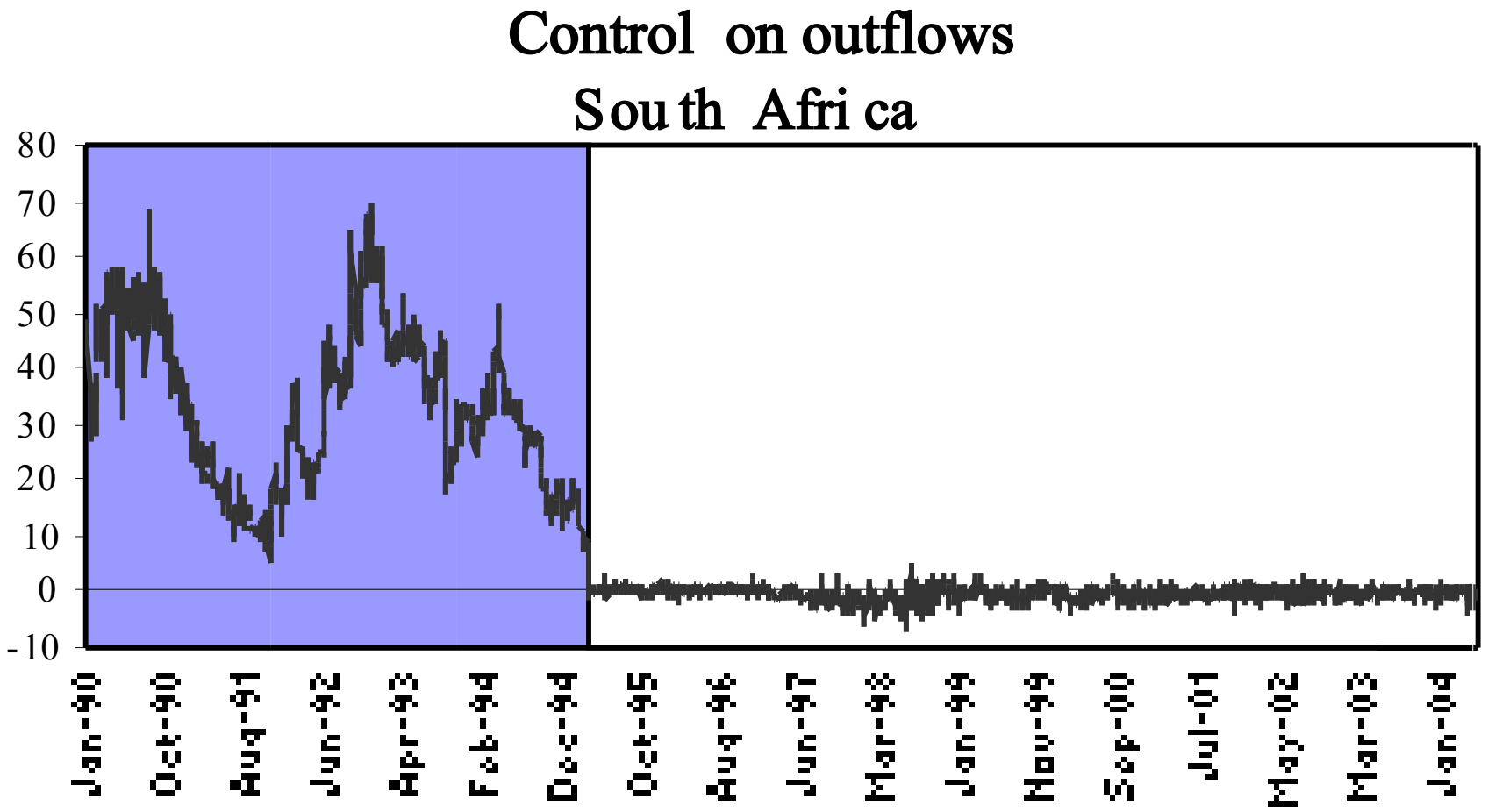
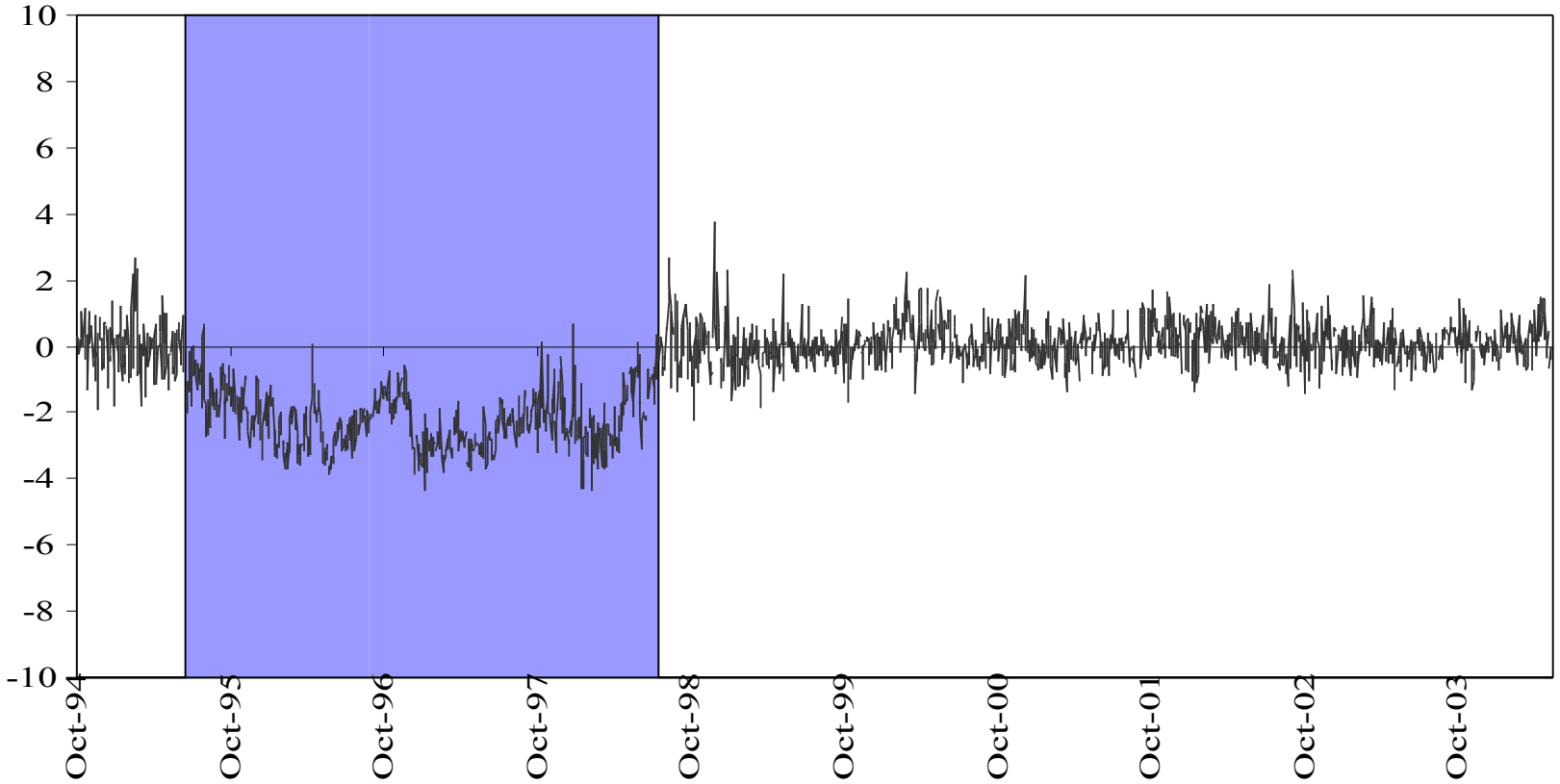
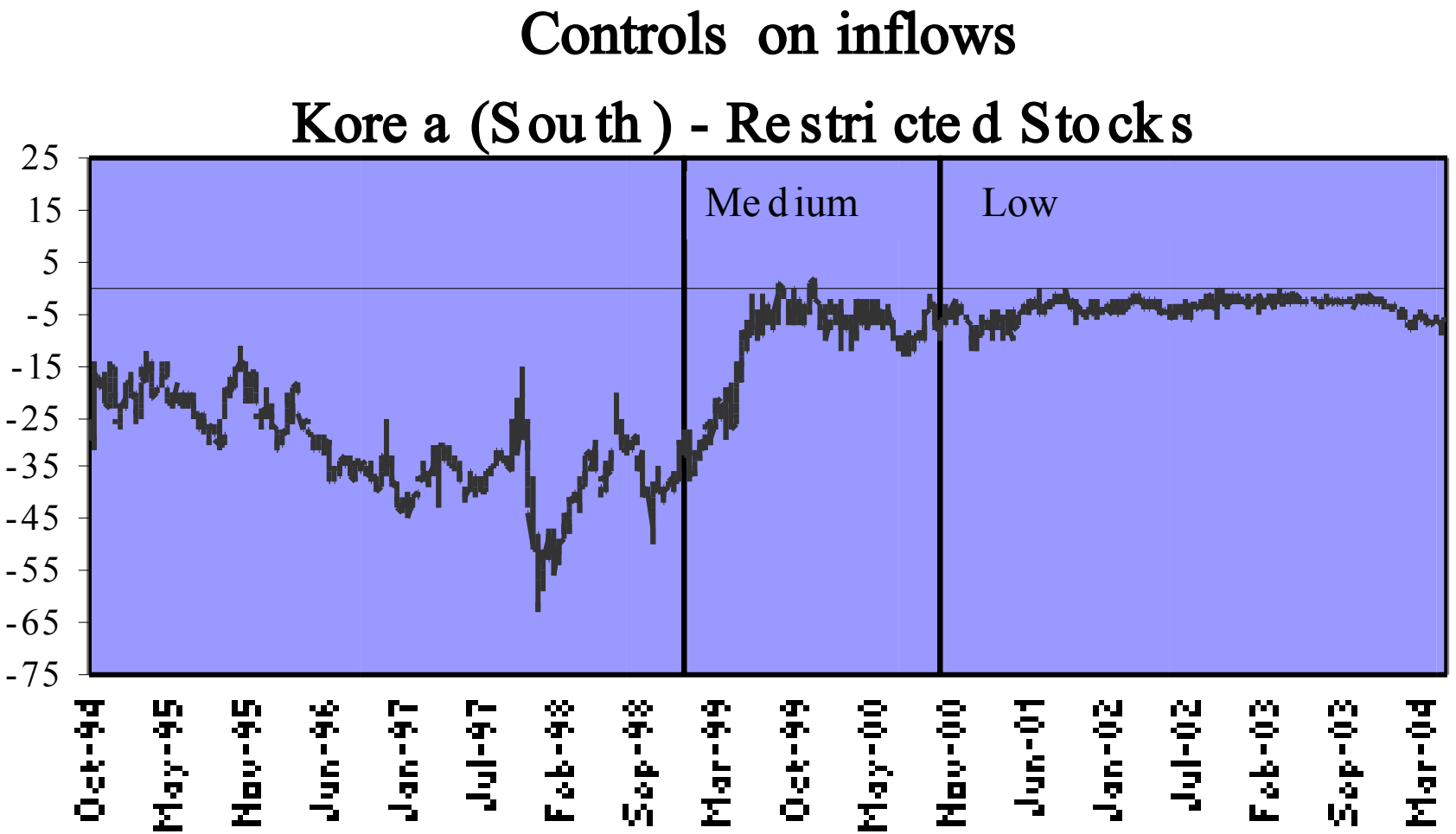


4. Capital controls

Control on inflows
Chile



4. Capital controls



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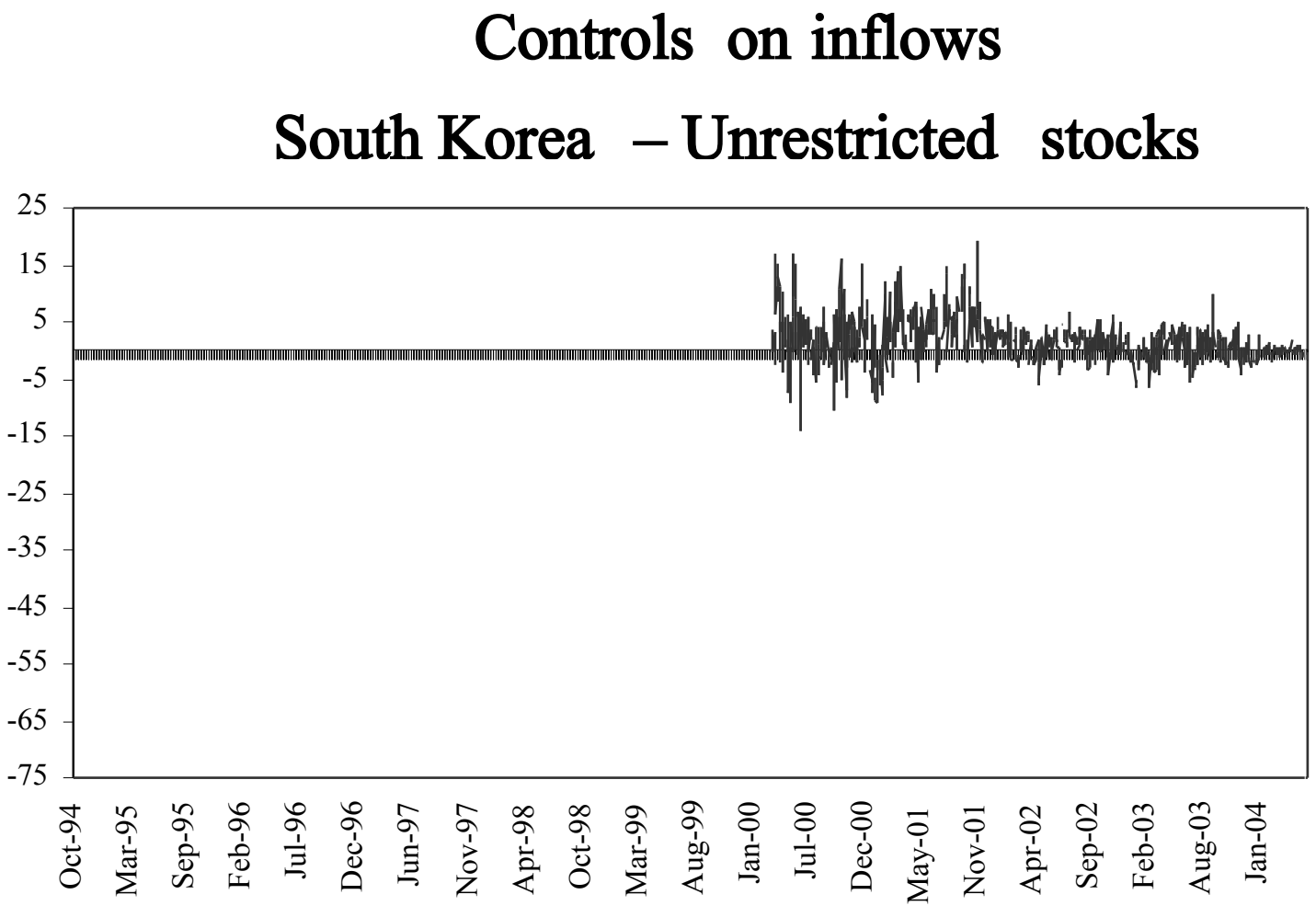

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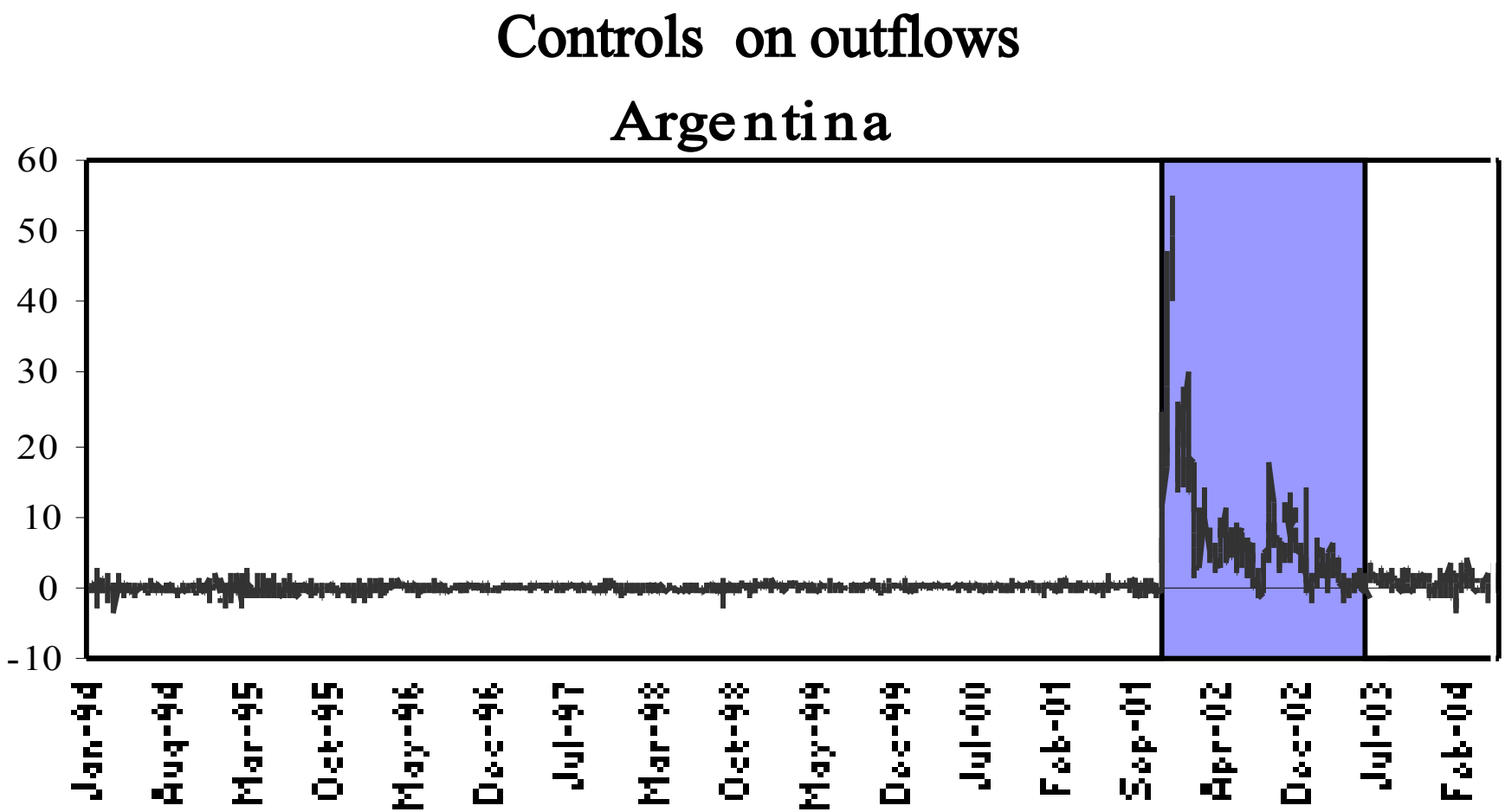

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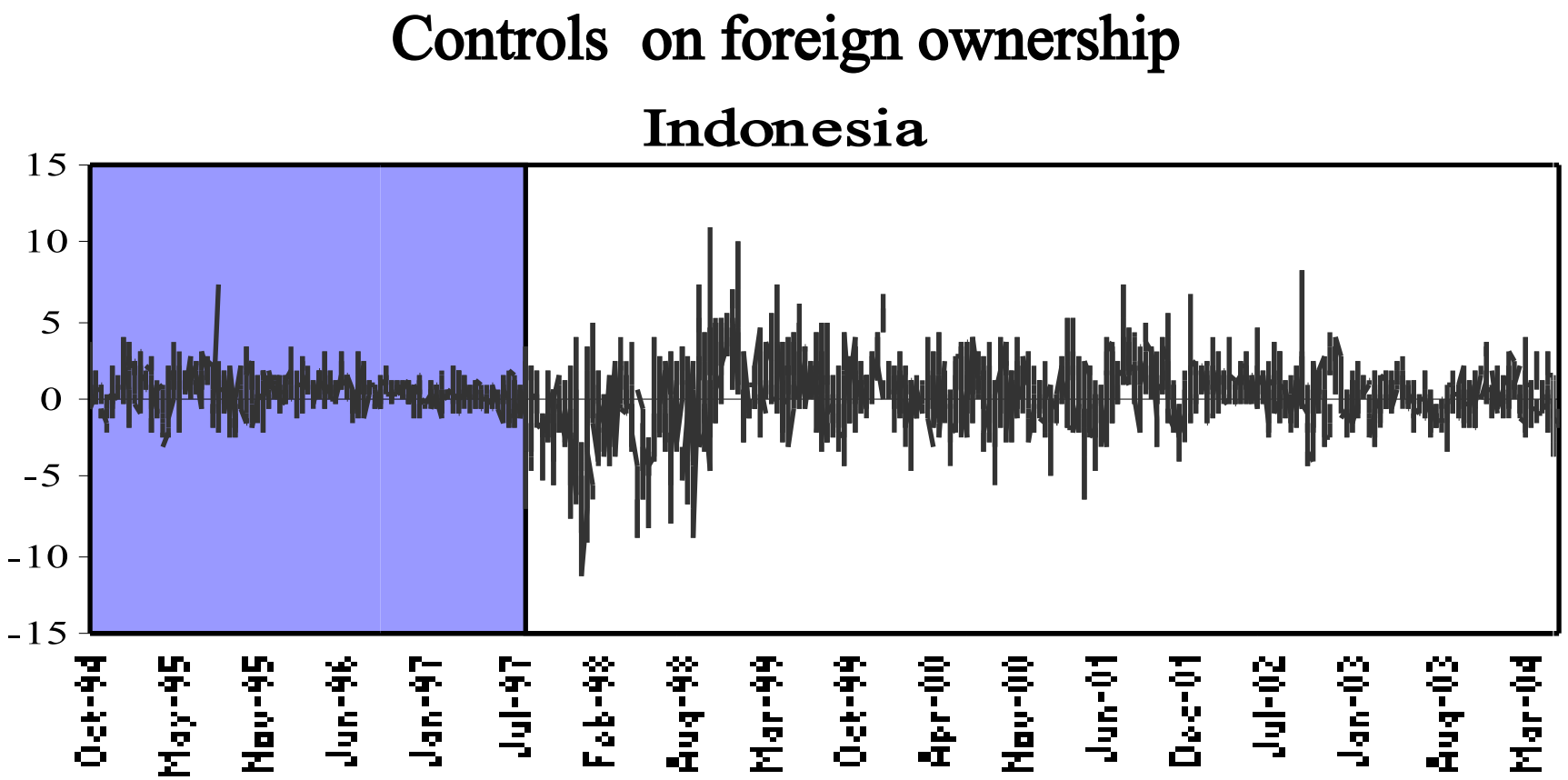

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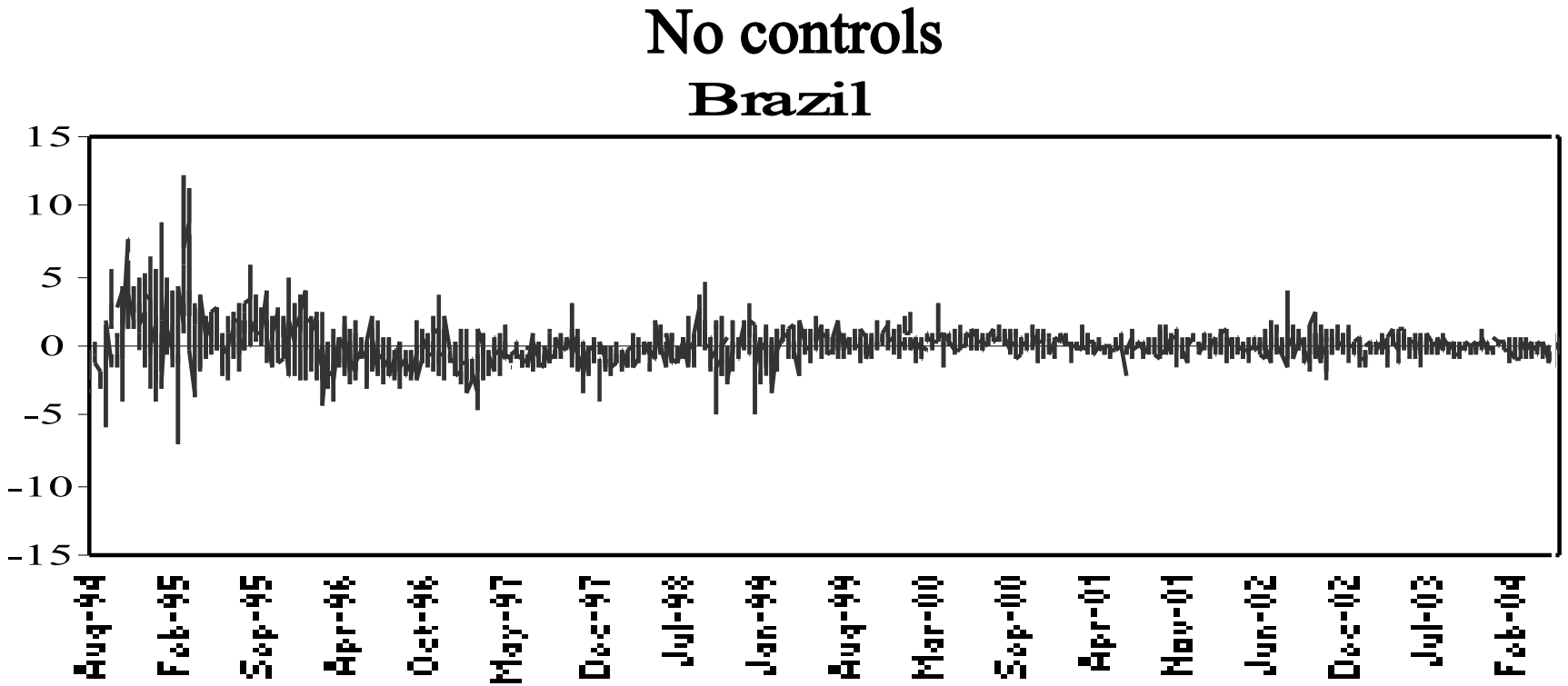

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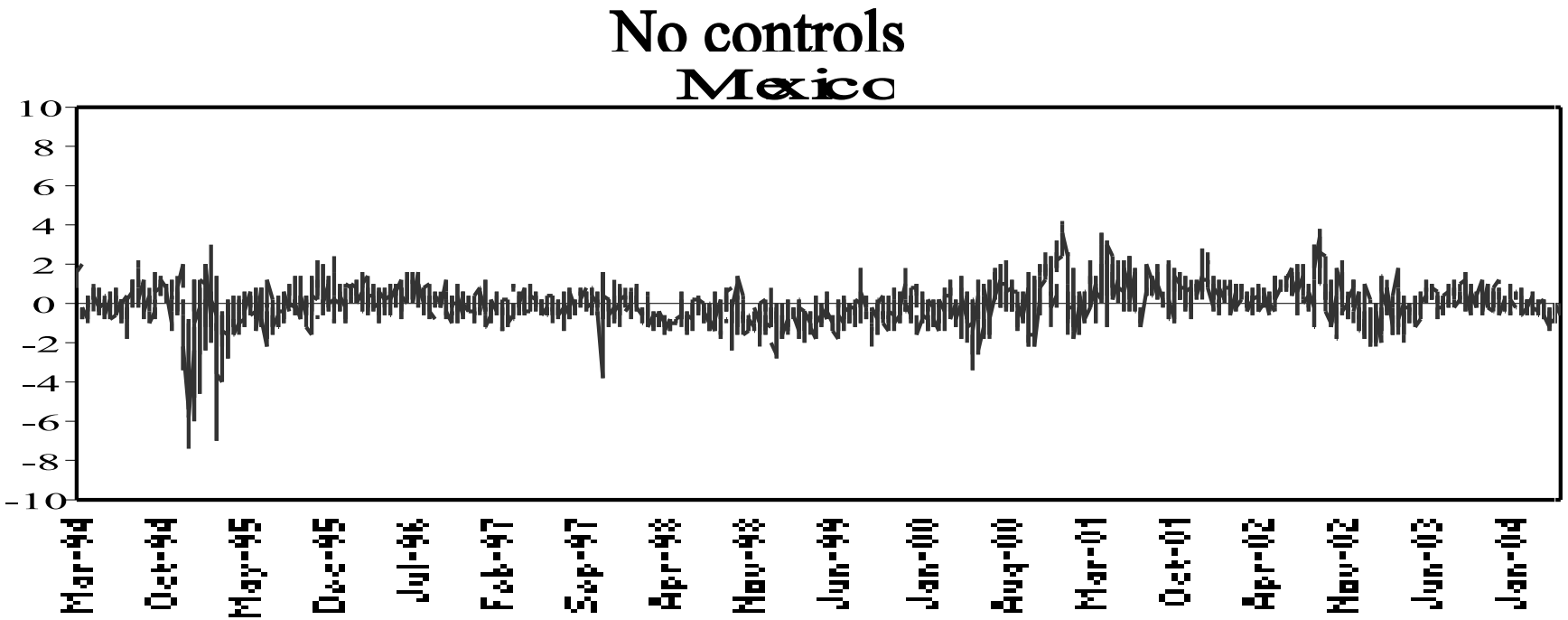

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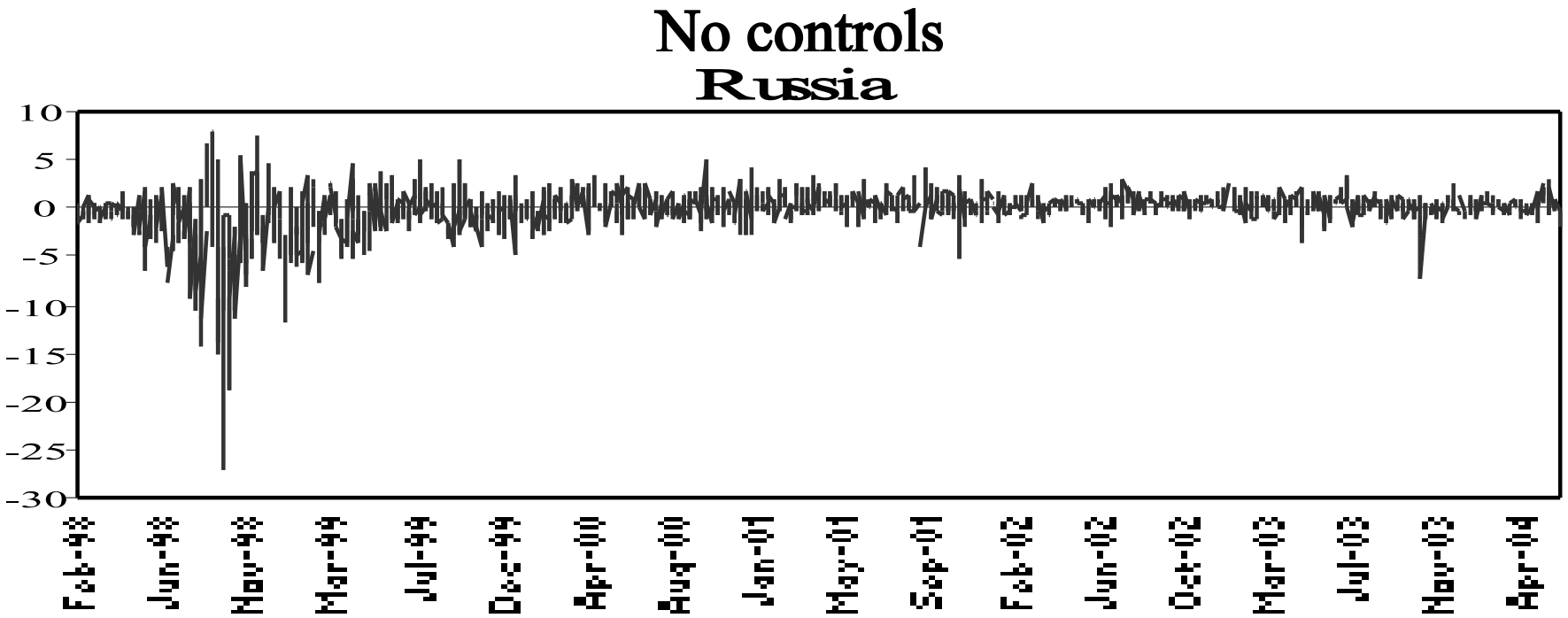


4. Capital controls

- AR estimates

$$x_t = \alpha_0 + \alpha_1 D_{cont} + \beta x_{t-1} + \beta_{cont} x_{t-1} D_{cont} + \sum_{j=1}^{k} \varphi_j \Delta x_{t-j} + \varphi_{cont,j} \Delta x_{t-j} D_{cont} + \varepsilon_t,$$

$$\sigma_t^2 = \alpha_0 + \exp(\lambda D_{cont}) \sum_{j=1}^{p} \alpha_j \varepsilon_{t-j}^2 + \sum_{j=1}^{q} \lambda_j \sigma_{t-j}^2.$$

is statistically different from the mean in the annual 1 period above, five, or ten percent significance level, respectively.

Pooled data

Period	Mean		Median	Std. Dev .	5th Pctile	95th Pctile	Obs.
No Control	0.29		0.12	2.02	-2.44	3.63	9,484
Control Inflows	-10.94	***	-3.34	13.95	-38.74	1.10	3,733
Control Outflows	31.16	***	30.60	20.97	1.29	64.20	1,963

4. Capital controls

Summary statistics

By Country

Country	Period	Mean	Median	Std. Dev.	5th Pctile	95th Pctile	Obs.
Argentina	No Control	0.06	0.00	0.72	-0.97	1.35	2,138
	Control Outflows	6.35 ***	4.70	7.54	-0.85	19.90	344
Chile	No Control	0.09	0.07	0.62	-0.85	1.13	1,587
	Control Inflows	-2.07 ***	-2.11	0.84	-3.31	-0.70	750
Indonesia	No Control	0.58	0.53	1.89	-2.32	3.88	1,315
	Control Inflows	0.48	0.50	1.19	-1.48	2.30	689
Korea	No Control	1.59	1.17	3.80	-3.76	7.87	972
	Control Inflows - High	-31.18 ***	-31.75	8.89	-46.10	-16.96	1,011
	Control Inflows - Medium	-8.84 ***	-6.25	8.11	-31.69	-1.46	670
	Control Inflows - Low	-3.60 ***	-3.13	1.58	-7.75	-1.71	612
South Africa	No Control	-0.09	-0.13	1.45	-2.33	2.45	2,032
	Control Outflows	33.58 ***	33.65	14.04	11.76	55.73	1,277
Venezuela	No Control	0.00	-0.06	2.84	-4.43	4.95	1,440
	Control Outflows	50.50 ***	57.46	26.85	1.40	87.60	319

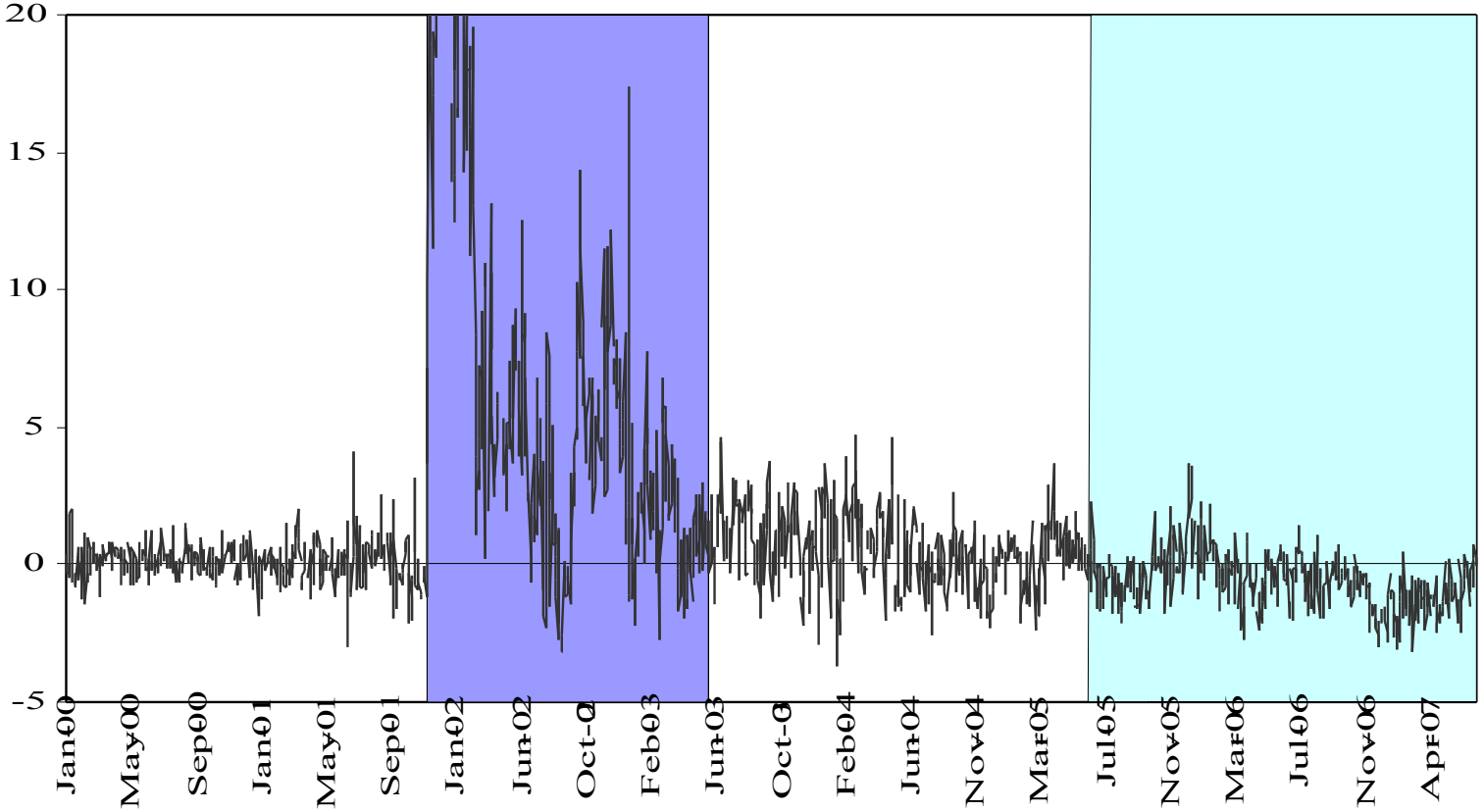
4. Capital controls

AR and TAR estimates

Country	Period	AR Average Half-Life	AR Avg. Volatility Increase	TAR Average Thres-Up	TAR Average Thres-Low	TAR Average Half-Life
Argentina	No Control	1.02		0.29	-0.29	0.69
	Control Outflows	10.01	2.71	7.85	-0.29	3.65
Chile	No Control	0.84		0.23	-0.23	0.56
	Control Inflows	3.42	-0.26	0.23	-3.11	1.08
Indonesia	No Control	1.31		0.17	-0.17	1.42
	Control Inflows	1.31	-1.25	0.17	-1.19	1.04
South Africa	No Control	0.92		0.09	-0.09	0.71
	Control Outflows	44.46	1.55	53.36	-0.09	4.28
Venezuela	No Control	1.17		-	-	-
	Control Outflows	53.92	1.53	-	-	-

4. Capital controls

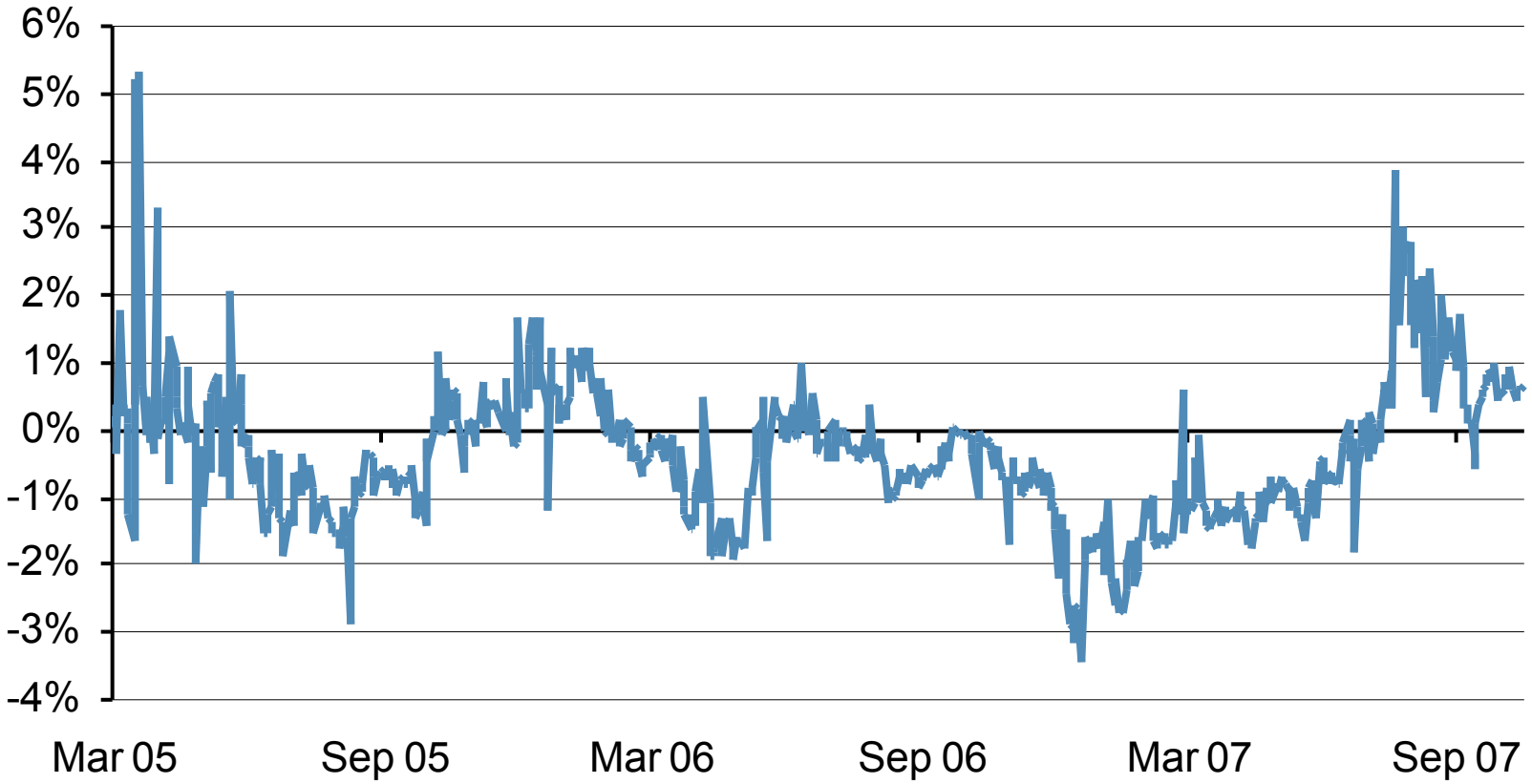
Controls on outflows and inflows
Argentina



4. Capital controls

Controls on outflows and inflows

Argentina – Sovereign government bond market



4. Capital controls

Argentina

Summary Statistics

Country	Mean	Median	Std. Dev .	5th Pctile	95th Pctile	Obs.
No Control	0.32	0.25	0.89	-1.08	1.91	957
Control Outflows	5.97	4.68	6.22	-0.85	18.43	342
Control Inflows	-0.62	-0.61	0.91	-2.12	0.93	497

4. Capital controls

Argentina

AR and TAR Results

Period	AR Average Half-Life	TAR Average Thres-Up	TAR Average Thres-Low	TAR Average Half-Life
No Control	0.87	0.33	-0.33	0.75
Control Outflows	4.09	11.42	-0.33	2.10
Control Inflows	2.04	0.33	-0.72	2.07

Outline

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5. Conclusion: Summary of results

- Strong financial integration: cross-market premium close to 0, with rapid convergence and narrow bands
- Non-linear models capture well the premium, consistent a no-arbitrage band due to transaction costs
  - Convergence speeds slower under ARs, and the difference in speed proportional to the band-width
- Convergence speed more rapid and no-arbitrage bands narrower, the more liquid a stock is
  - Large companies (liquid stocks) well financially integrated

5. Conclusion: Summary of results

- Capital controls effectively segment stock markets, weakening arbitrage across markets
  - Controls lead to wider bands and more persistent deviations
- In sum, arbitrage works well for liquid companies, fully integrated with the international financial system …
- … but integration disrupted as stocks become less liquid or governments introduce capital controls

5. Conclusion: Policy implications

- Cross-market premium useful measure of IFI
- Capital controls directly reflected in the premium
- The more binding the constraint, the larger the premium
  - Stricter controls
  - More capital flows (given controls)
- Premium shows actual effectiveness of controls
- Controls that don't segment markets are not reflected
  - Foreign/domestic resident partition immaterial
- No evasion, but tax paid to financial market participants
- No welfare analysis

Thank you!