Observatory on Exchange Rate

Emerson Fernandes Marçal

CEMAP-EESP-FGV

Talking points

Brief Review of Observatory on Exchange Rate History:

Approaches to estimate Misalignment:

- Current Account Targets.
- Stabilization of NFA
- PPP
- Effective equilibrium RER based on fundamentals.
- Observatory Approach:
- A Long Run Perspective:

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- Brazilian Case:

Observatory Methodology

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Observatory on Exchange Rate: Some Facts

- First Release of Exchange Rate Estimates were 2010 in CEMAP's Letter number 2;
- In 2013 Observatory on Exchange Rate was officially created;
- Two years research partnership with IPEA (2013-2014);
- One year research partnership with BNDES (2014);
- Three years research partnership with WTO Chair (2015-2017);

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- Releases Estimates of Exchange Rate Misalignment in a Quartely Basis;
- A Series of Working Papers on the subject;
- Peer Review Papers Published on Economic Journals;
- Papers discussed with Staff of Peterson Institute, IMF and World Bank;
- Papers presented and discussed in Conferences such as IAAF, EMG-ECB, LAMES, Oxmetrics Users, Petersen Institute.

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Researchers:

- Emerson Fernandes Marçal (CEMAP);
- Beatrice Zimmerman (World Bank);
- Diogo de Prince (CEMAP - UNIFESP);
- Giovanni Merlin (PhD candidate, EESP);
- Ronan Cunha (PhD candidate, EESP);
- Oscar Simões (PhD candidate, EAESP).

Exchange Rate Misalignment: a Macroeconomic Phenomena.

- Effective exchange rate misalignment:
  - Deviations from a long run macroeconomic equilibrium;
  - Economic discussion to define this equilibrium;
  - Empirical questions about how to estimate this equilibrium;

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Exchange Rate Misalignment: Different Approaches.

Different Norms to address exchange rate misalignment:

- Current account Norm:
  - Current account Targets: Level of real exchange rate that guarantees some target level of current account results is obtained;
  - NFA stabilization Norm: Current account Level that stabilizes NFA;
- Relative Price Models:
  - Behavioral Approach: Real exchange rate in line with fundamentals obtained from a theoretical model and implemented using econometric models;
  - Purchasing Power Parity;

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Current Account Targets.

- Current account Targets: Level of real exchange rate necessary to reach some target current account result;
  - Need to estimate elasticity of trade (exports and imports) to real exchange rate;
  - Address aggregate consistence;

- Problems:
  - Results can be sensitive to elasticity estimate;
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Stabilization of NFA

- Stability of NFA: Real exchange rate necessary to reach some NFA level;
  - It can be seen as a minimum prudential level to avoid current account imbalances;
  - Simplicity and transparency;

- Problems:
  - Stabilize NFA does not prevent necessarily countries to have disorderly current account adjustment;
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Purchasing Power Parity

- Recent advances in the literature suggest that PPP may hold after all for some currencies;
  - Some studies using not temporally aggregated data suggests that PPP may hold in the long run. (Taylor, 2010);
    - Strong evidence that PPP holds for dollar-pound sterling parity using consumer price deflators and long time series; (Ahmad & Craighead)
- Misalignment is calculated in relation to a base country;
- This approach can not be linked to competitiveness;
- Balassa-Samuelson effect or any source of time trends must be addressed;
- What to do if PPP does not hold?
  - Decompose exchange rate in permanent and transitory components using time series techniques (Beveridge-Nelson decomposition and others);

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Effective equilibrium RER based on fundamentals.

- Fundamental Real exchange rate is calculated using a econometric model based on theoretical model:
  - Cointegration techniques based on selected series associated with fundamentals;
  - Some possible choices of the fundamentals variables
    - an indicator of relative tradeable and non-tradeable prices;
    - net international investment position as GDP share;
    - terms of trade;
    - government consumption;
    - trade openness;
    - etc ...

Basic Equilibrium Equation for RER.

- From many intertemporal macroeconomic models it's possible to obtain to steady state equations:

$$\overline{tb} = -r * \overline{NFA} \quad (1)$$

$$\overline{RER} = -\phi \overline{tb} + \lambda \overline{X} \quad (2)$$

- First equation states that a country can run a trade deficits if revenues from NFA are large enough;
- Second equation states that if a country can run a trade deficit in equilibrium the RER has to appreciate;
- The term X accounts for any other factor affecting equilibrium RER such as Balassa-Samuleson Effect;

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First Step: Effective RER based on fundamentals.

- Fundamental Real exchange rate is calculated using a econometric model:
  - Cointegration techniques based on selected series associated with fundamentals (Faruquee, 1994, IMF Working Paper, 90);
  - Some possible choices of the fundamentals variables
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- Econometric Questions:
  - Detect long run relationship - cointegration analysis;
  - Perform permanent and transitory decomposition to better understand the adjustment towards equilibrium;
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Second Step: Bilateral RER based on fundamentals.

- Converting real effective exchange rate misalignment in bilateral misalignment:
  - From real effective exchange rates estimates calculated under step 1 for a group of countries it is possible to calculate bilateral misalignment for each country using Alberola, Cervero et al. (1999);

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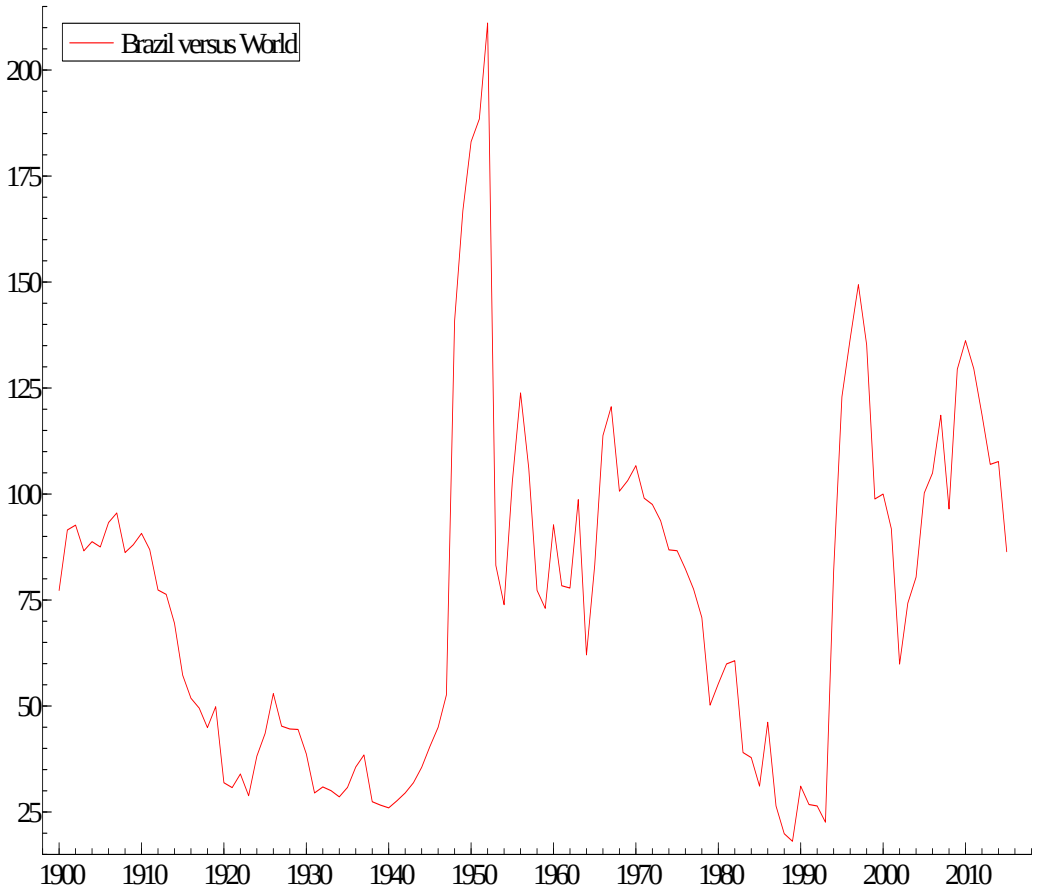

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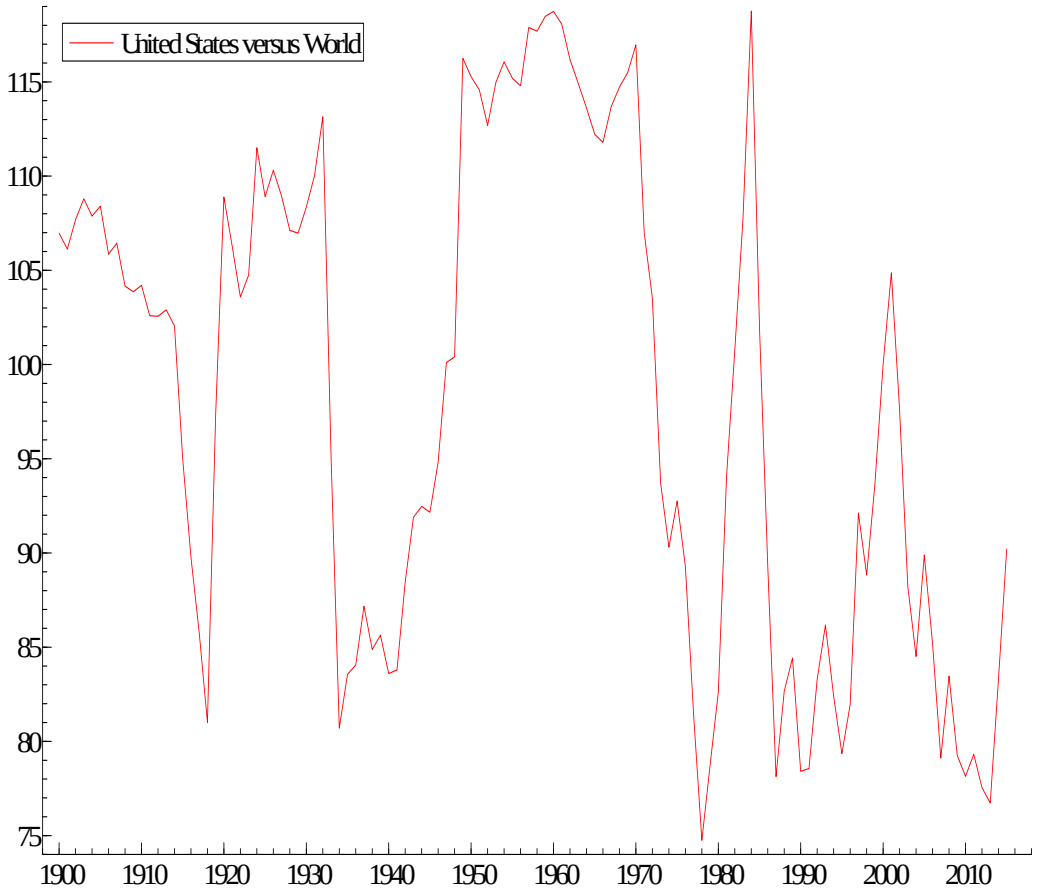
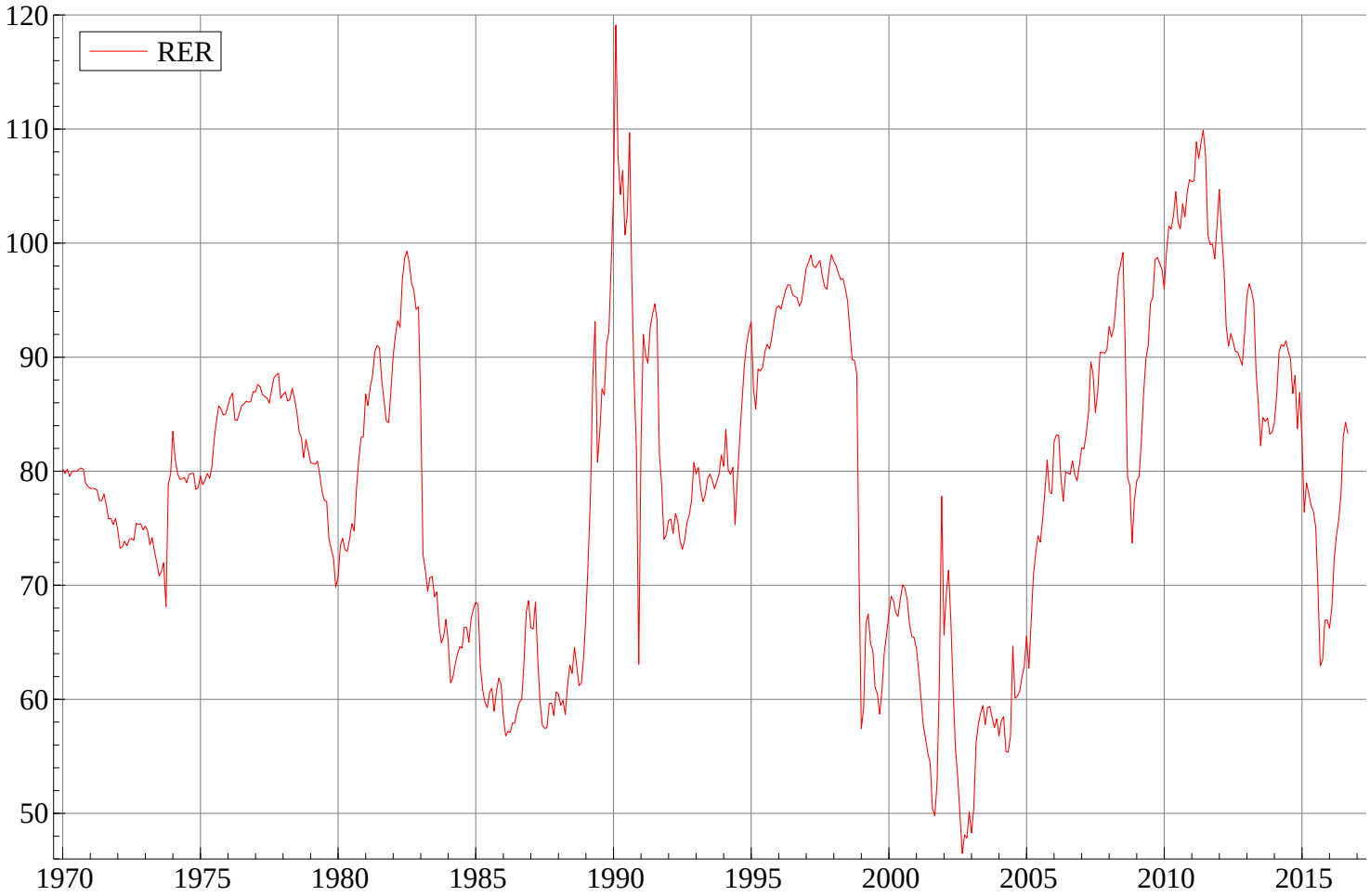


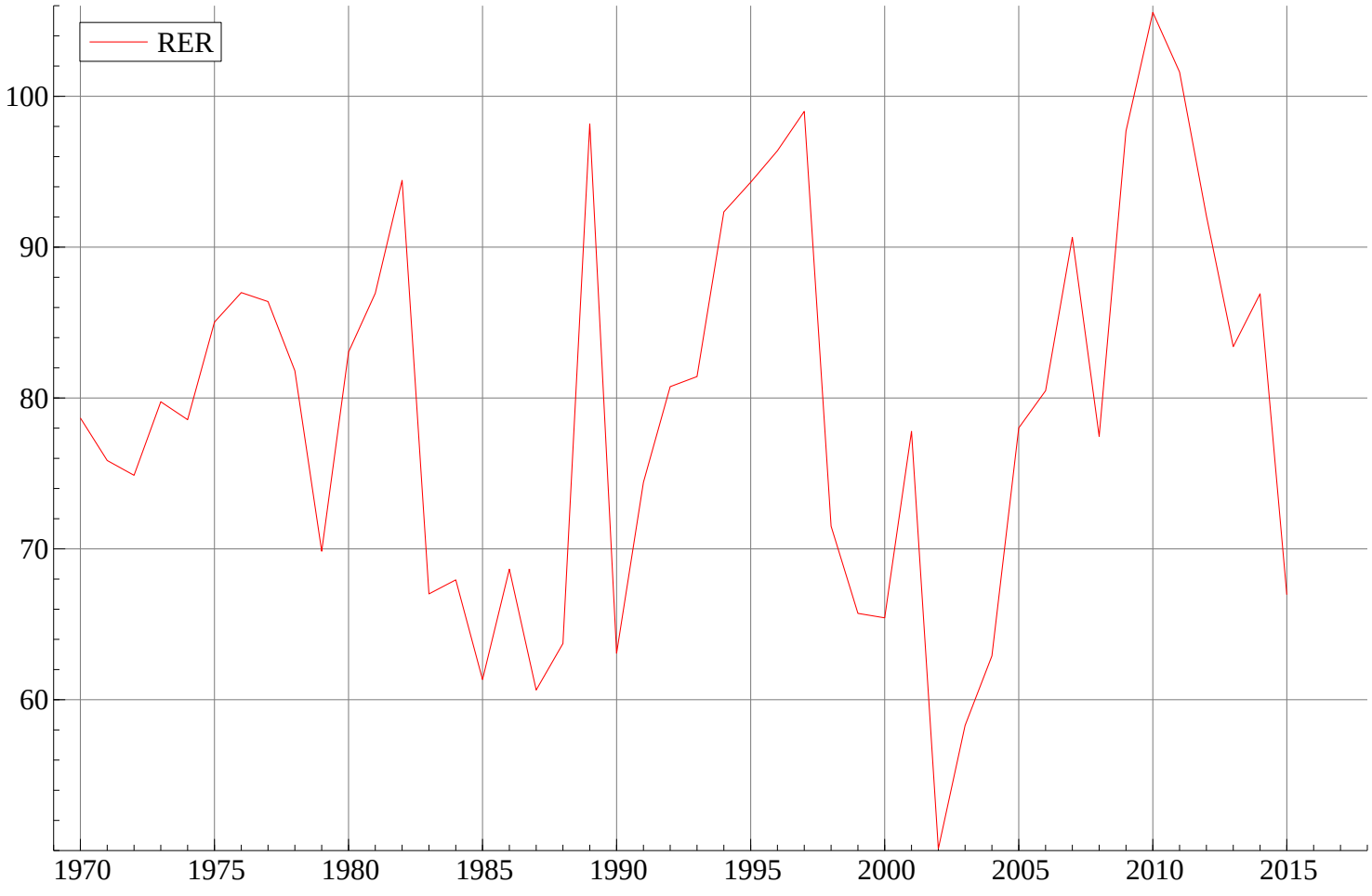
Database Description:

- Real Effective Exchange Rate - IFS-IMF - CPI index;
- NFA/GDP - Milesi & Ferreti database until 2000 and Brazilian Central Bank afterward;
- Balassa Samuelson effect - ratio of wholesales price and consumer price index compared to same ratio of trading partners - FGV, IBGE and IFS-IMF;
- Balassa Samuelson effect - ratio of GDP per capita of country and its trading partners - FGV, IBGE and IFS-IMF;
- Relative Terms of trade - Brazilian terms of trade (Funcex) compared to trading parterns' terms of trade (IFS-IMF);

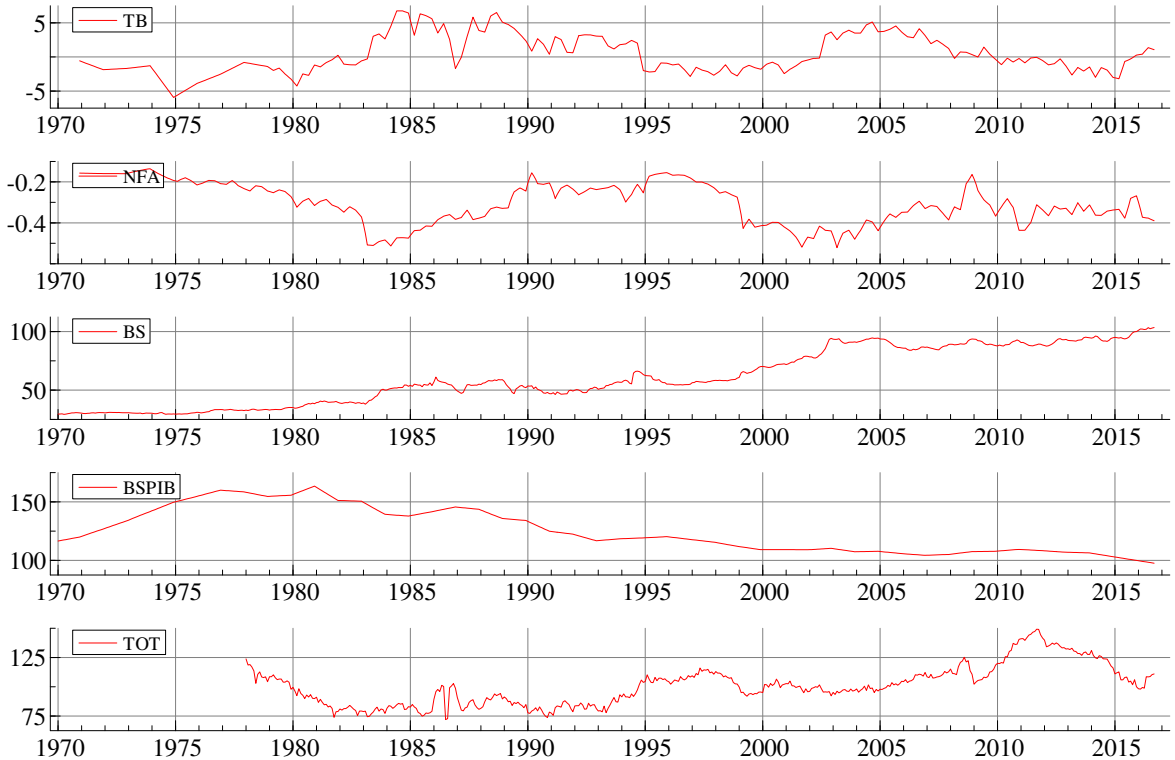
Target Variable: Monthly



Target Variable: Annual

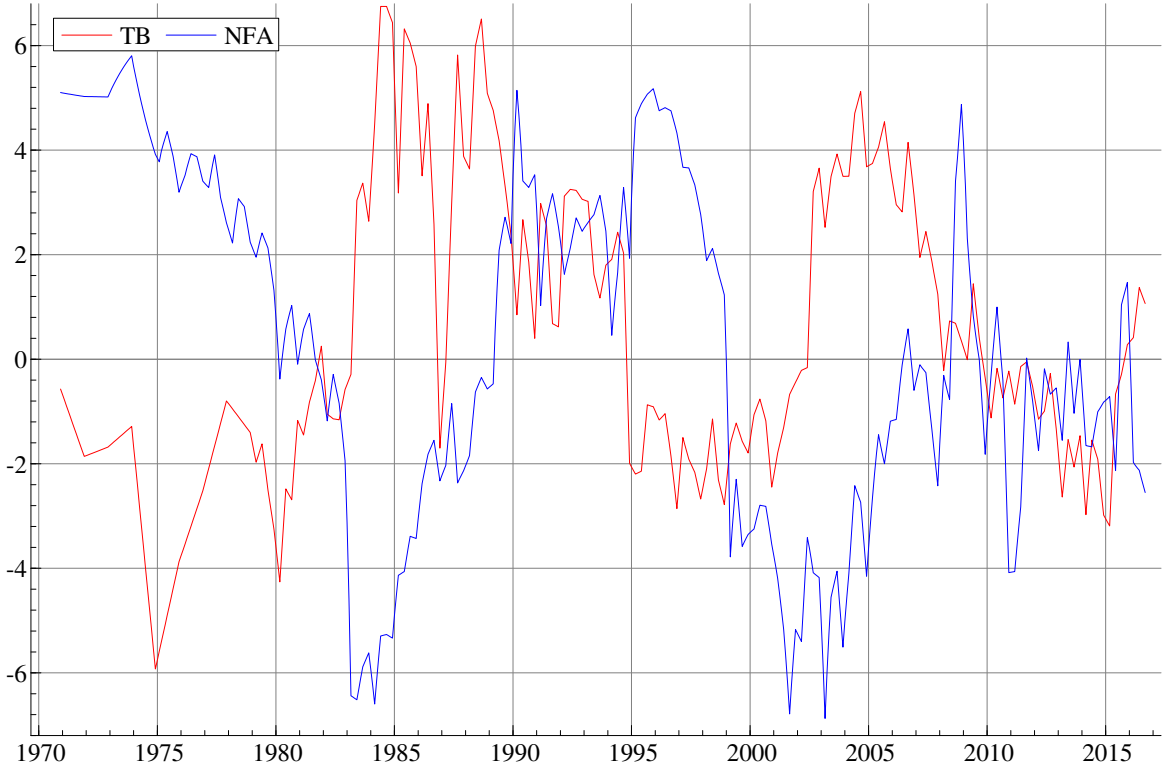


Fundamentals Variables:



Plot of RER and Fundamentals: Same Scale.

Trade balance versus NFA



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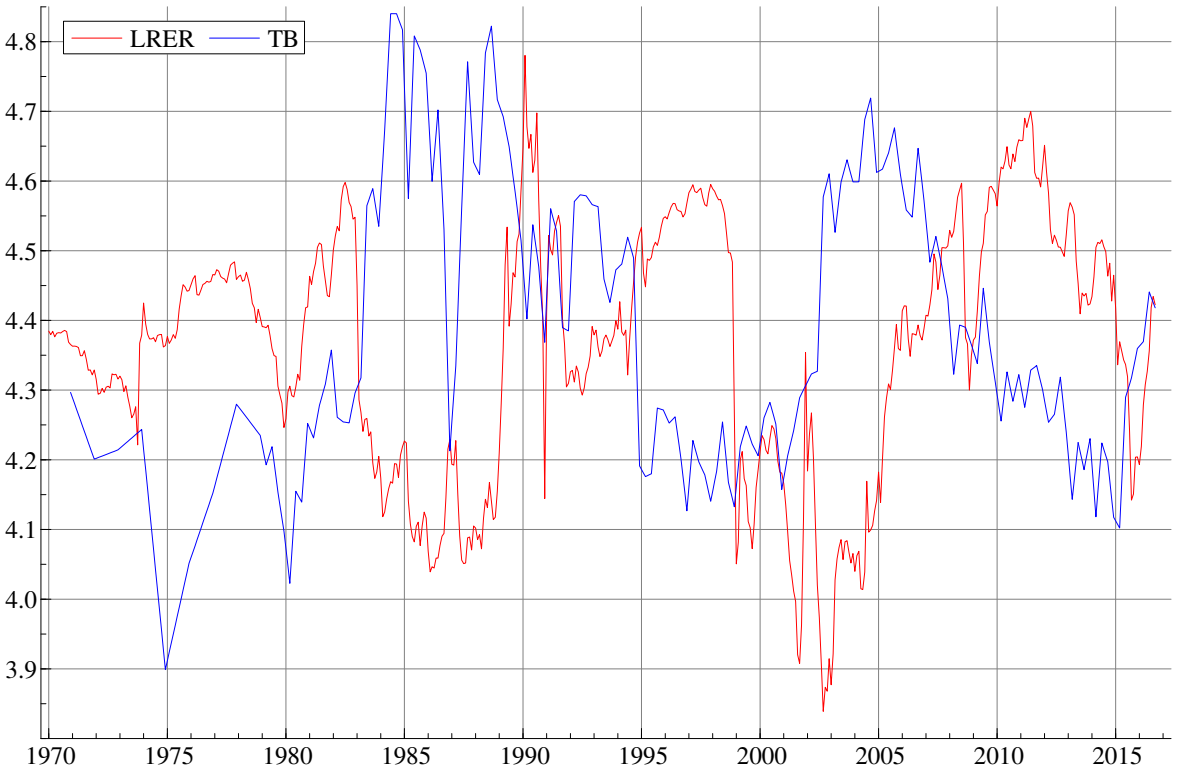
RER and trade balance



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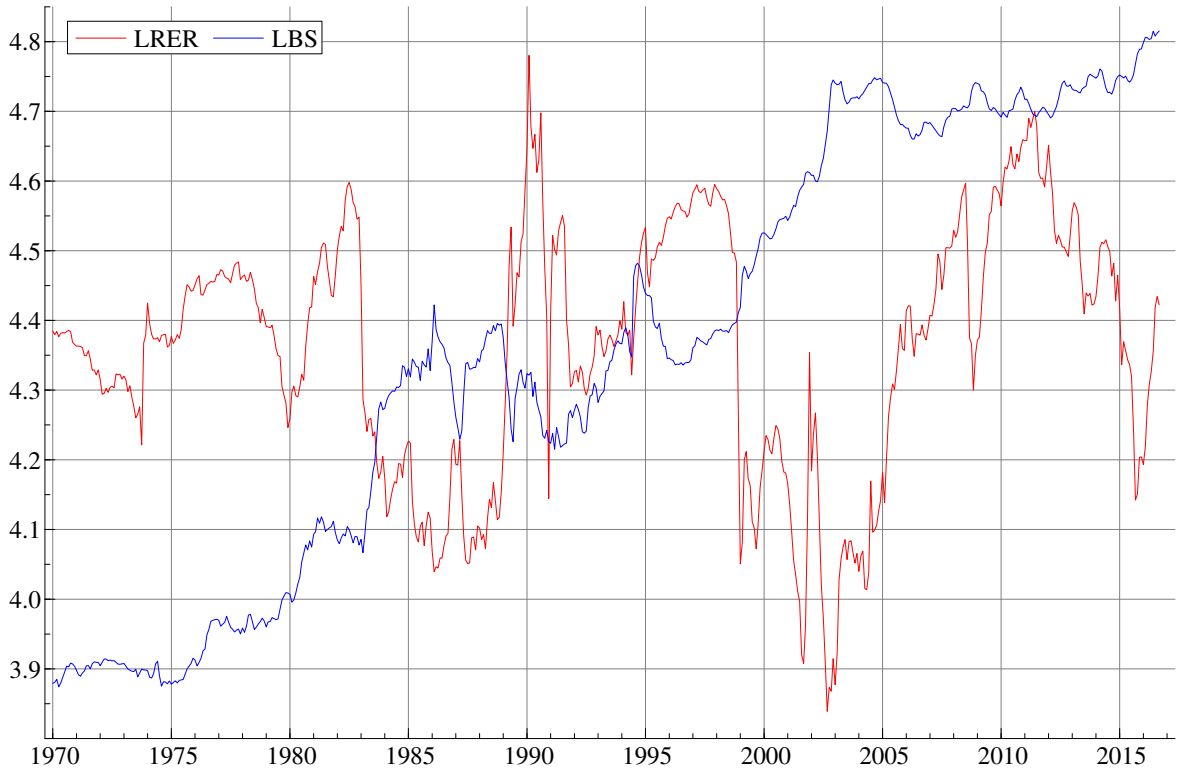
RER and Relative Prices



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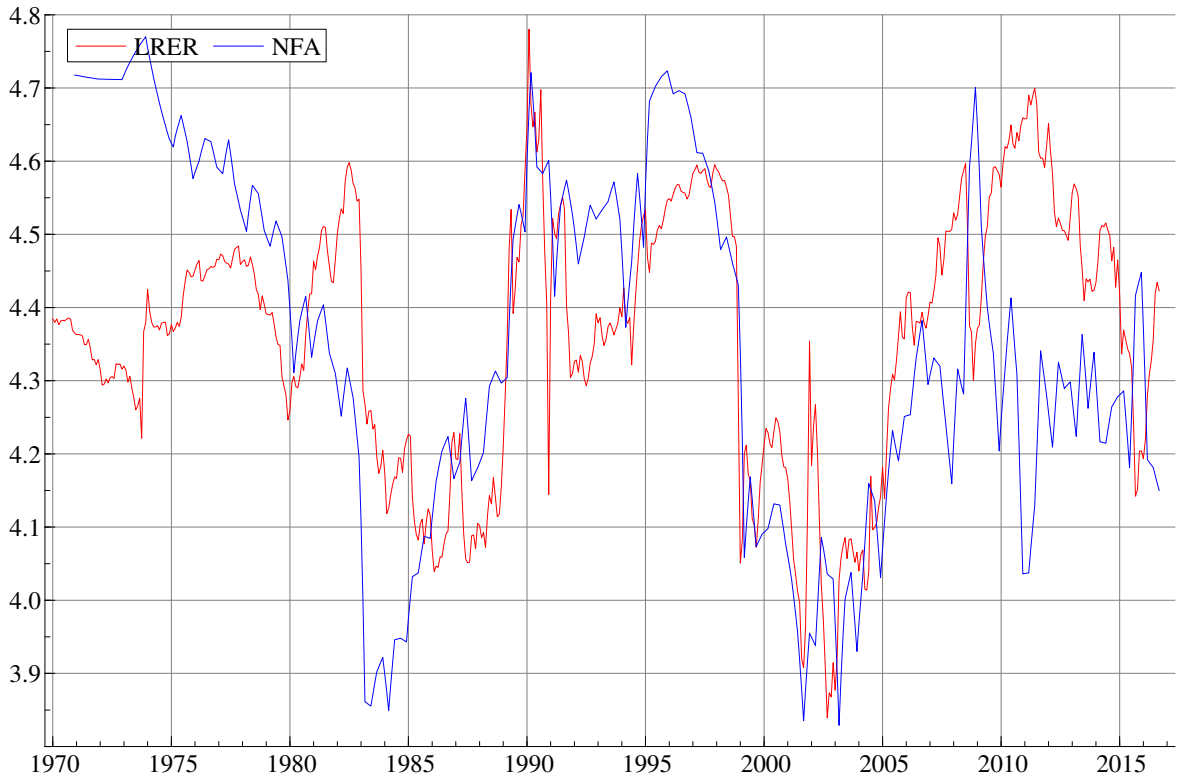
RER and NFA



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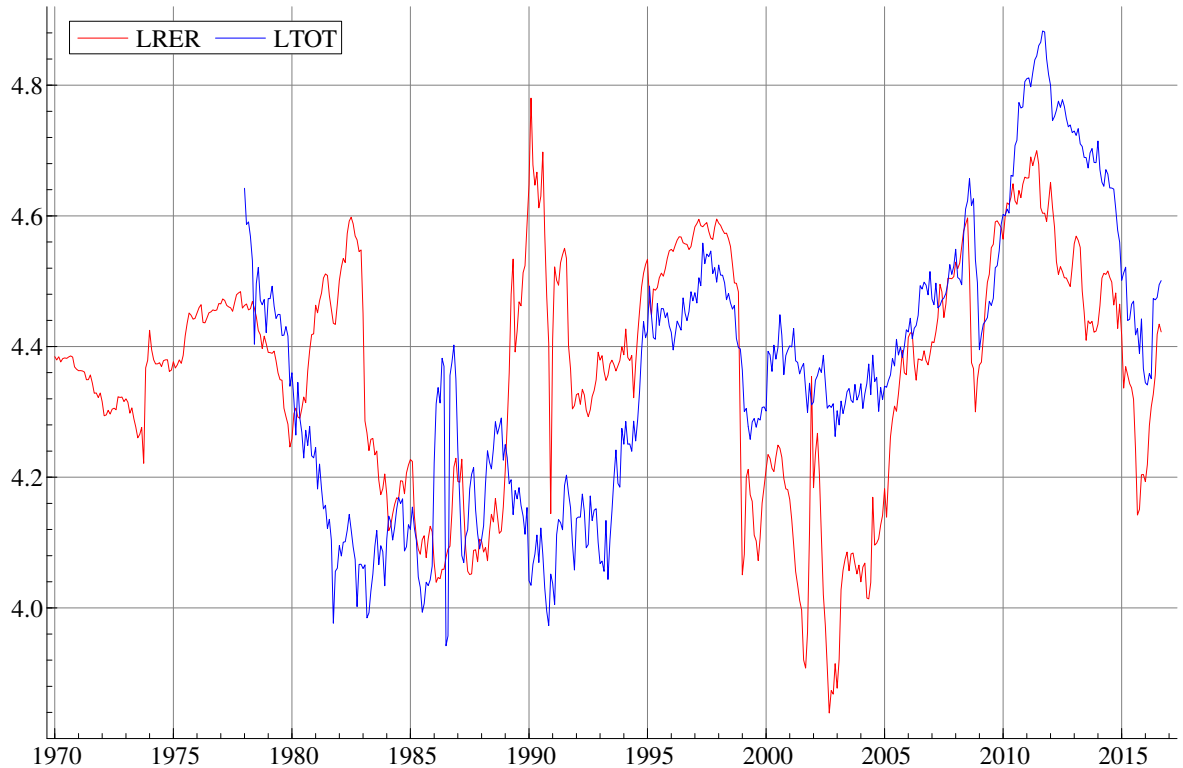
RER and TOT



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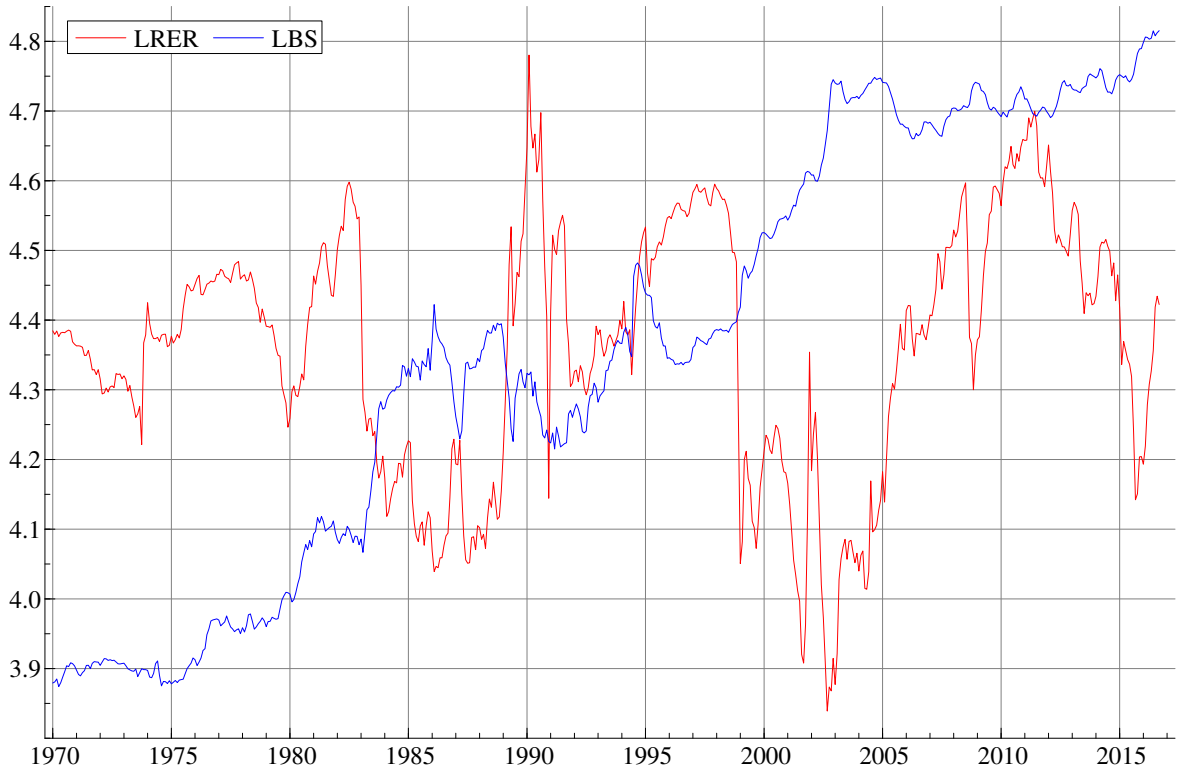
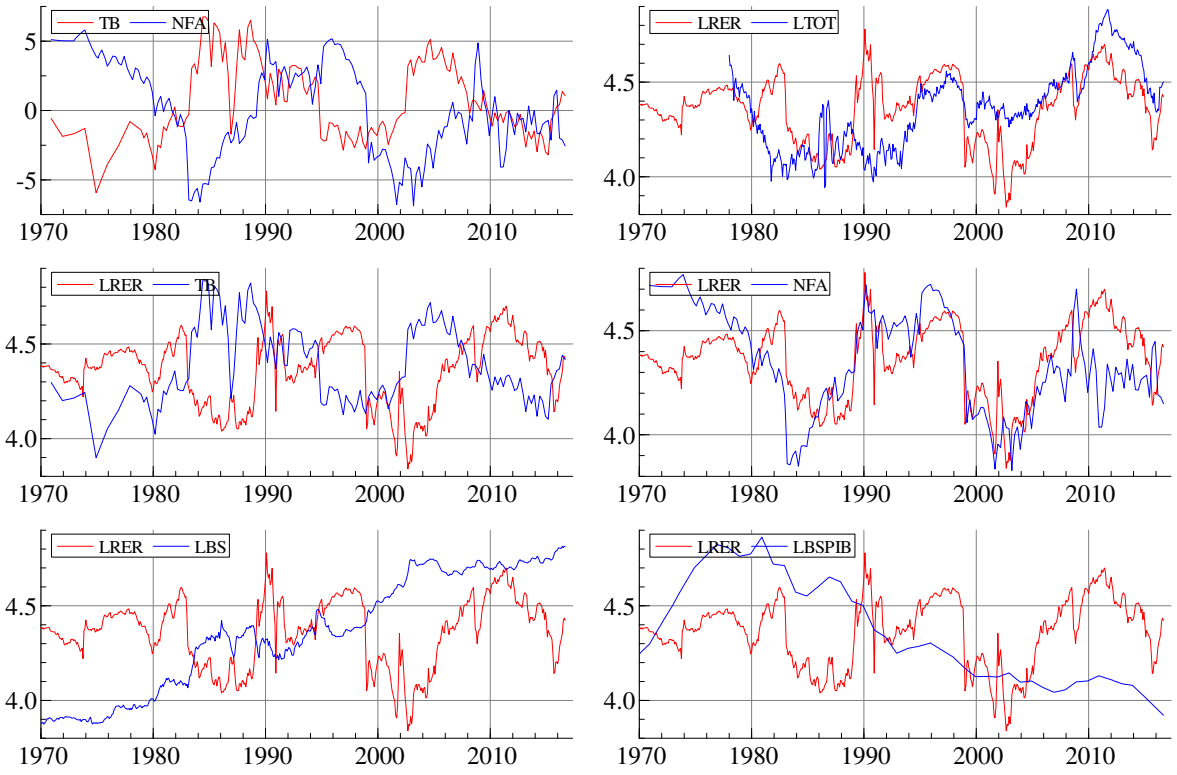
RER and Relative GDP per capita

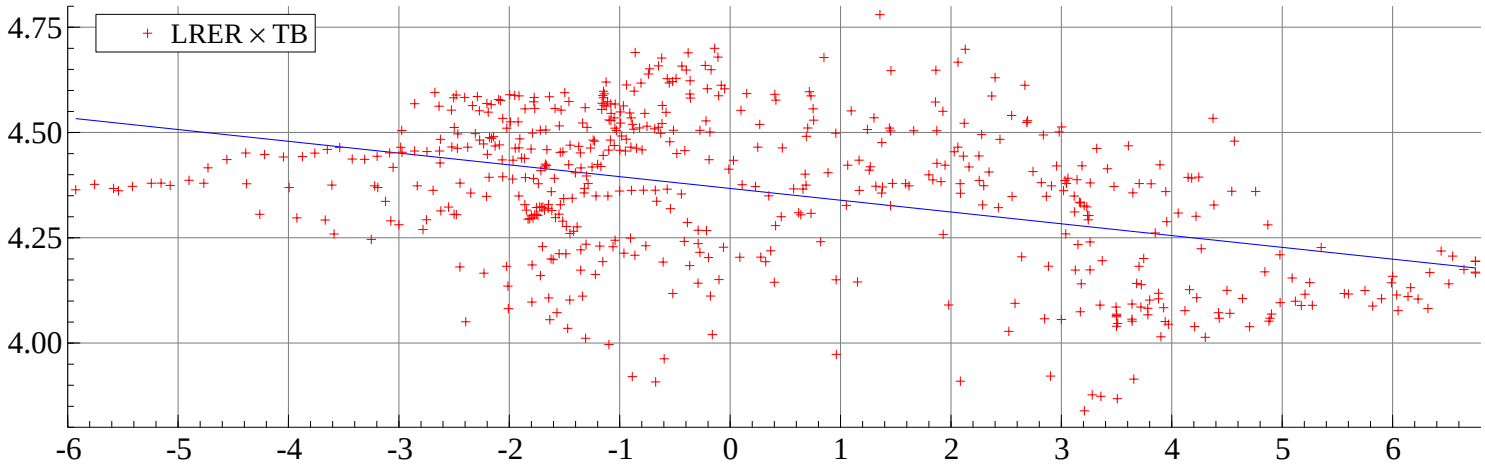


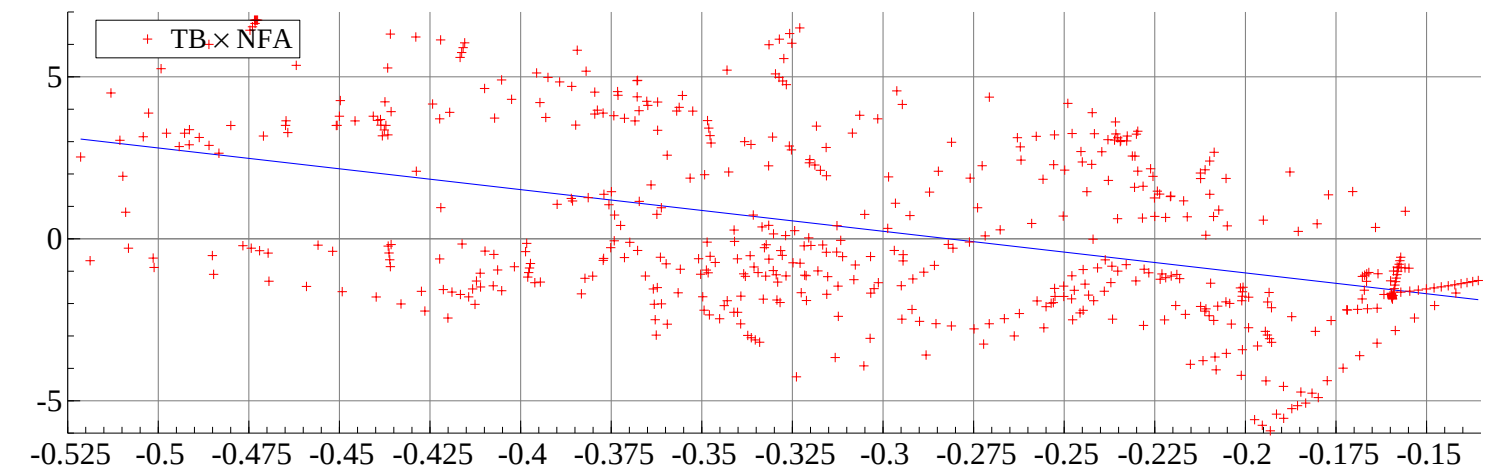
Plot of RER and Fundamentals: Same Scale.

All graphs together



Cross-Plot of RER and Fundamentals:





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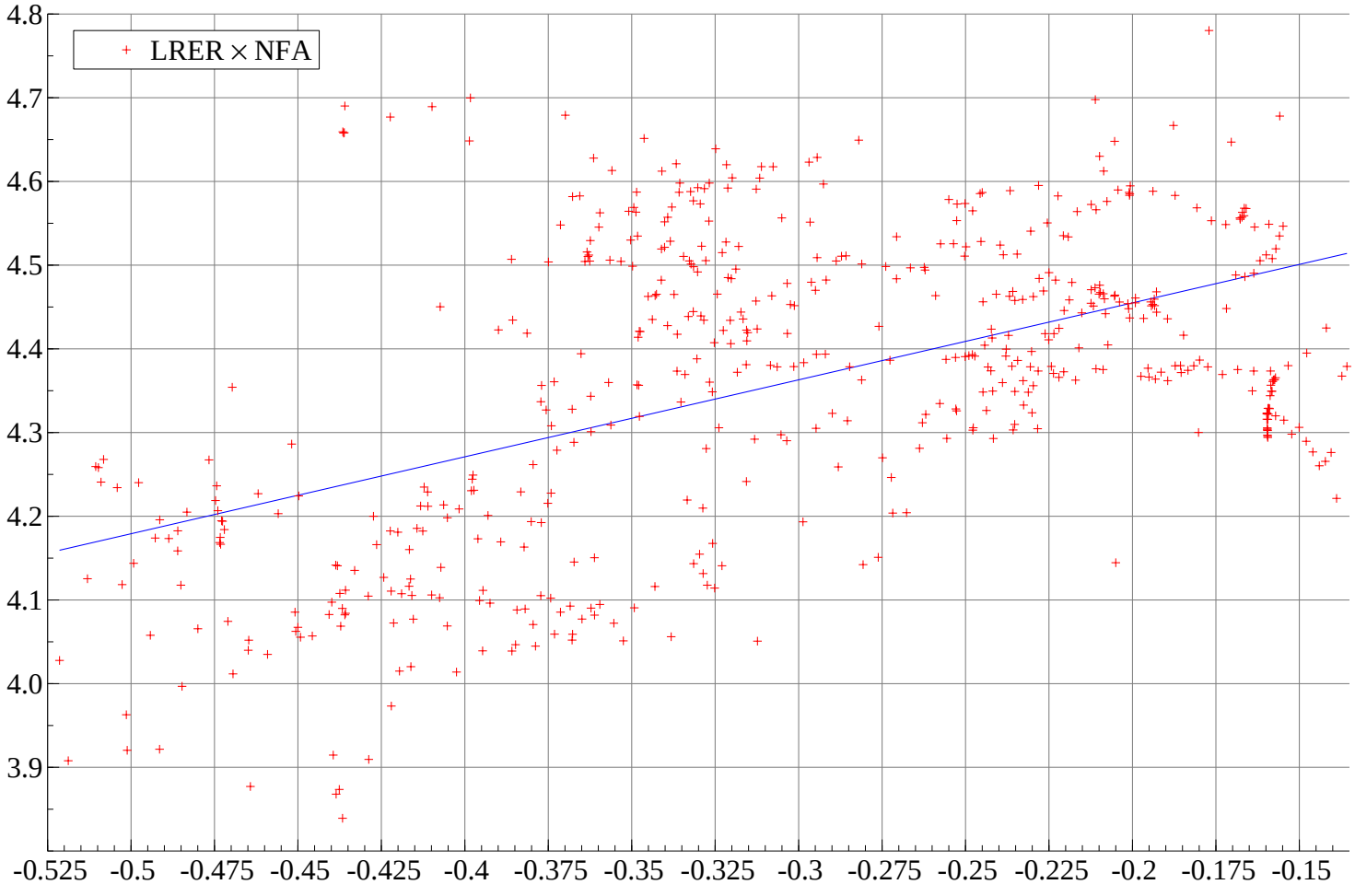

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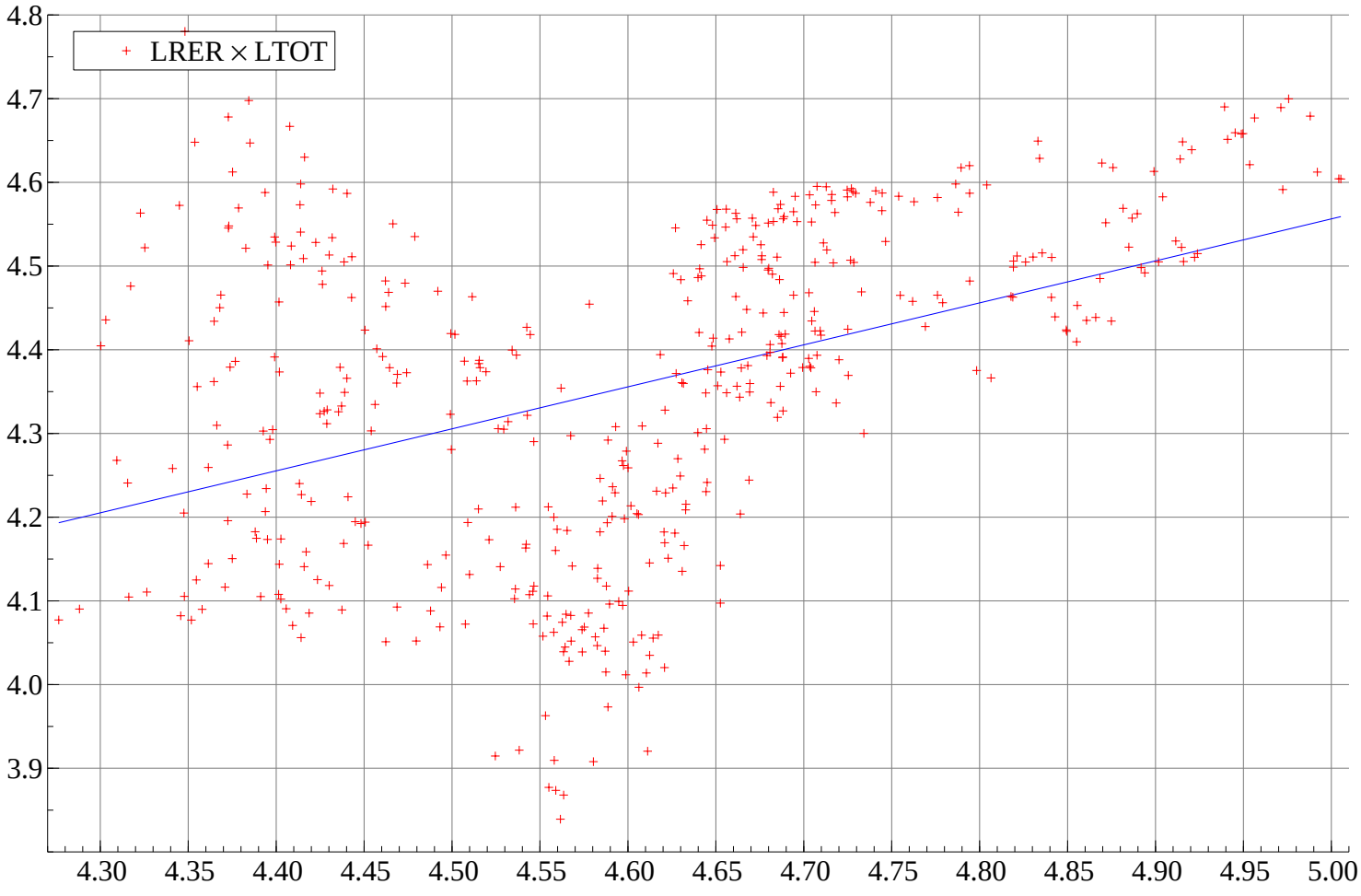

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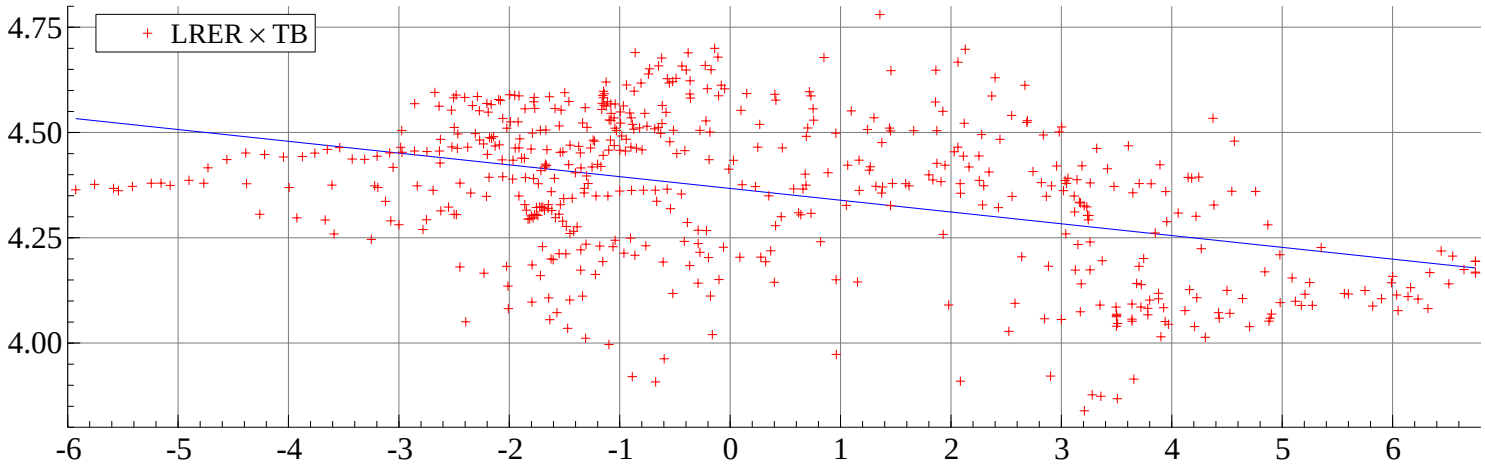

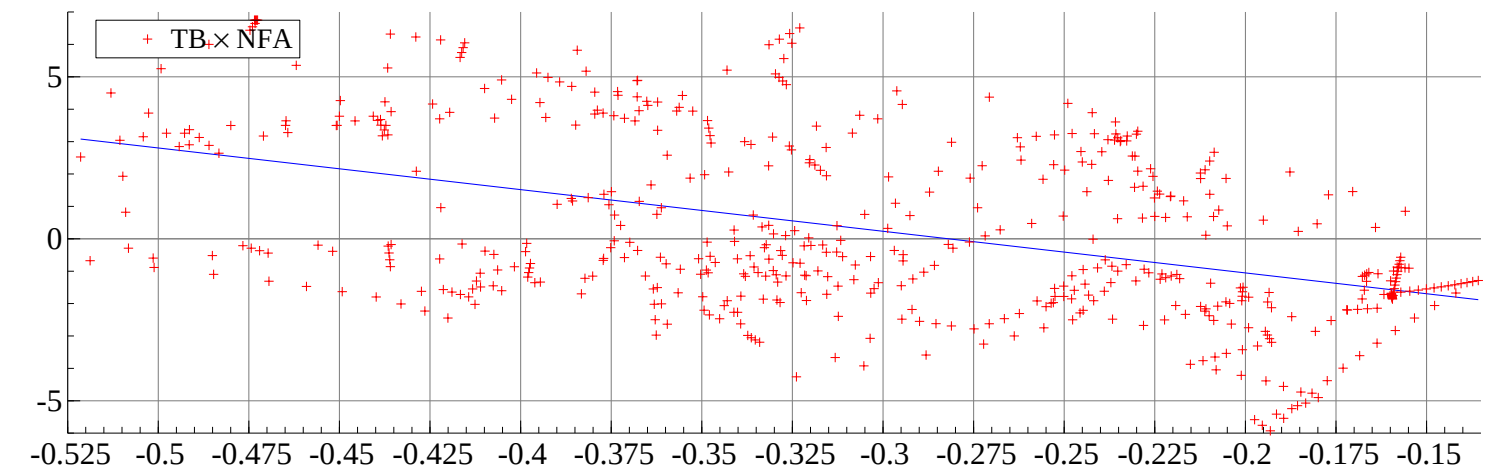

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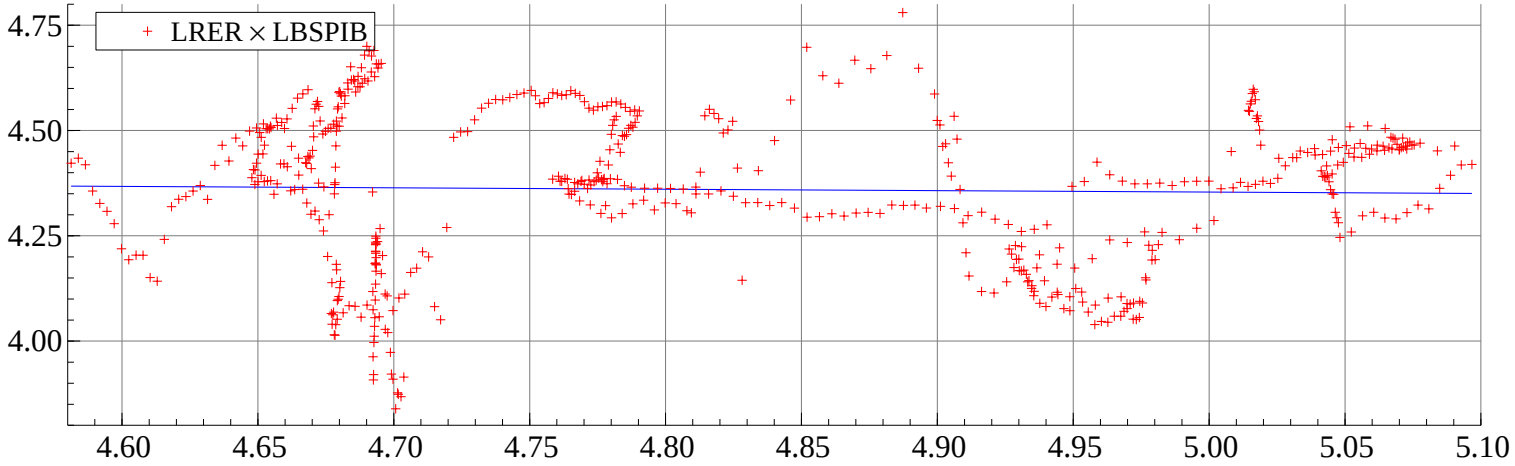

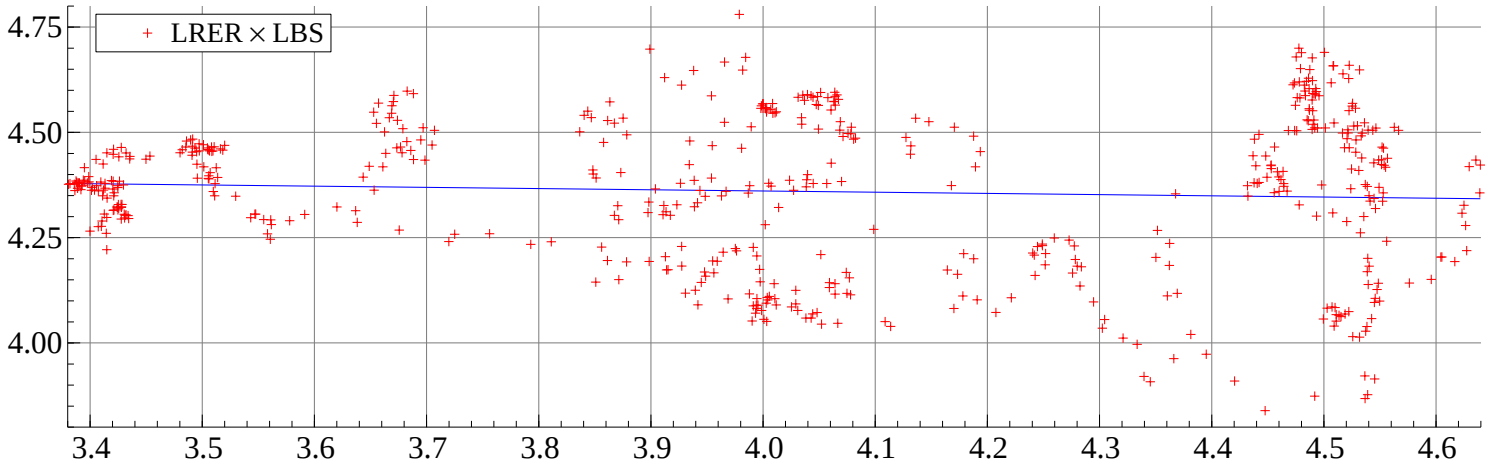

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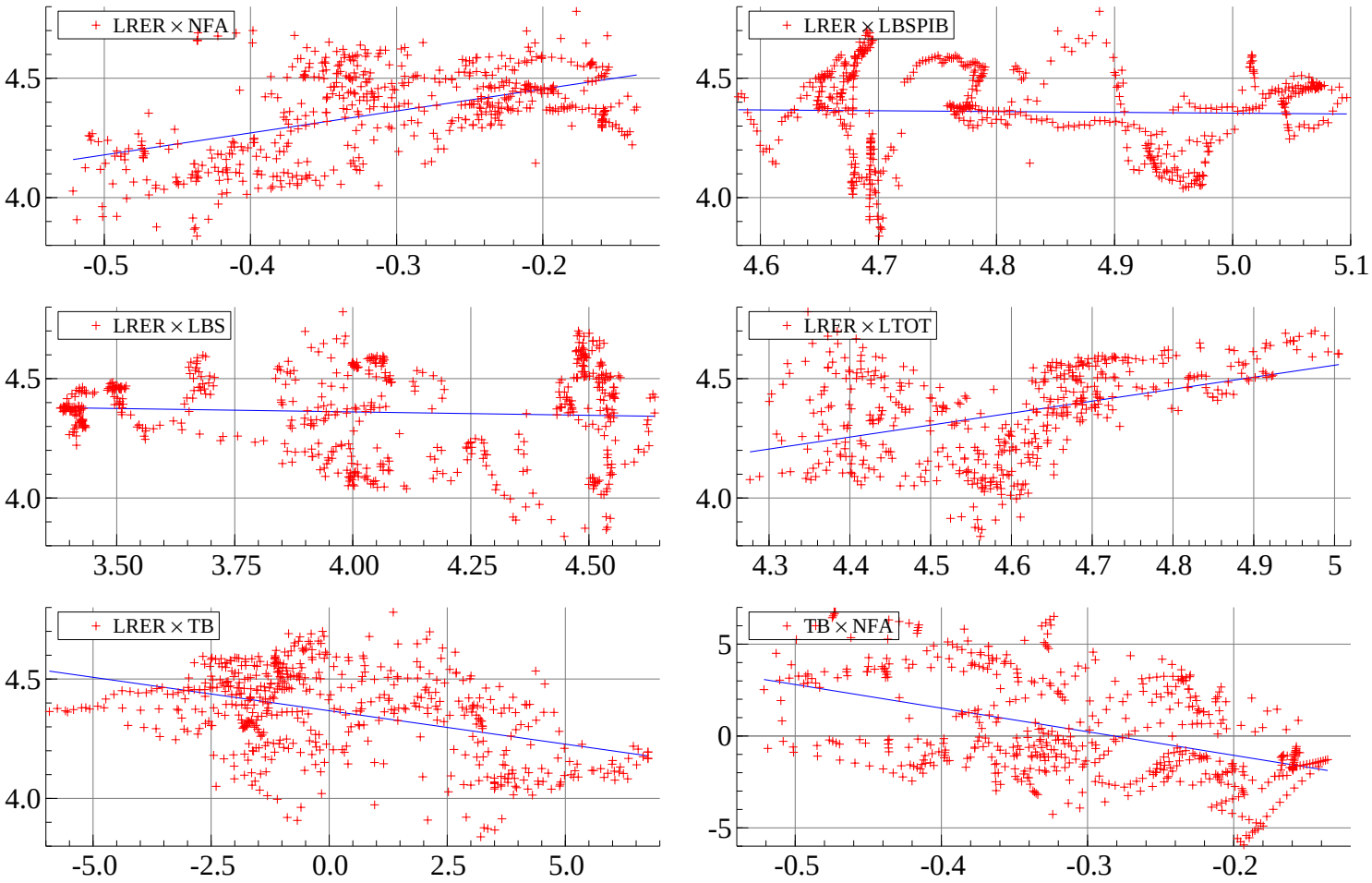

Cointegration Test:

Endogenous Variables						Johansen Cointegration Test					
						Trace Statistic - Unrestricted constant					
							r=0	r=1	r=2	r=3	r=4
M1	TB	NFA				Statistic	***21.433***	***7.2471***			
						p-value	***[0.005] *****	***[0.007] *****			
M2	REER	NFA	TOT	BS		Statistic	**49.739**	19.179	8.5688	2.2557	
						p-value	**[0.031] ***	[0.491]	[0.414]	[0.133]	
M3	REER	NFA	TOT	BS-PIB		Statistic	**50.91**	17.84	7.69	1.54	
						p-value	**[0.023] ***	[0.587]	[0.507]	[0.215]	
M4	REER	TB	TOT	TOT	BS	Statistic	***81.8***	**47.342**	19.864	9.718	1.2628
						p-value	***[0.003] *****	**[0.054]**	[0.443]	[0.309]	[0.261]
M5	REER	TB	NFA	TOT	BS-PIB	Statistic	**90.12**	**44.679**	19.45	7.9422	0.95682
						p-value	**[0.000] ****	**[0.095]**	[0.472]	[0.479]	[0.328]
						Trace Statistic - Restricted constant					
							r=0	r=1	r=2	r=3	r=4
M6	TB	NFA				Statistic	**21.48**	7.2928			
						p-value	**[0.032] ***	[0.114]			
M7	REER	NFA	TOT	BS		Statistic	**58.26**	27.47	13.24	3.04	
						p-value	**[0.019] ***	[0.269]	[0.353]	[0.581]	
M8	REER	NFA	TOT	BS-PIB		Statistic	**58.24**	25.08	11.79	4.12	
						p-value	**[0.019] ***	[0.400]	{0.476]	[0.407]	
M9	REER	TB	TOT	TOT	BS	Statistic	***88.813***	**54.336**	26.097	13.851	4.6786
						p-value	***[0.004] *****	**[0.046] ***	[0.341]	[0.307]	[0.332]
M10	REER	TB	NFA	TOT	BS-PIB	Statistic	***98.017***	**52.223**	26.976	12.774	5.7855
						p-value	***[0.000] *****	**[0.071]**	[0.294]	[0.390]	[0.215]
						Trace Statistic - No constante					
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M11	TB	NFA				Statistic	**10.548**	0.32055			
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						p-value	**[0.023] ***	[0.587]	[0.507]	[0.215]	
M4	REER	TB	TOT	TOT	BS	Statistic	***81.8***	**47.342**	19.864	9.718	1.2628
						p-value	***[0.003] *****	**[0.054]**	[0.443]	[0.309]	[0.261]
M5	REER	TB	NFA	TOT	BS-PIB	Statistic	**90.12**	**44.679**	19.45	7.9422	0.95682
						p-value	**[0.000] ****	**[0.095]**	[0.472]	[0.479]	[0.328]

Trace Statistic - Restricted constant

							r=0	r=1	r=2	r=3	r=4
M6	TB	NFA				Statistic	**21.48**	7.2928			
						p-value	**[0.032] ***	[0.114]			
M7	REER	NFA	TOT	BS		Statistic	**58.26**	27.47	13.24	3.04	
						p-value	**[0.019] ***	[0.269]	[0.353]	[0.581]	
M8	REER	NFA	TOT	BS-PIB		Statistic	**58.24**	25.08	11.79	4.12	
						p-value	**[0.019] ***	[0.400]	{0.476]	[0.407]	
M9	REER	TB	TOT	TOT	BS	Statistic	***88.813***	**54.336**	26.097	13.851	4.6786
						p-value	***[0.004] *****	**[0.046] ***	[0.341]	[0.307]	[0.332]
M10	REER	TB	NFA	TOT	BS-PIB	Statistic	***98.017***	**52.223**	26.976	12.774	5.7855
						p-value	***[0.000] *****	**[0.071]**	[0.294]	[0.390]	[0.215]

Trace Statistic - No constante

							r=0	r=1	r=2	r=3	r=4
M11	TB	NFA				Statistic	**10.548**	0.32055			
						p-value	**[0.097]**	[0.643]			

Cointegration Test:

Endogenous Variables						Johansen Cointegration Test				
						Trace Statistic - Unrestricted constant				
						r=0	r=1	r=2	r=3	r=4
M1	TB	NFA			Statistic	***21.433***	***7.2471***			
					p-value	***[0.005] *****	***[0.007] *****			
M2	REER	NFA	TOT	BS	Statistic	**49.739**	19.179	8.5688	2.2557	
					p-value	**[0.031] ***	[0.491]	[0.414]	[0.133]	
M3	REER	NFA	TOT	BS-PIB	Statistic	**50.91**	17.84	7.69	1.54	
					p-value	**[0.023] ***	[0.587]	[0.507]	[0.215]	
M4	REER	TB	TOT	TOT	BS	Statistic	***81.8***	**47.342**	19.864	9.718	1.2628
						p-value	***[0.003] *****	**[0.054]**	[0.443]	[0.309]	[0.261]
M5	REER	TB	NFA	TOT	BS-PIB	Statistic	**90.12**	**44.679**	19.45	7.9422	0.95682
						p-value	**[0.000] ****	**[0.095]**	[0.472]	[0.479]	[0.328]
						Trace Statistic - Restricted constant				
						r=0	r=1	r=2	r=3	r=4
M6	TB	NFA			Statistic	**21.48**	7.2928			
					p-value	**[0.032] ***	[0.114]			
M7	REER	NFA	TOT	BS	Statistic	**58.26**	27.47	13.24	3.04	
					p-value	**[0.019] ***	[0.269]	[0.353]	[0.581]	
M8	REER	NFA	TOT	BS-PIB	Statistic	**58.24**	25.08	11.79	4.12	
					p-value	**[0.019] ***	[0.400]	{0.476]	[0.407]	
M9	REER	TB	TOT	TOT	BS	Statistic	***88.813***	**54.336**	26.097	13.851	4.6786
						p-value	***[0.004] *****	**[0.046] ***	[0.341]	[0.307]	[0.332]
M10	REER	TB	NFA	TOT	BS-PIB	Statistic	***98.017***	**52.223**	26.976	12.774	5.7855
						p-value	***[0.000] *****	**[0.071]**	[0.294]	[0.390]	[0.215]
						Trace Statistic - No constante				
						r=0	r=1	r=2	r=3	r=4
M11	TB	NFA			Statistic	**10.548**	0.32055			
					p-value	**[0.097]**	[0.643]			

Cointegration Test:

Endogenous Variables						Johansen Cointegration Test					
						Trace Statistic - Unrestricted constant					
							r=0	r=1	r=2	r=3	r=4
M1	TB	NFA				Statistic	***21.433***	***7.2471***			
						p-value	***[0.005] *****	***[0.007] *****			
M2	REER	NFA	TOT	BS		Statistic	**49.739**	19.179	8.5688	2.2557	
						p-value	**[0.031] ***	[0.491]	[0.414]	[0.133]	
M3	REER	NFA	TOT	BS-PIB		Statistic	**50.91**	17.84	7.69	1.54	
						p-value	**[0.023] ***	[0.587]	[0.507]	[0.215]	
M4	REER	TB	TOT	TOT	BS	Statistic	***81.8***	**47.342**	19.864	9.718	1.2628
						p-value	***[0.003] *****	**[0.054]**	[0.443]	[0.309]	[0.261]
M5	REER	TB	NFA	TOT	BS-PIB	Statistic	**90.12**	**44.679**	19.45	7.9422	0.95682
						p-value	**[0.000] ****	**[0.095]**	[0.472]	[0.479]	[0.328]
						Trace Statistic - Restricted constant					
							r=0	r=1	r=2	r=3	r=4
M6	TB	NFA				Statistic	**21.48**	7.2928			
						p-value	**[0.032] ***	[0.114]			
M7	REER	NFA	TOT	BS		Statistic	**58.26**	27.47	13.24	3.04	
						p-value	**[0.019] ***	[0.269]	[0.353]	[0.581]	
M8	REER	NFA	TOT	BS-PIB		Statistic	**58.24**	25.08	11.79	4.12	
						p-value	**[0.019] ***	[0.400]	{0.476]	[0.407]	
M9	REER	TB	TOT	TOT	BS	Statistic	***88.813***	**54.336**	26.097	13.851	4.6786
						p-value	***[0.004] *****	**[0.046] ***	[0.341]	[0.307]	[0.332]
M10	REER	TB	NFA	TOT	BS-PIB	Statistic	***98.017***	**52.223**	26.976	12.774	5.7855
						p-value	***[0.000] *****	**[0.071]**	[0.294]	[0.390]	[0.215]
						Trace Statistic - No constante					
							r=0	r=1	r=2	r=3	r=4
M11	TB	NFA				Statistic	**10.548**	0.32055			
						p-value	**[0.097]**	[0.643]			

FGV EESP CENTRO DE ESTUDOS EM MACROECONOMIA APLICADA

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WTO CHAIRS PROGRAMME

VECM: Long Run coefficients.

VECM																		
Endogenous Variables	**Model 7**			**Model 8**			**Model 9**						**Model 10**					
Loading Matrix																		
	Coef.	SD*	t	Coef.	SD*	t	Coef.	SD*	t	Coef.	SD	t	Coef.	SD	t	Coef.	SD	t
REER	- 0.7	0.2	-3.24	- 0.8	0.2	-4.30	- 0.8	0.2	- 5.0	0.0	0.0	4.1	-0.70	0.01	-64.9	0.01	0.01	0.8
TB							3.3	2.4	1.4	- 0.5	0.1	- 3.8	-4.14	-0.52	7.9	-0.52	0.19	- 2.8
NFA	0.1	0.1	1.24	0.1	0.1	1.62	0.1	0.1	1.5	0.0	0.0	1.1	-0.05	0.01	- 3.6	0.01	0.01	2.1
BS	- 0.1	0.1	-0.49				0.1	0.1	0.9	- 0.0	0.0	- 2.6						
BS-PIB				- 0.0	0.0	-0.72							-0.03	0.00	- 9.4	0.00	0.00	1.2
TOT	0.2	0.1	1.74	0.1	0.1	1.16	0.1	0.1	0.8	0.0	0.0	2.8	0.30	0.02	12.6	0.02	0.01	3.6
Cointegrated Relationships																		
REER	1.0			1.0			1.0			0.0	0.0		1.00			0.00		
TB							0.0			1.0	0.0		0.00			1.00		
NFA	-0.5	0.3	-1.81	-1.1	0.2	-4.93	-0.9	0.2	-3.59	2.9	1.5	1.95	-0.48	0.19	-2.55	2.09	1.467	1.43
BS	0.5	0.1	4.651				0.5	0.1	4.87	0.0	0.0							
BS-PIB				-0.8	0.2	-3.85							-0.85	0.15	-5.70	0.00		
TOT	-1.2	0.2	-6.64	-1.0	0.2	-6.39	-1.4	0.2	-7.98	0.0	0.0		-0.96	0.13	-7.44	0.00		
Constant	-1.0	0.6	-1.62	3.7	1.6	2.368	-0.3	0.6	-0.52	0.0	0.0		4.01	1.21	3.31	0.00		

SD - Standard Deviation

VECM: Long Run coefficients.

VECM																		
Endogenous Variables	**Model 7**			**Model 8**			**Model 9**						**Model 10**					
Loading Matrix																		
	Coef.	SD*	t	Coef.	SD*	t	Coef.	SD*	t	Coef.	SD	t	Coef.	SD	t	Coef.	SD	t
REER	- 0.7	0.2	-3.24	- 0.8	0.2	-4.30	- 0.8	0.2	- 5.0	0.0	0.0	4.1	-0.70	0.01	-64.9	0.01	0.01	0.8
TB							3.3	2.4	1.4	- 0.5	0.1	- 3.8	-4.14	-0.52	7.9	-0.52	0.19	- 2.8
NFA	0.1	0.1	1.24	0.1	0.1	1.62	0.1	0.1	1.5	0.0	0.0	1.1	-0.05	0.01	- 3.6	0.01	0.01	2.1
BS	- 0.1	0.1	-0.49				0.1	0.1	0.9	- 0.0	0.0	- 2.6						
BS-PIB				- 0.0	0.0	-0.72							-0.03	0.00	- 9.4	0.00	0.00	1.2
TOT	0.2	0.1	1.74	0.1	0.1	1.16	0.1	0.1	0.8	0.0	0.0	2.8	0.30	0.02	12.6	0.02	0.01	3.6
Cointegrated Relationship																		
REER	1.0			1.0			1.0			0.0	0.0		1.00			0.00		
TB							0.0			1.0	0.0		0.00			1.00		
NFA	-0.5	0.3	-1.81	-1.1	0.2	-4.93	-0.9	0.2	-3.59	2.9	1.5	1.95	-0.48	0.19	-2.55	2.09	1.467	1.43
BS	0.5	0.1	4.651				0.5	0.1	4.87	0.0	0.0							
BS-PIB				-0.8	0.2	-3.85							-0.85	0.15	-5.70	0.00		
TOT	-1.2	0.2	-6.64	-1.0	0.2	-6.39	-1.4	0.2	-7.98	0.0	0.0		-0.96	0.13	-7.44	0.00		
Constant	-1.0	0.6	-1.62	3.7	1.6	2.368	-0.3	0.6	-0.52	0.0	0.0		4.01	1.21	3.31	0.00		

SD - Standard Deviation

VECM: Long Run coefficients.

VECM																		
Endogenous Variables	**Model 7**			**Model 8**			**Model 9**						**Model 10**					
Loading Matrix																		
	Coef.	SD*	t	Coef.	SD*	t	Coef.	SD*	t	Coef.	SD	t	Coef.	SD	t	Coef.	SD	t
REER	- 0.7	0.2	-3.24	- 0.8	0.2	-4.30	- 0.8	0.2	- 5.0	0.0	0.0	4.1	-0.70	0.01	-64.9	0.01	0.01	0.8
TB							3.3	2.4	1.4	- 0.5	0.1	- 3.8	-4.14	-0.52	7.9	-0.52	0.19	- 2.8
NFA	0.1	0.1	1.24	0.1	0.1	1.62	0.1	0.1	1.5	0.0	0.0	1.1	-0.05	0.01	- 3.6	0.01	0.01	2.1
BS	- 0.1	0.1	-0.49				0.1	0.1	0.9	- 0.0	0.0	- 2.6						
BS-PIB				- 0.0	0.0	-0.72							-0.03	0.00	- 9.4	0.00	0.00	1.2
TOT	0.2	0.1	1.74	0.1	0.1	1.16	0.1	0.1	0.8	0.0	0.0	2.8	0.30	0.02	12.6	0.02	0.01	3.6
Cointegrated Relationships																		
REER	1.0			1.0			1.0			0.0	0.0		1.00			0.00		
TB							0.0			1.0	0.0		0.00			1.00		
NFA	-0.5	0.3	-1.81	-1.1	0.2	-4.93	-0.9	0.2	-3.59	2.9	1.5	1.95	-0.48	0.19	-2.55	2.09	1.467	1.43
BS	0.5	0.1	4.651				0.5	0.1	4.87	0.0	0.0							
BS-PIB				-0.8	0.2	-3.85							-0.85	0.15	-5.70	0.00		
TOT	-1.2	0.2	-6.64	-1.0	0.2	-6.39	-1.4	0.2	-7.98	0.0	0.0		-0.96	0.13	-7.44	0.00		
Constant	-1.0	0.6	-1.62	3.7	1.6	2.368	-0.3	0.6	-0.52	0.0	0.0		4.01	1.21	3.31	0.00		

SD - Standard Deviation

VECM: Long Run coefficients.

VECM																		
Endogenous Variables	**Model 7**			**Model 8**			**Model 9**						**Model 10**					
Loading Matrix																		
	Coef.	SD*	t	Coef.	SD*	t	Coef.	SD*	t	Coef.	SD	t	Coef.	SD	t	Coef.	SD	t
REER	- 0.7	0.2	-3.24	- 0.8	0.2	-4.30	- 0.8	0.2	- 5.0	0.0	0.0	4.1	-0.70	0.01	-64.9	0.01	0.01	0.8
TB							3.3	2.4	1.4	- 0.5	0.1	- 3.8	-4.14	-0.52	7.9	-0.52	0.19	- 2.8
NFA	0.1	0.1	1.24	0.1	0.1	1.62	0.1	0.1	1.5	0.0	0.0	1.1	-0.05	0.01	- 3.6	0.01	0.01	2.1
BS	- 0.1	0.1	-0.49				0.1	0.1	0.9	- 0.0	0.0	- 2.6						
BS-PIB				- 0.0	0.0	-0.72							-0.03	0.00	- 9.4	0.00	0.00	1.2
TOT	0.2	0.1	1.74	0.1	0.1	1.16	0.1	0.1	0.8	0.0	0.0	2.8	0.30	0.02	12.6	0.02	0.01	3.6
Cointegrated Relationships																		
REER	1.0			1.0			1.0			0.0	0.0		1.00			0.00		
TB							0.0			1.0	0.0		0.00			1.00		
NFA	-0.5	0.3	-1.81	-1.1	0.2	-4.93	-0.9	0.2	-3.59	2.9	1.5	1.95	-0.48	0.19	-2.55	2.09	1.467	1.43
BS	0.5	0.1	4.651				0.5	0.1	4.87	0.0	0.0							
BS-PIB				-0.8	0.2	-3.85							-0.85	0.15	-5.70	0.00		
TOT	-1.2	0.2	-6.64	-1.0	0.2	-6.39	-1.4	0.2	-7.98	0.0	0.0		-0.96	0.13	-7.44	0.00		
Constant	-1.0	0.6	-1.62	3.7	1.6	2.368	-0.3	0.6	-0.52	0.0	0.0		4.01	1.21	3.31	0.00		

SD - Standard Deviation

Decomposing exchange rate misalignment:

Imposing these restrictions , it is possible to decompose misalignment into two pieces:

$$mis_{i,t}^{VECM_2} = T_{i,t}^{ECM_{2,1}} + T_{i,t}^{EMC_{2,2}} \quad (3)$$

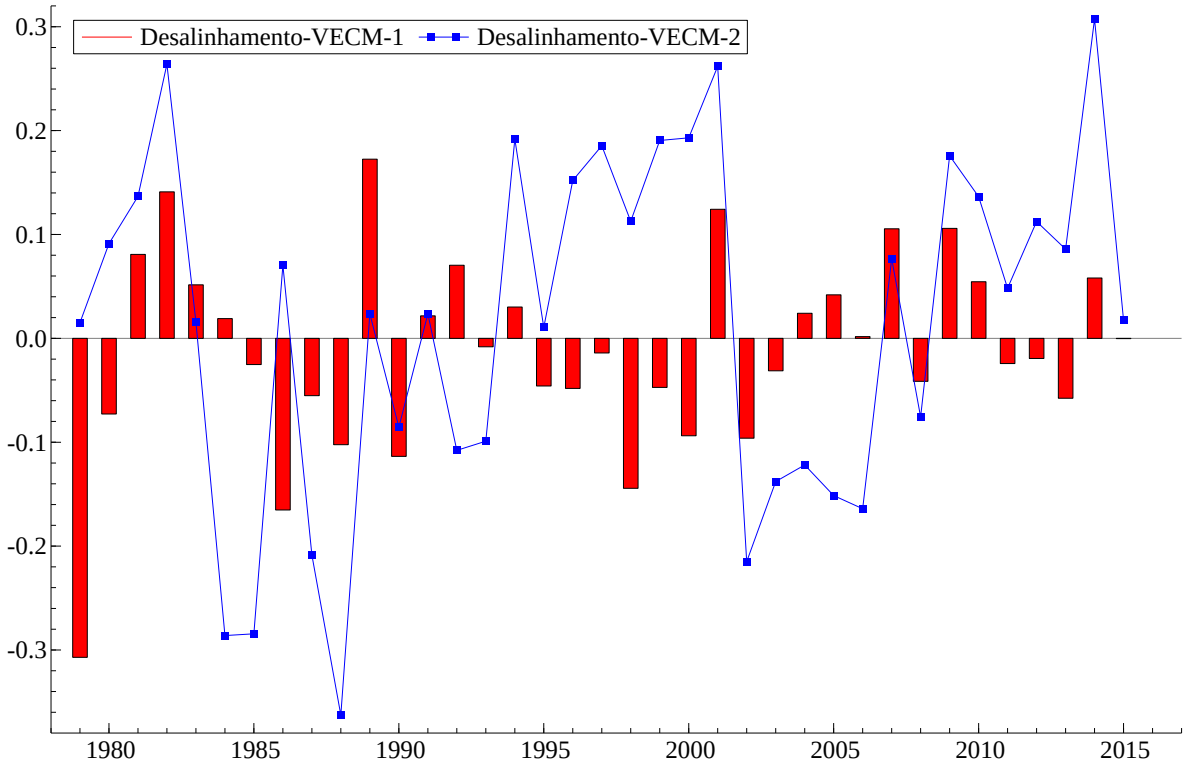
By calculating $mis_{i,t}^{VECM_2} - mis_{i,t}^{VECM_1}$ it is possible to obtain:

$$mis_{i,t}^{VECM_2} - mis_{i,t}^{VECM_1} = (\frac{h_{2,1}}{h_{1,1}} - 1)h_{1,1}f_{1,1,t} + \left(\frac{h_{2,1}}{h_{1,1}}\right)(h_{1,1}f_{2,1t} - h_{1,1}f_{1,1t}) + h_{2,2}f_{2,1t} \quad (4)$$

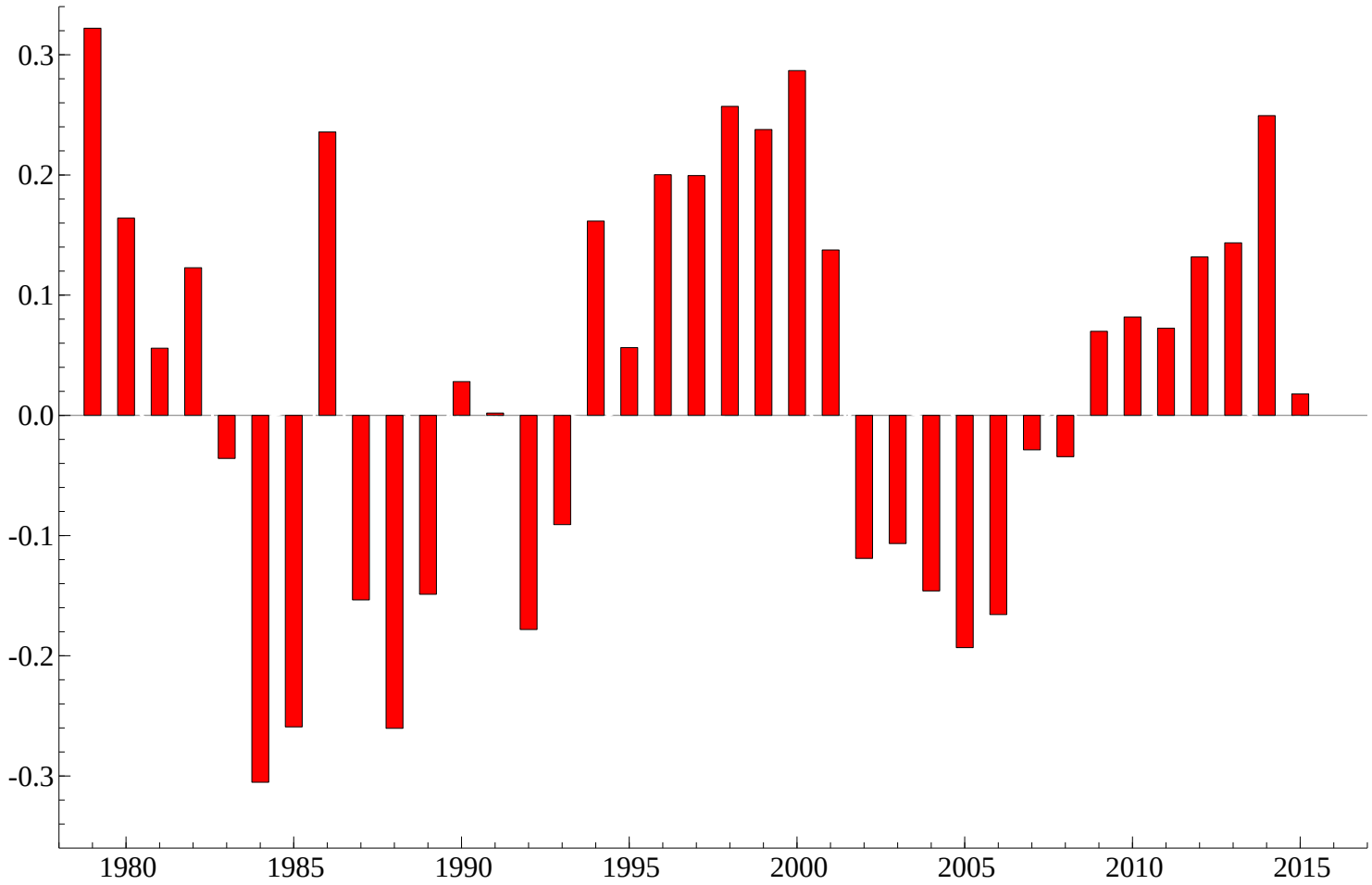
where $h_{2,i}$ and $h_{1,i}$ are the weights, in $VECM_2$ and $VECM_1$ respectively, of the domestic vectors on misalignment, and $f_{2,i}$ and $f_{1,i}$ are the estimated cointegrated vectors.

What factors can explain the difference?

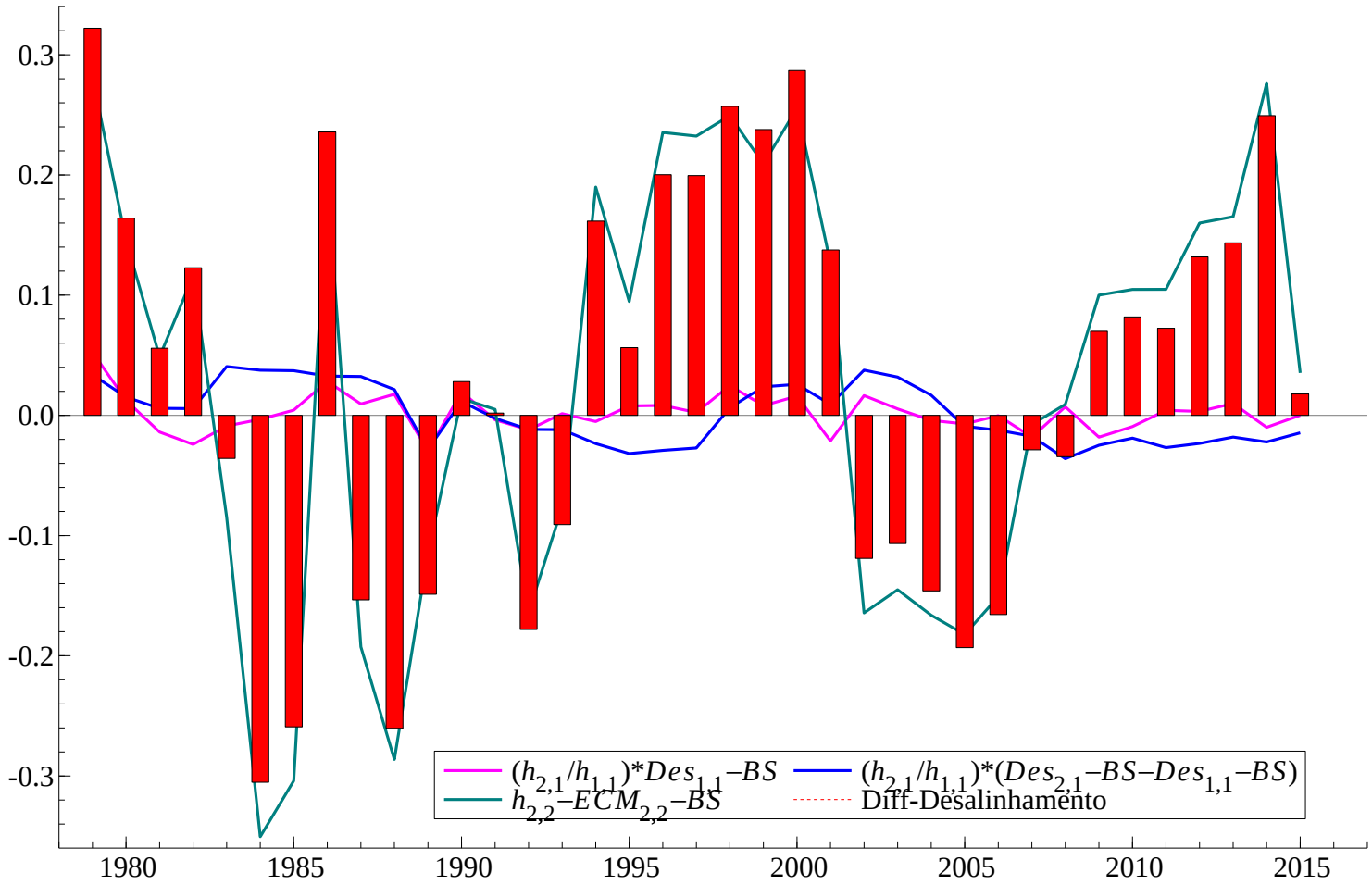
- VECM-1: NFA, TOT, BS
- VECM-2: TB, NFA, TOT, BS;



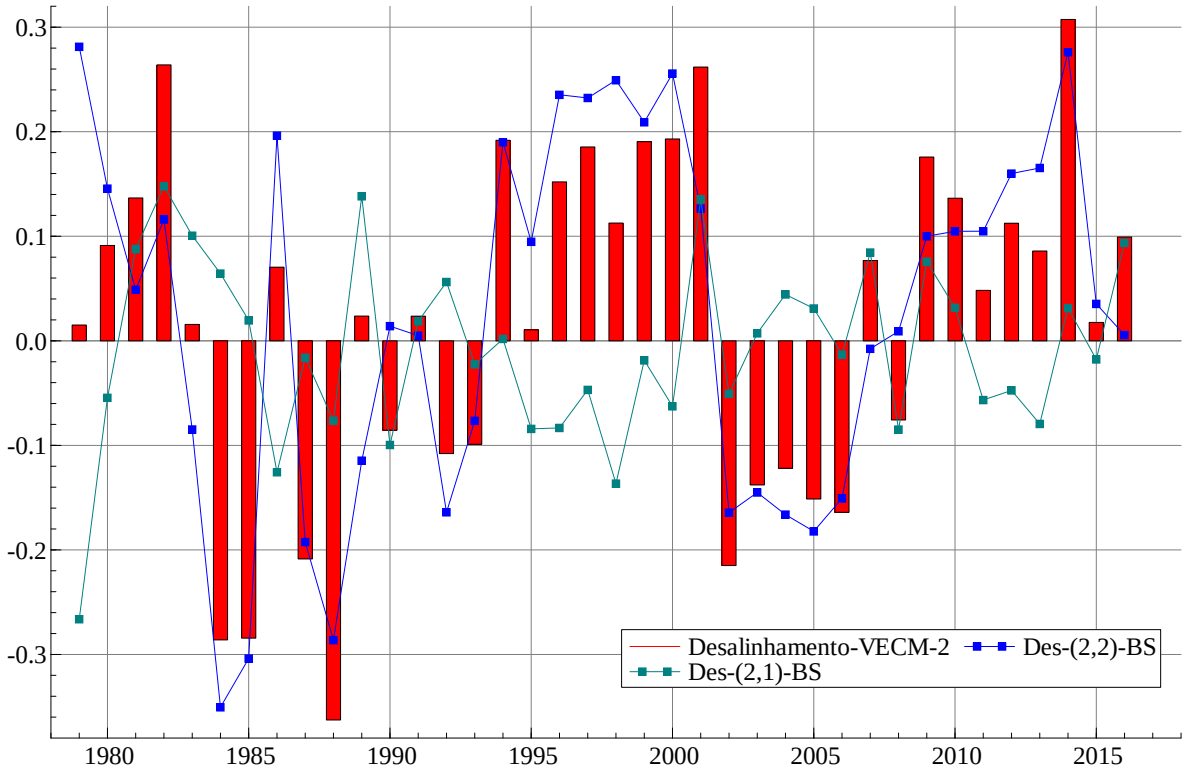
Changes in Estimated Exchange Rate Misalignment:



Changes in Estimated Exchange Rate Misalignment:

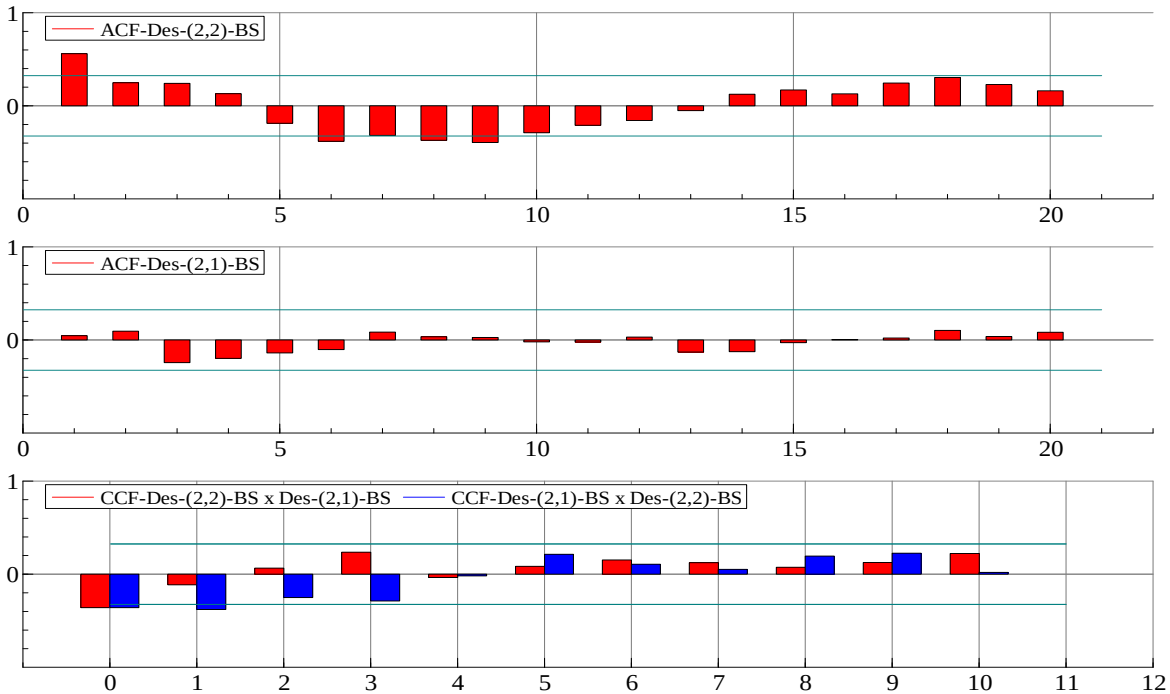


Exchange rate misalignment and its components:

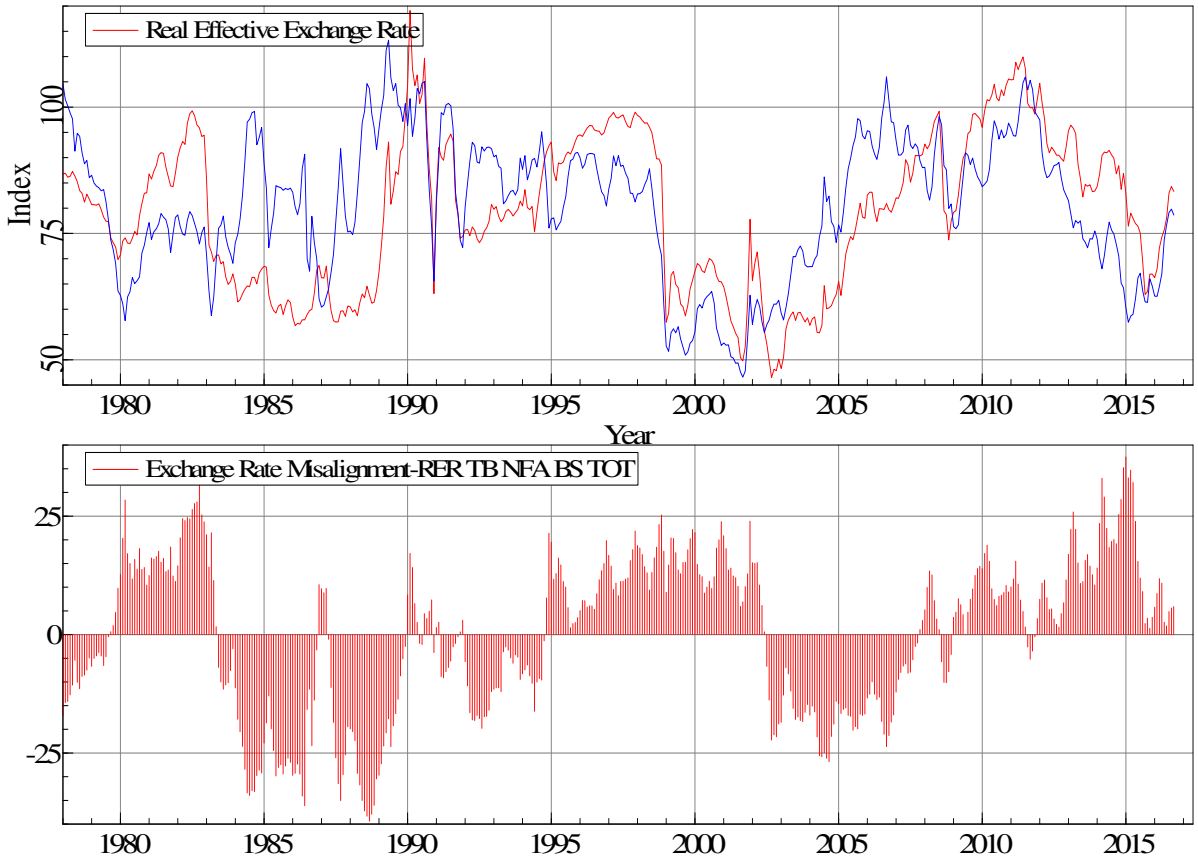


Time Series Properties of Exchange Rate Misalignment:

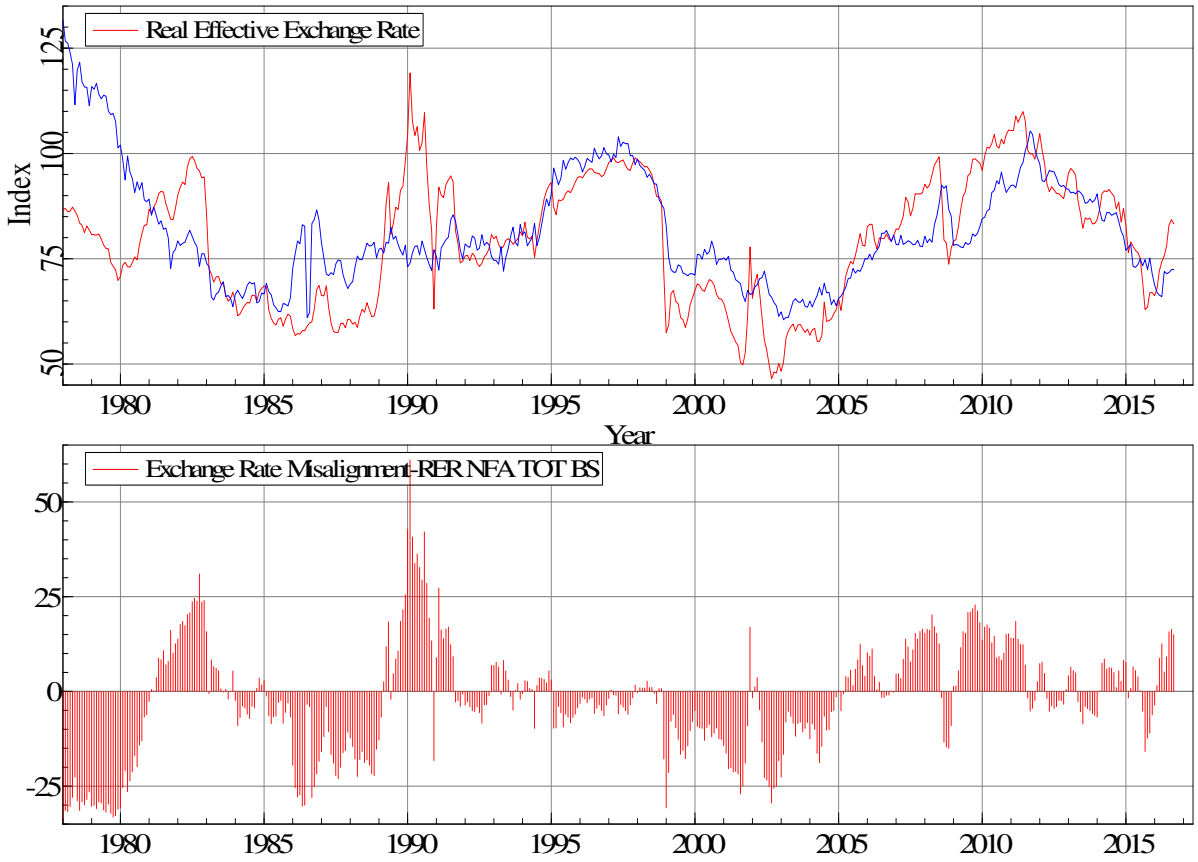
- No time correlation in the first ECM;
- Positive autocorrelation in the second ECM;



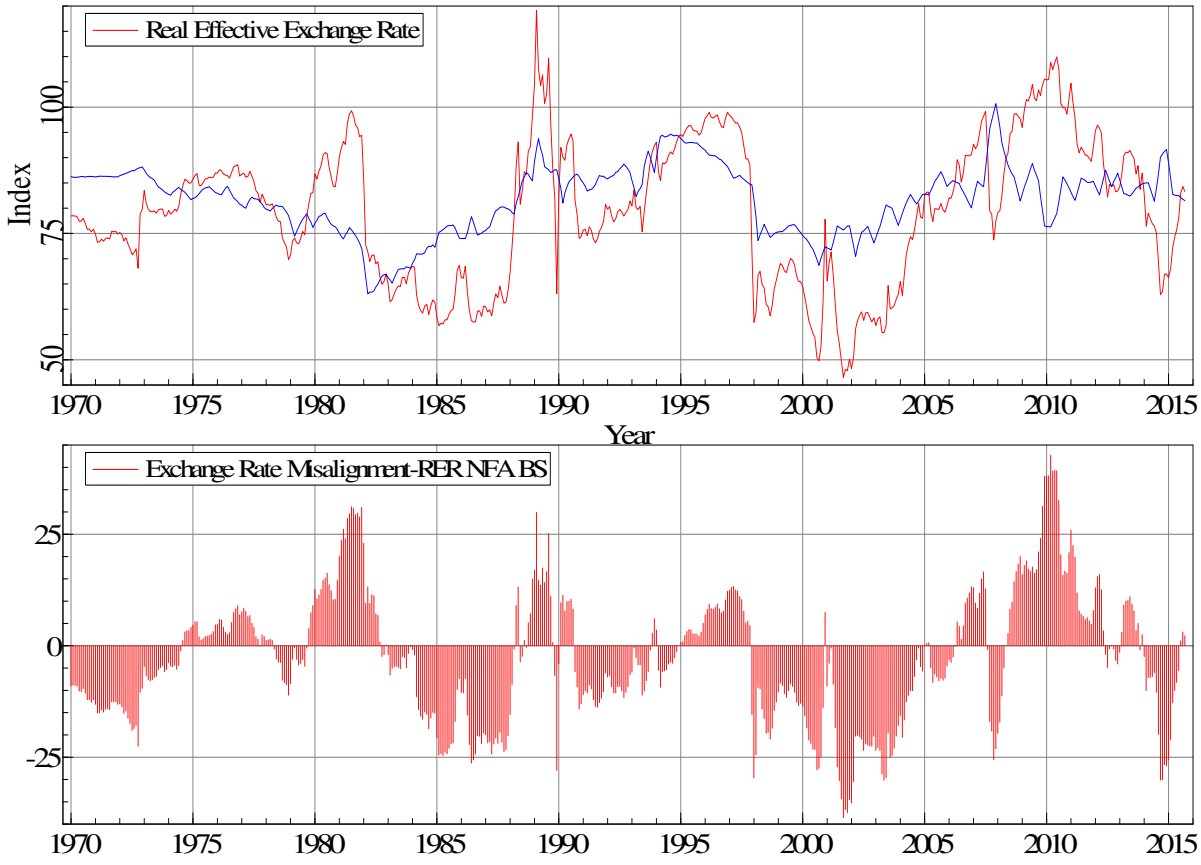
Model 1:


Real Effective Exchange Rate
Index
100
75
50
1980
1985
1990
1995
2000
2005
2010
2015
Year
Exchange Rate Misalignment-RER TB NFA BS TOT
25
0
-25
1980
1985
1990
1995
2000
2005
2010
2015

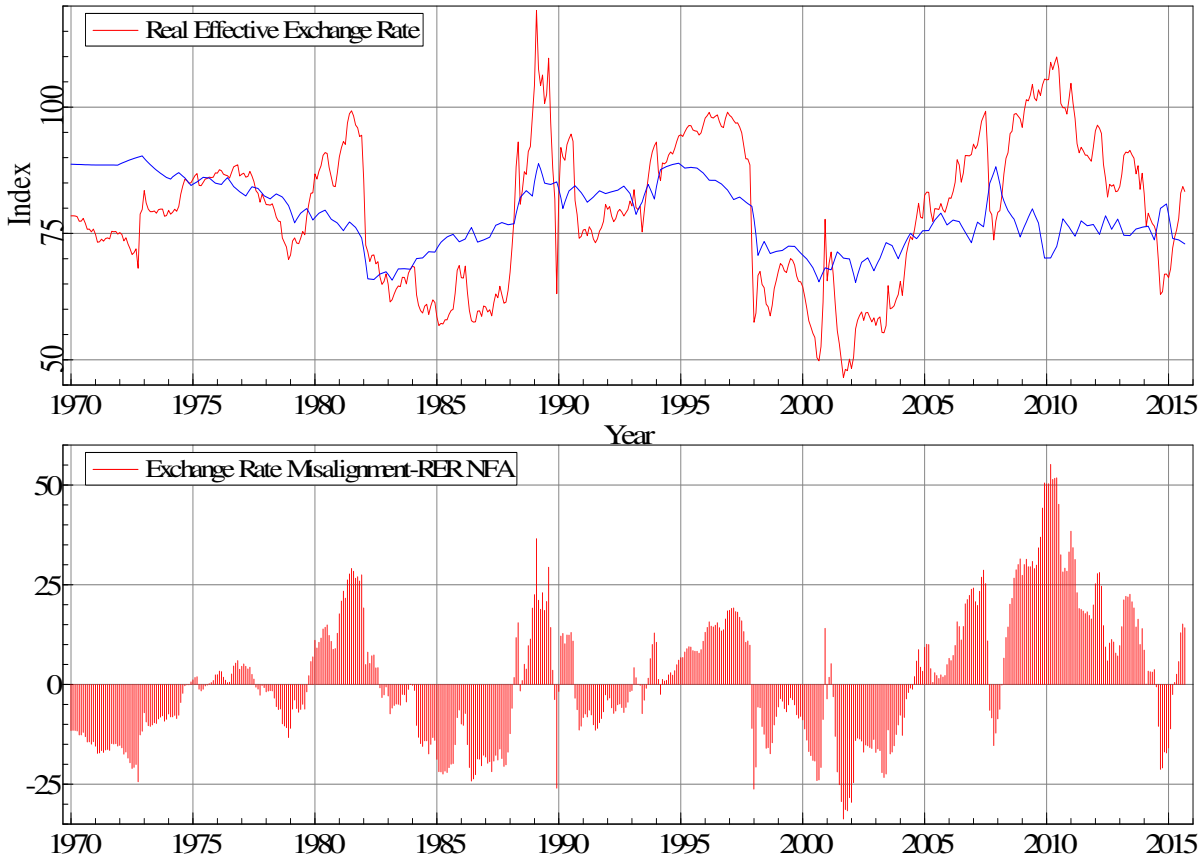
Model 2:


Real Effective Exchange Rate
Index
125
100
75
50
1980
1985
1990
1995
2000
2005
2010
2015
Year
Exchange Rate Misalignment-RER NFA TOT BS
50
25
0
-25
1980
1985
1990
1995
2000
2005
2010
2015

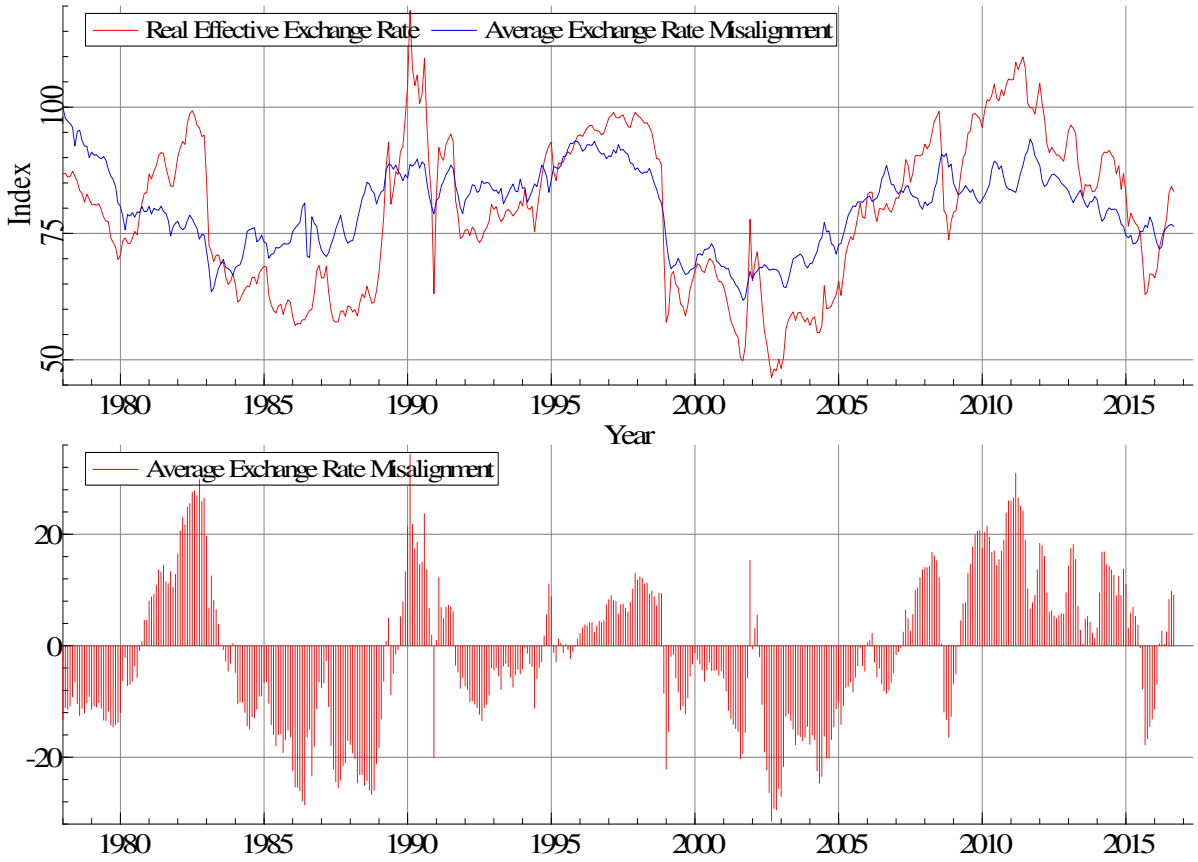
Model 3:


Real Effective Exchange Rate
Index
100
75
50
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year
Exchange Rate Misalignment-RER NFA BS
25
0
-25
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

Model 4:

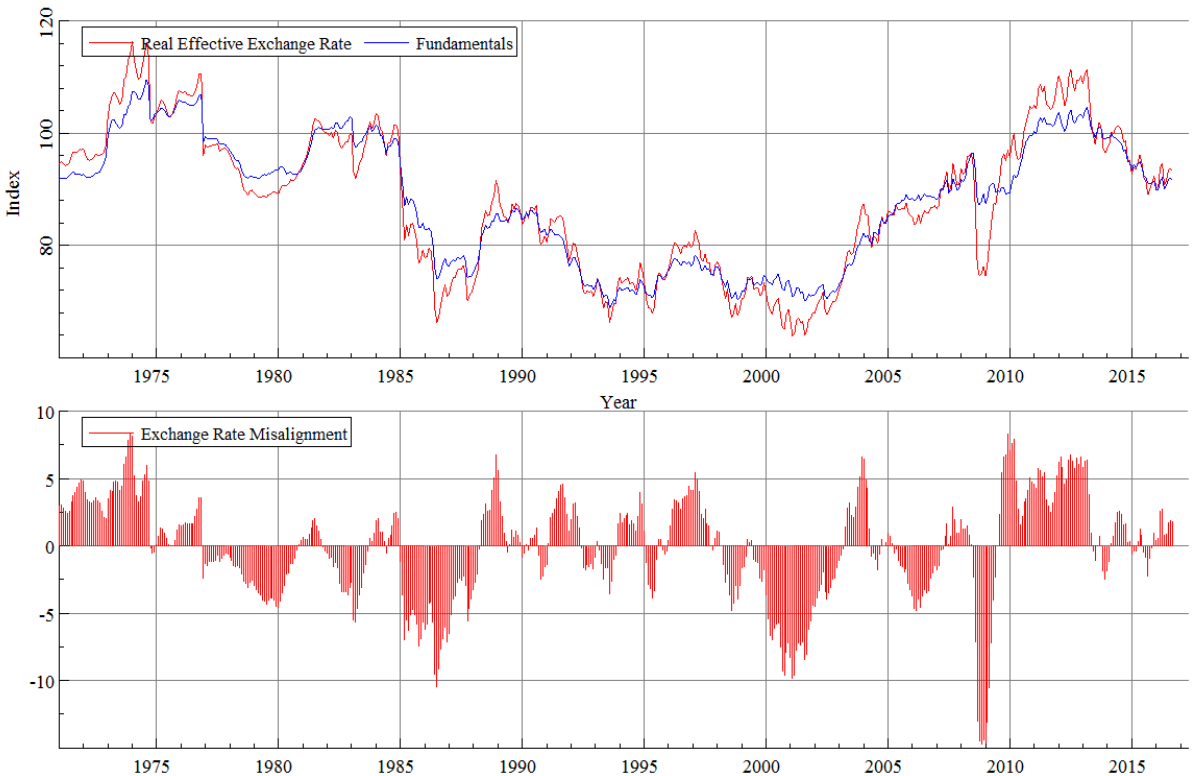

Real Effective Exchange Rate
Index
100
75
50
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year
Exchange Rate Misalignment-RER NFA
50
25
0
-25
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

Average of the Models:



Countries Analyzed in Observatory:

Australia



Countries Analyzed in Observatory:

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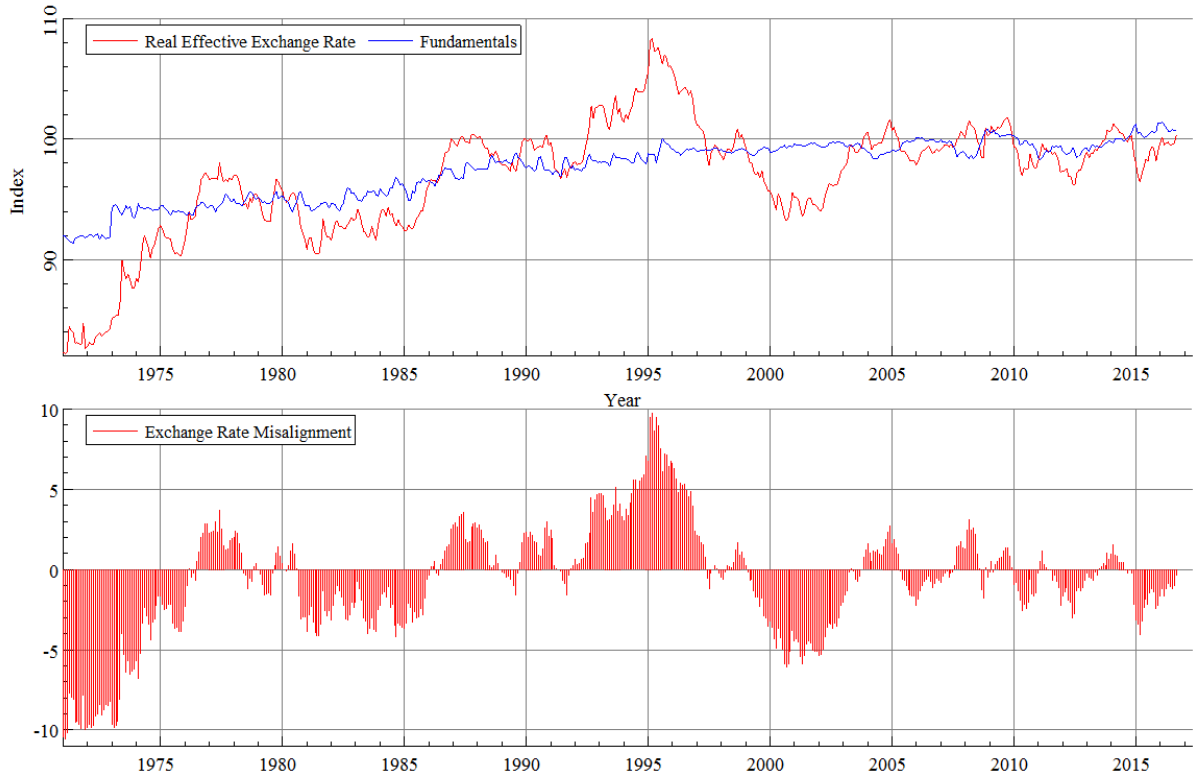
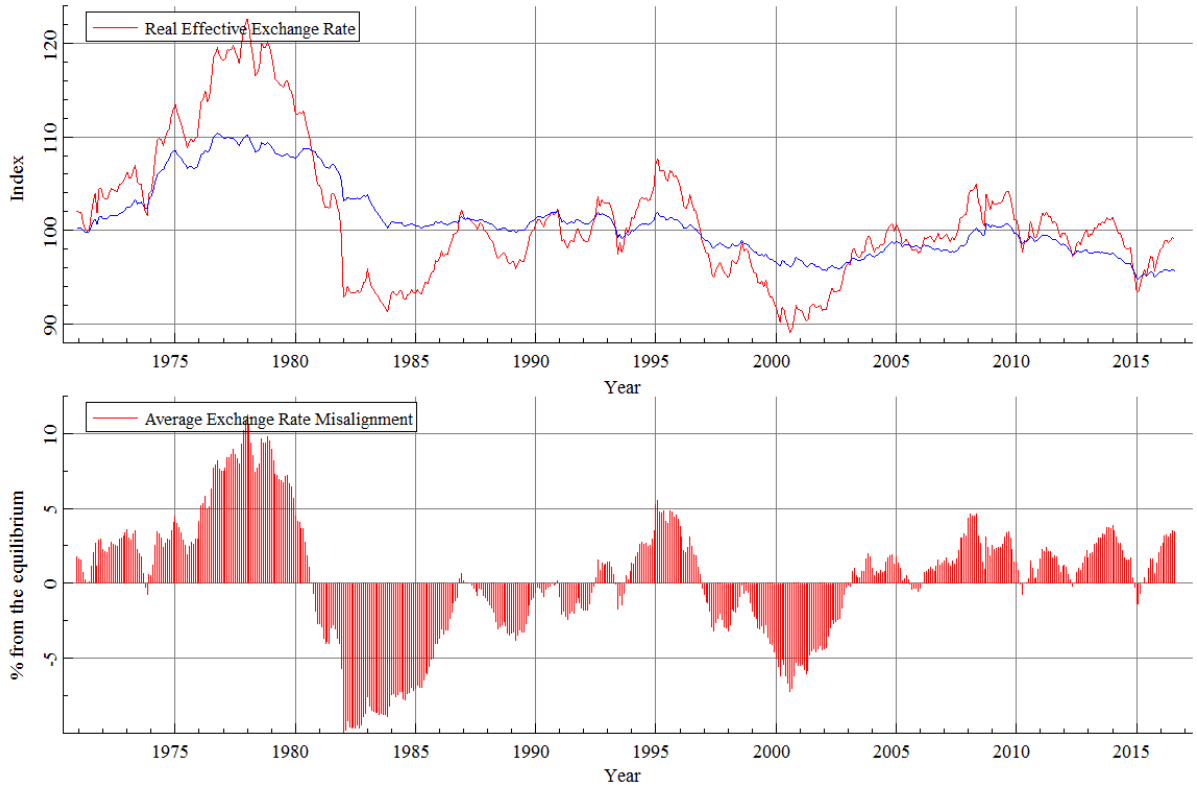


Countries Analyzed in Observatory:

Belgium



Countries Analyzed in Observatory:

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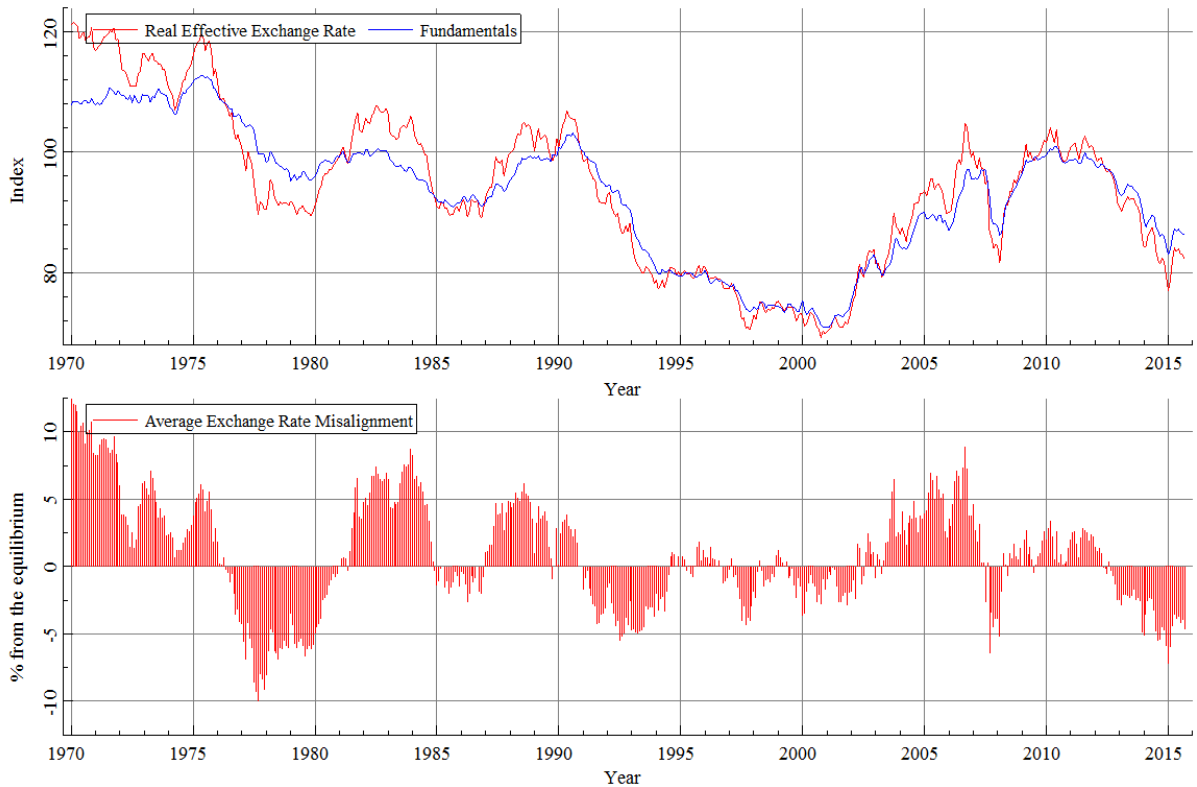
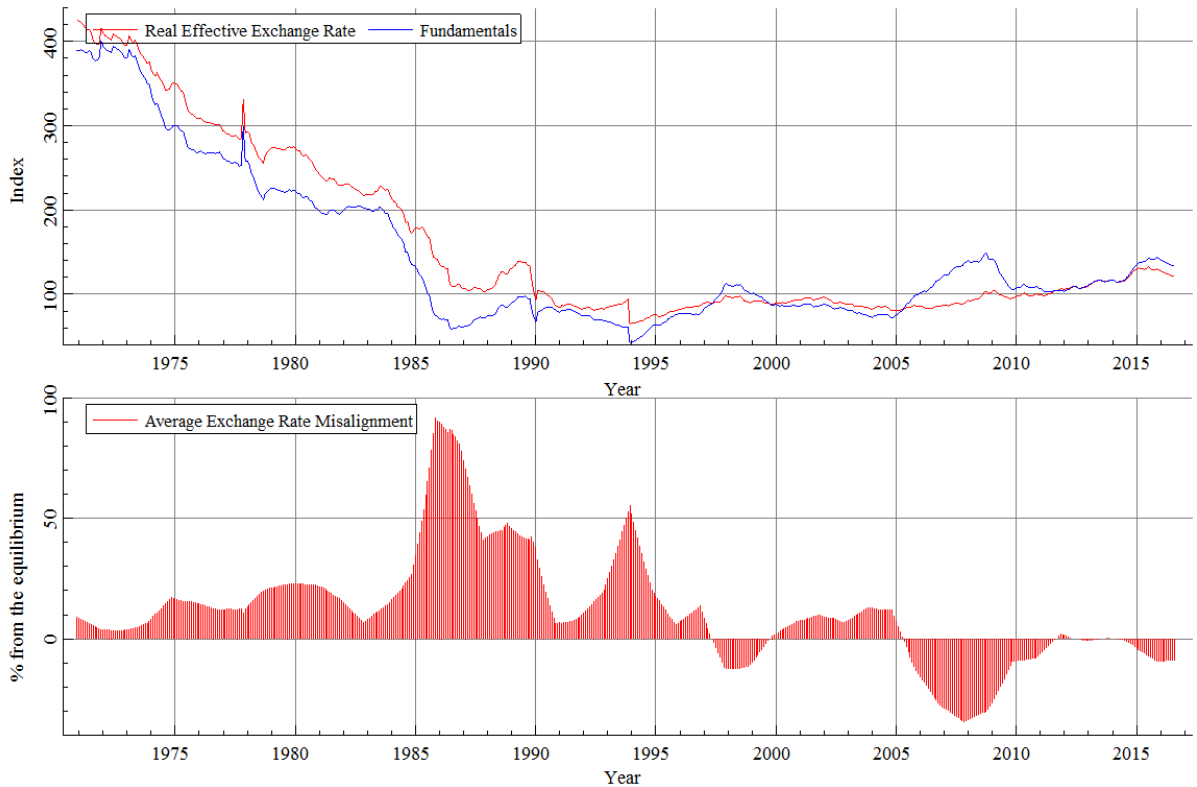


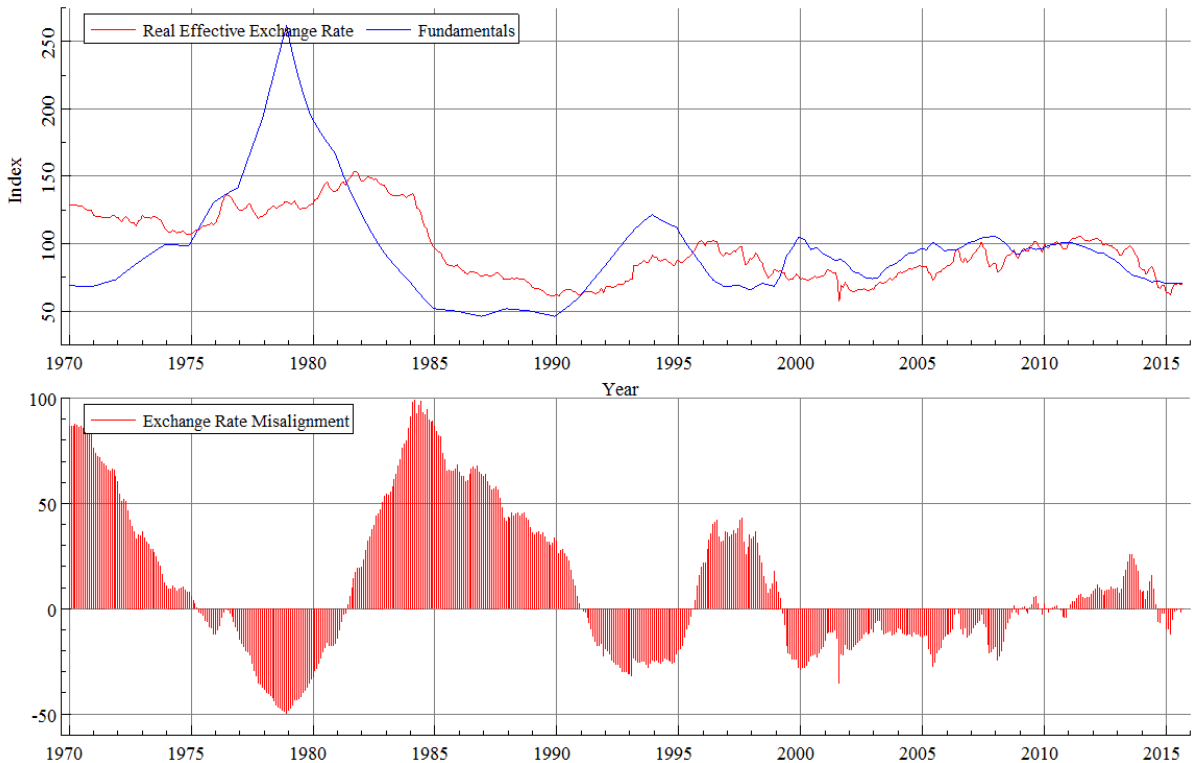
Countries Analyzed in Observatory:

China



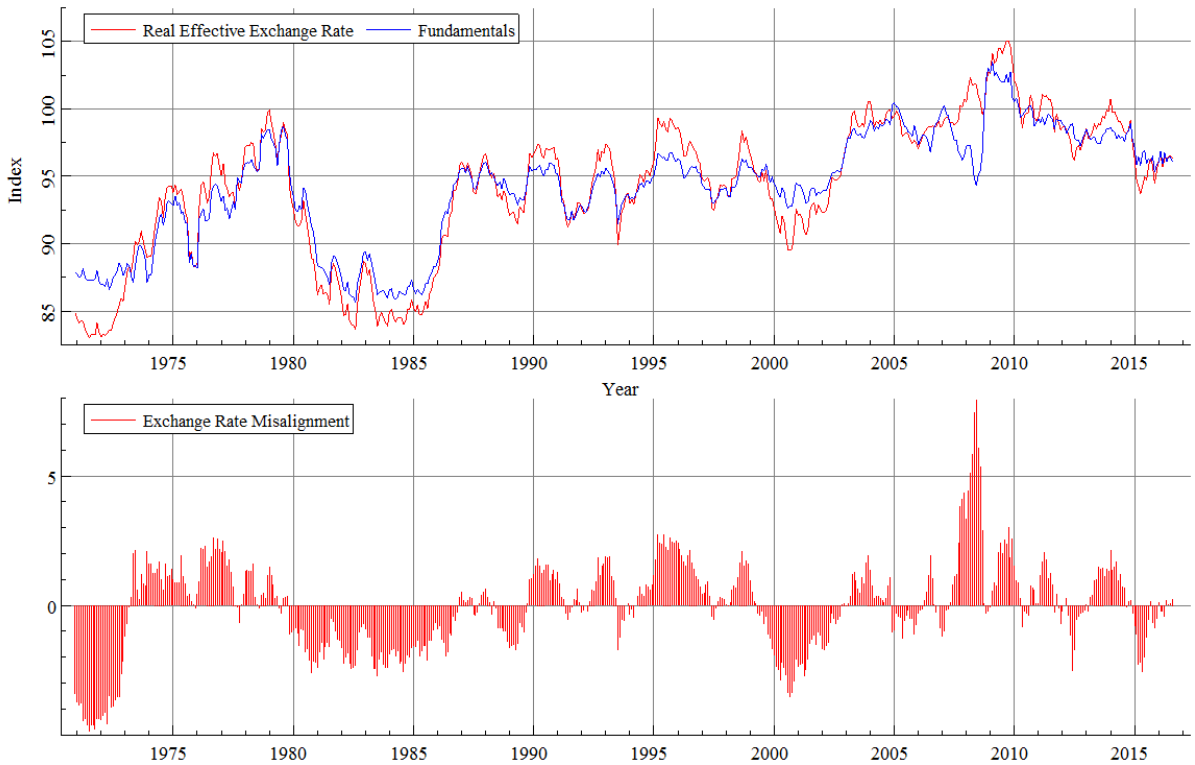
Countries Analyzed in Observatory:

Colombia



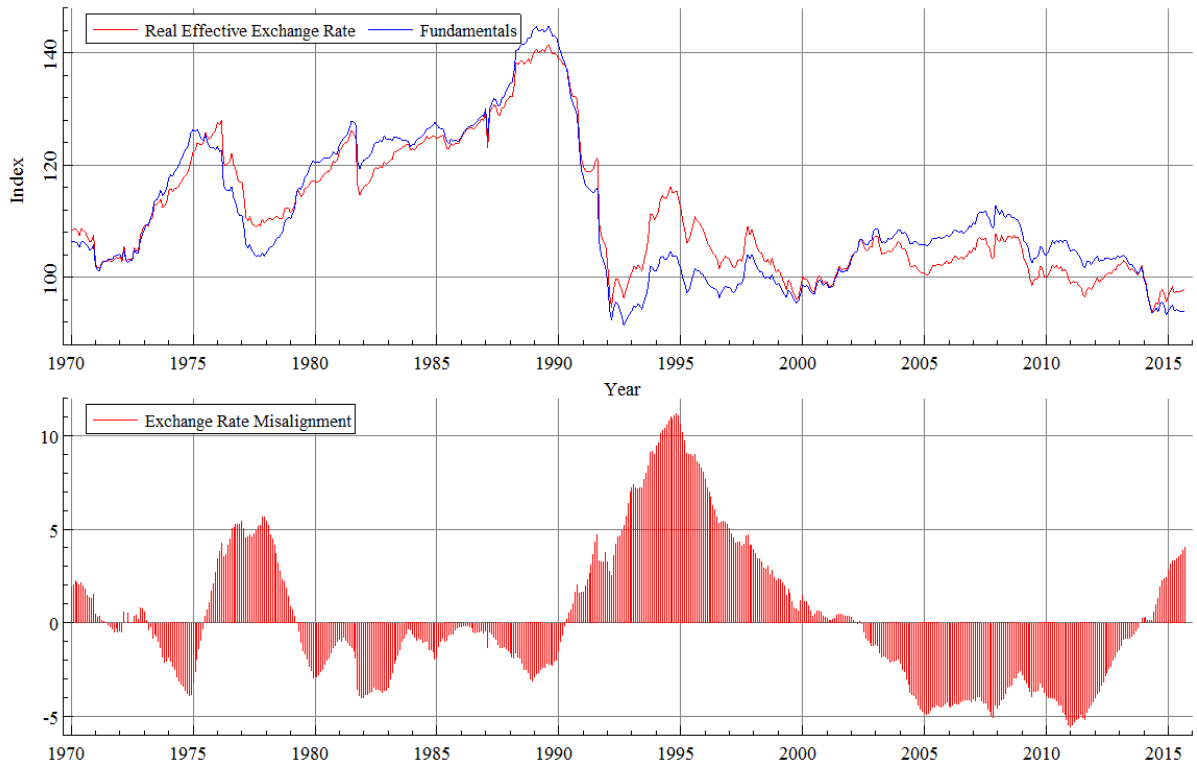
Countries Analyzed in Observatory:

Denmark



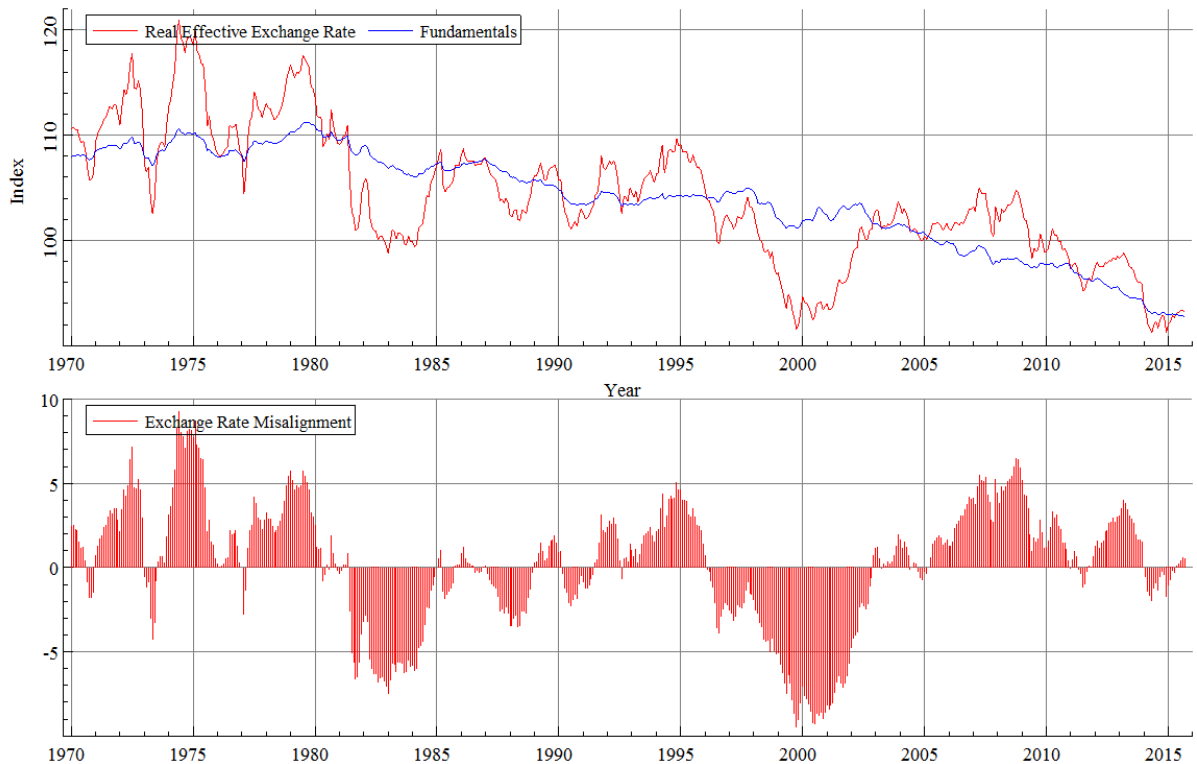
Countries Analyzed in Observatory:

Finland



Countries Analyzed in Observatory:

France



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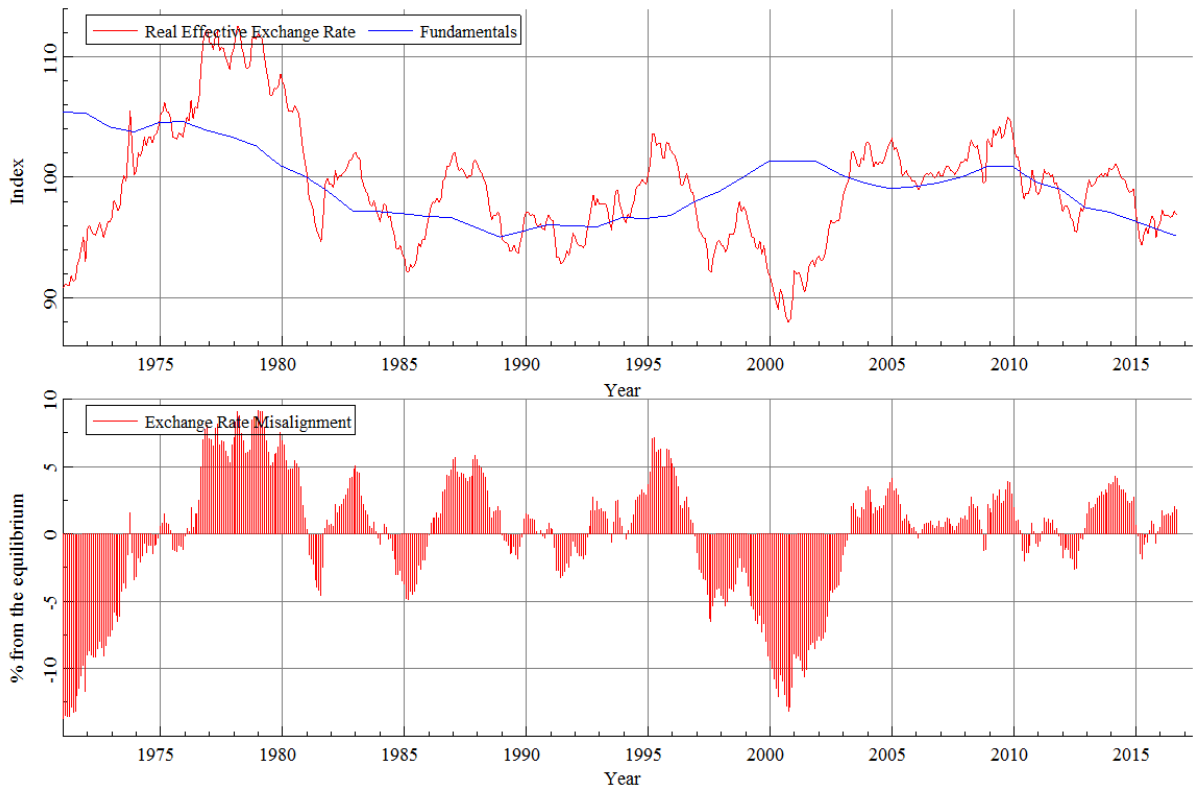
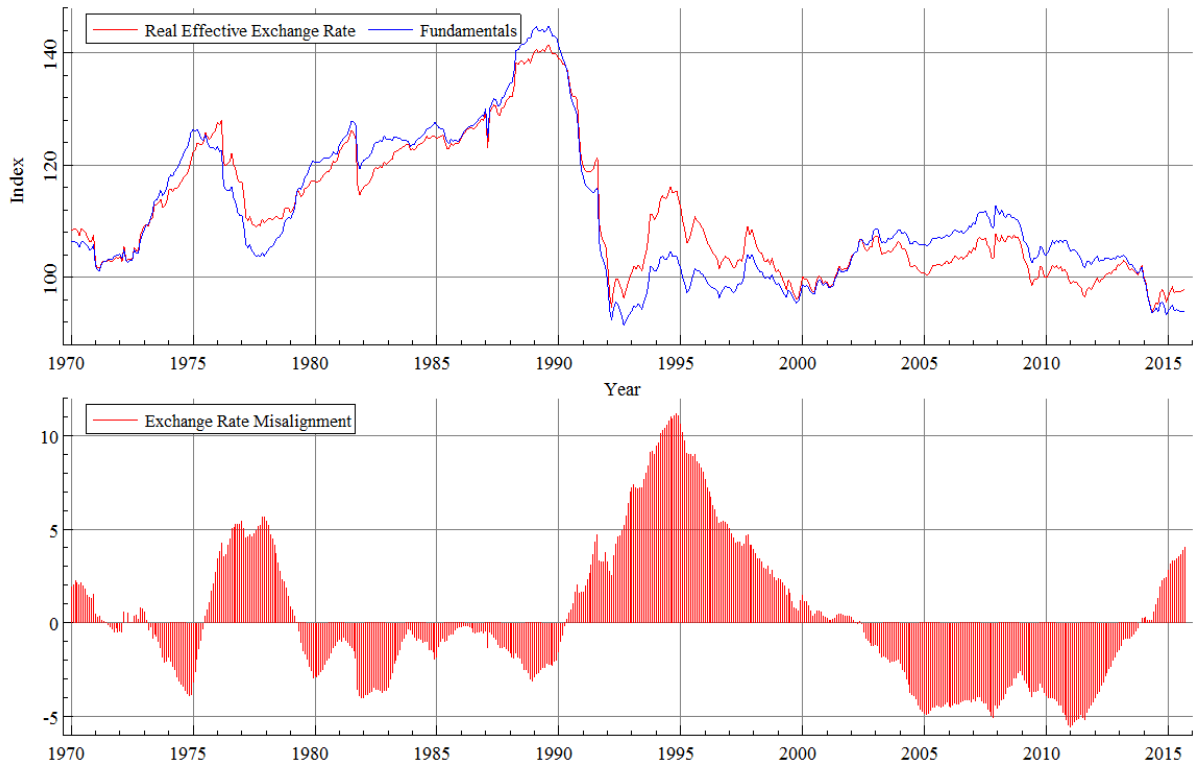


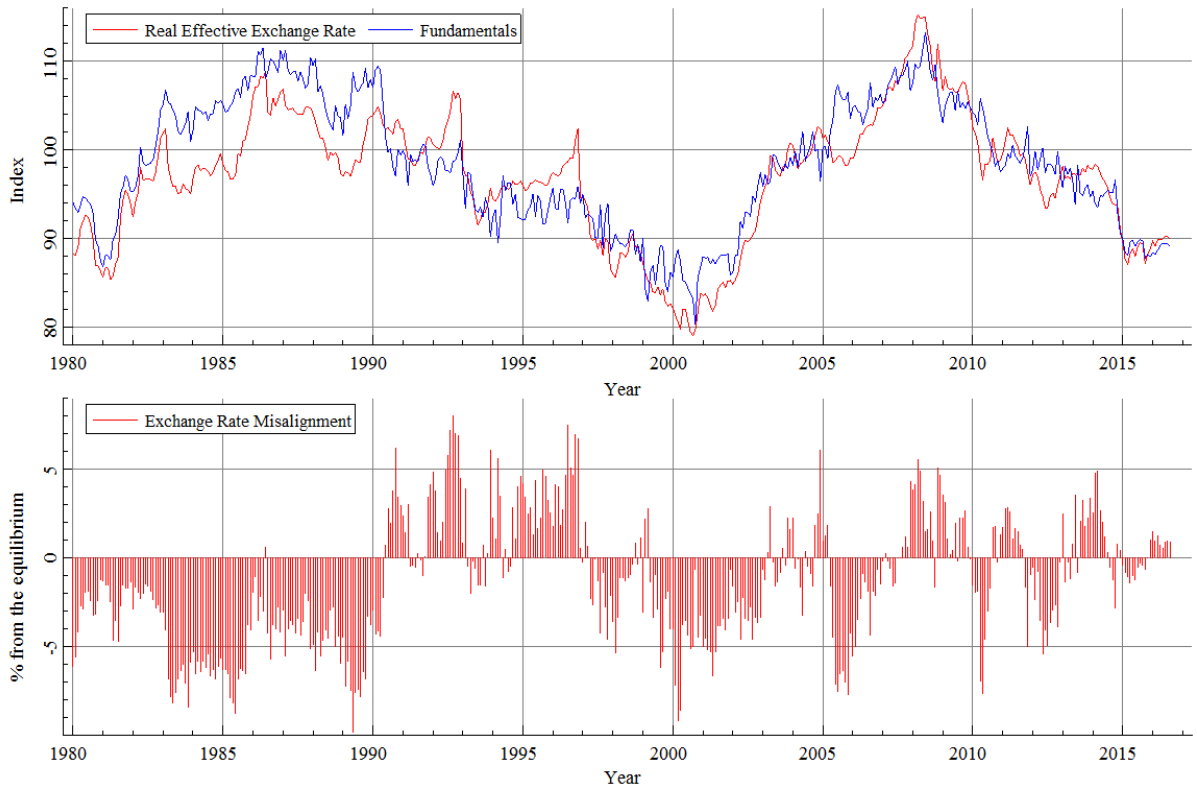
Countries Analyzed in Observatory:

Netherlands



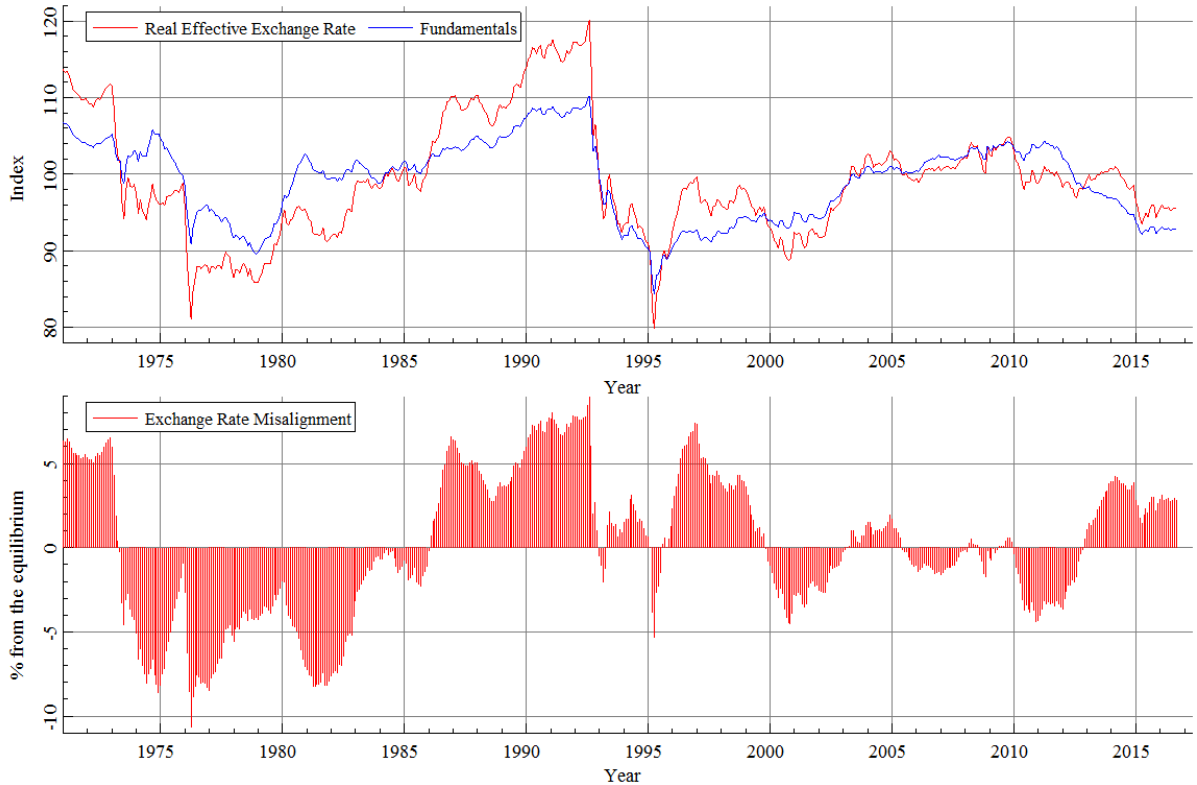
Countries Analyzed in Observatory:

Ireland



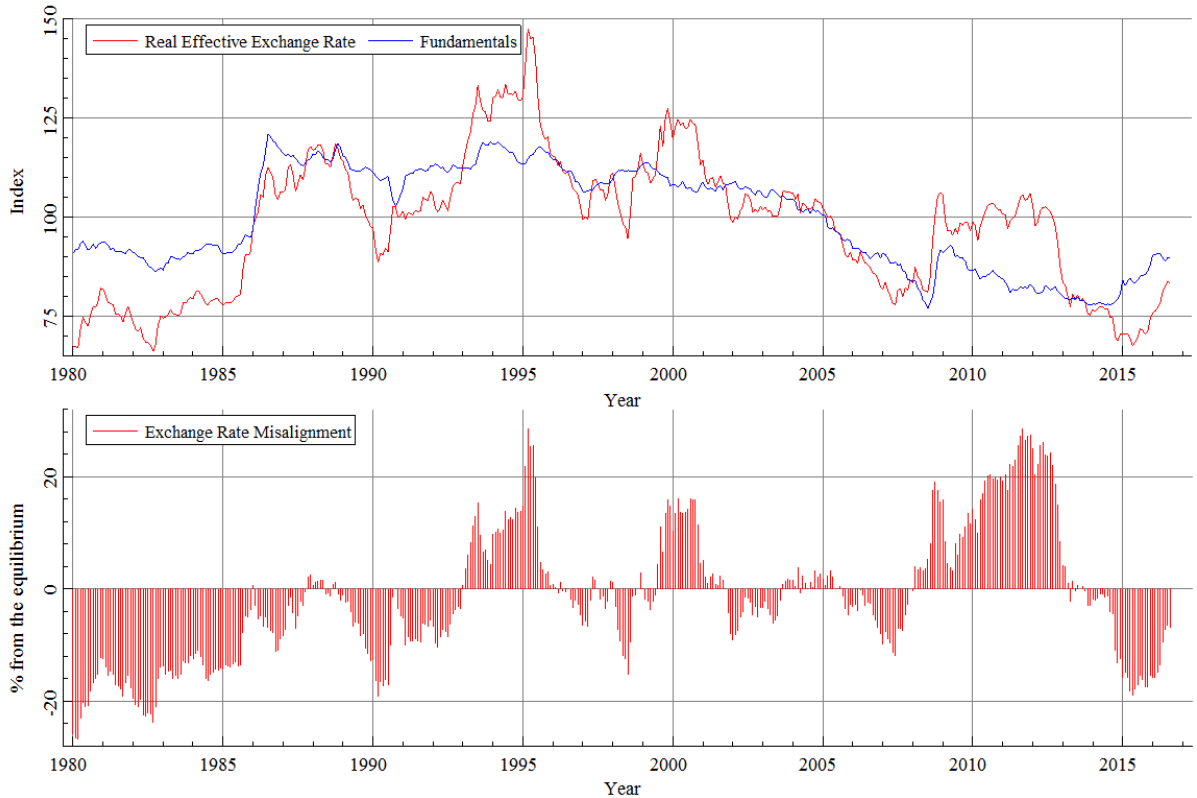
Countries Analyzed in Observatory:

Italy



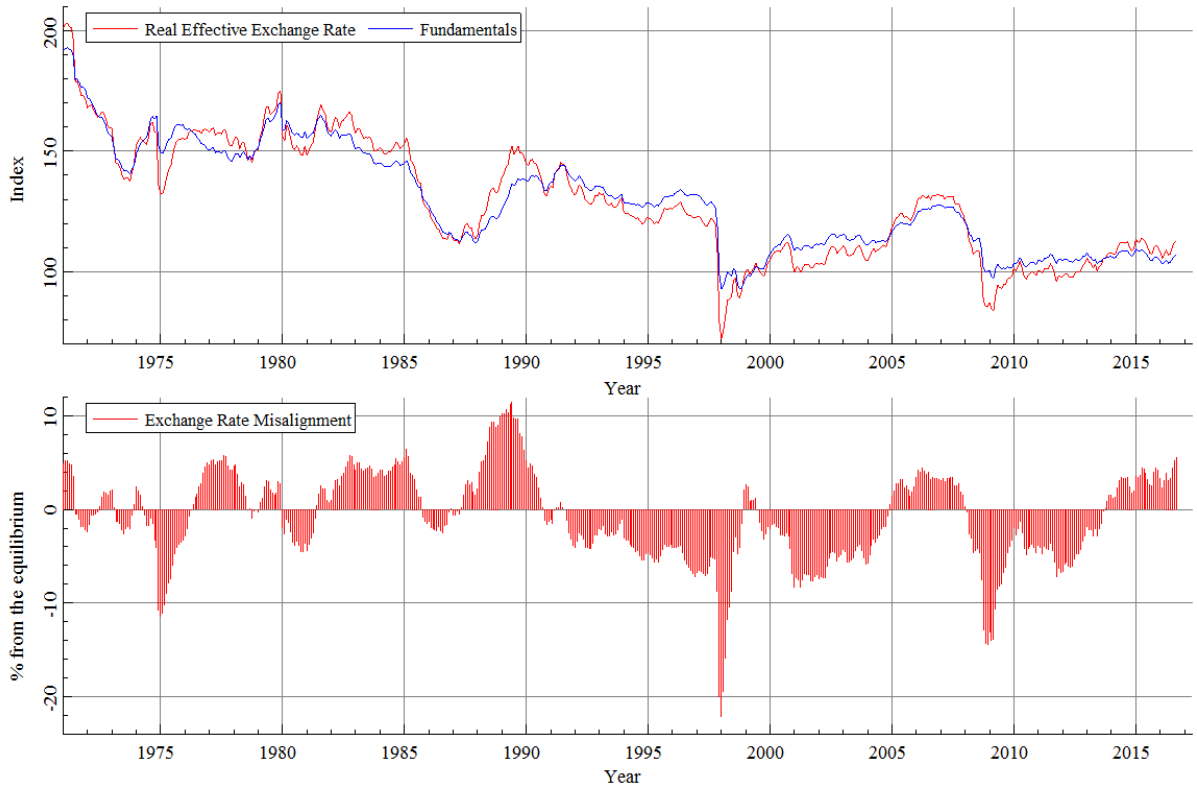
Countries Analyzed in Observatory:

Japan



Countries Analyzed in Observatory:

Korea



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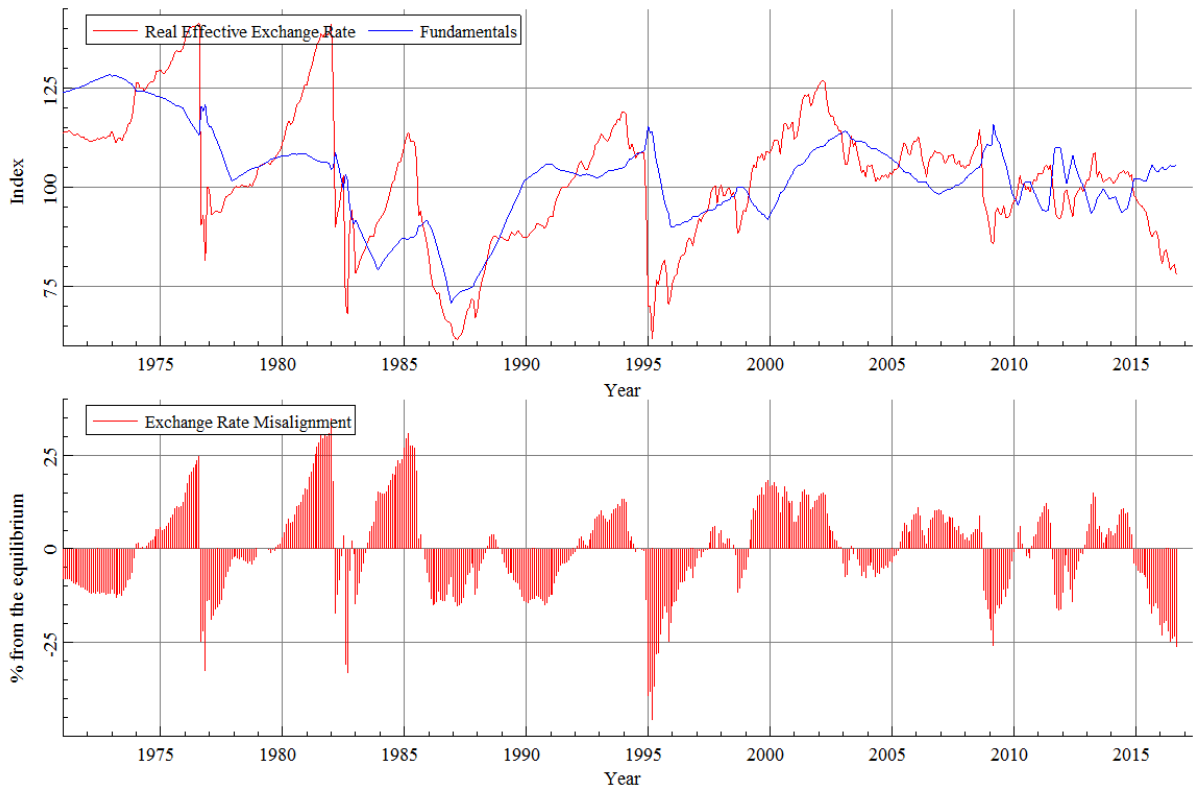
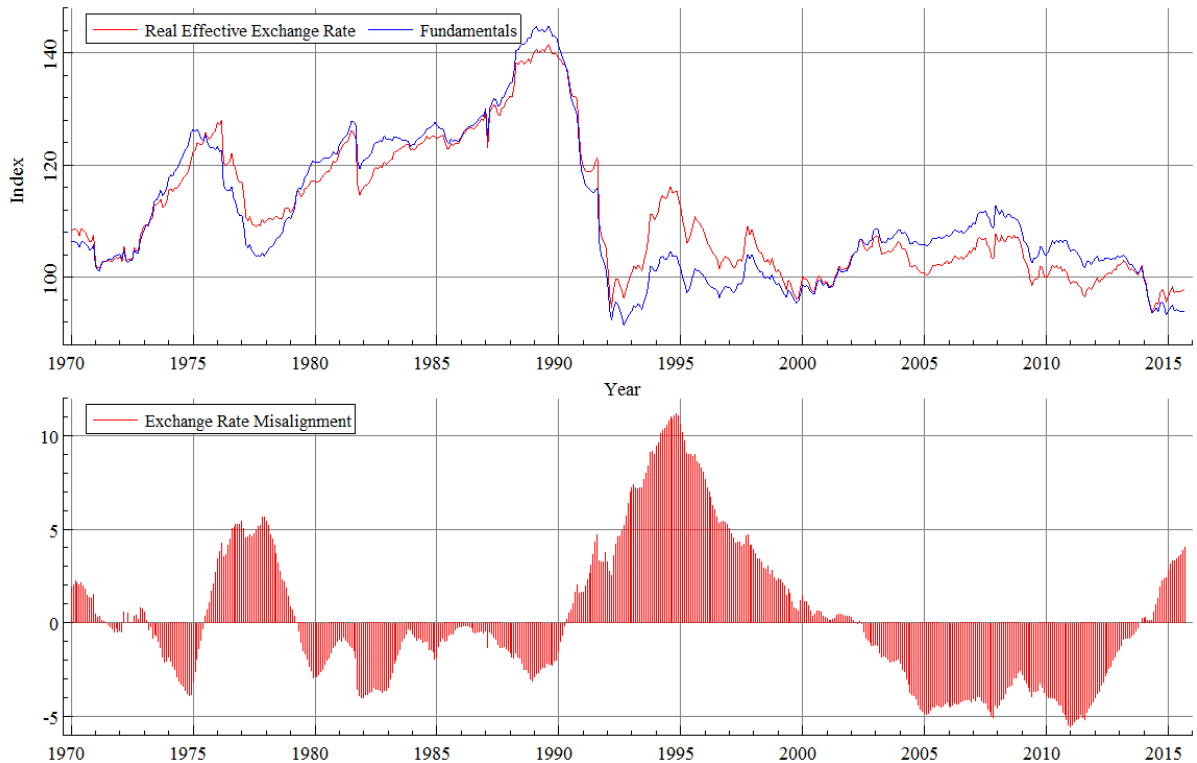


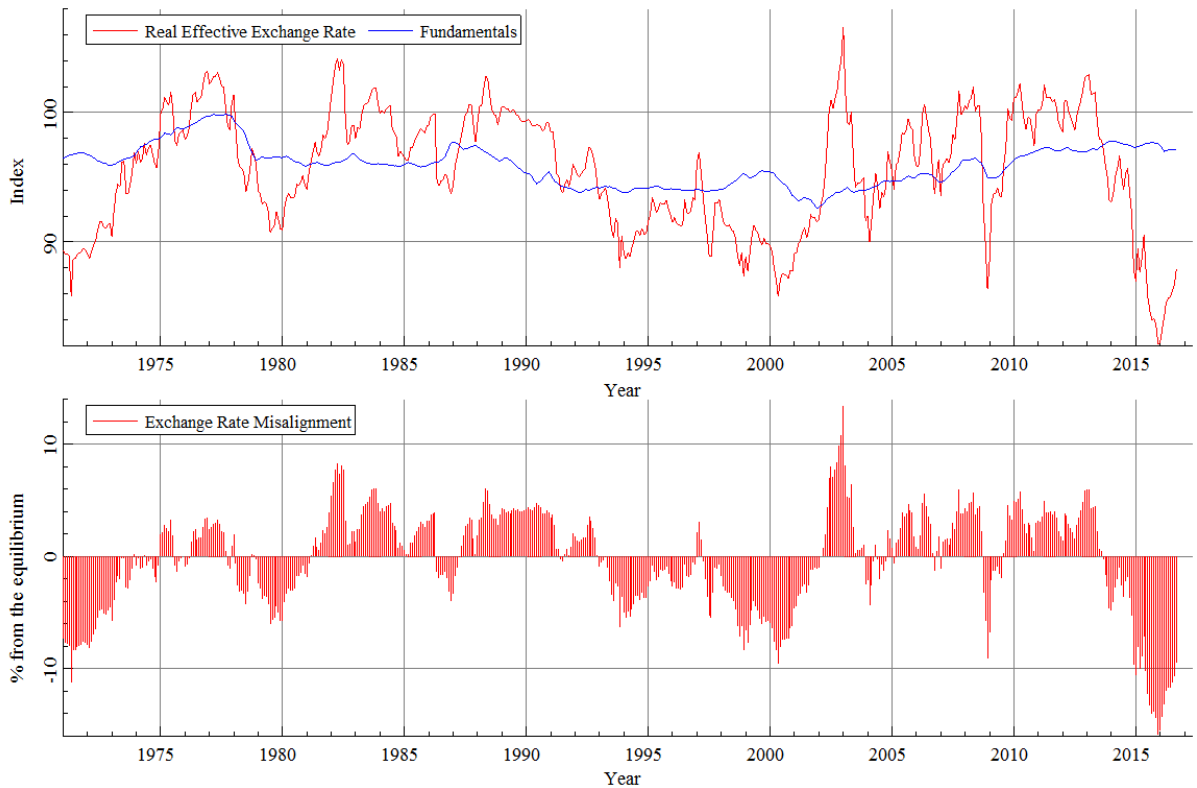
Countries Analyzed in Observatory:

New Zeland



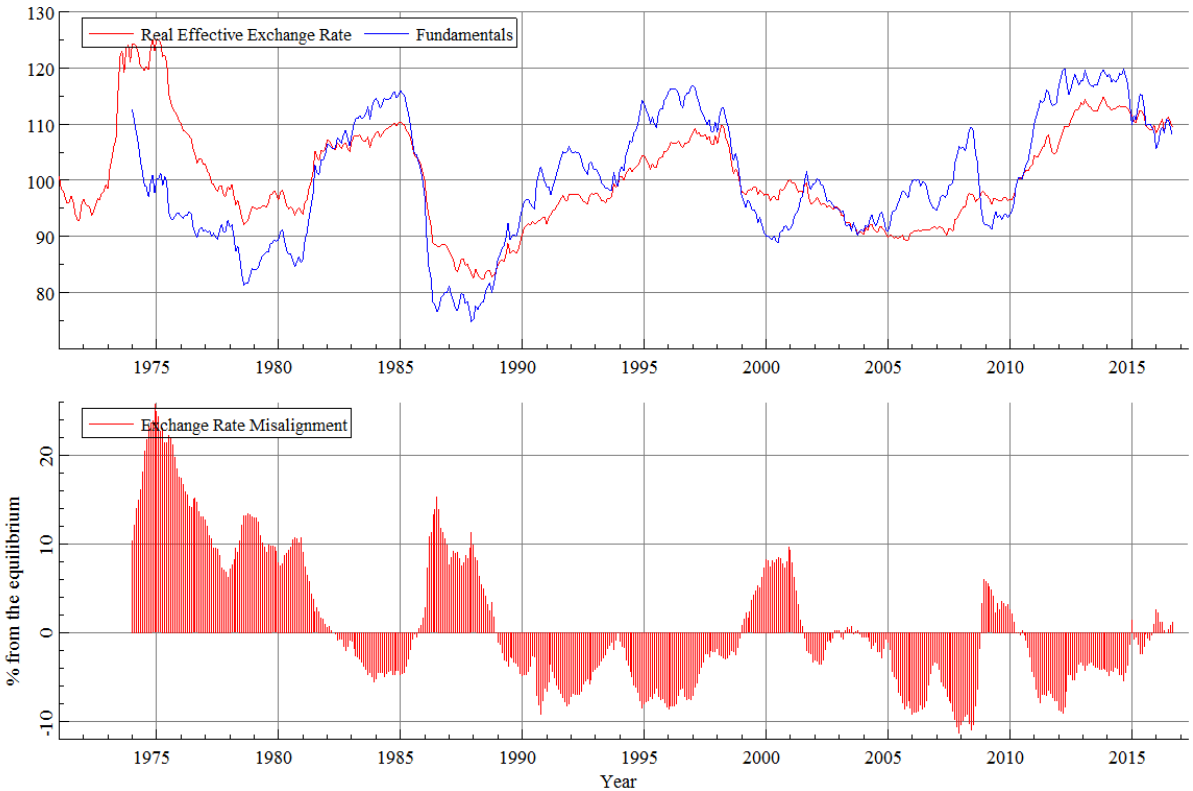
Countries Analyzed in Observatory:

Norway



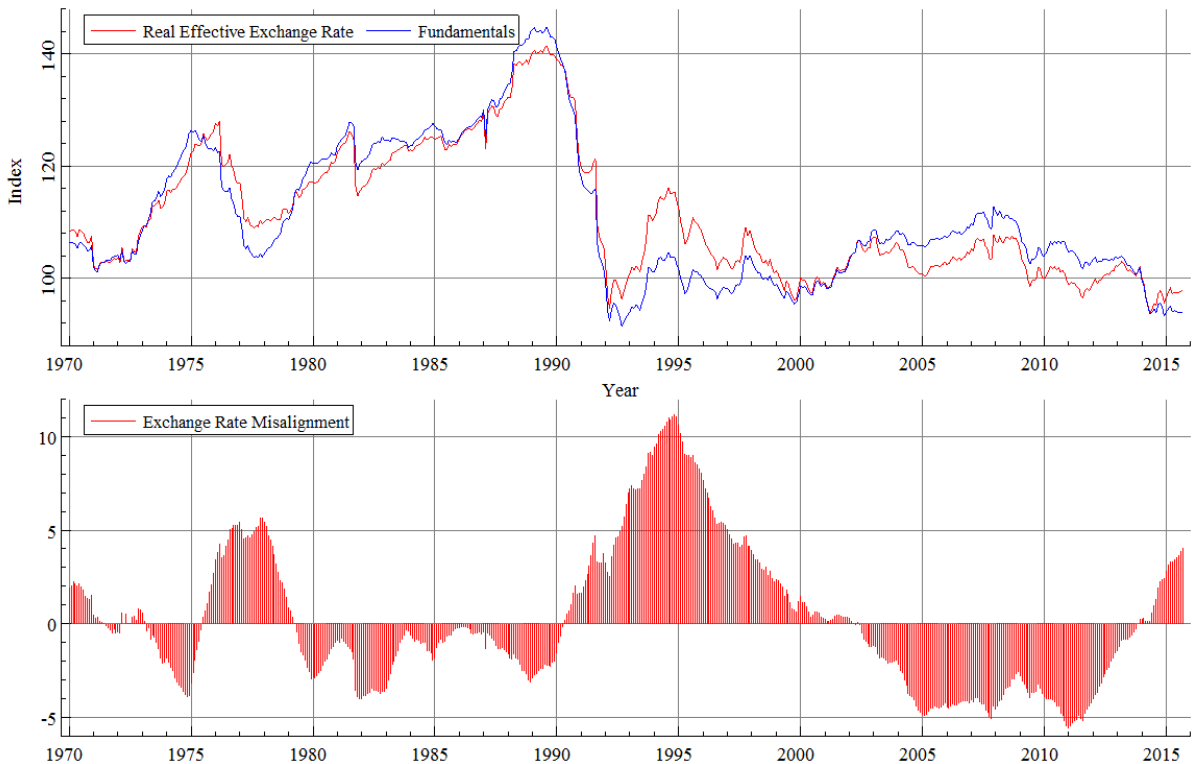
Countries Analyzed in Observatory:

Portugal



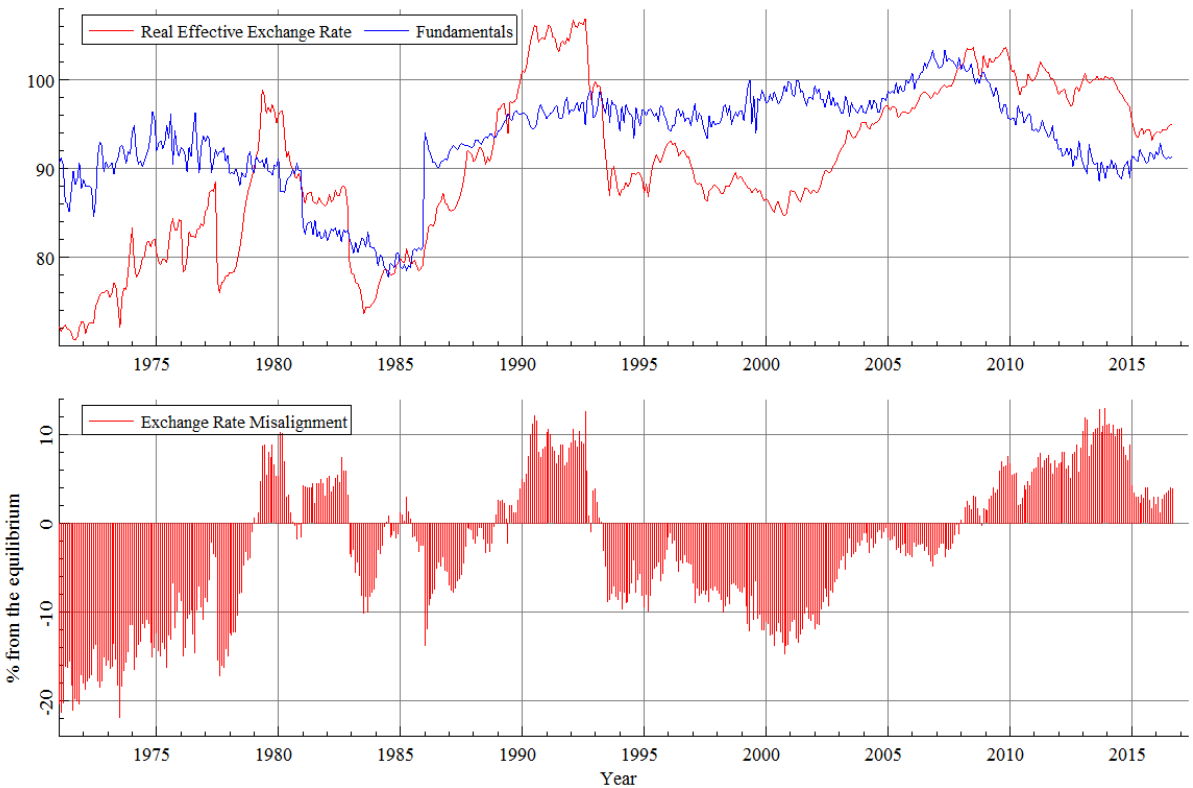
Countries Analyzed in Observatory:

Singapore



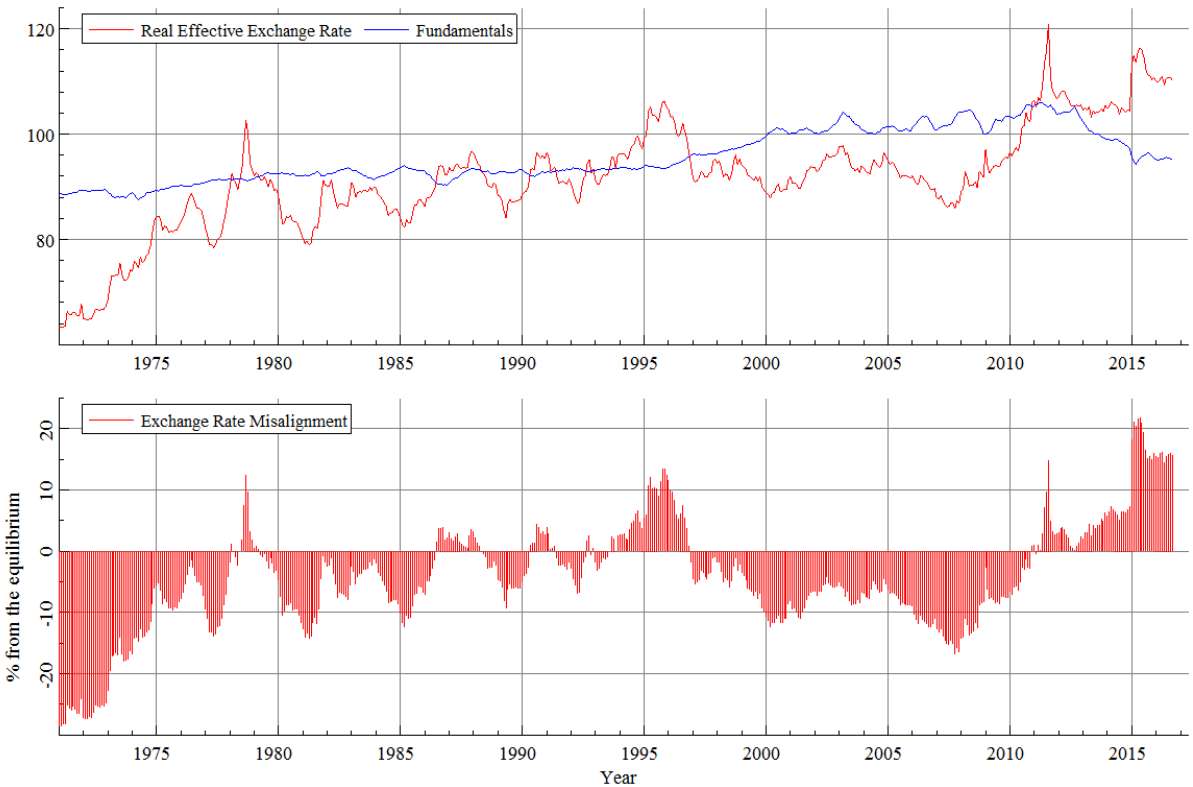
Countries Analyzed in Observatory:

Spain



Countries Analyzed in Observatory:

Switzerland

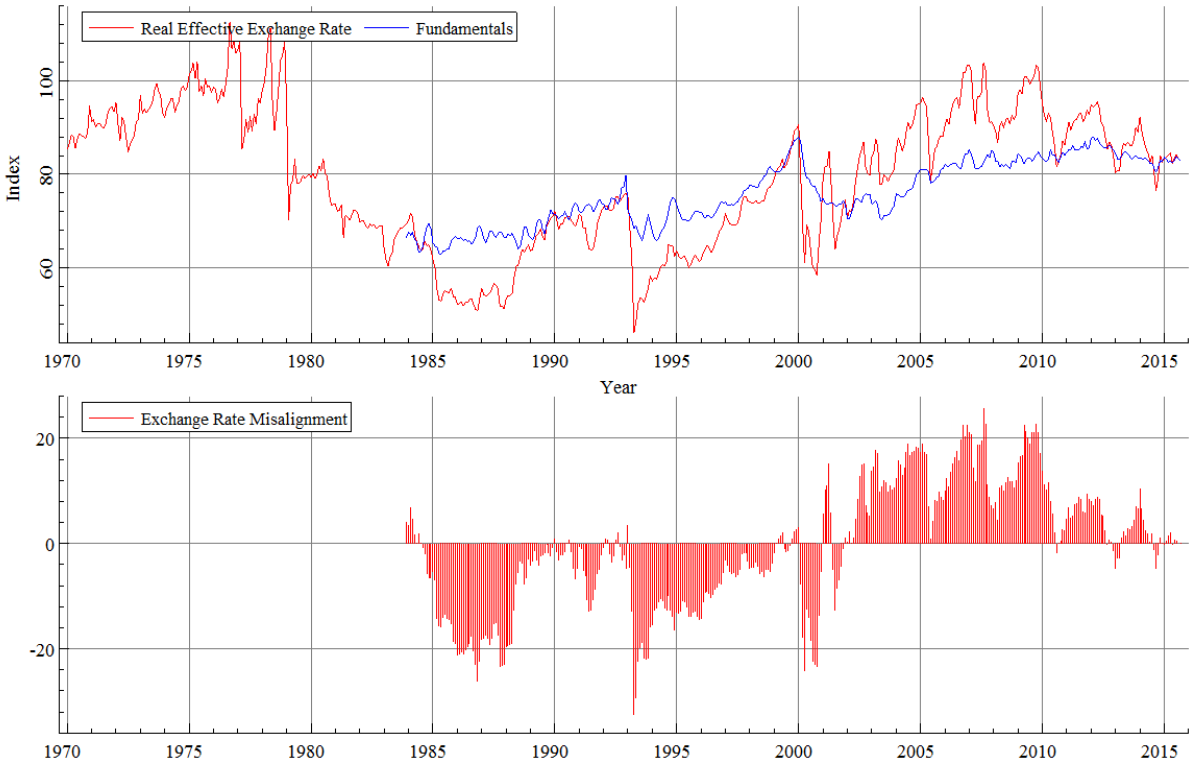


Countries Analyzed in Observatory:

Sweden

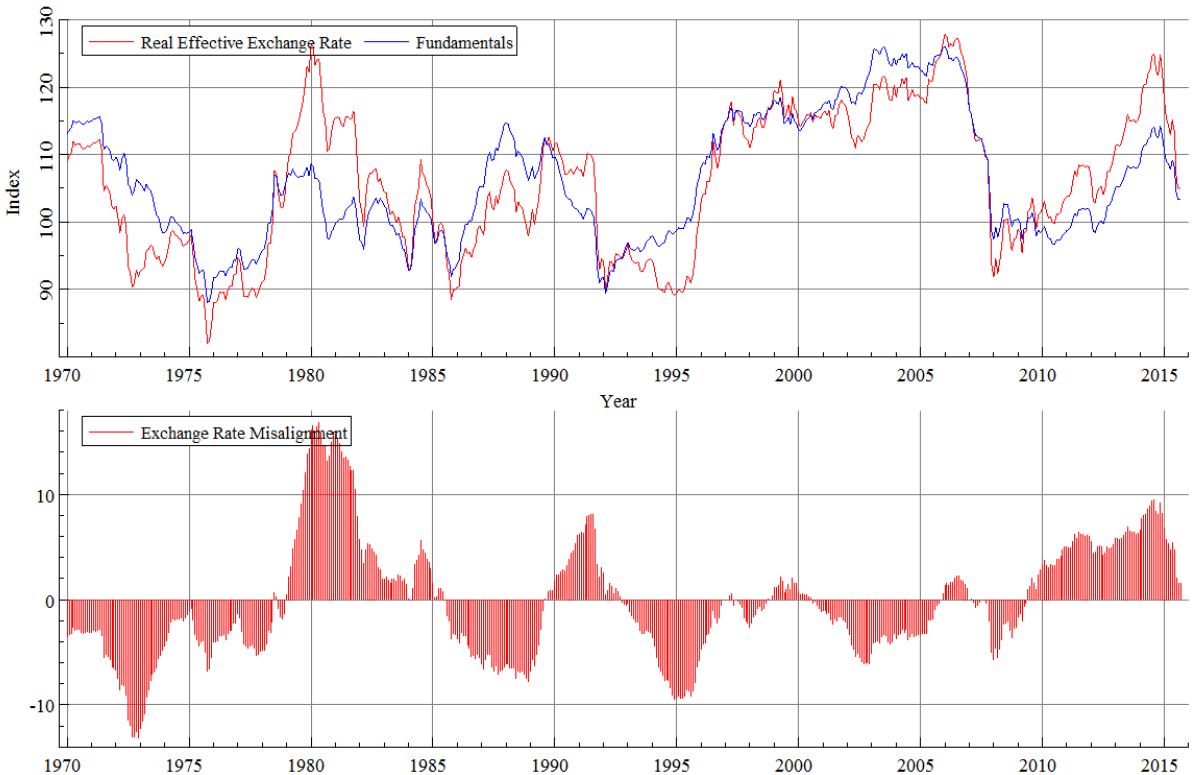
Countries Analyzed in Observatory:

Turkey



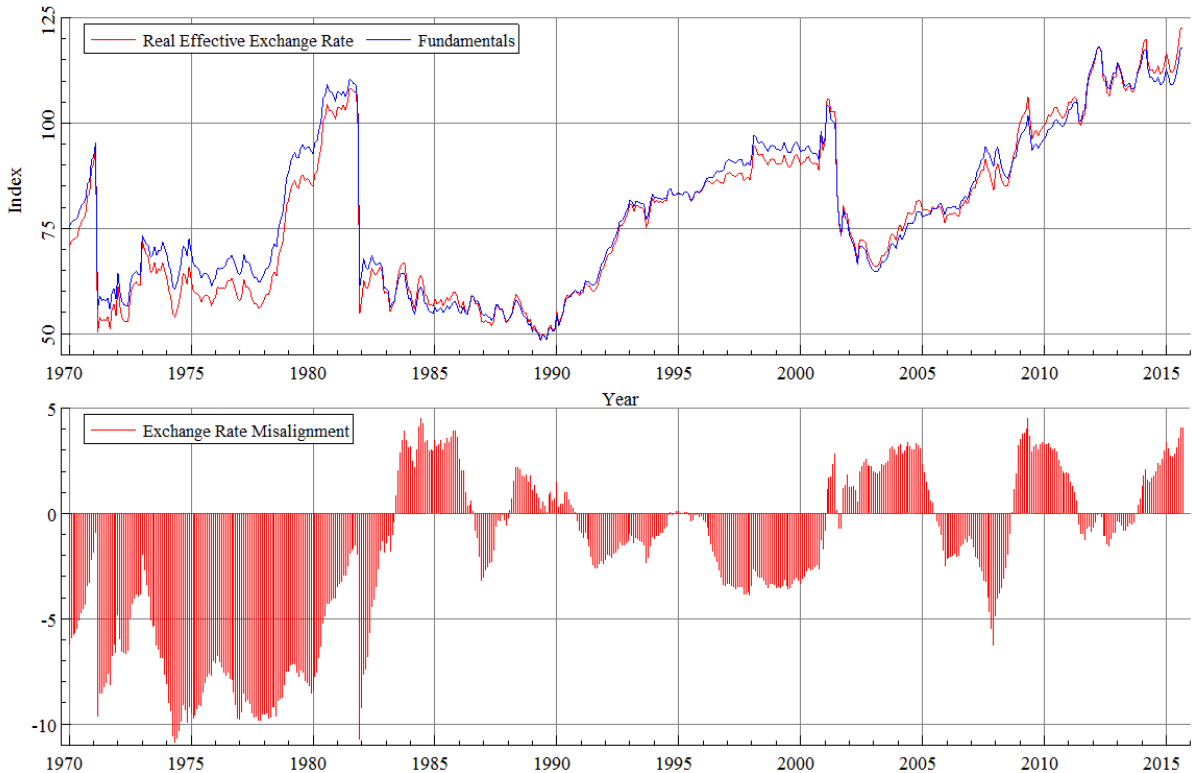
Countries Analyzed in Observatory:

United Kingdom



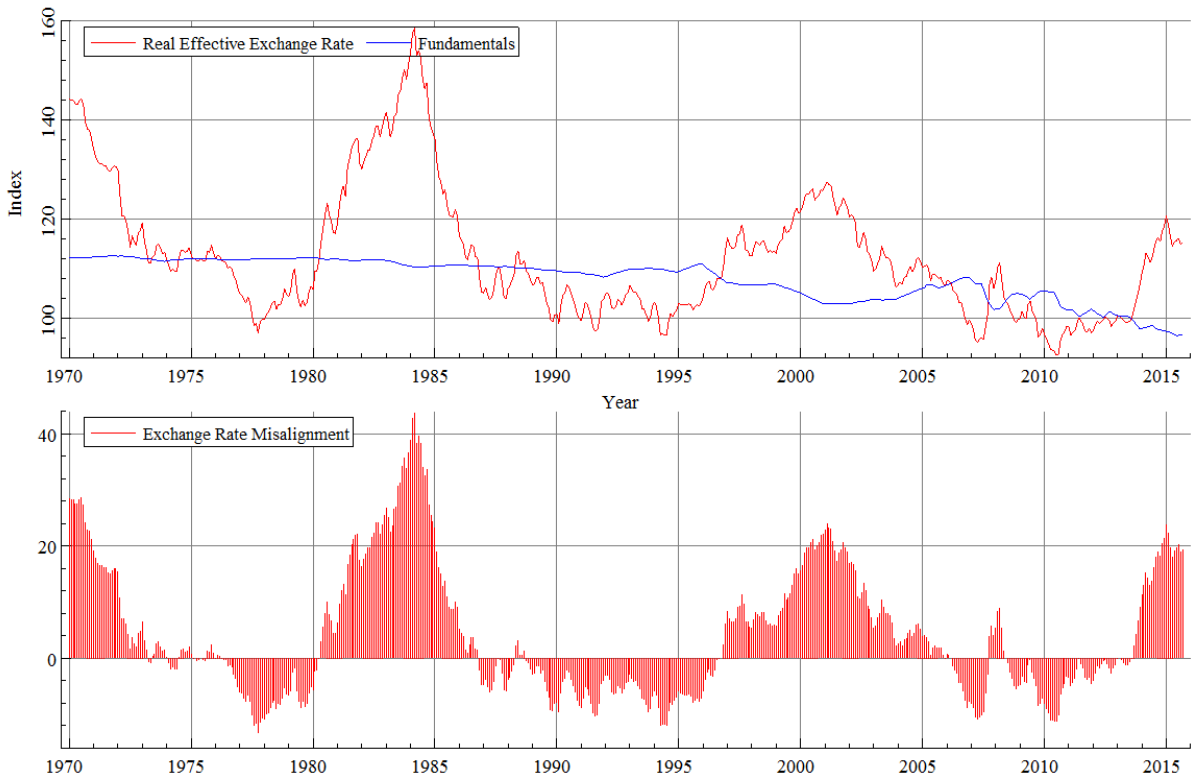
Countries Analyzed in Observatory:

Uruguay



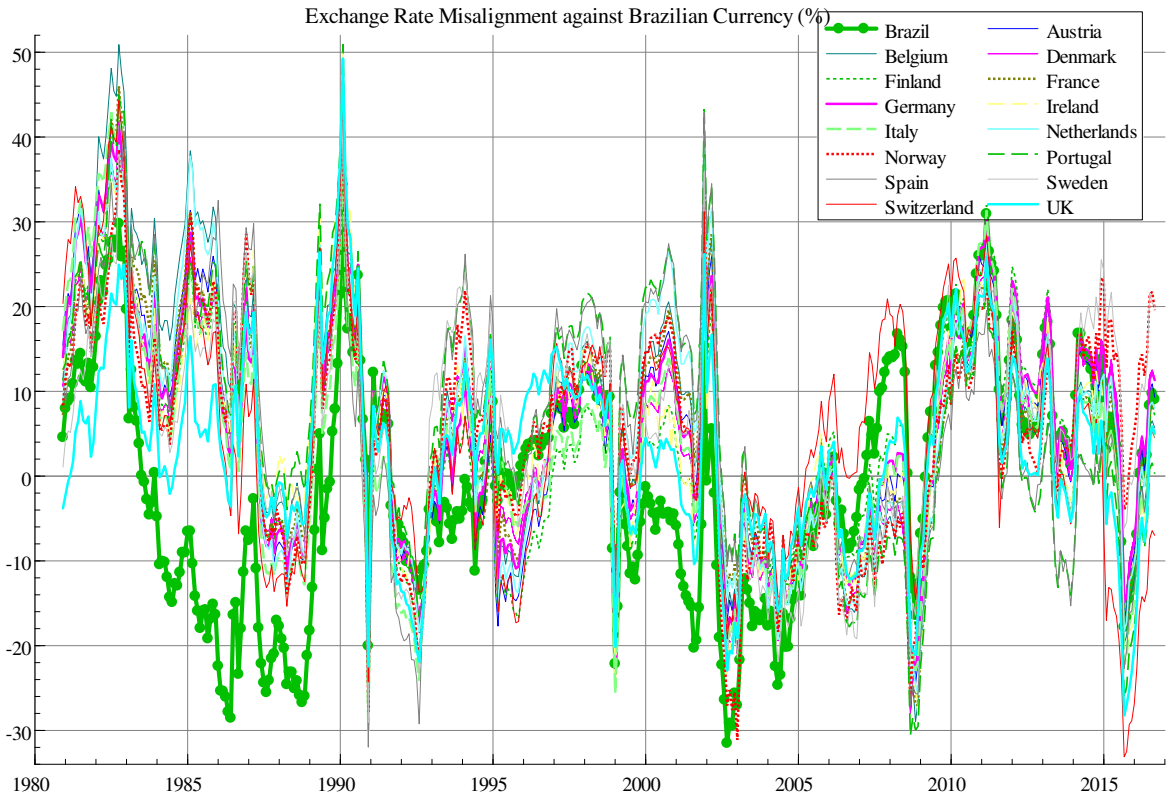
Countries Analyzed in Observatory:

United States



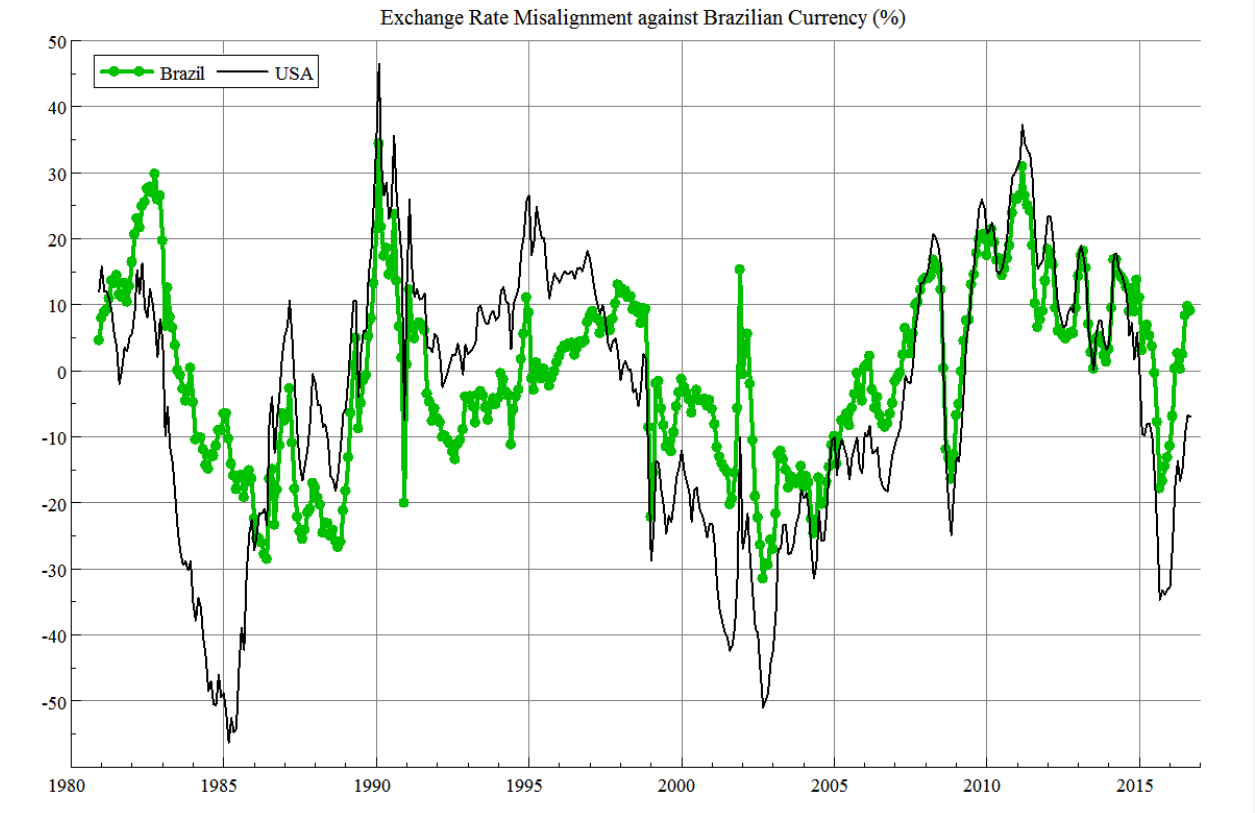
Multilateral versus Bilateral Misalignment:

Brazil - Europe.



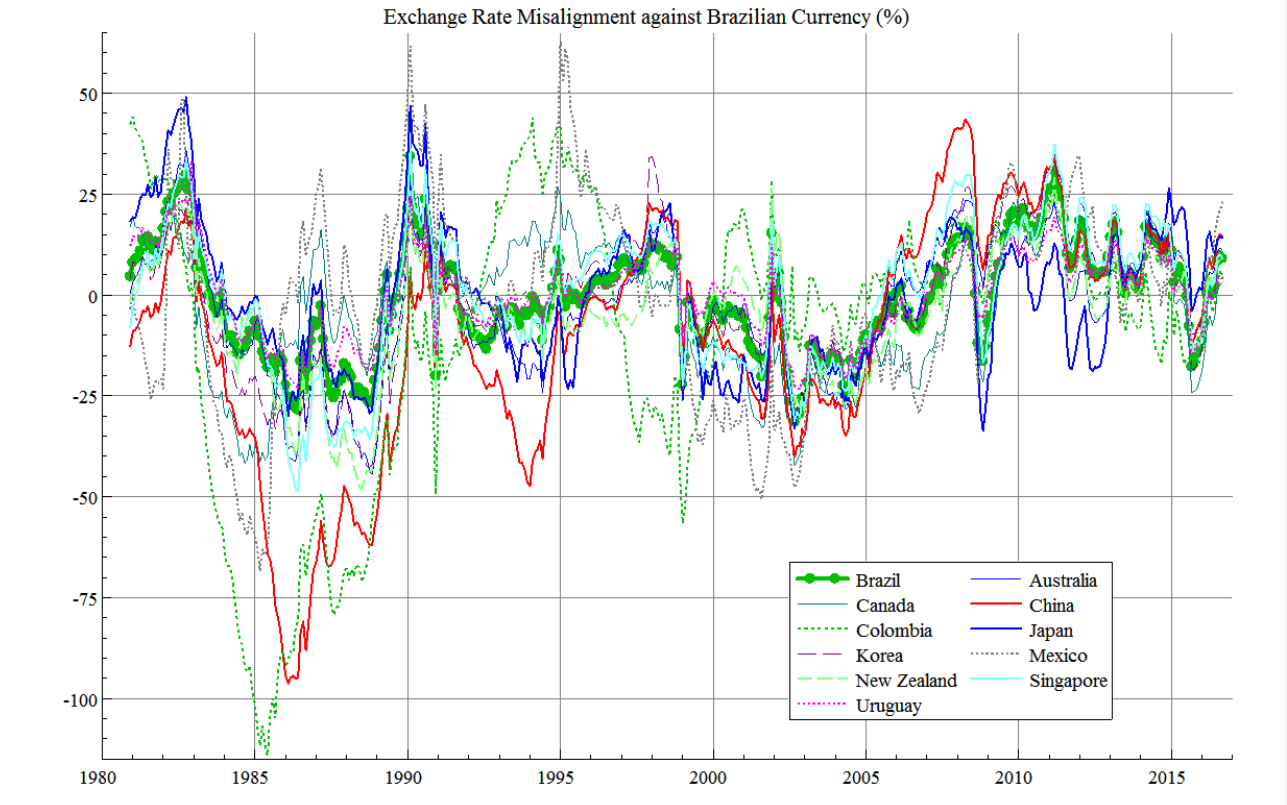
Multilateral versus Bilateral Misalignment:

Brazil -United States



Multilateral versus Bilateral Misalignment:

Brazil - Rest of the World



Multilateral versus Bilateral Misalignment:

Brazil - All Nations