THE BMI, EXCHANGE RATES AND FUNDAMENTALS

by

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Outline

- Purchasing Power Parity Theory
- The Big Mac Index
- Enhancing the BMI
- The BMI as a predictor
- Now

Purchasing Power Parity

$$P = SP^*$$

- A weaker version:

$$P = KSP^*, \; K > 0$$

$$S = \frac{1}{K}\frac{P}{P^*}$$

- In logs:

$$s = -k + p - p^*$$

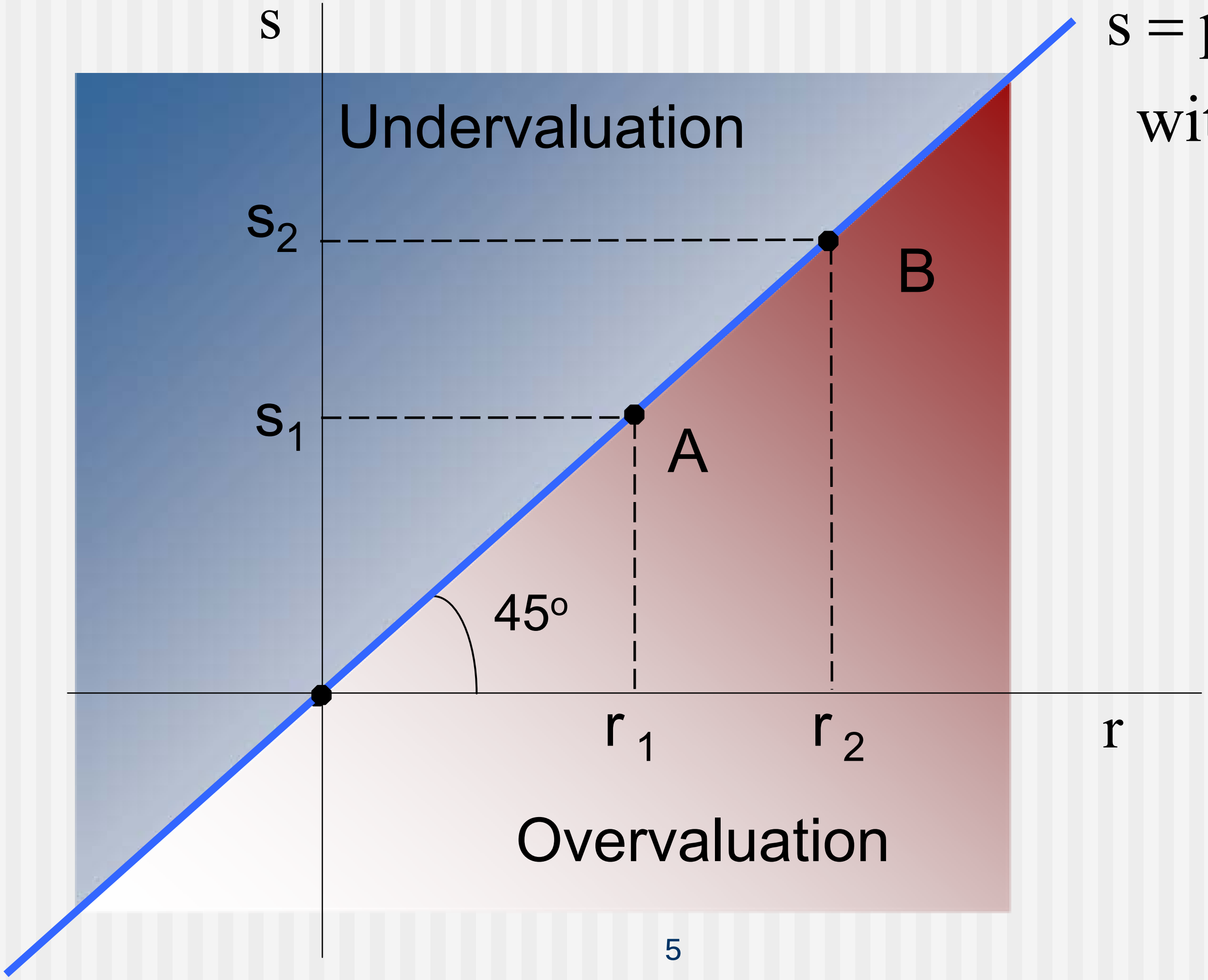
Three Versions of PPP

$$s = p - p^{*} - k + e$$

where e is a random disturbance term with $E(e)=0$

- Absolute PPP: $k=e=0$
- Relative PPP: $k \neq 0$ and $e=0$
- Stochastic departures from relative PPP: $k \neq 0$ and $e \neq 0$

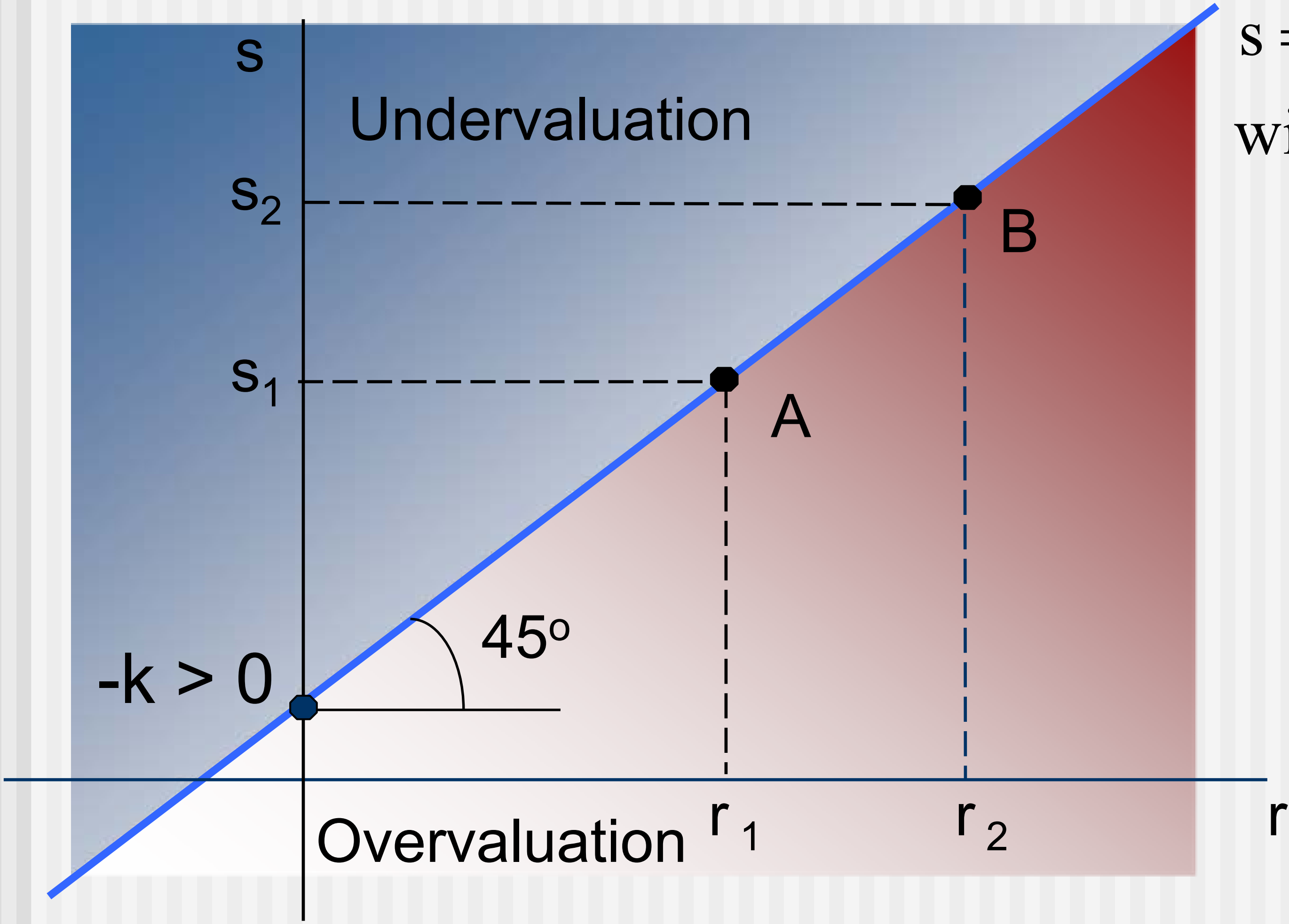
Absolute PPP



$$s = p - p^* - k + e$$

with $k = e = 0$

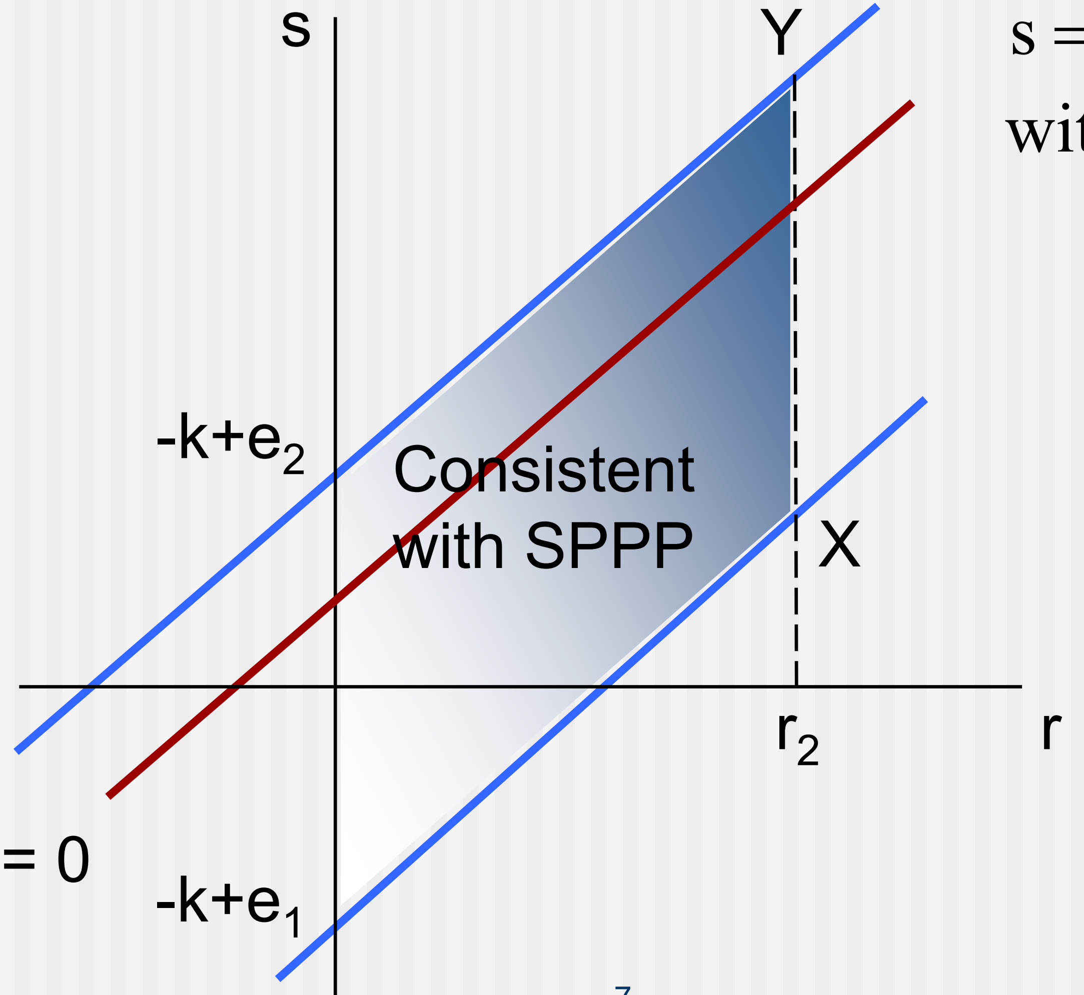
Relative PPP



$$s = p - p^* - k + e$$

$$\text{with } k \neq 0, \; e = 0$$

Stochastic PPP



$$s = p - p^* - k + e$$

$$\text{with } k \neq 0,\ e \neq 0$$

E (e) = 0

More on Stochastic PPP

- Define the real exchange rate as:

$$q = p - p^{*} - s$$

with E(q) = k, var(q) = σ^2.

- Chebyshev's inequality: $\Pr\left(|q-k| > c\right) \leq \dfrac{\sigma^2}{c^2}$

- The bounds are: $k - \sqrt{\sigma^2/\alpha},\ k + \sqrt{\sigma^2/\alpha},$

where α is the probability of a Type I error.

Big Mac Index

Country	Big Mac prices		Implied PPP of the dollar	Actual $ exchange rate 02/07/07	Under/over valuation, %
	In local currency	In dollars			
United States	$3.41	3.41	-	-	-
Australia	A$3.45	2.95	1.01	1.17	-14
Britain	£1.99	4.01	1.71	2.01	+18
Canada	C$3.88	3.68	1.14	1.05	+8
Euro area	€ 3.06	4.17	1.12	1.36	+22
Japan	¥280	2.29	82.1	122	-33
Switzerland	SFr 6.30	5.20	1.85	1.21	+53

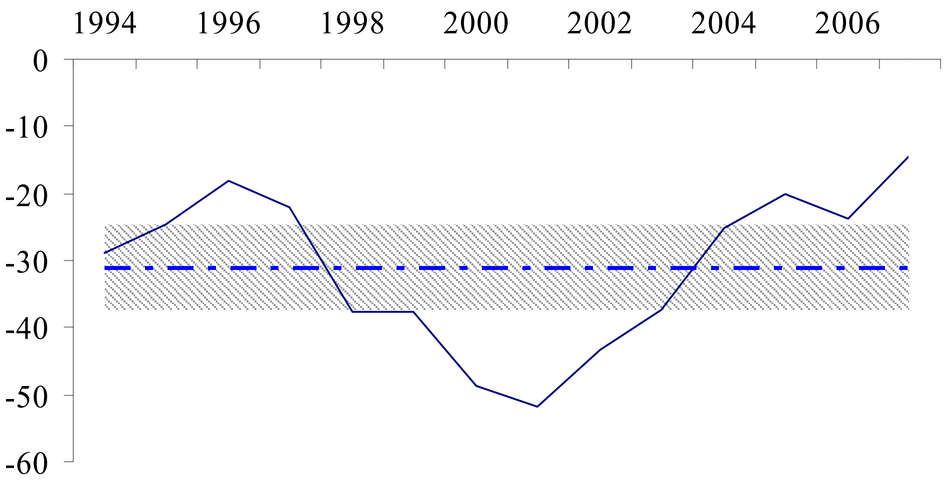
Source: The Economist (2007)

Equilibrium Exchange Rate

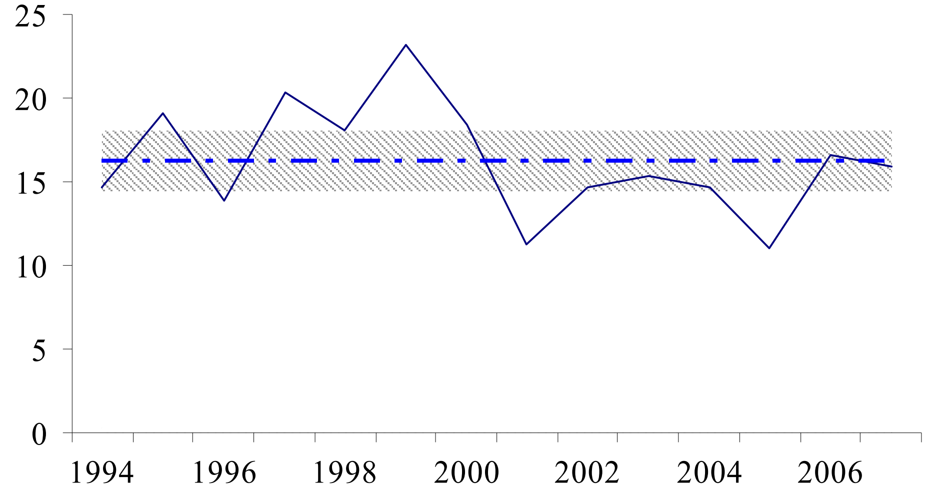
Should go to 0

Big Mac Real Exchange Rates

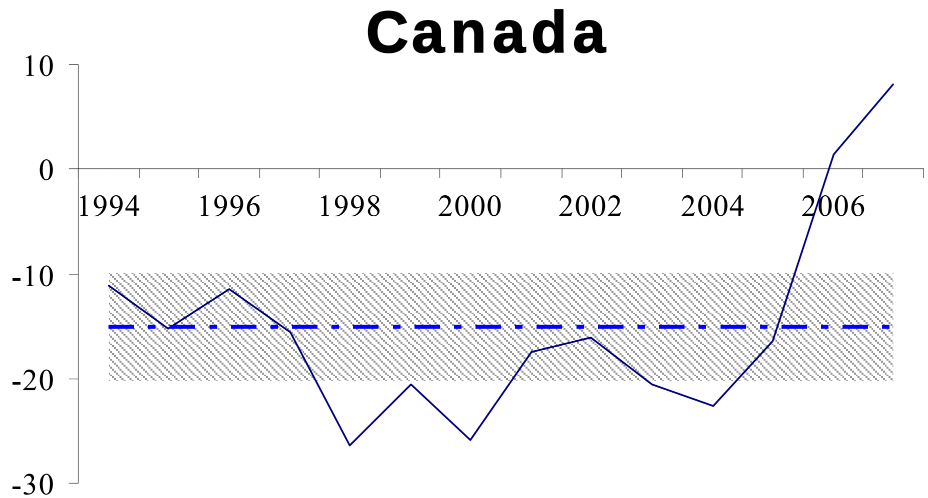
Australia

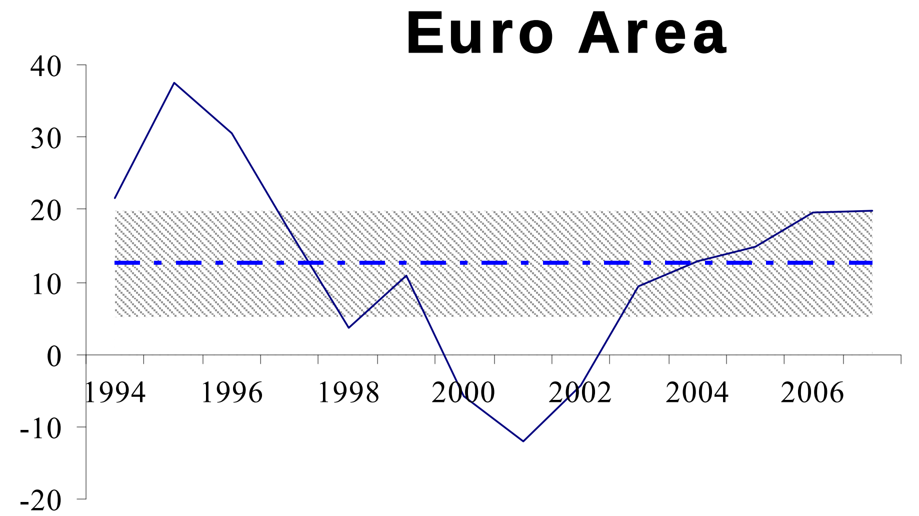


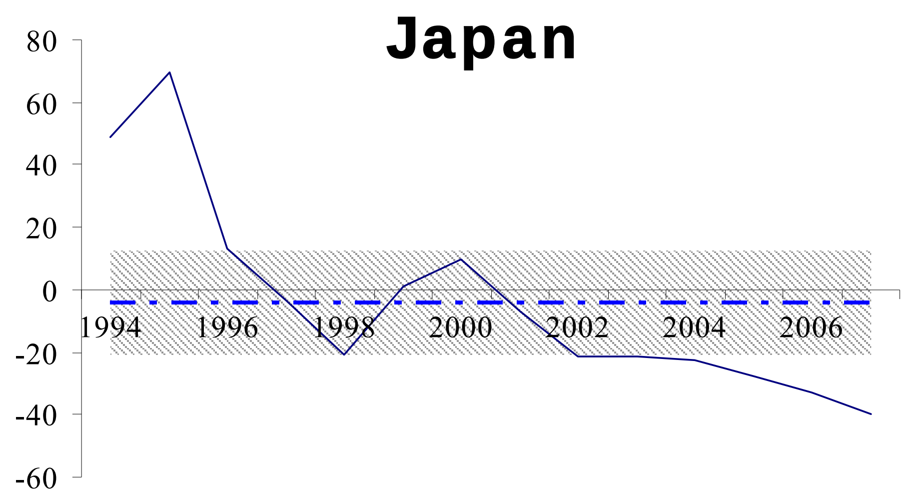
Britain

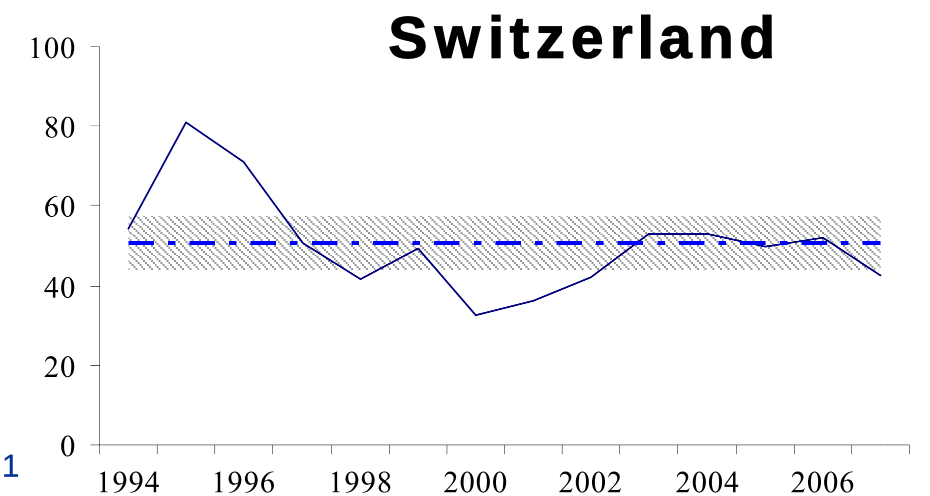


Big Mac Real Exchange Rates









Conclusion

- There are substantial, sustained and significant deviations of exchange rates from the BMI
- The BMI is biased

Enhancing the BMI

- Adjusting the BMI for a bias we obtain relative PPP

$$s = b + p - p^*$$

where b is the bias

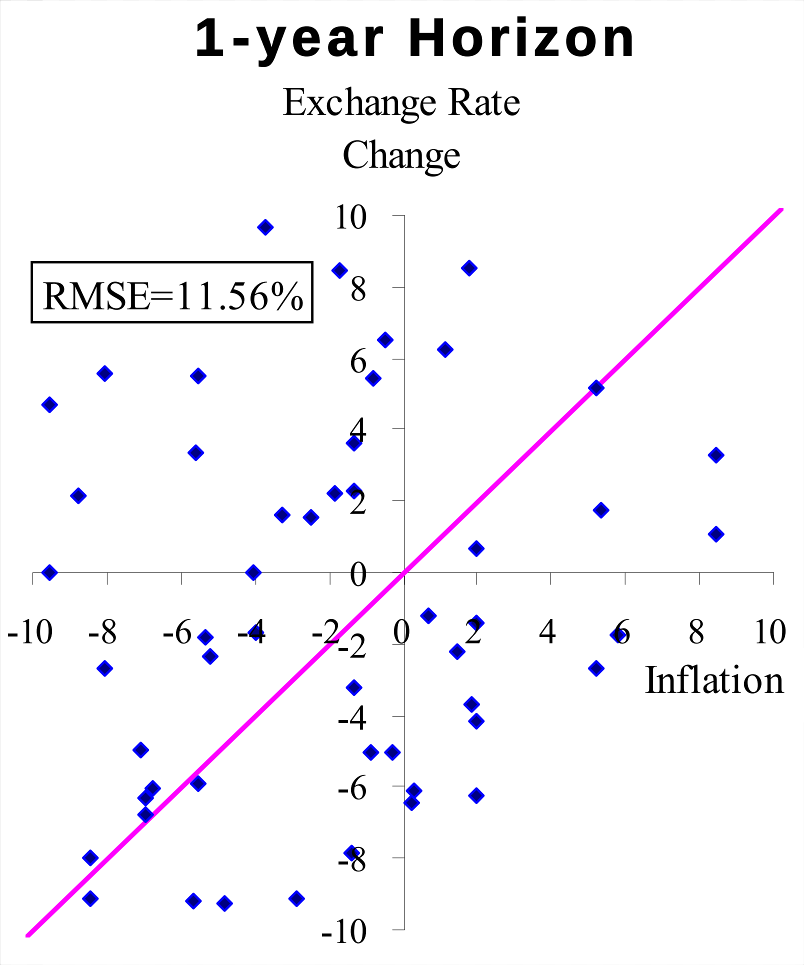
- This relative PPP over horizon of h years:

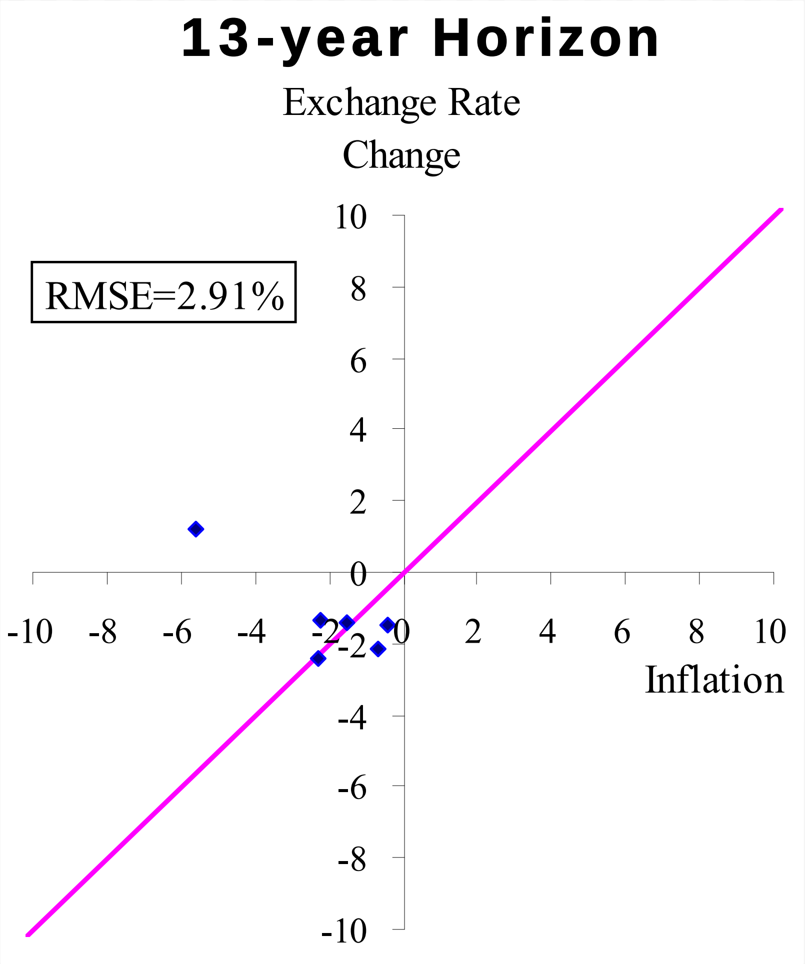
$$\Delta^{(h)} s_{ct} = \Delta^{(h)} r_{ct}, \quad \text{where } \Delta^{(h)} x_t = \frac{1}{h}\left(\log X_t - \log X_{t-h}\right)$$

is the annualised change over horizon h

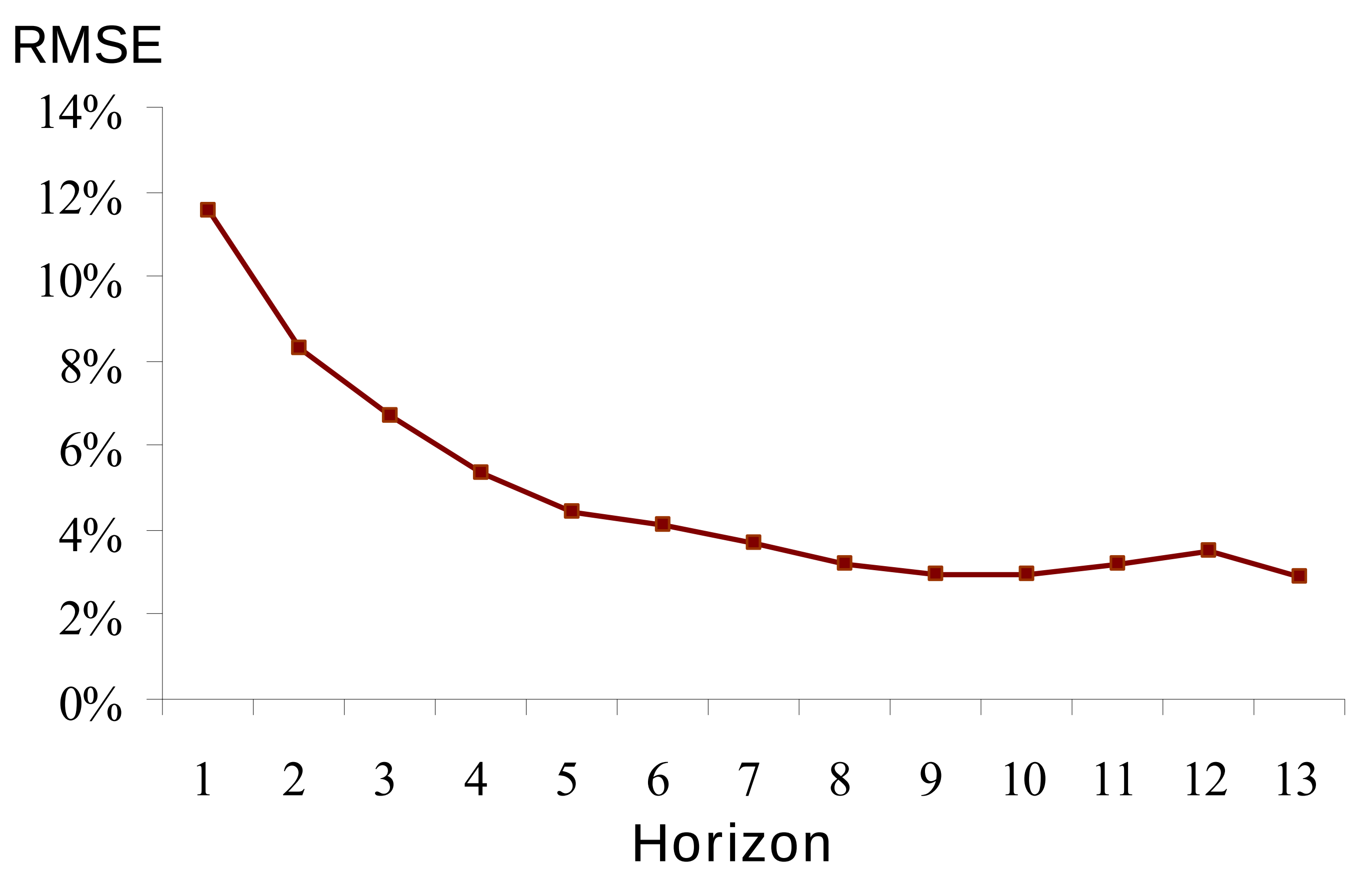
- The annualised change in the nominal exchange rate, $\Delta^{(h)} s_{ct}$, equals the corresponding relative price change, $\Delta^{(h)} r_{ct}$

Evidence on Relative PPP
6 countries 1994-2007

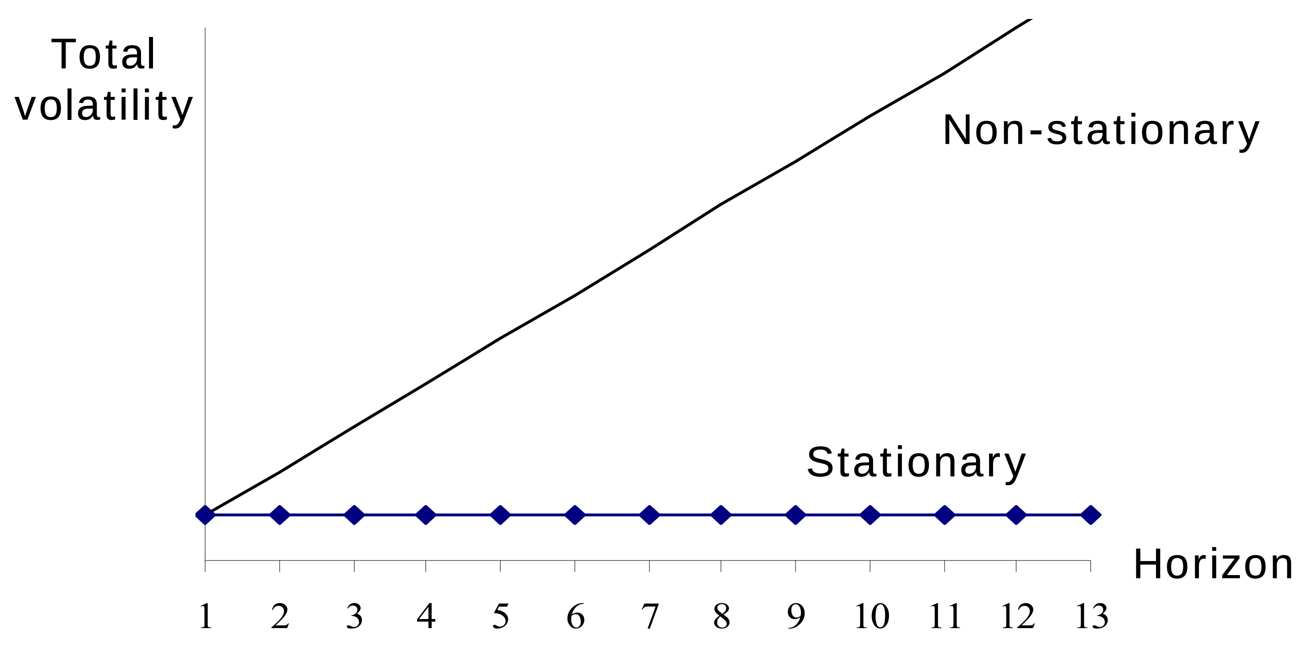




The Transition From the Short Run to the Long Run

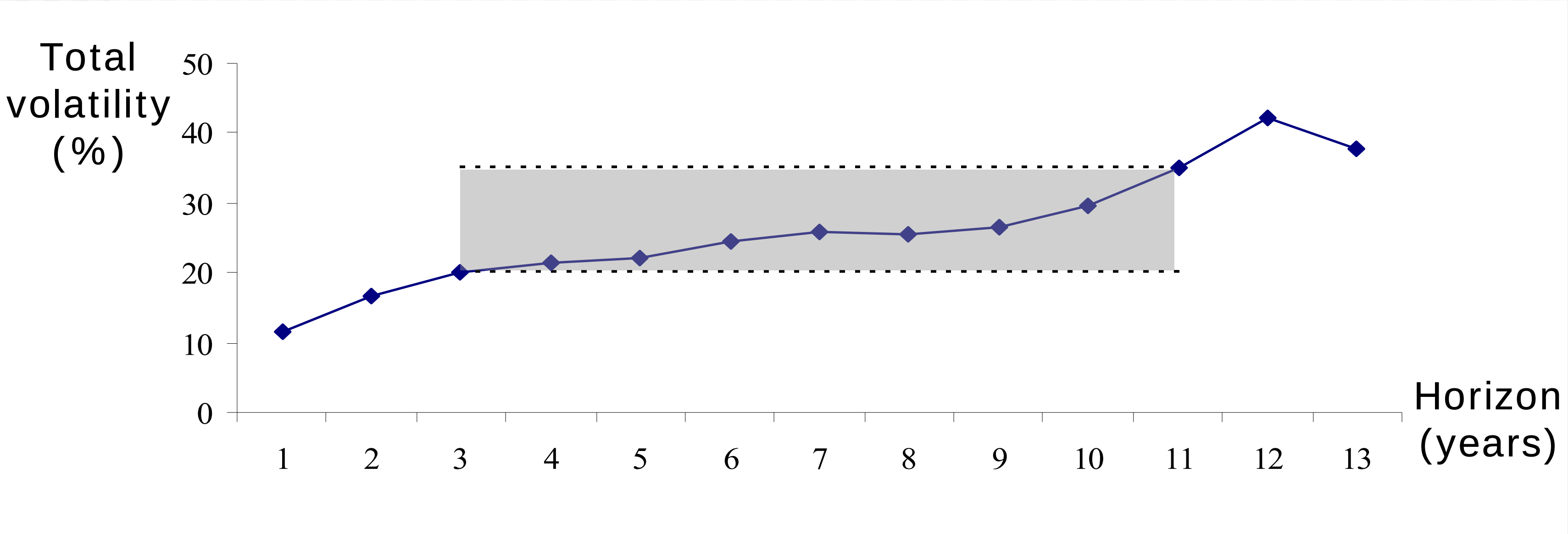


Stationarity



- When the real rate is stationary, the total volatility is constant as the length of the horizon expands, while it increases in the non-stationary case.

Evidence from 6 Countries
1994-2007



- Real rates are weakly stationary
- Relative PPP holds at longer horizons

BMI as a Predictor

- Absolute PPP $q_{t+h} = 0$ The Economist BMI
- Relative PPP $q_{t+h} = \overline{q}$ Bias-adjusted BMI
- Stochastic PPP $q_{t+h} = \overline{q} + \varepsilon_t$ Stochastic Bias-Adjusted BMI

$$\therefore \underbrace{q_{t+h} - q_t}_{\text{Subsequent Appreciation}} = -\underbrace{\left(q_t - \overline{q}\right)}_{\text{Current Mispricing}} + \varepsilon_t$$

More on Prediction

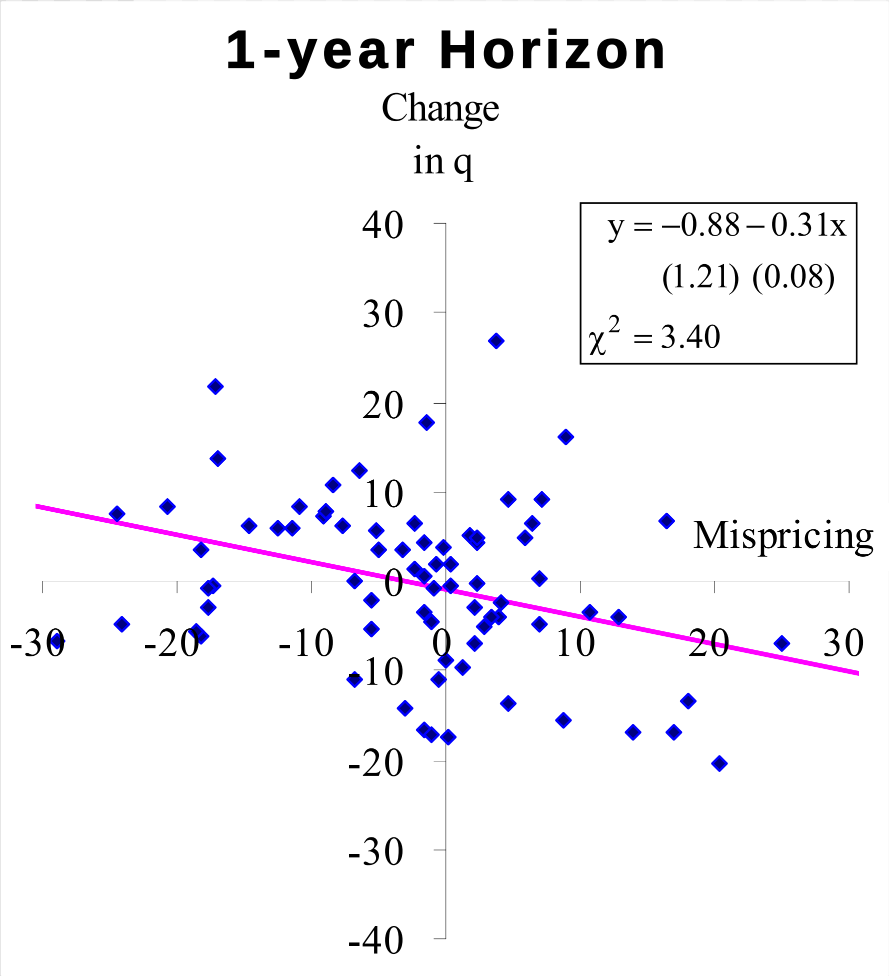
$$\underbrace{q_{t+h} - q_t}_{\text{Subsequent Appreciation}} = -\underbrace{\left(q_t - \bar{q}\right)}_{\text{Current Mispricing}} + \varepsilon_t$$

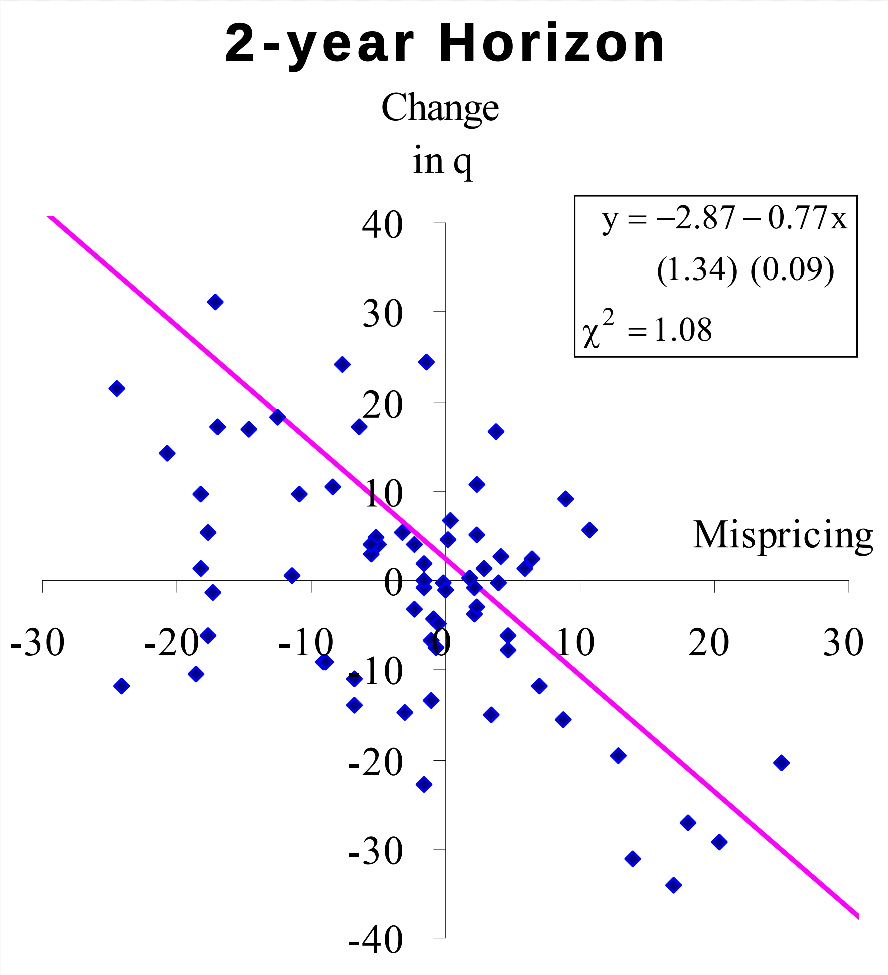
- E.g. if $q_t - \bar{q} > 0$ $\Rightarrow$ currently overvalued
  then $q_{t+h} - q_t < 0$ $\Rightarrow$ depreciates in the future
- Test the above by estimating:

$$q_{c,t+h} - q_{c,t} = \eta + \phi\left(q_{c,t} - \bar{q}_c\right) + \varepsilon_{c,t}$$

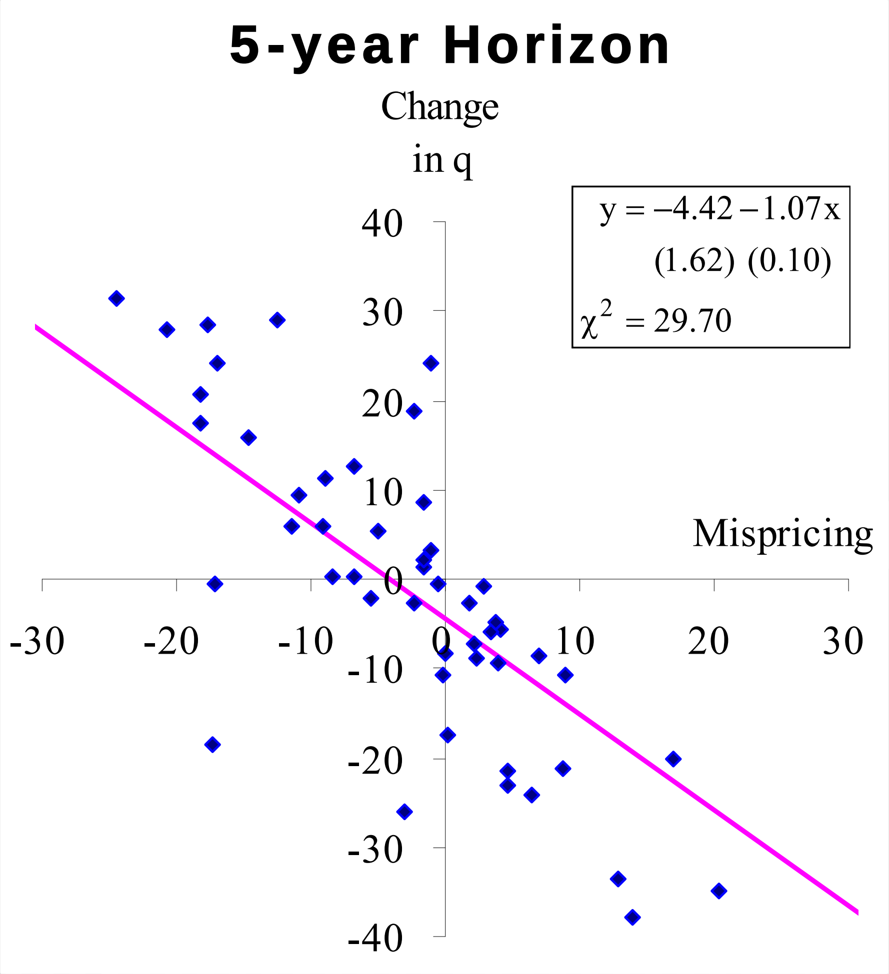
If $\eta = 0$ and $\phi = -1$, then there is full adjustment to mispricing in h years

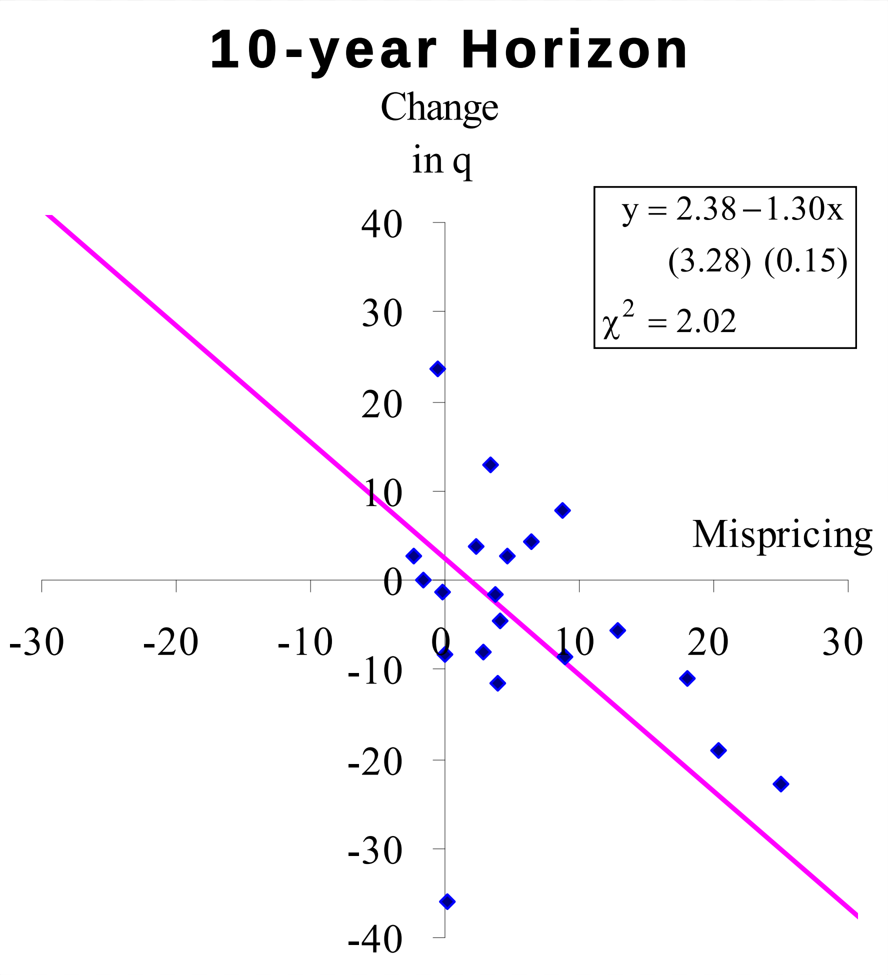
Evidence on BMI Predictions
6 countries, 1994-2007





… and at longer time horizons





Regression results

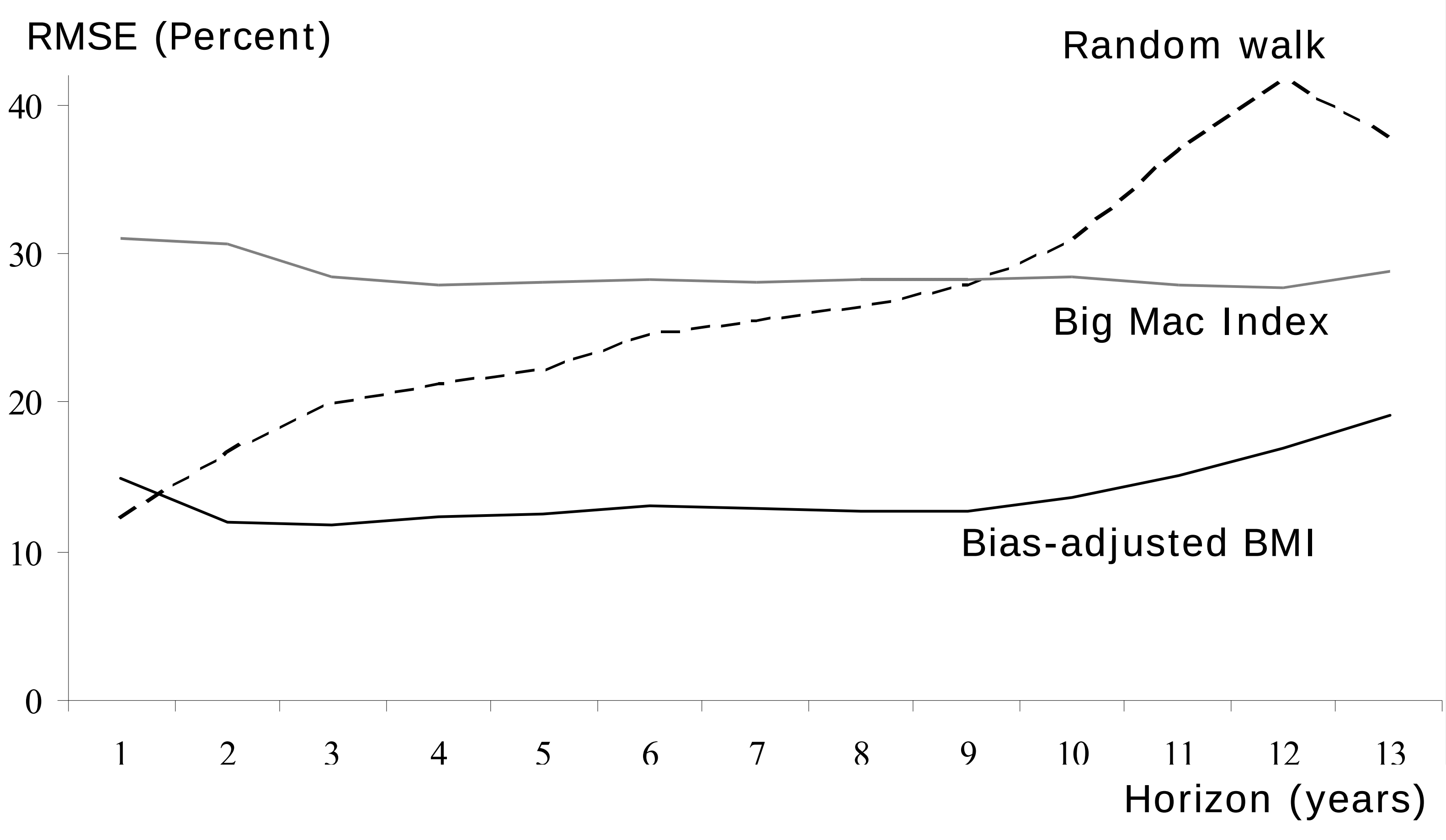
$$q_{c,t+h} - q_{c,t} = \eta + \phi\left(q_{c,t} - \bar{q}_c\right) + \varepsilon_{c,t}$$

- Full adjustment requires: $\eta = 0$ and $\phi = -1$

Horizon (h)	Intercept $\eta \times 100$	Slope ϕ	No of obs.	R^2	χ^2	F (H_0: $\eta = 0$, $\phi = -1$)
2	-2.657 (1.999)	-0.755 (0.140)	36	0.461	1.8	2.600
3	-2.511 (2.331)	-0.966 (0.166)	24	0.607	8.2	0.596
4	-6.105 (2.656)	-1.101 (0.170)	18	0.723	7.2	2.680
5	-2.313 (2.252)	-0.922 (0.141)	12	0.811	8.4	0.549
6	-3.667 (4.396)	-1.085 (0.234)	12	0.682	12.0	0.447

Standard errors in parenthesis. Non-overlapping observations.

BMI versus a Random Walk

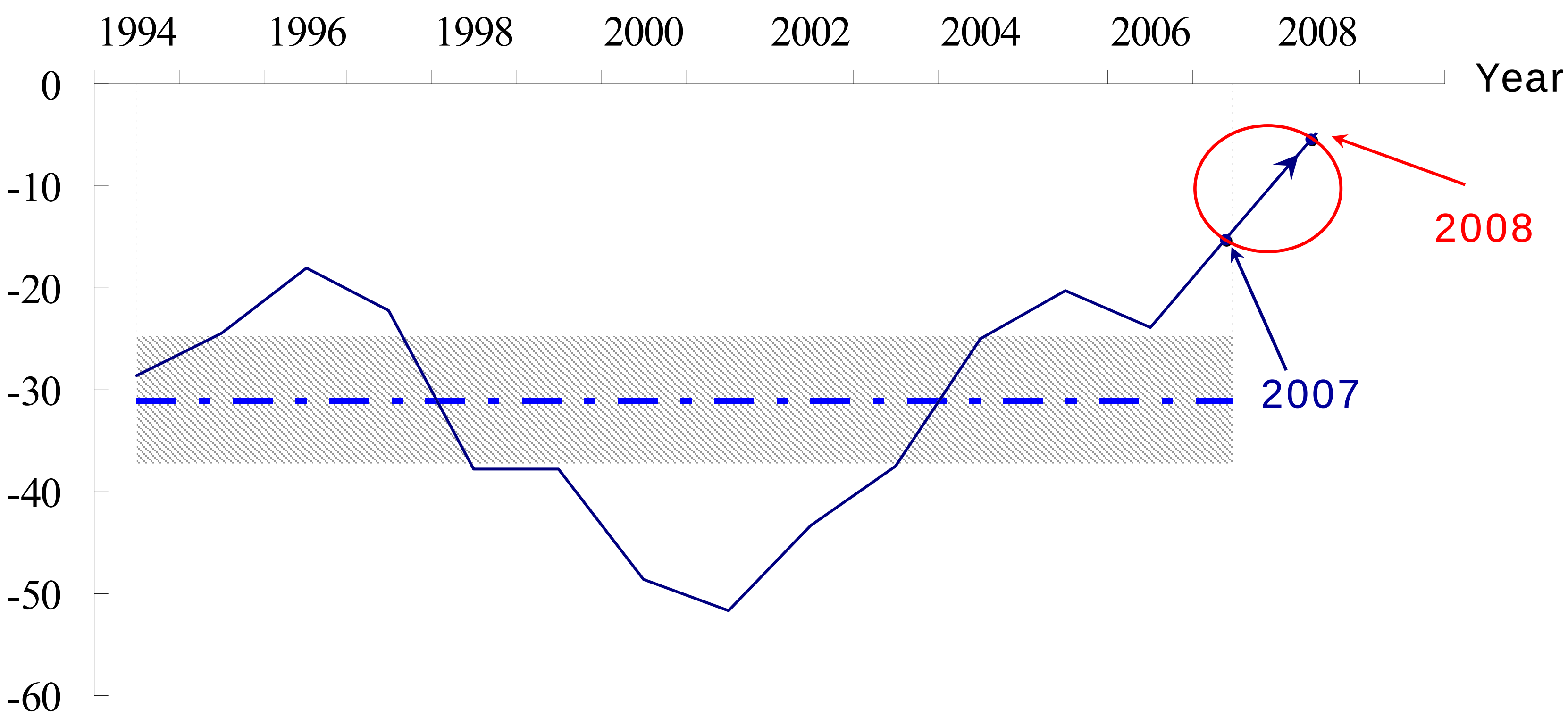


Conclusion

- The Big Mac Index has considerable predictive power regarding future currency values.

And now...

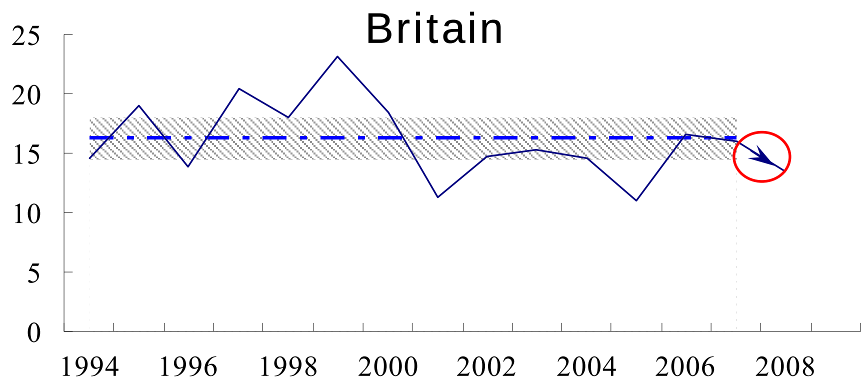
Now – The OZ

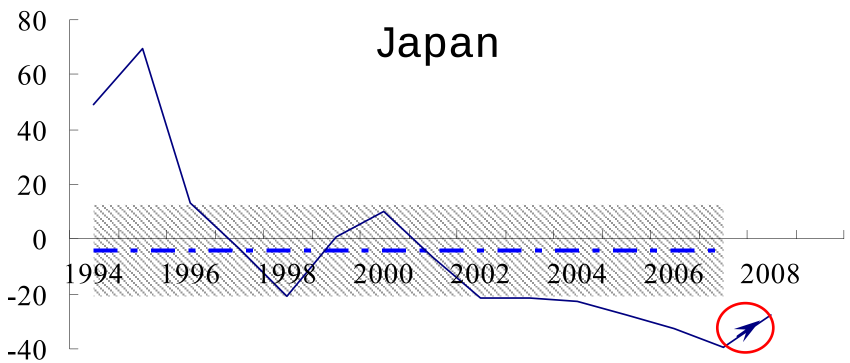


1994
1996
1998
2000
2002
2004
2006
2008
Year
0
-10
-20
-30
-40
-50
-60
2008
2007

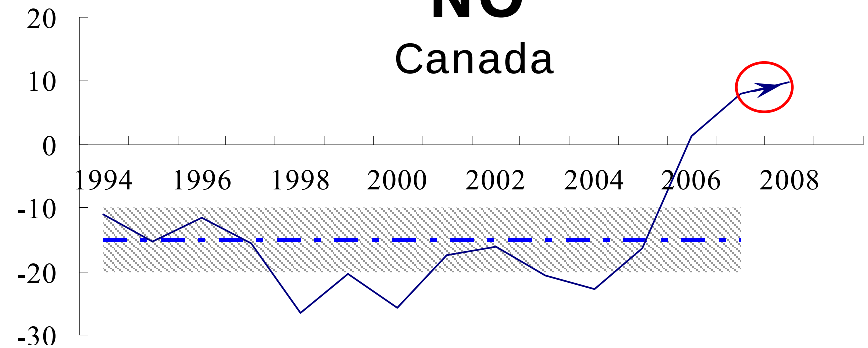
Are the Others the Same?

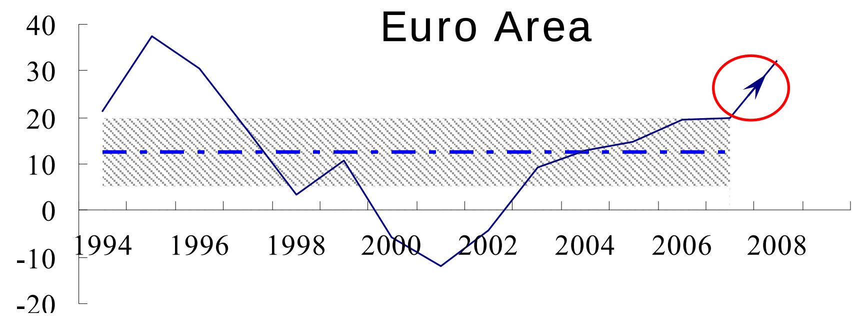
YES

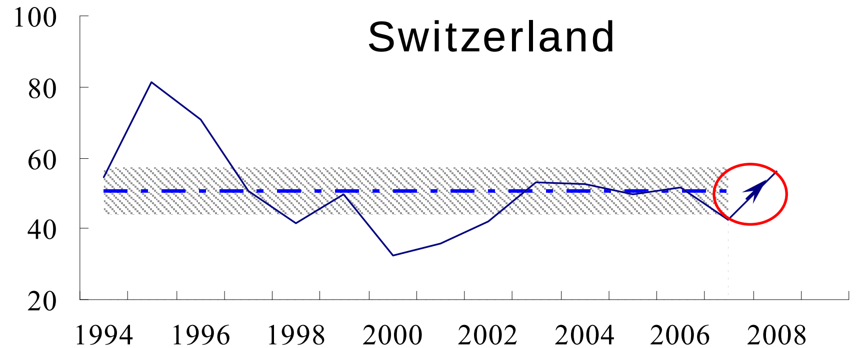




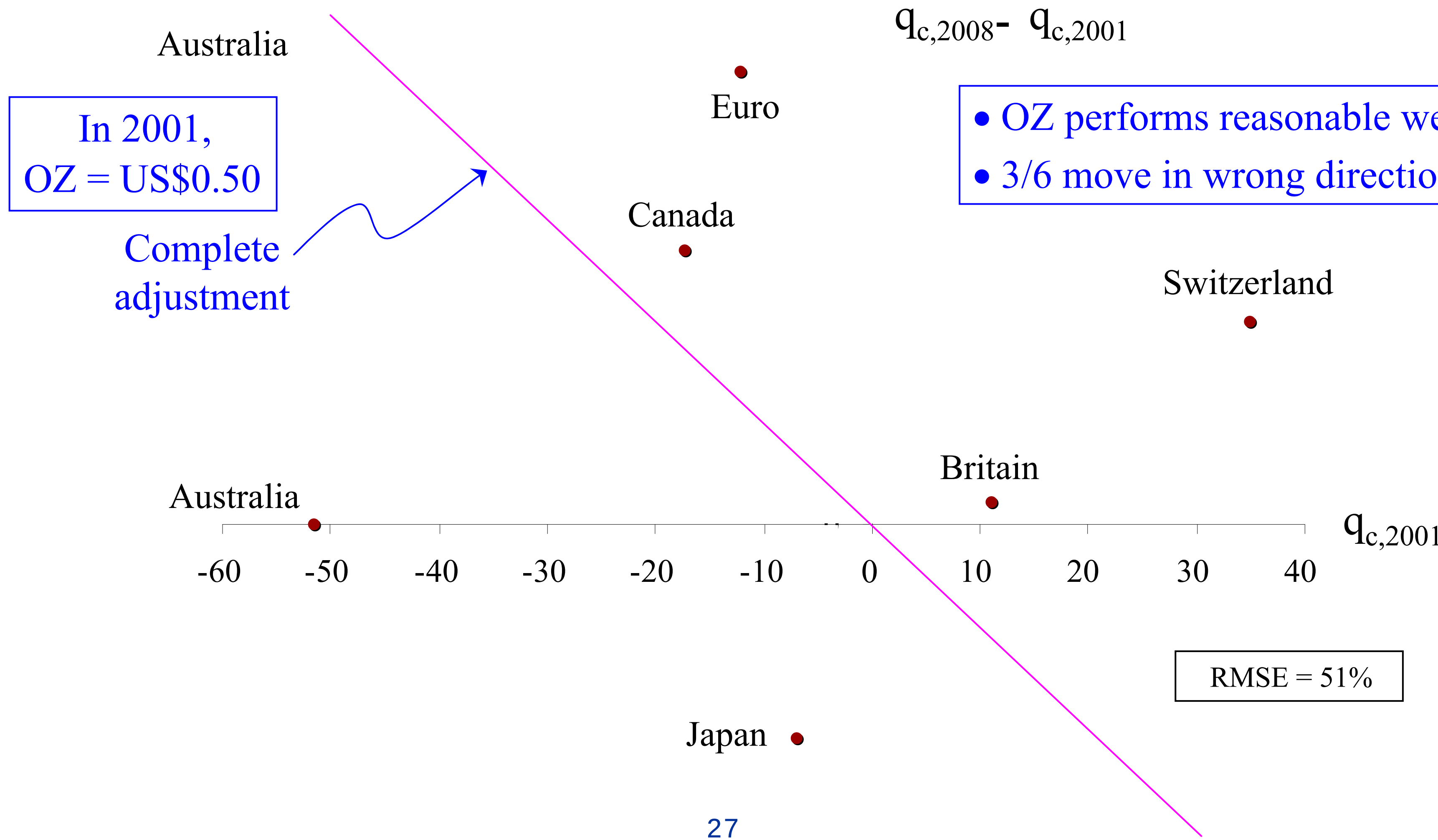
NO





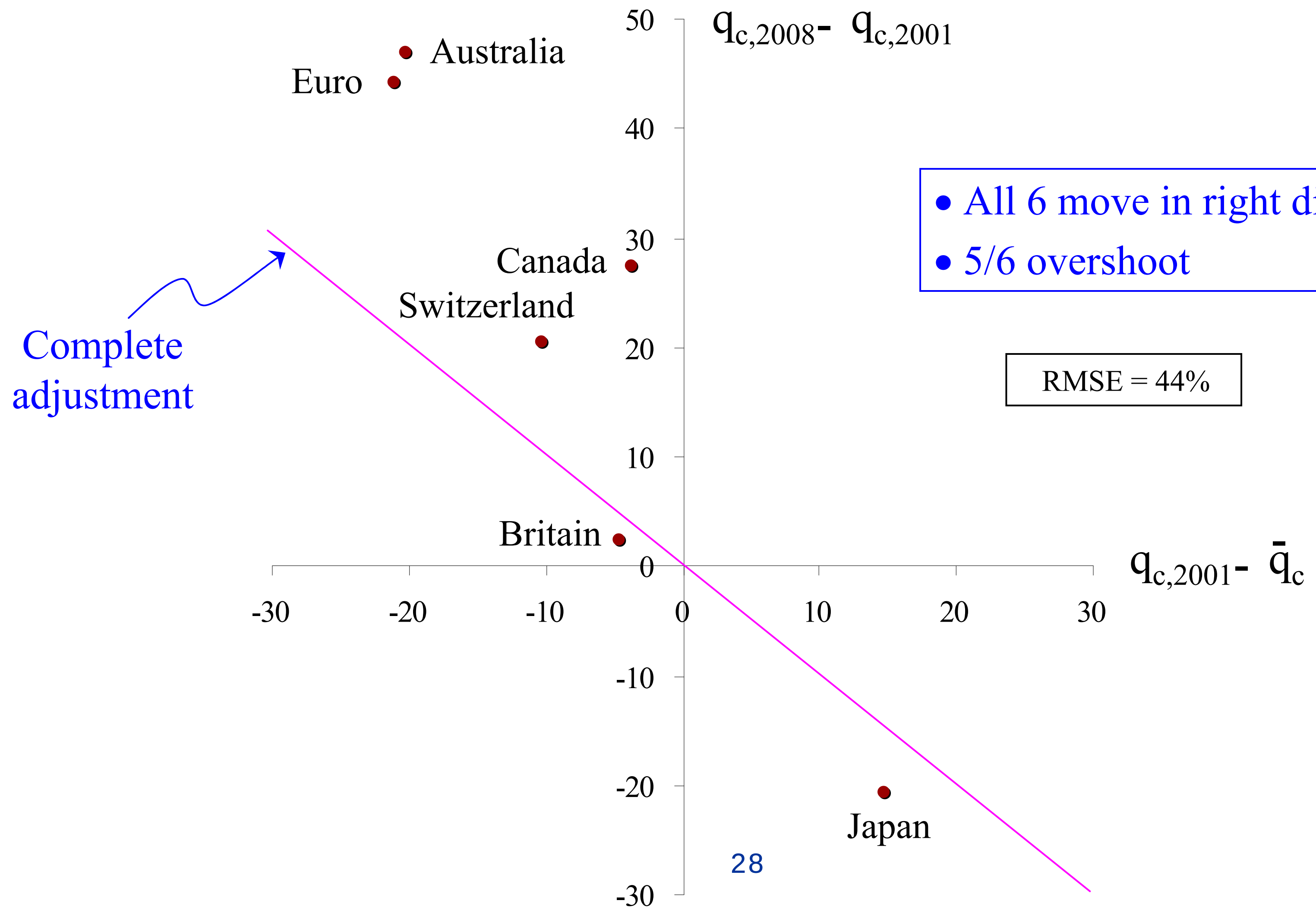


7 Years Ago... and now



- OZ performs reasonable well
- 3/6 move in wrong direction

Bias Adjusted



Conclusion

- BMI is biased
- Bias-adjusted BMI performs reasonably well
- Can predict future currency movements over longer horizons