Exchange-Rate Dynamics
Chapter 3

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Empirical Macro Models

Outline:

1. Present Value Models
2. Monetary Models
   i. Money-Income Models
   ii. Taylor Rule Models
3. External Balance Models
4. Predicting Exchange-Rate Movements

3.1 Present Value Models

Drivers of Depreciation Rates

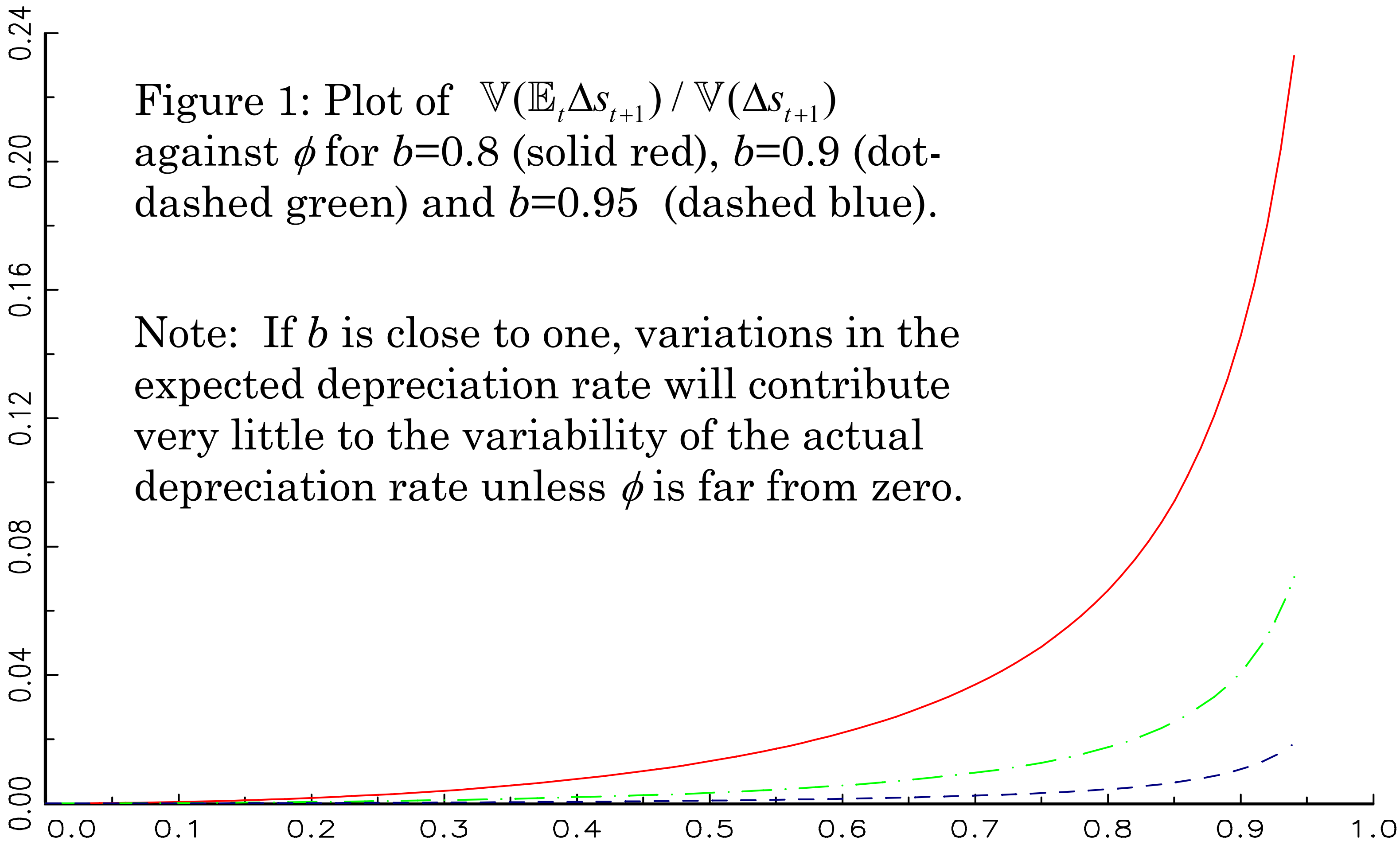


Figure 1: Plot of $\mathbb{V}(\mathbb{E}_t \Delta s_{t+1}) / \mathbb{V}(\Delta s_{t+1})$ against ϕ for b=0.8 (solid red), b=0.9 (dot-dashed green) and b=0.95 (dashed blue).

Note: If b is close to one, variations in the expected depreciation rate will contribute very little to the variability of the actual depreciation rate unless ϕ is far from zero.

3.1 Present Value Models

Volatility

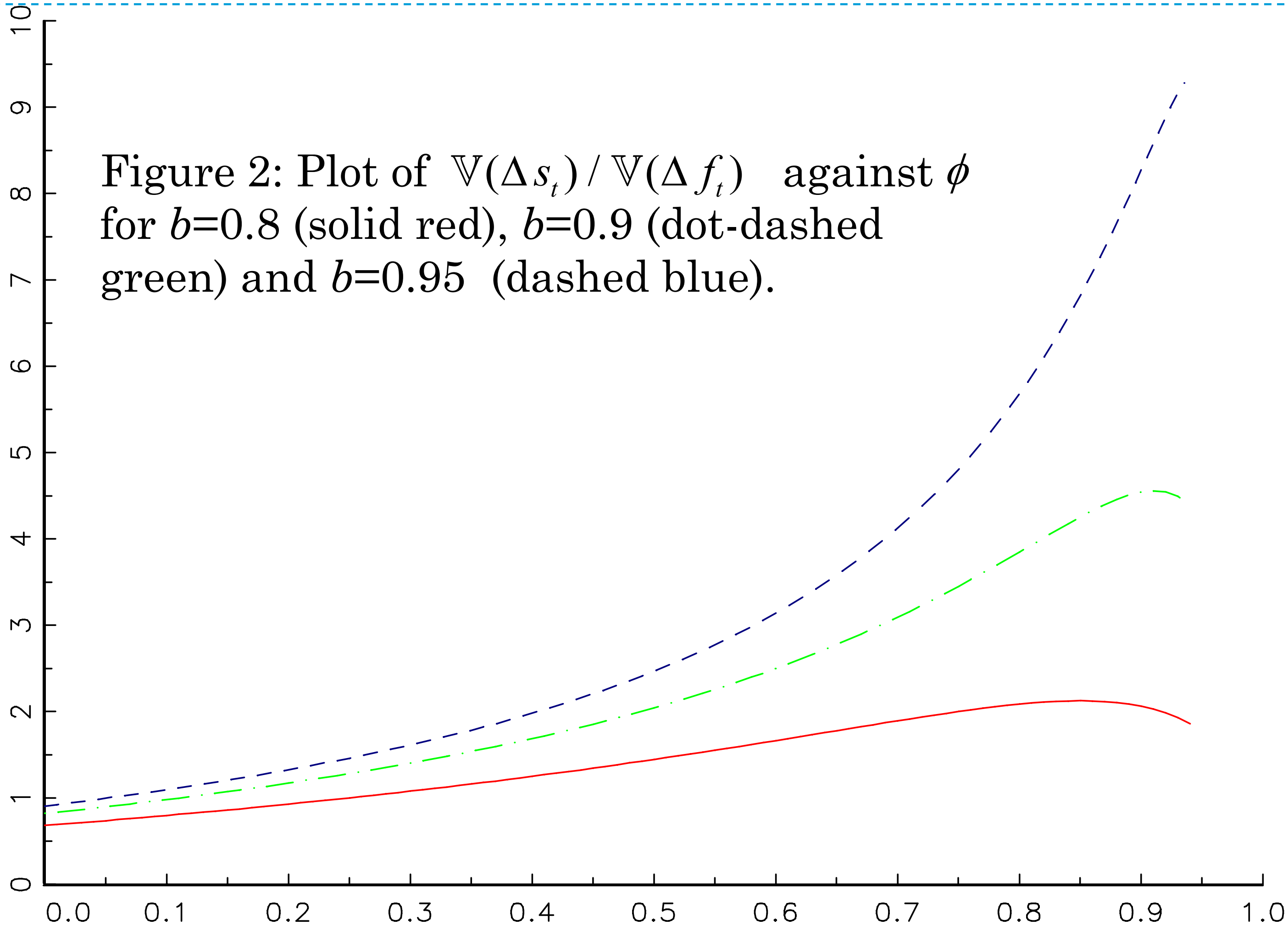


Figure 2: Plot of $\mathbb{V}(\Delta s_t)/\mathbb{V}(\Delta f_t)$ against ϕ for b=0.8 (solid red), b=0.9 (dot-dashed green) and b=0.95 (dashed blue).

3.1 Present Value Models

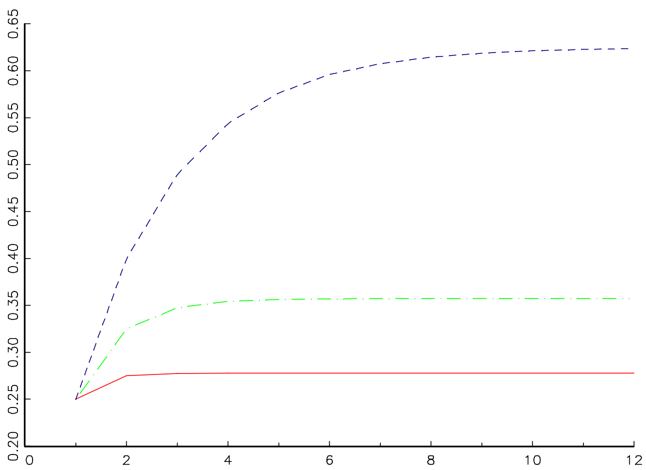
Forecasting

These forecasting implications of the PV model depend critically on the value of the discount parameter *b*, and the behavior of fundamentals. For example, if

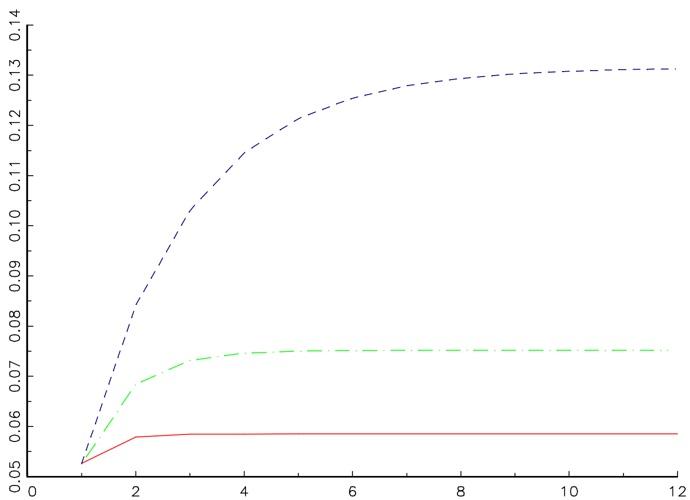
$$\Delta f_t = \phi \Delta f_{t-1} + \eta_t \quad \text{with} \quad |\phi| < 1$$

then

$$\beta_h = \frac{1-b}{b}\frac{1-\phi^h}{1-\phi}$$



β_h vs. *h* when *b*=0.8



β_h vs. *h* when *b*=0.95

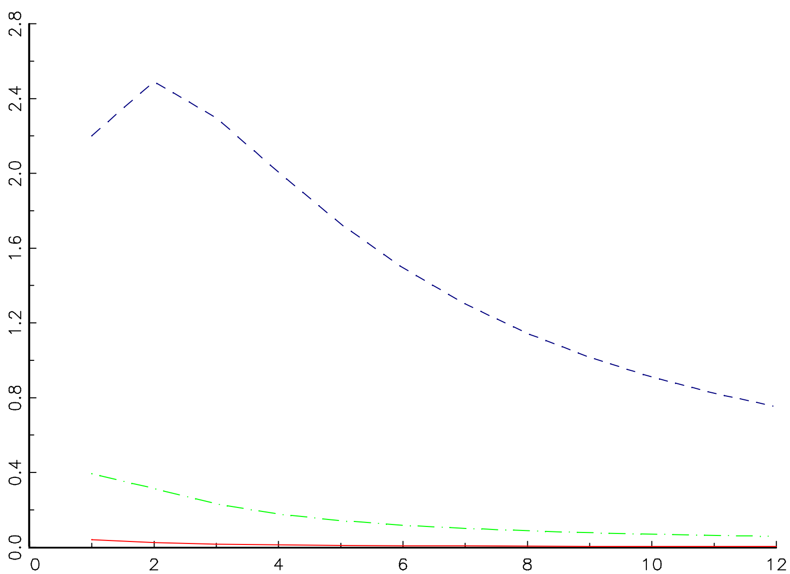
Key: $\phi = 0.1$ (solid red, $\phi = 0.3$ (dashed-dot green) and $\phi = 0.6$ (dashed blue).

3.1 Present Value Models

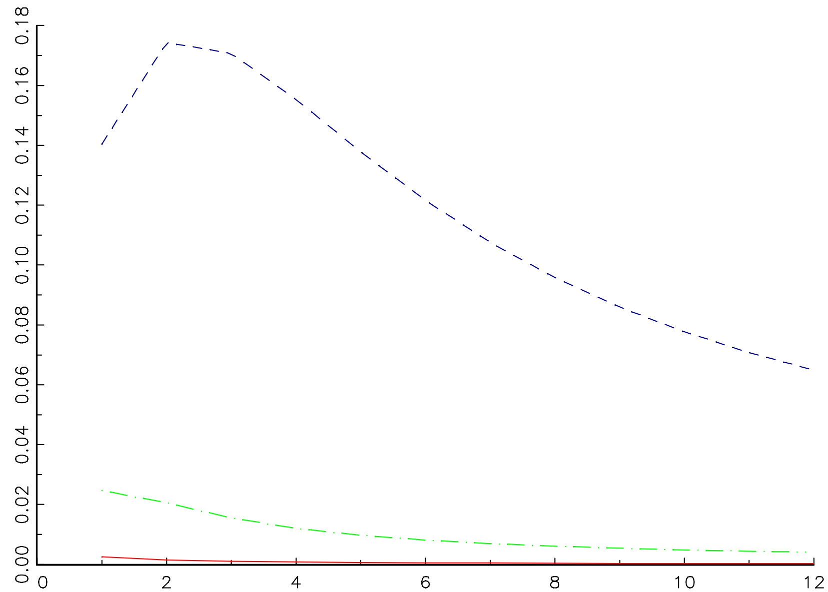
Forecasting

Overall forecasting power calculated as 100 times the theoretical R^2 statistic from the projection (3.27):

$$100 \times R_h^2 \quad \text{where} \quad R_h^2 = \beta_h^2 \mathbb{V}\left(s_t - f_t\right) / \mathbb{V}\left(\Delta^h s_{t+h}\right)$$



$100R^2$ vs. h when b=0.8



$100R^2$ vs. h when b=0.95

Key: ϕ=0.1 (solid red, ϕ =0.3 (dashed-dot green) and ϕ =0.6 (dashed blue).

3.2 Monetary Models

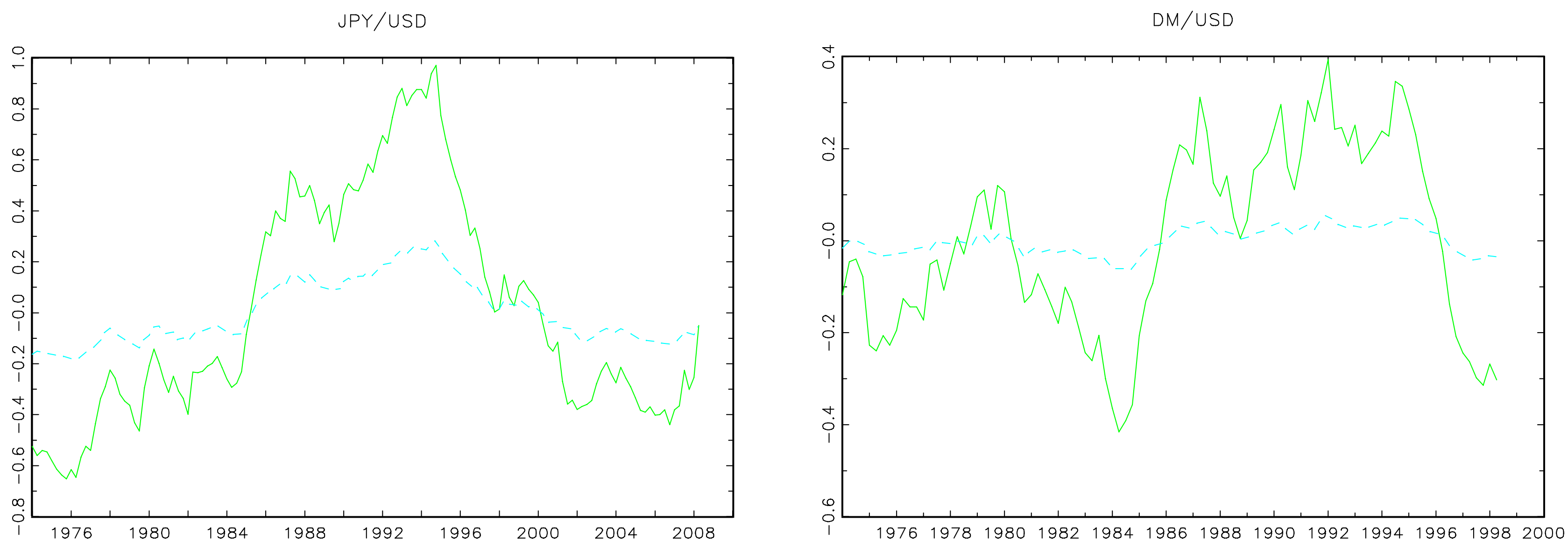
Money-Income Models

MacDonald and Taylor (1993) computed monthly fundamentals for the DM/USD exchange rate as

$$f_t^{M/Y} = m_t - \hat{m}_t - y_t + \hat{y}_t$$

They then estimated a VAR for $s_t - f_t^{M/Y}$ and $\Delta f_t^{M/Y}$ and compared the actual behavior of $s_t - f_t^{M/Y}$ against the values predicted by the VAR estimates and the PV relation implied by the Money-Income model.

They found that the time series for $s_t - f_t^{M/Y}$ varied considerably but the predicted values were essentially constant. This is a robust result, see below.



3.2 Monetary Models

Taylor Rule Models

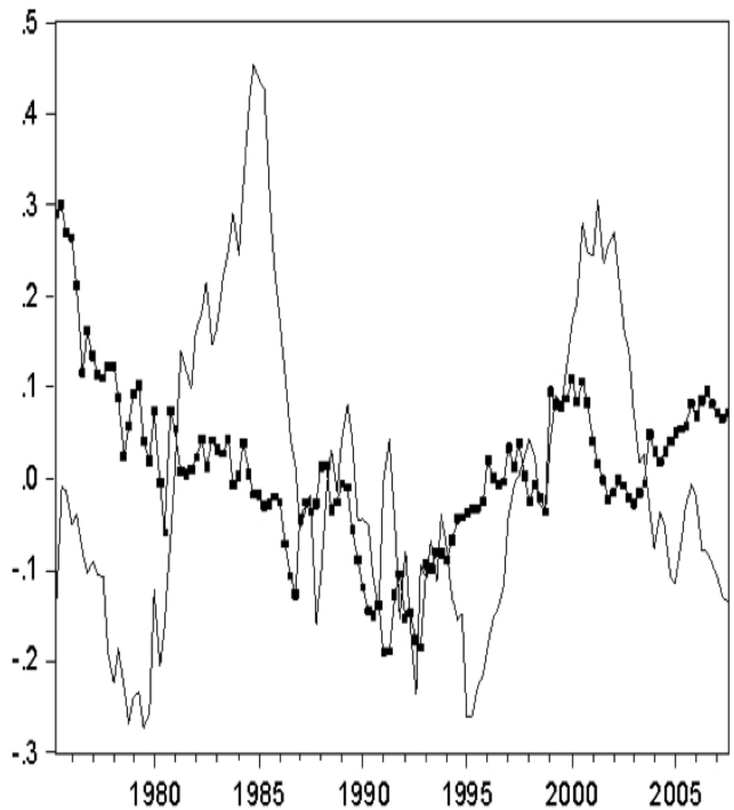


Figure 5: Actual values for the real DM/USD (solid), and predicted values (boxed), calculated by Mark (2009)

Mark (2009) estimates Taylor rules for the Fed, the Bundesbank and European Central Bank (ECB) in quarterly data between 1962 and 2007.

- He allows for first-order serial correlation in the policy deviations, and for changes in the Taylor Rule parameters.
- The estimates of ψ are insignificant so ψ is set equal to zero when he computes the present value relation.
- The parameter estimates are then combined with VAR forecasts for inflation and the output gap to compute the predicted values for the real DM/USD rate between 1976:1 and 2007:III using the implied present value relation.

3.2 Monetary Models

Taylor Rule Models

Table 1: Forecasting Depreciation Rates

Currency		$\pi_t - \hat{\pi}_t$	$y_t^G - \hat{y}_t^G$	ε_t	$r_{t-1} - \hat{r}_{t-1}$	z_t^{TR}	z_t^M	R^2
JPY/USD	(i)	1.014*	-0.073	-0.087	-2.086***			0.028
		(0.665)	(0.128)	(0.096)	(0.610)			
	(ii)				-1.64***	0.054		0.021
					(0.527)	(0.199)		
	(iii)			-0.069				0.002
				(0.081)				
	(iv)						-0.037*	0.004
							(0.026)	
GBP/USD	(i)	-0.404	-0.022	-0.033	0.795			0.017
		(0.529)	(0.308)	(0.069)	(0.617)			
	(ii)				0.913**	-0.214		0.016
					(0.540)	(0.152)		
	(iii)			-0.107**				0.011
				(0.046)				
	(iv)						-0.085**	0.009
							(0.042)	
DM/USD	(i)	0.226	0.330	-0.118**	0.555			0.016
		(1.056)	(0.387)	(0.060)	(0.946)			
	(ii)				0.990	-0.246		0.005
					(0.954)	(0.339)		
	(iii)			-0.082*				0.007
				(0.058)				
	(iv)						-0.010	<0.001
							(0.089)	

Molodtsova and Papell (2009), Engel, Mark, and West (2007) and Rogoff, Stavrakeva, and Center (2008) study the forecasting power of Taylor Rule fundamentals with regressions like

$$\Delta s_{t+1} = a_0 + a' z_t + v_{t+1} \quad (3.44)$$

Table 1 shows little evidence of a stable, economically significant relationship between current macroeconomic conditions, and the nominal depreciation rate over the next month for major currencies.

3.3 External Balance Models

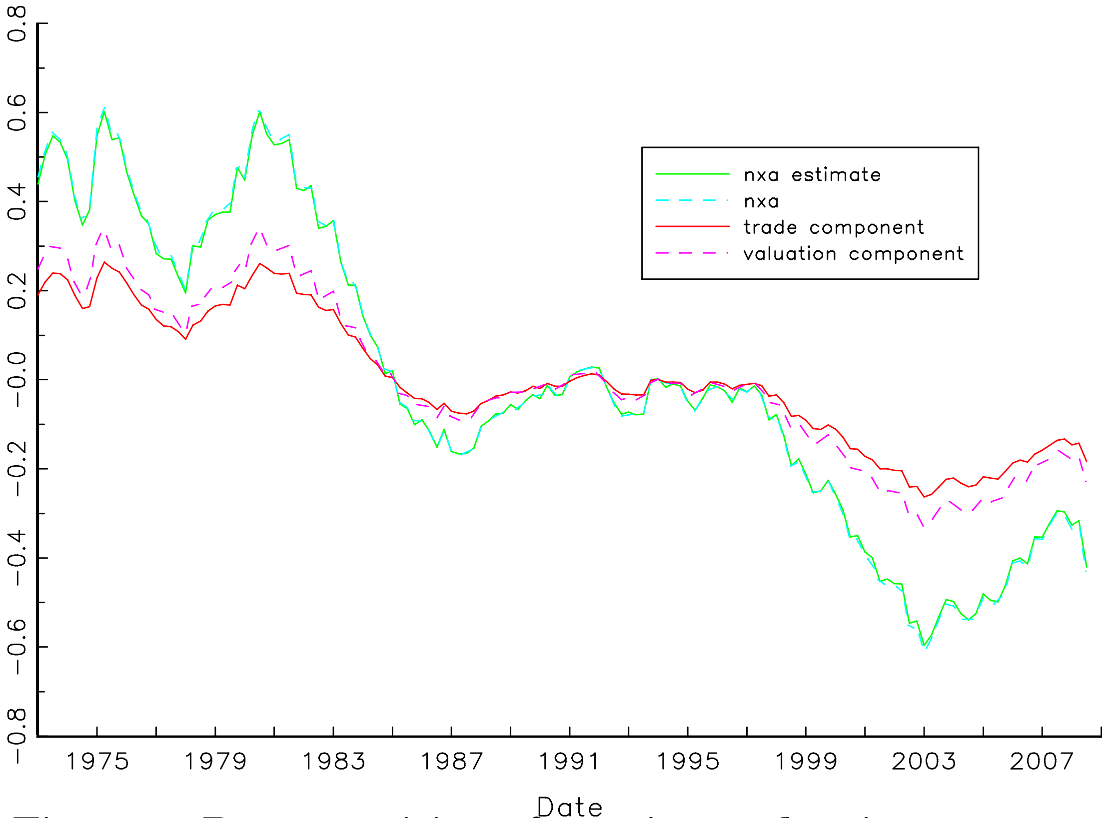


Figure 6: Decomposition of nxa_t into valuation component, nxa_t^r; trade component, $nxa_t^{\Delta nx}$; and total estimate, $nxa_t^r + nxa_t^{\Delta nx}$.

Note:

1. The good fit of the PV relation.
2. The positive correlation in the components.
3. Valuation effects account for ~ 50% of external adjustment.
4. Hard to understand what economic factors could justify the ever-greater optimism implicit in the long run fall in nxa_t.

3.3 External Balance Models

Table 2: Forecasting with Measures of the U.S. External Position

Horizon	Forecasting variables: (i) nxa_t 1	(i) nxa_t 4	(ii) nxa_t^{DT} 1	(ii) nxa_t^{DT} 4	(iii) nxa_t^{C} 1	(iii) nxa_t^{C} 4
Portfolio Returns	-0.011**	-0.014***	-0.052***	-0.051***	-0.360***	-0.330***
	(0.006)	(0.005)	(0.014)	(0.010)	(0.070)	(0.040)
R^2	0.023	0.112	0.092	0.251	0.110	0.260
Depreciation Rates						
FDI	-0.021***	-0.022***	-0.081***	-0.081***	-0.080***	-0.080***
	(0.008)	(0.006)	(0.021)	(0.016)	(0.020)	(0.010)
R^2	0.042	0.149	0.106	0.326	0.090	0.310
DM/USD	-0.019	-0.021**	-0.124***	-0.110***		
	(0.015)	(0.011)	(0.035)	(0.029)		
R^2	0.011	0.052	0.079	0.200		
GBP/USD	-0.028***	-0.031***	-0.088***	-0.095***		
	(0.011)	(0.010)	(0.031)	(0.021)		
R^2	0.035	0.149	0.058	0.226		
JPY/USD	-0.009	-0.007	-0.078***	-0.076***		
	(0.013)	(0.011)	(0.038)	(0.029)		
R^2	0.003	0.006	0.033	0.106		

The table reports estimates of a_1 from regressions of the form $\mathfrak{r}_{t,h} = a_0 + a_1 z_t + \epsilon_{t+h}$, where $\mathfrak{r}_{t,h}$ is the h-period return between t and $t+h$, and the forecasting variable z_t is nxa_t in panel (i), detrended nxa_t, nxa_t^{DT}, in panel (ii), or the the cyclical component nxa_t^{C} as computed by G&R in panel (iii). Newey-West robust standard errors are reported in parentheses that account for $(h-1)$-order serial correlation in regression error process. Panel (iii) replicates the results reported by G&R. Coefficient estimates that are significant different from zero in one-sided t-tests at the 10%, 5%, and 1% levels are indicated by "*", "**" and "***".

Note that:

1. Some measures of the U.S. external balance have forecasting power for future depreciation rates.
2. The degree of forecasting power varies according to whether the depreciation rate is for a basket or a single currency pair, and whether the external balance measure includes the long-term deterioration in the U.S. external position.