Dissecting the Exchange Rates and Fundamentals: The Role of Permanent and Transitory Shocks

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Introduction

- Stylized facts about "exchange rate disconnect puzzle":
  1. Economic fundamentals fail to explain the short-term volatility in exchange rates.
  2. Economic models have difficulty to outperform a simple random walk model in terms of out-of-sample forecasts.

Introduction

- Engel and West (2005) adopted a new line of attack to this puzzle.
- They first by showing that a wide range of exchange rate models imply that the exchange rate is determined by the present discounted value of expected economic fundamentals,
- Then they show that if the fundamentals are I(1) and the discount factor is close to one, then the models predicting the exchange rate follow an approximate random walk.
- As a result, Engel and West (2005) argue that judging exchange rate models based on their out-of-sample predictive power compared with a random walk is inappropriate.

Introduction

- By contrast, models incorporating Taylor rules have recently gained some prominence as a means of predicting the exchange rate:
  1. Molodtsova and Papell (2009) provide evidence of significant short-horizon, out-of-sample predictability of exchange rates with Taylor rule fundamentals for 11 of 12 currencies vis-á-vis the US dollar during the post-Bretton Woods era.
  2. Molodtsova et al. (2008) find evidence of out-of-sample predictability for the dollar/mark nominal exchange rate with forecasts based on Taylor rule fundamentals using a real-time dataset.
  3. Wu and Wang (2012) find that the predictability of exchange rates in the context of interval forecasting is favorable toward the Taylor rule model.

The goal of this paper

- The empirical success of the Taylor rule-based model provides apparently contradictory implications for the relationship between the exchange rate and its underlying economic fundamentals, as documented by Engel and West (2005).
- The goal of this paper is to reconcile these two alternative views on the exchange rate model by gauging the relative contributions of permanent and transitory shocks in both nominal exchange rates and the economic fundamentals, and point out the source of this contradiction in the present value form of the exchange rates in the Taylor rule model.

- In Engel and West (2005), the Taylor rule model suggests that economic fundamentals determine nominal exchange rates, including price and interest rate differentials across countries and other potentially unobserved variables relating to central bank behavior.
- Following Engel and West (2005), we collect quarterly data on exchange rates, price levels and interest rates from 1973Q1 to 2011Q4 for France, Germany, Italy, Japan, Switzerland, and the UK, with the US serving as the numeraire.
- We employ vector error-correction models (VECM) to investigate the relationship between exchange rates and the economic fundamentals.
- We reveal the origins of these fluctuations in exchange rates and the fundamentals using the permanent–transitory decomposition method developed by Gonzalo and Ng (2001).

- Our empirical findings show that transitory shocks are able to explain most exchange rate movements, while permanent shocks appear to dominate explanation of the variability in the economic fundamentals.
- This suggests that because exchange rates and economic fundamentals are cointegrated, their movements must be tied together in the very long run, and, therefore, so must any variations.
- Due to exchange rate variation is far more volatile than economic fundamentals over short horizons, the short- and long-run properties of these variables can only be reconciled over time if either
    1. The variations in economic fundamentals increase, or
    2. The variations in exchange rates decrease.
- The results in this paper are most consistent with the latter explanation.

- Our finding yields a novel interpretation of the exchange rate disconnect puzzle.
- That is, it is unsurprising to obtain evidence that economic fundamentals, such as price and interest rate differentials across countries, fail to account for the large transitory impacts on exchange rates because the fluctuations in the fundamentals are primarily attributable to permanent shocks.

- These findings suggest that we should not approximate exchange rate behavior with a pure random-walk model.
- And that empirical models based solely on macroeconomic variables may fail to provide much more information beyond the permanent components in these macroeconomic variables themselves, because this makes any predictability indistinguishable from a pure random walk.

- Our results suggest that the transitory components in the Taylor rule model, such as the policy responses of the central bank and the foreign exchange risk premium, are essential in explaining the exchange rate dynamics.
- This helps explain why the empirical evidence of models incorporating Taylor rules are mostly favorable to other models.
- Most of the studies in this strand of the literature do not make use of the price and interest rate differentials directly. Instead, they construct the fundamentals by estimating the expected inflation, output gap, etc.
- In other words, they reveal the transitory components, or those assumed to be unobservable in Engel and West (2005).

Taylor Rule Model

- Assume the Taylor rule in the home country takes the form

$$i_t = \phi_\pi \pi_t^e + \phi_x x_t + \phi_s (s_t - \overline{s}_t) + \nu_t, \tag{1}$$

- Analogously, the Taylor rule of the foreign country is:

$$i_t^* = \phi_\pi \pi_t^{e*} + \phi_x x_t^* + \nu_t^*, \tag{2}$$

Taylor Rule Model

- And interest parity holds:

$$E_t s_{t+1} - s_t = i_t - i_t^* + \rho_t, \tag{3}$$

- Subtracting equation (2) from (1) and using interest parity (3) to substitute for $i_t - i_t^*$, we have:

$$s_t = \frac{\phi_s}{1+\phi_s}(p_t - p_t^*) - \frac{1}{1+\phi_s}[\phi_\pi(\pi_t^e - \pi_t^{e*}) + \phi_x(x_t - x_t^*) + (\nu_t - \nu_t^*) + \rho_t] \tag{4}$$

$$+ \frac{1}{1+\phi_s} E_t s_{t+1}.$$

Taylor Rule Model

- Following Engel and West (2005), let the discount factor b_1 be equal to $1/(1+\phi_s)$, and $f_t = p_t - p_t^*$,
  $\zeta_t = -[\phi_\pi(\pi_t^e - \pi_t^{e*}) + \phi_x(x_t - x_t^*) + (\nu_t - \nu_t^*) + \rho_t]$, equation (4) can be expressed as the present value form:

$$s_t = (1-b_1)\sum_{j=0}^{\infty} b_1^j E_t f_{t+j} + b_1 \sum_{j=0}^{\infty} b_1^j E_t \zeta_{t+j}. \tag{5}$$

- We follow Engel and West (2005) and Engel et al. (2007) and consider ζ_t as unobserved variables and use $p_t - p_t^*$ as measures of the fundamentals.

Taylor Rule Model

- By subtracting f_t from both sides of (5), we rewrite it as:

$$s_t - f_t = \sum_{j=1}^{\infty} b_1^j E_t \Delta f_{t+j} + b_1 \sum_{j=0}^{\infty} b_1^j E_t \zeta_{t+j}. \tag{6}$$

- If s_t and $p_t - p_t^*$ are I(1) and ζ_t is I(0), then it implies $s_t - f_t$ is I(0).
- s_t and f_t are cointegrated with the cointegration vector $[1, -1]'$ in accordance with equation (6).

Taylor Rule Model

- We thus construct a VECM based on s_t and f_t, as follows:

$$\Delta Y_t = \mu + \alpha z_{t-1} + A_1 \Delta Y_{t-1} + \cdots + A_{p-1} \Delta Y_{t-p+1} + e_t, \qquad (7)$$

Taylor Rule Model: Alternative Expression

- As in Engel and West (2005), we can re-express equation (4) as:

$$s_t = \phi_s[(p_t - p_t^*) + (i_t - i_t^*)] + \xi_t - (1-\phi_s)\rho_t + (1-\phi_s)E_t s_{t+1}, \qquad (8)$$

where $\xi_t = -[\phi_\pi(\pi_t^e - \pi_t^{e*}) + \phi_x(x_t - x_t^*) + (\nu_t - \nu_t^*)]$.

- This leads to the associated present value form as follows:

$$s_t = (1-b_2)\sum_{j=0}^{\infty} b_2^j E_t(f_{t+j} + \xi_{t+j}) + b_2 \sum_{j=0}^{\infty} b_2^j E_t \zeta_{t+j}, \qquad (9)$$

where $b_2 = 1 - \phi_s$, $f_t = p_t - p_t^* + i_t - i_t^*$.

- In this case, the observed fundamentals are given by $f_t = p_t - p_t^* + i_t - i_t^*$. Equation (9) suggests a VECM with s_t and $p_t - p_t^* + i_t - i_t^*$.

Permanent Transitory Decomposition

- According to the Granger representation theorem, under the maintained hypothesis that the growth rates in Y_t are covariance stationary around some deterministic terms, there exists a multivariate Wold representation of ΔY_t as:

$$\Delta Y_t = \delta D_t + C(L)e_t, \tag{10}$$

- In accordance with Gonzalo and Granger (1995), we define u_t^P as a permanent shock if $\lim_{k\to\infty} \partial E_t Y_{t+k}/\partial u_t^P \neq 0$, and u_t^T as a transitory shock if $\lim_{k\to\infty} \partial E_t Y_{t+k}/\partial u_t^T = 0$.

Permanent Transitory Decomposition

- Gonzalo and Ng (2001) identify the permanent and transitory shocks by using

$$u_t \equiv \begin{bmatrix} u_t^P \\ u_t^T \end{bmatrix} = Ge_t. \tag{11}$$

where

$$G = \begin{bmatrix} \alpha'_{\perp} \\ \beta' \end{bmatrix} \tag{12}$$

Permanent Transitory Decomposition

- We can express (10) as:

$$\begin{aligned} \Delta Y_t &= \delta D_t + C(L) G^{-1} G e_t \\ &= \delta D_t + D(L) u_t . \end{aligned} \tag{13}$$

- The polynomial matrix $D(L) = D_0 + D_1 L + D_2 L^2 + \cdots$ in equation (13) has the property that the last column of $D(1) = C(1) G^{-1}$ are full of zeros because they refer to the long-run impact of the transitory shocks.

Permanent Transitory Decomposition

- However, u_t^P and u_t^T are not mutually orthogonal, and thus computing the impulse response functions and making the causal statements of the permanent and transitory shocks at this stage is not appropriate.
- Gonzalo and Ng (2001) further uses Cholesky factorization of the variance-covariance matrix $E(u_t u_t') = G\Sigma_e G'$ to obtain the orthogonal permanent and transitory shock.

Estimation Results of VECM

- We estimate VECM as follows:

$$\Delta s_t = \mu_1 + \alpha_1 z_{t-1} + \sum_{i=1}^{p} a_{11}^{i} \Delta s_{t-i} + \sum_{i=1}^{p} a_{12}^{i} \Delta f_{t-i} + e_{1t}, \tag{14}$$

$$\Delta f_t = \mu_2 + \alpha_2 z_{t-1} + \sum_{i=1}^{p} a_{21}^{i} \Delta s_{t-i} + \sum_{i=1}^{p} a_{22}^{i} \Delta f_{t-i} + e_{2t}. \tag{15}$$

Estimation Results of VECM

	$f_t = p_t - p_t^*$		$f_t = p_t - p_t^* + i_t - i_t^*$	
	α_1	α_2	α_1	α_2
France	-0.089*	0.001	-0.062*	0.014*
	(-2.549)	(0.330)	(-2.024)	(2.247)
Germany	-0.075*	0.002	-0.073*	0.007
	(-2.408)	(0.842)	(-2.332)	(1.228)
Italy	-0.108*	0.005	-0.069*	0.013
	(-3.151)	(1.172)	(-2.315)	(1.401)
Japan	-0.071*	0.004	-0.051*	0.012*
	(-2.521)	(1.356)	(-1.808)	(1.795)
Switzerland	-0.091*	0.002	-0.069*	0.009
	(-2.604)	(0.560)	(-1.982)	(1.155)
UK	-0.119*	-0.003	-0.061*	0.034*
	(-3.211)	(-0.483)	(-2.087)	(3.112)

Forecast Error Variance Decomposition: $\Delta s_{t+h} - E_t \Delta s_{t+h}$: Orthogonalized Shocks, $f_t = p_t - p_t^*$

		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
France ($\alpha_2 = 0$)	P	0.034	0.076	0.099	0.127	0.158	0.290
		[0.000 , 0.074]	[0.003 , 0.168]	[0.003 , 0.246]	[0.003 , 0.327]	[0.004 , 0.394]	[0.014 , 0.543]
	T	0.966	0.924	0.901	0.873	0.842	0.710
		[0.926 , 1.000]	[0.832 , 0.997]	[0.754 , 0.997]	[0.673 , 0.997]	[0.606 , 0.996]	[0.457 , 0.986]
Germany ($\alpha_2 = 0$)	P	0.020	0.031	0.022	0.019	0.019	0.068
		[0.000 , 0.056]	[0.001 , 0.092]	[0.001 , 0.109]	[0.001 , 0.144]	[0.002 , 0.177]	[0.009 , 0.313]
	T	0.980	0.969	0.978	0.981	0.981	0.932
		[0.944 , 1.000]	[0.908 , 0.999]	[0.891 , 0.999]	[0.856 , 0.999]	[0.823 , 0.998]	[0.687 , 0.991]
Italy ($\alpha_2 = 0$)	P	0.016	0.021	0.075	0.200	0.348	0.658
		[0.000 , 0.072]	[0.000 , 0.110]	[0.005 , 0.277]	[0.015 , 0.489]	[0.056 , 0.648]	[0.280 , 0.894]
	T	0.984	0.979	0.925	0.800	0.652	0.342
		[0.928 , 1.000]	[0.890 , 1.000]	[0.723 , 0.995]	[0.511 , 0.985]	[0.352 , 0.944]	[0.106 , 0.720]
Japan ($\alpha_2 = 0$)	P	0.043	0.021	0.017	0.014	0.013	0.046
		[0.000 , 0.095]	[0.002 , 0.077]	[0.001 , 0.095]	[0.001 , 0.121]	[0.002 , 0.145]	[0.007 , 0.233]
	T	0.957	0.979	0.983	0.986	0.987	0.954
		[0.905 , 1.000]	[0.923 , 0.998]	[0.905 , 0.999]	[0.879 , 0.999]	[0.855 , 0.998]	[0.767 , 0.993]
Switzerland ($\alpha_2 = 0$)	P	0.000	0.012	0.010	0.012	0.018	0.120
		[0.000 , 0.025]	[0.000 , 0.067]	[0.000 , 0.097]	[0.001 , 0.142]	[0.002 , 0.184]	[0.015 , 0.369]
	T	1.000	0.988	0.990	0.988	0.982	0.880
		[0.975 , 1.000]	[0.933 , 1.000]	[0.903 , 1.000]	[0.858 , 0.999]	[0.816 , 0.998]	[0.631 , 0.985]
UK ($\alpha_2 = 0$)	P	0.010	0.025	0.136	0.273	0.369	0.537
		[0.000 , 0.064]	[0.000 , 0.136]	[0.005 , 0.362]	[0.022 , 0.547]	[0.078 , 0.659]	[0.221 , 0.808]
	T	0.990	0.975	0.864	0.727	0.631	0.463
		[0.936 , 1.000]	[0.864 , 1.000]	[0.638 , 0.995]	[0.453 , 0.978]	[0.341 , 0.922]	[0.192 , 0.779]

Forecast Error Variance Decomposition of $\Delta f_{t+h} - E_t \Delta f_{t+h}$: Orthogonalized Shocks, $f_t = p_t - p_t^*$

		$h=1$	$h=4$	$h=8$	$h=12$	$h=16$	$h=32$
France ($\alpha_2 = 0$)	P	1.000	0.939	0.910	0.910	0.921	0.962
		[1.000 , 1.000]	[0.881 , 1.000]	[0.831 , 0.999]	[0.832 , 1.000]	[0.853 , 1.000]	[0.924 , 1.000]
	T	0.000	0.061	0.090	0.090	0.079	0.038
		[0.000 , 0.000]	[0.000 , 0.119]	[0.001 , 0.169]	[0.000 , 0.168]	[0.000 , 0.147]	[0.000 , 0.076]
Germany ($\alpha_2 = 0$)	P	1.000	0.932	0.911	0.911	0.921	0.960
		[1.000 , 1.000]	[0.870 , 0.999]	[0.827 , 0.999]	[0.828 , 1.000]	[0.848 , 1.000]	[0.920 , 1.000]
	T	0.000	0.068	0.089	0.089	0.079	0.040
		[0.000 , 0.000]	[0.001 , 0.130]	[0.001 , 0.173]	[0.000 , 0.172]	[0.000 , 0.152]	[0.000 , 0.080]
Italy ($\alpha_2 = 0$)	P	1.000	0.942	0.923	0.930	0.944	0.980
		[1.000 , 1.000]	[0.856 , 0.997]	[0.791 , 0.999]	[0.796 , 0.999]	[0.827 , 1.000]	[0.923 , 1.000]
	T	0.000	0.058	0.077	0.070	0.056	0.020
		[0.000 , 0.000]	[0.003 , 0.144]	[0.001 , 0.209]	[0.001 , 0.204]	[0.000 , 0.173]	[0.000 , 0.077]
Japan ($\alpha_2 = 0$)	P	1.000	0.983	0.936	0.915	0.916	0.953
		[1.000 , 1.000]	[0.943 , 1.000]	[0.849 , 1.000]	[0.822 , 1.000]	[0.830 , 1.000]	[0.902 , 1.000]
	T	0.000	0.017	0.064	0.085	0.084	0.047
		[0.000 , 0.000]	[0.000 , 0.057]	[0.000 , 0.151]	[0.000 , 0.178]	[0.000 , 0.170]	[0.000 , 0.098]
Switzerland ($\alpha_2 = 0$)	P	1.000	0.963	0.945	0.945	0.952	0.978
		[1.000 , 1.000]	[0.914 , 1.000]	[0.874 , 1.000]	[0.876 , 1.000]	[0.894 , 1.000]	[0.948 , 1.000]
	T	0.000	0.037	0.055	0.055	0.048	0.022
		[0.000 , 0.000]	[0.000 , 0.086]	[0.000 , 0.126]	[0.000 , 0.124]	[0.000 , 0.106]	[0.000 , 0.052]
UK ($\alpha_2 = 0$)	P	1.000	0.999	0.999	1.000	1.000	1.000
		[1.000 , 1.000]	[0.968 , 1.000]	[0.940 , 1.000]	[0.940 , 1.000]	[0.950 , 1.000]	[0.974 , 1.000]
	T	0.000	0.001	0.001	0.000	0.000	0.000
		[0.000 , 0.000]	[0.000 , 0.032]	[0.000 , 0.060]	[0.000 , 0.060]	[0.000 , 0.050]	[0.000 , 0.026]

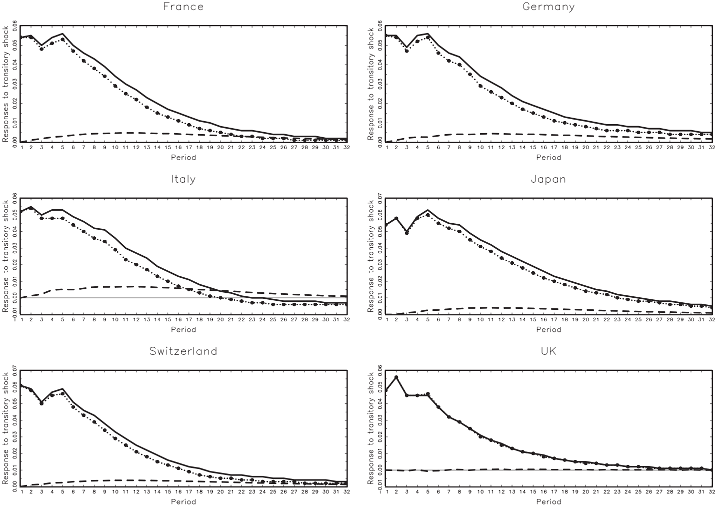
Forecast Error Variance Decomposition: $\Delta s_{t+h} - E_t \Delta s_{t+h}$: Orthogonalized Shocks, $f_t = p_t - p_t^* + i_t - i_t^*$

		$h=1$	$h=4$	$h=8$	$h=12$	$h=16$	$h=32$
France	P	0.399	0.454	0.495	0.528	0.556	0.633
		[0.000 , 0.720]	[0.000 , 0.761]	[0.003 , 0.793	[0.070 , 0.863]	[0.112 , 0.883]	[0.261 , 0.926]
	T	0.601	0.546	0.505	0.472	0.444	0.367
		[0.280 , 1.000]	[0.239 , 1.000]	[0.207 , 0.997]	[0.137 , 0.930]	[0.117 , 0.888]	[0.074 , 0.739]
Germany ($\alpha_2 = 0$)	P	0.000	0.000	0.001	0.003	0.012	0.124
		[0.000 , 0.035]	[0.000 , 0.065]	[0.000 , 0.116]	[0.001 , 0.181]	[0.001 , 0.243]	[0.010 , 0.456]
	T	1.000	1.000	0.999	0.997	0.988	0.876
		[0.965 , 1.000]	[0.935 , 1.000]	[0.884 , 1.000]	[0.819 , 0.999]	[0.757 , 0.999]	[0.544 , 0.990]
Italy ($\alpha_2 = 0$)	P	0.030	0.136	0.226	0.283	0.328	0.449
		[0.000 , 0.071]	[0.023 , 0.253]	[0.059 , 0.402]	[0.110 , 0.496]	[0.140 , 0.542]	[0.264 , 0.666]
	T	0.970	0.864	0.774	0.717	0.672	0.551
		[0.929 , 1.000]	[0.747 , 0.977]	[0.598 , 0.941]	[0.504 , 0.890]	[0.458 , 0.860]	[0.334 , 0.736]
Japan	P	0.324	0.308	0.291	0.295	0.309	0.380
		[0.000 , 0.808]	[0.000 , 0.786]	[0.001 , 0.776]	[0.001 , 0.778]	[0.002 , 0.790]	[0.032 , 0.834]
	T	0.676	0.692	0.709	0.705	0.691	0.620
		[0.192 , 1.000]	[0.214 , 1.000]	[0.224 , 0.999]	[0.222 , 0.999]	[0.210 , 0.998]	[0.166 , 0.968]
Switzerland ($\alpha_2 = 0$)	P	0.000	0.002	0.004	0.011	0.028	0.204
		[0.000 , 0.035]	[0.000 , 0.072]	[0.000 , 0.138]	[0.000 , 0.234]	[0.000 , 0.325]	[0.006 , 0.594]
	T	1.000	0.998	0.996	0.989	0.972	0.796
		[0.965 , 1.000]	[0.928 , 1.000]	[0.862 , 1.000]	[0.766 , 1.000]	[0.675 , 1.000]	[0.406 , 0.994]
UK	P	0.672	0.739	0.782	0.811	0.833	0.883
		[0.217 , 0.971]	[0.322 , 1.000]	[0.405 , 1.000]	[0.468 , 1.000]	[0.522 , 1.000]	[0.654 , 1.000]
	T	0.328	0.261	0.218	0.189	0.167	0.117
		[0.029 , 0.783]	[0.000 , 0.678]	[0.000 , 0.595]	[0.000 , 0.532]	[0.000 , 0.478]	[0.000 , 0.346]

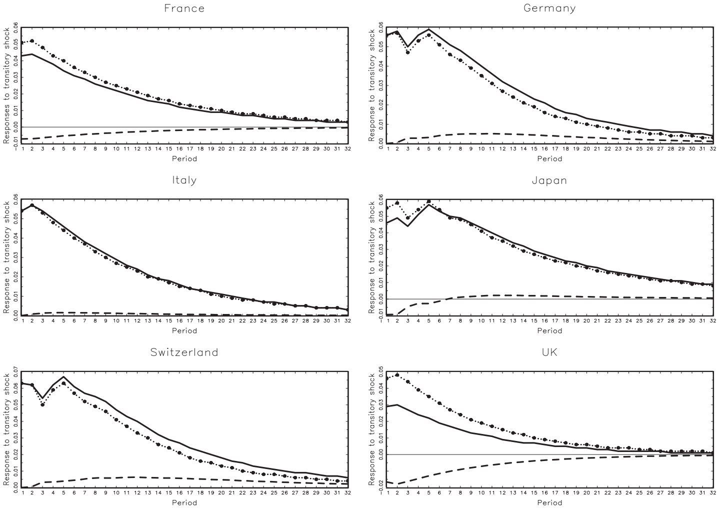
Forecast Error Variance Decomposition of $\Delta f_{t+h} - E_t \Delta f_{t+h}$: Orthogonalized Shocks, $f_t = p_t - p_t^* + i_t - i_t^*$

		$h=1$	$h=4$	$h=8$	$h=12$	$h=16$	$h=32$
France	P	0.627	0.799	0.867	0.903	0.925	0.964
		[0.305 , 1.000]	[0.531 , 1.000]	[0.675 , 1.000]	[0.762 , 1.000]	[0.821 , 1.000]	[0.918 , 1.000]
	T	0.373	0.201	0.133	0.097	0.075	0.036
		[0.000 , 0.695]	[0.000 , 0.469]	[0.000 , 0.325]	[0.000 , 0.238]	[0.000 , 0.179]	[0.000 , 0.082]
Germany ($\alpha_2 = 0$)	P	1.000	0.971	0.945	0.938	0.942	0.970
		[1.000 , 1.000]	[0.905 , 1.000]	[0.834 , 1.000]	[0.818 , 1.000]	[0.830 , 1.000]	[0.907 , 1.000]
	T	0.000	0.029	0.055	0.062	0.058	0.030
		[0.000 , 0.000]	[0.000 , 0.095]	[0.000 , 0.166]	[0.000 , 0.182]	[0.000 , 0.170]	[0.000 , 0.093]
Italy ($\alpha_2 = 0$)	P	1.000	0.995	0.995	0.996	0.996	0.998
		[1.000 , 1.000]	[0.976 , 1.000]	[0.976 , 1.000]	[0.981 , 1.000]	[0.985 , 1.000]	[0.992 , 1.000]
	T	0.000	0.005	0.005	0.004	0.004	0.002
		[0.000 , 0.000]	[0.000 , 0.024]	[0.000 , 0.024]	[0.000 , 0.019]	[0.000 , 0.015]	[0.000 , 0.008]
Japan	P	0.492	0.762	0.906	0.941	0.955	0.977
		[0.071 , 1.000]	[0.353 , 0.982]	[0.597 , 0.970]	[0.696 , 0.979]	[0.752 , 0.984]	[0.870 , 0.993]
	T	0.508	0.238	0.094	0.059	0.045	0.023
		[0.000 , 0.929]	[0.018 , 0.647]	[0.030 , 0.403]	[0.021 , 0.304]	[0.016 , 0.248]	[0.007 , 0.130]
Switzerland ($\alpha_2 = 0$)	P	1.000	0.972	0.956	0.953	0.956	0.977
		[1.000 , 1.000]	[0.900 , 1.000]	[0.835 , 1.000]	[0.823 , 1.000]	[0.835 , 1.000]	[0.909 , 1.000]
	T	0.000	0.028	0.044	0.047	0.044	0.023
		[0.000 , 0.000]	[0.000 , 0.100]	[0.000 , 0.165]	[0.000 , 0.177]	[0.000 , 0.165]	[0.000 , 0.091]
UK	P	0.272	0.419	0.595	0.714	0.789	0.908
		[0.000 , 0.711]	[0.149 , 0.893]	[0.392 , 0.960]	[0.581 , 0.986]	[0.685 , 0.983]	[0.867 , 0.991]
	T	0.728	0.581	0.405	0.286	0.211	0.092
		[0.289 , 1.000]	[0.107 , 0.851]	[0.040 , 0.608]	[0.014 , 0.419]	[0.017 , 0.315]	[0.009 , 0.133]

Impulse Response Functions of Nominal Exchange Rate (s_t), Fundamentals (f_t) and Error Correction (z_t) to a One-Standard-Deviation Transitory Shock: $f_t = p_t - p_t^*$.



Impulse Response Functions of Nominal Exchange Rate (s_t), Fundamentals (f_t) and Error Correction (z_t) to a One-Standard-Deviation Transitory Shock: $f_t = p_t - p_t^* + i_t - i_t^*$.



Forecast Error Variance Decomposition: Unorthogonalized Shocks, $f_t = p_t - p_t^*$

Forecast Error Variance Decomposition of $\Delta s_{t+h} - E_t \Delta s_{t+h}$							
		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
France ($\alpha_2 = 0$)	$\tilde{P}$	0.008	0.035	0.052	0.075	0.103	0.236
	$\tilde{T}$	0.975	0.932	0.909	0.881	0.849	0.717
	$\tilde{P}, \tilde{T}$	0.017	0.033	0.039	0.044	0.048	0.048
Germany ($\alpha_2 = 0$)	$\tilde{P}$	0.009	0.018	0.012	0.010	0.010	0.056
	$\tilde{T}$	0.982	0.971	0.980	0.983	0.983	0.934
	$\tilde{P}, \tilde{T}$	0.008	0.011	0.008	0.007	0.007	0.010
Italy ($\alpha_2 = 0$)	$\tilde{P}$	0.020	0.024	0.080	0.206	0.352	0.663
	$\tilde{T}$	0.959	0.954	0.885	0.749	0.603	0.312
	$\tilde{P}, \tilde{T}$	0.021	0.022	0.034	0.045	0.045	0.025
Japan ($\alpha_2 = 0$)	$\tilde{P}$	0.012	0.034	0.040	0.047	0.057	0.108
	$\tilde{T}$	0.957	0.917	0.907	0.895	0.882	0.824
	$\tilde{P}, \tilde{T}$	0.031	0.049	0.053	0.057	0.061	0.067
Switzerland ($\alpha_2 = 0$)	$\tilde{P}$	0.010	0.031	0.029	0.031	0.039	0.141
	$\tilde{T}$	0.964	0.925	0.929	0.925	0.915	0.810
	$\tilde{P}, \tilde{T}$	0.026	0.044	0.042	0.044	0.047	0.049
UK ($\alpha_2 = 0$)	$\tilde{P}$	0.035	0.058	0.188	0.333	0.428	0.585
	$\tilde{T}$	0.997	0.982	0.871	0.732	0.635	0.466
	$\tilde{P}, \tilde{T}$	-0.032	-0.041	-0.059	-0.065	-0.063	-0.051

Forecast Error Variance Decomposition: Unorthogonalized Shocks, $f_t = p_t - p_t^*$

Forecast Error Variance Decomposition of $\Delta f_{t+h} - E_t \Delta f_{t+h}$							
		$h=1$	$h=4$	$h=8$	$h=12$	$h=16$	$h=32$
France ($\alpha_2 = 0$)	$\tilde{P}$	1.000	0.899	0.859	0.858	0.872	0.931
	$\tilde{T}$	0.000	0.062	0.090	0.091	0.080	0.038
	$\tilde{P}, \tilde{T}$	0.000	0.040	0.051	0.052	0.049	0.031
Germany ($\alpha_2 = 0$)	$\tilde{P}$	1.000	0.912	0.887	0.887	0.898	0.945
	$\tilde{T}$	0.000	0.068	0.089	0.089	0.079	0.040
	$\tilde{P}, \tilde{T}$	0.000	0.020	0.024	0.025	0.024	0.016
Italy ($\alpha_2 = 0$)	$\tilde{P}$	1.006	0.945	0.919	0.920	0.931	0.970
	$\tilde{T}$	0.008	0.034	0.050	0.048	0.040	0.015
	$\tilde{P}, \tilde{T}$	-0.014	0.020	0.031	0.032	0.029	0.016
Japan ($\alpha_2 = 0$)	$\tilde{P}$	0.920	0.976	0.998	0.987	0.978	0.978
	$\tilde{T}$	0.204	0.113	0.038	0.022	0.018	0.010
	$\tilde{P}, \tilde{T}$	-0.124	-0.089	-0.037	-0.009	0.004	0.012
Switzerland ($\alpha_2 = 0$)	$\tilde{P}$	1.013	0.992	0.969	0.959	0.958	0.973
	$\tilde{T}$	0.045	0.012	0.012	0.014	0.014	0.007
	$\tilde{P}, \tilde{T}$	-0.058	-0.004	0.020	0.027	0.028	0.020
UK ($\alpha_2 = 0$)	$\tilde{P}$	1.000	0.998	0.998	1.000	1.001	1.001
	$\tilde{T}$	0.000	0.001	0.001	0.000	0.000	0.000
	$\tilde{P}, \tilde{T}$	0.000	0.002	0.002	0.000	-0.001	-0.001

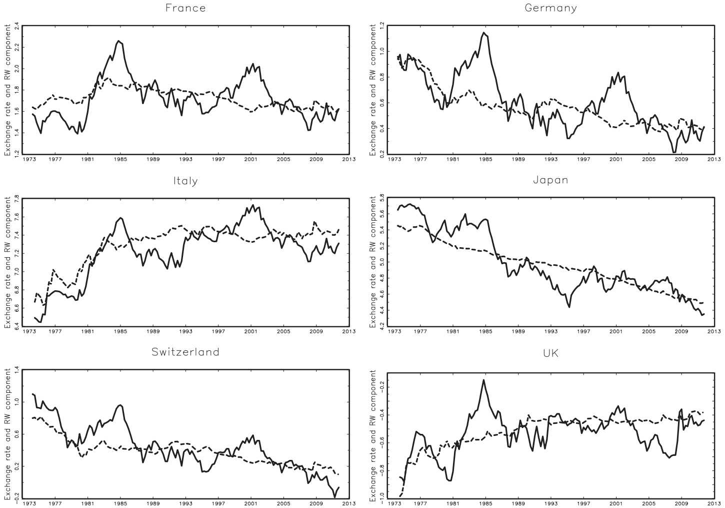
Forecast Error Variance Decomposition: Unorthogonalized Shocks, $f_t = p_t - p_t^* + i_t - i_t^*$

Forecast Error Variance Decomposition of $\Delta s_{t+h} - E_t \Delta s_{t+h}$							
		$h=1$	$h=4$	$h=8$	$h=12$	$h=16$	$h=32$
France	$\tilde{P}$	0.055	0.088	0.119	0.148	0.177	0.282
	$\tilde{T}$	0.759	0.690	0.638	0.597	0.561	0.463
	$\tilde{P}, \tilde{T}$	0.186	0.222	0.243	0.256	0.262	0.255
Germany ($\alpha_2 = 0$)	$\tilde{P}$	0.039	0.048	0.054	0.064	0.081	0.201
	$\tilde{T}$	0.857	0.840	0.828	0.810	0.785	0.667
	$\tilde{P}, \tilde{T}$	0.103	0.112	0.118	0.126	0.133	0.132
Italy ($\alpha_2 = 0$)	$\tilde{P}$	0.025	0.127	0.214	0.271	0.315	0.437
	$\tilde{T}$	0.970	0.864	0.774	0.717	0.673	0.552
	$\tilde{P}, \tilde{T}$	0.005	0.009	0.011	0.012	0.012	0.012
Japan	$\tilde{P}$	0.055	0.047	0.039	0.041	0.049	0.108
	$\tilde{T}$	0.789	0.808	0.827	0.822	0.806	0.723
	$\tilde{P}, \tilde{T}$	0.157	0.146	0.134	0.137	0.145	0.169
Switzerland ($\alpha_2 = 0$)	$\tilde{P}$	0.056	0.061	0.074	0.093	0.123	0.302
	$\tilde{T}$	0.811	0.803	0.780	0.749	0.711	0.546
	$\tilde{P}, \tilde{T}$	0.132	0.136	0.146	0.158	0.166	0.152
UK	$\tilde{P}$	0.179	0.258	0.323	0.378	0.426	0.571
	$\tilde{T}$	0.485	0.387	0.324	0.280	0.247	0.173
	$\tilde{P}, \tilde{T}$	0.336	0.355	0.354	0.343	0.327	0.257

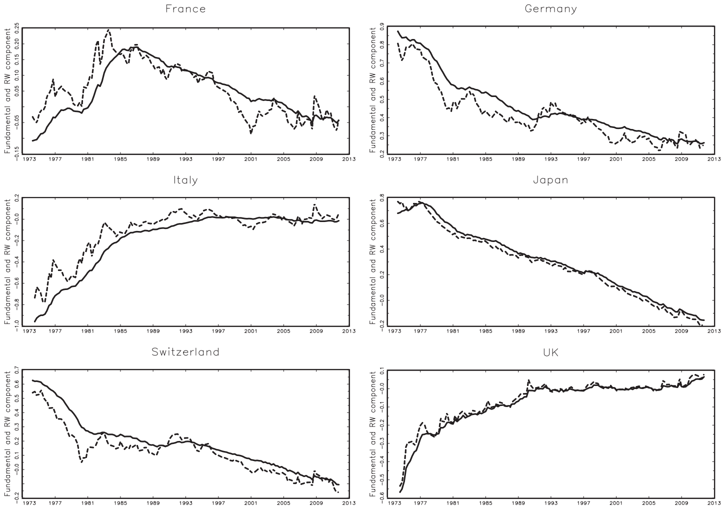
Forecast Error Variance Decomposition: Unorthogonalized Shocks, $f_t = p_t - p_t^* + i_t - i_t^*$

Forecast Error Variance Decomposition of $\Delta f_{t+h} - E_t \Delta f_{t+h}$							
		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
France	$\tilde{P}$	1.221	1.251	1.232	1.206	1.182	1.112
	$\tilde{T}$	0.471	0.254	0.168	0.123	0.095	0.046
	$\tilde{P}, \tilde{T}$	-0.692	-0.504	-0.400	-0.329	-0.277	-0.158
Germany ($\alpha_2 = 0$)	$\tilde{P}$	1.039	1.062	1.046	1.020	1.003	0.991
	$\tilde{T}$	0.246	0.116	0.044	0.023	0.015	0.007
	$\tilde{P}, \tilde{T}$	-0.285	-0.178	-0.090	-0.043	-0.019	0.002
Italy ($\alpha_2 = 0$)	$\tilde{P}$	1.000	0.993	0.992	0.994	0.995	0.997
	$\tilde{T}$	0.000	0.005	0.005	0.004	0.004	0.002
	$\tilde{P}, \tilde{T}$	0.000	0.002	0.002	0.002	0.002	0.001
Japan	$\tilde{P}$	0.985	1.090	1.045	0.990	0.966	0.959
	$\tilde{T}$	0.593	0.277	0.110	0.069	0.053	0.027
	$\tilde{P}, \tilde{T}$	-0.578	-0.368	-0.155	-0.059	-0.019	0.014
Switzerland ($\alpha_2 = 0$)	$\tilde{P}$	1.058	1.082	1.075	1.055	1.038	1.012
	$\tilde{T}$	0.276	0.137	0.060	0.031	0.019	0.007
	$\tilde{P}, \tilde{T}$	-0.333	-0.219	-0.134	-0.086	-0.058	-0.019
UK	$\tilde{P}$	1.240	1.367	1.415	1.385	1.334	1.183
	$\tilde{T}$	1.079	0.861	0.601	0.424	0.312	0.136
	$\tilde{P}, \tilde{T}$	-1.319	-1.228	-1.015	-0.809	-0.647	-0.319

Multivariate Beveridge-Nelson Decomposition



Multivariate Beveridge-Nelson Decomposition



Multivariate Beveridge-Nelson Decomposition

	$f_t = p_t - p_t^*$			
	Correlation with Random Walk Components		Correlation with Transitory Components	
	$Corr(\Delta s_t, \Delta s_t^T)$	$Corr(\Delta f_t, \Delta f_t^T)$	$Corr(\Delta s_t, \Delta s_t^C)$	$Corr(\Delta f_t, \Delta f_t^C)$
France ($\alpha_2 = 0$)	0.187	0.735	0.926	-0.540
Germany ($\alpha_2 = 0$)	0.123	0.760	0.929	-0.567
Italy ($\alpha_2 = 0$)	0.112	0.659	0.791	-0.458
Japan ($\alpha_2 = 0$)	0.232	0.704	0.973	-0.161
Switzerland ($\alpha_2 = 0$)	0.014	0.761	0.931	-0.575
UK ($\alpha_2 = 0$)	0.075	0.811	0.921	-0.440
	$f_t = p_t - p_t^* + i_t - i_t^*$			
	Correlation with Random Walk Components		Correlation with Transitory Components	
	$Corr(\Delta s_t, \Delta s_t^T)$	$Corr(\Delta f_t, \Delta f_t^T)$	$Corr(\Delta s_t, \Delta s_t^C)$	$Corr(\Delta f_t, \Delta f_t^C)$
France	0.618	0.742	0.953	-0.082
Germany ($\alpha_2 = 0$)	-0.032	0.894	0.927	-0.642
Italy ($\alpha_2 = 0$)	0.144	0.811	0.933	-0.421
Japan	0.540	0.611	0.949	0.219
Switzerland ($\alpha_2 = 0$)	0.002	0.900	0.858	-0.741
UK	0.804	0.502	0.874	0.244

Long-Horizon Regression: $f_t = p_t - p_t^*$. Dependent Variable is $s_{t+h} - s_t$

		$s_{t+h} - s_t$ regressed on					
		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
France	Δs_t	0.112	0.351*	0.637*	0.652*	0.685*	0.203
	t-ratio	(1.375)	(2.056)	(2.360)	(1.881)	(1.838)	(1.370)
	Δf_t	1.165*	2.174	5.595	5.558	5.298	15.293*
	t-ratio	(1.844)	(0.638)	(0.989)	(1.048)	(1.222)	(2.142)
	z_t	-0.081*	-0.312*	-0.709*	-1.036*	-1.320*	-1.766*
	t-ratio	(-2.387)	(-3.166)	(-6.467)	(-6.017)	(-5.394)	(-10.664)
	$\overline{R}^2$	[0.040]	[0.138]	[0.326]	[0.436]	[0.539]	[0.727]
Germany	Δs_t	0.072	0.293	0.515*	0.409*	0.518*	0.083
	t-ratio	(0.978)	(1.526)	(2.704)	(2.073)	(1.782)	(0.553)
	Δf_t	0.643	-1.090	-0.841	-1.493	-1.976	8.759*
	t-ratio	(0.912)	(-0.848)	(-0.646)	(-1.015)	(-0.534)	(2.727)
	z_t	-0.074*	-0.258*	-0.600*	-0.835*	-1.054*	-1.385*
	t-ratio	(-2.264)	(-2.323)	(-5.540)	(-8.888)	(-9.510)	(-11.730)
	$\overline{R}^2$	[0.020]	[0.116]	[0.277]	[0.385]	[0.498]	[0.782]
Italy	Δs_t	0.137*	0.382*	0.626*	0.588*	0.723*	0.447
	t-ratio	(1.661)	(1.863)	(3.096)	(2.270)	(1.854)	(1.112)
	Δf_t	0.957*	2.805*	6.614*	7.698*	9.055*	15.529*
	t-ratio	(2.649)	(1.989)	(2.428)	(2.823)	(3.500)	(2.856)
	z_t	-0.078*	-0.306*	-0.705*	-0.972*	-1.214*	-1.692*
	t-ratio	(-2.170)	(-2.748)	(-4.773)	(-6.729)	(-5.969)	(-7.709)
	$\overline{R}^2$	[0.050]	[0.140]	[0.320]	[0.351]	[0.409]	[0.504]

Long-Horizon Regression: $f_t = p_t - p_t^*$. Dependent Variable is $s_{t+h} - s_t$

		$s_{t+h} - s_t$ regressed on					
		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
Japan	Δs_t	0.105	0.391*	0.240	0.235	-0.147	0.500
	t-ratio	(1.432)	(2.362)	(1.035)	(1.017)	(-1.314)	(1.633)
	Δf_t	0.615	0.741	0.107	-0.114	-0.928	8.403*
	t-ratio	(1.523)	(0.432)	(0.036)	(-0.032)	(-0.361)	(7.472)
	z_t	-0.050*	-0.197*	-0.414*	-0.629*	-0.735*	-0.938*
	t-ratio	(-1.815)	(-1.941)	(-3.479)	(-5.457)	(-6.918)	(-5.670)
	$\overline{R}^2$	[0.013]	[0.089]	[0.193]	[0.342]	[0.462]	[0.607]
Switzerland	Δs_t	0.035	0.243	0.332*	0.190	0.385*	0.039
	t-ratio	(0.478)	(1.358)	(2.307)	(1.132)	(1.816)	(0.345)
	Δf_t	0.617	-0.535	-0.197	-2.156	-4.819*	0.986
	t-ratio	(0.882)	(-0.383)	(-0.135)	(-1.620)	(-1.767)	(0.314)
	z_t	-0.075*	-0.283*	-0.625*	-0.846*	-1.058*	-1.068*
	t-ratio	(-2.197)	(-2.392)	(-5.697)	(-8.211)	(-5.842)	(-8.779)
	$\overline{R}^2$	[0.018]	[0.112]	[0.267]	[0.382]	[0.517]	[0.640]
UK	Δs_t	0.189*	0.276	0.492*	0.430	0.170	-0.288
	t-ratio	(2.200)	(1.592)	(1.787)	(1.506)	(0.578)	(-1.223)
	Δf_t	0.574	1.620	2.914*	2.897*	2.305*	6.724*
	t-ratio	(1.497)	(1.573)	(2.787)	(3.543)	(1.887)	(4.632)
	z_t	-0.081*	-0.303*	-0.599*	-0.818*	-0.986*	-0.331
	t-ratio	(-2.207)	(-3.302)	(-3.974)	(-4.018)	(-4.140)	(-0.947)
	$\overline{R}^2$	[0.054]	[0.130]	[0.249]	[0.314]	[0.396]	[0.219]

Long-Horizon Regression: $f_t = p_t - p_t^*$. Dependent Variable is $f_{t+h} - f_t$

		$f_{t+h} - f_t$ regressed on					
		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
France	Δs_t	0.013	0.047*	0.105*	0.172*	0.205*	0.180*
	t-ratio	(1.276)	(1.709)	(1.849)	(1.990)	(1.921)	(2.113)
	Δf_t	0.466*	1.790*	3.369*	4.348*	5.770*	9.986*
	t-ratio	(4.059)	(4.695)	(4.597)	(4.361)	(6.378)	(3.562)
	z_t	0.003	0.001	-0.023	-0.069	-0.136	-0.338*
	t-ratio	(1.284)	(0.107)	(-0.750)	(-1.264)	(-1.639)	(-2.582)
	$\overline{R}^2$	[0.258]	[0.373]	[0.365]	[0.313]	[0.337]	[0.405]
Germany	Δs_t	0.006	0.028*	0.073*	0.096*	0.095*	-0.035
	t-ratio	(0.572)	(1.710)	(2.268)	(2.590)	(2.722)	(-0.522)
	Δf_t	0.360*	1.244*	2.029*	2.263*	2.552*	3.295*
	t-ratio	(5.425)	(3.062)	(3.337)	(4.881)	(6.150)	(3.005)
	z_t	0.006*	0.018	0.022	0.017	0.015	0.085
	t-ratio	(1.748)	(0.930)	(0.506)	(0.265)	(0.193)	(0.748)
	$\overline{R}^2$	[0.159]	[0.269]	[0.216]	[0.130]	[0.090]	[0.104]
Italy	Δs_t	0.015	0.089*	0.171*	0.241*	0.287*	0.264
	t-ratio	(0.950)	(2.015)	(2.155)	(2.384)	(1.960)	(0.825)
	Δf_t	0.566*	2.000*	3.788*	5.437*	7.078*	12.221*
	t-ratio	(7.852)	(8.215)	(5.765)	(5.434)	(6.292)	(5.588)
	z_t	0.009*	0.022	0.002	-0.042	-0.111	-0.237
	t-ratio	(1.865)	(1.144)	(0.069)	(-0.765)	(-1.476)	(-1.373)
	$\overline{R}^2$	[0.396]	[0.463]	[0.442]	[0.407]	[0.399]	[0.354]

Long-Horizon Regression: $f_t = p_t - p_t^*$ Dependent Variable is $f_{t+h} - f_t$

		$f_{t+h} - f_t$ regressed on					
		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
Japan	Δs_t	0.011	0.070*	0.158*	0.210*	0.223*	0.087
	t-ratio	(0.865)	(2.568)	(3.067)	(3.004)	(2.414)	(0.993)
	Δf_t	0.253*	1.310*	2.077*	2.523*	2.588*	0.984*
	t-ratio	(2.574)	(5.288)	(4.762)	(3.070)	(2.550)	(2.347)
	z_t	0.013*	0.035*	0.041	0.032	0.008	0.006
	t-ratio	(3.689)	(2.381)	(1.433)	(0.831)	(0.206)	(0.167)
	$\overline{R}^2$	[0.155]	[0.409]	[0.386]	[0.309]	[0.237]	[0.047]
Switzerland	Δs_t	0.010	0.026	0.084*	0.152*	0.194*	0.145
	t-ratio	(0.928)	(1.274)	(1.884)	(2.046)	(1.840)	(0.786)
	Δf_t	0.206*	1.224*	2.276*	2.736*	3.327*	3.091*
	t-ratio	(1.733)	(2.374)	(2.219)	(2.137)	(2.561)	(6.610)
	z_t	0.006	0.015	0.011	-0.022	-0.066	-0.060
	t-ratio	(1.496)	(0.956)	(0.402)	(-0.521)	(-1.007)	(-0.406)
	$\overline{R}^2$	[0.053]	[0.237]	[0.232]	[0.169]	[0.149]	[0.047]
UK	Δs_t	-0.009	-0.016	-0.008	-0.024	-0.041	-0.042
	t-ratio	(-0.444)	(-0.409)	(-0.159)	(-0.439)	(-0.808)	(-0.371)
	Δf_t	0.219	1.046*	1.628*	1.827*	2.022*	2.872*
	t-ratio	(1.583)	(3.662)	(3.154)	(3.649)	(4.415)	(4.606)
	z_t	0.017*	0.065*	0.123	0.160	0.209	0.351*
	t-ratio	(2.749)	(1.749)	(1.558)	(1.470)	(1.627)	(1.956)
	$\overline{R}^2$	[0.081]	[0.264]	[0.246]	[0.214]	[0.238]	[0.298]

Long-Horizon Regression: $f_t = p_t - p_t^* + i_t - i_t^*$. Dependent Variable is $s_{t+h} - s_t$

		$s_{t+h} - s_t$ regressed on					
		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
France	Δs_t	0.130	0.385*	0.719*	0.718	0.764*	0.590*
	t-ratio	(1.585)	(1.845)	(1.927)	(1.518)	(1.691)	(3.279)
	Δf_t	0.164	0.773	2.860	1.397	-0.075	3.079*
	t-ratio	(0.494)	(0.657)	(1.444)	(0.695)	(-0.042)	(1.918)
	z_t	-0.068*	-0.282*	-0.641*	-0.909*	-1.172*	-1.722*
	t-ratio	(-2.024)	(-2.959)	(-5.249)	(-4.540)	(-4.308)	(-7.918)
	$\overline{R}^2$	[0.021]	[0.117]	[0.289]	[0.348]	[0.448]	[0.707]
Germany	Δs_t	0.073	0.293	0.513*	0.371*	0.468	0.259*
	t-ratio	(0.978)	(1.468)	(2.230)	(1.788)	(1.613)	(2.605)
	Δf_t	-0.011	0.208	0.142	-0.811	-1.546*	1.371
	t-ratio	(-0.032)	(0.307)	(0.251)	(-1.358)	(-1.961)	(1.589)
	z_t	-0.060*	-0.238*	-0.542*	-0.744*	-0.951*	-1.336*
	t-ratio	(-1.902)	(-2.289)	(-5.736)	(-8.974)	(-9.589)	(-11.903)
	$\overline{R}^2$	[0.001]	[0.092]	[0.235]	[0.326]	[0.440]	[0.813]
Italy	Δs_t	0.152*	0.427*	0.701*	0.662*	0.851	0.784*
	t-ratio	(1.835)	(1.955)	(2.548)	(1.758)	(1.576)	(2.164)
	Δf_t	0.325	0.774	2.423*	2.224*	1.736*	3.800*
	t-ratio	(1.625)	(1.114)	(1.988)	(2.012)	(1.765)	(2.005)
	z_t	-0.066*	-0.271*	-0.597*	-0.805*	-1.022*	-1.550*
	t-ratio	(-1.850)	(-2.658)	(-4.326)	(-5.212)	(-3.898)	(-4.093)
	$\overline{R}^2$	[0.037]	[0.113]	[0.263]	[0.260]	[0.295]	[0.417]

Long-Horizon Regression: $f_t = p_t - p_t^* + i_t - i_t^*$. Dependent Variable is $s_{t+h} - s_t$

		$s_{t+h} - s_t$ regressed on					
		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
Japan	Δs_t	0.088	0.362*	0.245	0.240	-0.158	0.513
	t-ratio	(1.162)	(2.007)	(1.183)	(1.089)	(-1.022)	(1.449)
	Δf_t	0.076	-0.145	-0.306	-0.841	-2.345*	2.359*
	t-ratio	(0.293)	(-0.179)	(-0.230)	(-0.573)	(-1.683)	(2.709)
	z_t	-0.035	-0.159	-0.377*	-0.579*	-0.681*	-0.913*
	t-ratio	(-1.300)	(-1.483)	(-3.006)	(-4.515)	(-5.010)	(-4.749)
	$\overline{R}^2$	[-0.004]	[0.062]	[0.159]	[0.299]	[0.460]	[0.558]
Switzerland	Δs_t	0.040	0.270	0.301*	0.113	0.223	0.057
	t-ratio	(0.506)	(1.318)	(1.696)	(0.725)	(1.259)	(0.501)
	Δf_t	-0.065	0.101	0.192	-1.190*	-2.922*	-0.414
	t-ratio	(-0.161)	(0.201)	(0.353)	(-2.823)	(-4.687)	(-0.813)
	z_t	-0.050	-0.194	-0.448*	-0.588*	-0.725*	-0.962*
	t-ratio	(-1.491)	(-1.482)	(-3.384)	(-5.376)	(-4.814)	(-7.577)
	$\overline{R}^2$	[-0.002]	[0.054]	[0.150]	[0.229]	[0.368]	[0.646]
UK	Δs_t	0.195*	0.299	0.533*	0.449	0.140	-0.221
	t-ratio	(2.222)	(1.531)	(1.667)	(1.285)	(0.374)	(-1.468)
	Δf_t	0.117	0.445	1.147	0.799*	0.163	1.854*
	t-ratio	(0.497)	(0.606)	(1.388)	(2.075)	(0.331)	(2.045)
	z_t	-0.061*	-0.238*	-0.461*	-0.627*	-0.769*	-0.151
	t-ratio	(-1.737)	(-2.553)	(-2.704)	(-2.555)	(-2.842)	(-0.332)
	$\overline{R}^2$	[0.032]	[0.082]	[0.166]	[0.208]	[0.280]	[0.050]

Long-Horizon Regression: $f_t = p_t - p_t^* + i_t - i_t^*$. Dependent Variable is $f_{t+h} - f_t$

		$f_{t+h} - f_t$ regressed on					
		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
France	Δs_t	0.033*	0.112	0.206	0.308	0.361*	0.389*
	t-ratio	(1.825)	(1.577)	(1.439)	(1.609)	(1.657)	(1.884)
	Δf_t	0.257*	0.649*	0.998*	1.059*	0.999*	1.895*
	t-ratio	(2.047)	(2.959)	(3.907)	(2.793)	(1.979)	(3.183)
	z_t	0.011	0.026	0.017	-0.022	-0.082	-0.200
	t-ratio	(1.469)	(1.537)	(0.386)	(-0.271)	(-0.618)	(-0.811)
	$\overline{R}^2$	[0.112]	[0.135]	[0.106]	[0.079]	[0.070]	[0.086]
Germany	Δs_t	0.019	0.062*	0.143*	0.180*	0.141*	-0.009
	t-ratio	(1.023)	(2.631)	(2.563)	(2.757)	(3.771)	(-0.114)
	Δf_t	0.092	0.290	0.541	0.522*	0.374*	0.410
	t-ratio	(0.914)	(0.902)	(1.564)	(2.355)	(4.035)	(1.133)
	z_t	0.016*	0.051*	0.068	0.067	0.075	0.225*
	t-ratio	(2.089)	(1.678)	(1.245)	(0.948)	(0.901)	(1.753)
	$\overline{R}^2$	[0.049]	[0.120]	[0.113]	[0.069]	[0.035]	[0.163]
Italy	Δs_t	0.031	0.163	0.286	0.404*	0.460	0.479
	t-ratio	(0.793)	(1.378)	(1.543)	(1.762)	(1.571)	(1.073)
	Δf_t	0.382*	0.752*	1.397*	1.721*	1.962*	3.531*
	t-ratio	(3.138)	(3.096)	(3.091)	(2.808)	(2.882)	(2.757)
	z_t	0.016	0.048	0.037	0.013	-0.050	-0.002
	t-ratio	(1.641)	(1.364)	(0.600)	(0.123)	(-0.308)	(-0.004)
	$\overline{R}^2$	[0.173]	[0.129]	[0.147]	[0.115]	[0.100]	[0.096]

Long-Horizon Regression: $f_t = p_t - p_t^* + i_t - i_t^*$. Dependent Variable is $f_{t+h} - f_t$

		$f_{t+h} - f_t$ regressed on					
		$h = 1$	$h = 4$	$h = 8$	$h = 12$	$h = 16$	$h = 32$
Japan	Δs_t	0.036*	0.171*	0.227*	0.314*	0.324*	0.164
	t-ratio	(2.192)	(3.217)	(3.361)	(2.676)	(2.031)	(1.560)
	Δf_t	0.277*	0.578*	0.669	0.877*	0.509	-0.247*
	t-ratio	(2.349)	(1.927)	(1.539)	(1.852)	(0.956)	(-2.113)
	z_t	0.021*	0.063*	0.070	0.058	0.028	0.031
	t-ratio	(3.346)	(2.762)	(1.612)	(1.098)	(0.475)	(0.470)
	$\overline{R}^2$	[0.166]	[0.243]	[0.163]	[0.150]	[0.069]	[0.043]
Switzerland	Δs_t	0.007	0.060	0.129	0.213	0.222	0.046
	t-ratio	(0.310)	(1.237)	(1.132)	(1.171)	(1.016)	(0.230)
	Δf_t	0.068	0.546	1.005	1.229	1.093	0.576
	t-ratio	(0.702)	(1.414)	(1.491)	(1.593)	(1.403)	(1.103)
	z_t	0.014*	0.042*	0.072*	0.077*	0.075	0.250*
	t-ratio	(2.142)	(1.903)	(1.726)	(1.674)	(1.239)	(2.520)
	$\overline{R}^2$	[0.015]	[0.111]	[0.118]	[0.101]	[0.063]	[0.224]
UK	Δs_t	0.004	-0.013	-0.032	-0.018	-0.016	-0.024
	t-ratio	(0.117)	(-0.187)	(-0.295)	(-0.185)	(-0.104)	(-0.103)
	Δf_t	0.172	0.266	0.274	0.202	0.264	0.660
	t-ratio	(1.508)	(0.602)	(0.667)	(0.570)	(0.782)	(1.299)
	z_t	0.034*	0.141*	0.259*	0.313*	0.364*	0.567*
	t-ratio	(2.690)	(2.630)	(2.148)	(1.978)	(2.056)	(2.383)
	$\overline{R}^2$	[0.083]	[0.204]	[0.283]	[0.288]	[0.307]	[0.378]

Comparing with Engel and West (2005)

- It is worth noting that in equation (5), the exchange rate is determined by the discounted sum of the observed fundamentals f_t and the discounted sum of the unobserved variables ζ_t.
- Engel and West (2005) show that when the discount factor b_1 is close to unity and either
  1. f_t is I(1) and ζ_t is zero, or
  2. ζ_t is I(1) with f_t unrestricted,
- then the exchange rate is dominated by the permanent components in observed fundamentals, and hence follows a near-random-walk process.

Comparing with Engel and West (2005)

- The value of b_1 is close to one given that intervention by central banks to target the exchange rate is not very active in practice (Engel and West, 2005) and the estimates of ϕ_s are small and close to zero (Clarida et al., 1998).
- However, we can rule out the possibility that ζ_t is I(1) because the cointegration test results suggest that s_t and f_t are indeed cointegrated. Hence, equation (5) implies that $b_1 \sum_{j=0}^{\infty} b_1^j \zeta_{t+j}$ cannot be I(1).
- That is, the large proportions of the transitory components in exchange rates that we observe may be attributable to the stationary terms $b_1 \sum_{j=0}^{\infty} b_1^j \zeta_{t+j}$.
- In other words, when potentially unobservable variables, such as ζ_t, are present in the present value model in Engel and West (2005), the importance of the transitory components in explaining the exchange rate can be restored.

Conclusion

- A key finding is that the transitory variations are quantitatively large and contribute to most of the fluctuations in the exchange rates for six currencies vis-á-vis the US dollar in the post-Bretton Woods era.
- We also find the variations in fundamentals based on macroeconomic variables, such as the price and interest rate differentials, appear to be dominated by permanent shocks.

Conclusion

- Our results suggest that the nominal exchange rate should not be approximated by a pure random walk.
- We also provide an alternative interpretation of the "exchange rate disconnect puzzle" such that economic fundamentals fail to explain the large observed fluctuations in exchange rates.
- Our findings also suggest that the transitory components in the Taylor rule model, such as the policy responses to expected inflation and the output gap, monetary policy shocks or the foreign exchange risk premium, are crucial in explaining exchange rate dynamics.
- The findings in this paper suggest that comprehensive modeling of the transitory components in Taylor rule models is essential.

Conclusion

- However, there are some caveats associated with the construction of the transitory components.
- For instance, Rossi (2013) shows that different specifications, including the choice of the output gap measure, can substantially affect the forecasting performance of the Taylor rule model.
- Thus, how to correctly specify and construct the transitory components in the Taylor rule model remains an important task for future research.