The Share of Systematic Variation in Bilateral Exchange Rates by Adrien Verdelhan

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Exchange Rate Disconnect Puzzle

- Describes the "exceedingly weak relationship (except, perhaps, in the longer run) between the exchange rate and virtually any macroeconomic aggregates." --Obstfeld and Rogoff (2000)
- Characterize as low adjusted R-square in typical exchange rate regressions
  - A finance approach towards solving the puzzle?

Contributions

$$\Delta s_{i,t+1} = f(\text{dollar factor}_{t+1}, \text{carry factor}_{t+1}) + \epsilon_{i,t+1}$$

- Identifies a two-factor model with high explanatory power
- Provides some structure on the factors: A story about what the factors represent
- Shows how global risks are priced in bilateral exchange rates. CD/USD exchange rate depends on more than US and Canadian variables
- Shows cross-country heterogeneity is key to understanding the data. Different countries respond differently to global shocks due to differences in underlying economic structure.

Identification

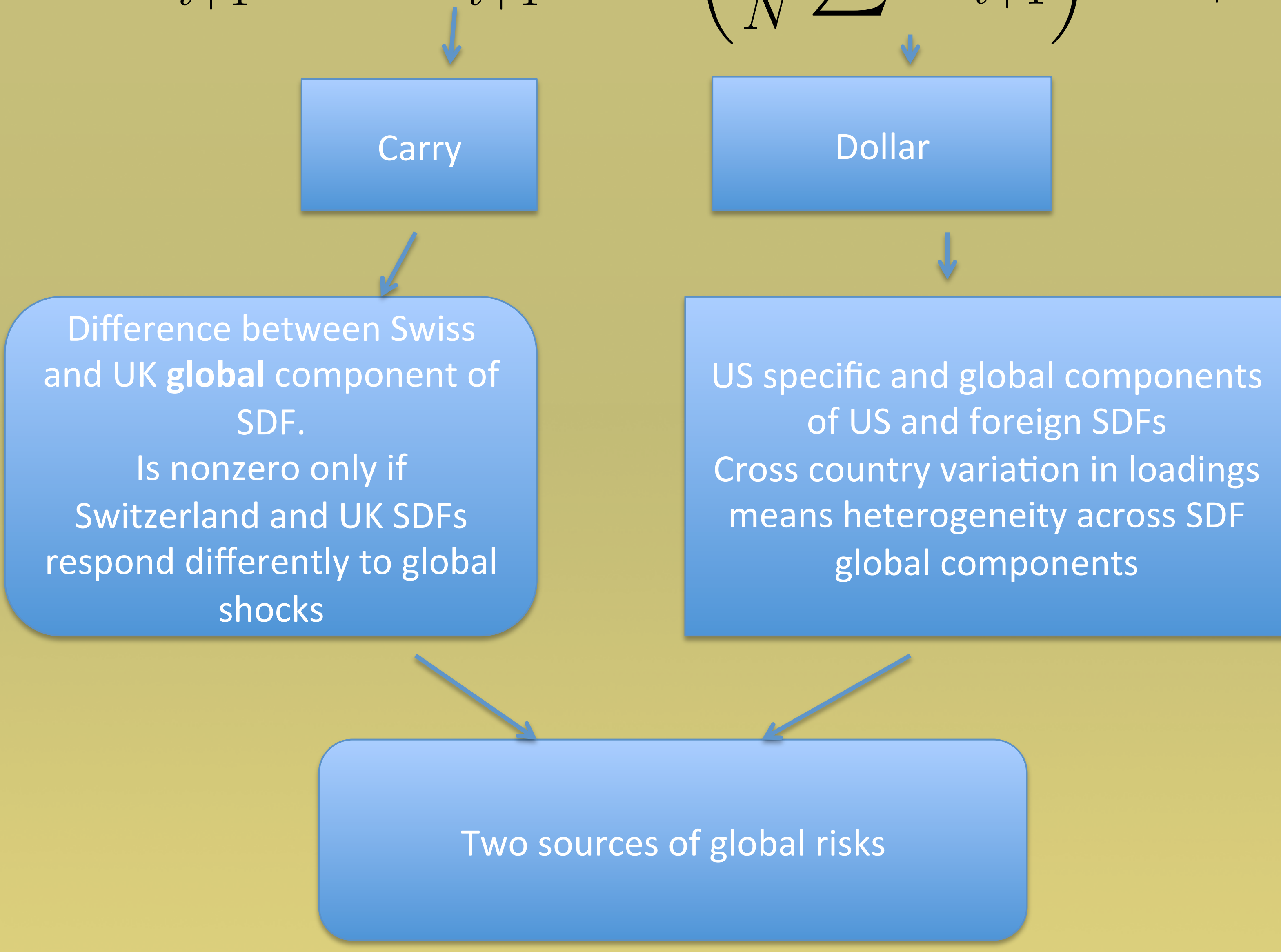
$$\Delta s_{i,t+1} = f(\text{dollar factor}_{t+1}, \text{carry factor}_{t+1}) + \epsilon_{i,t+1}$$

- Dollar factor-natural
  - Cross-sectional average of bilateral exchange rates
  - Naturally mimics the dominant factor. Is how you control for cross-sectional correlation in error components model

$$\Delta s_t^i = x'_{i,t}\beta + (\alpha_i + \theta_t + u_{i,t}) \qquad \theta_t = \delta f_t$$

- Carry factor-insightful
  - Sort countries by interest rate. Is the average exchange rate between groups of high and low interest rate countries.

$$\Delta s_{t+1}^{\mathrm{cd}/\$} = \delta \Delta s_{t+1}^{SF/\pounds} + \tau \left(\frac{1}{N} \sum \Delta s_{t+1}^{i} \right) + \epsilon_{t+1}$$



Structure on factors

- Plays with reduced form models try to identify these two global risks
  - Dollar: global growth risk
  - Carry: global volatility risk
- Global risk idea still pretty general. Maps exchange rates into exchange rates.
- Future challenge: Link the risks to exogenous shocks.
- Suggest a macro approach

Macroeconomic structure

$$\Delta s_{t+1} = m^1_{t+1} - m^2_{t+1} = \gamma \left(\Delta c^1_{t+1} - \Delta c^2_{t+1}\right)$$

- New Keynesian model with Calvo price stickiness, Taylor rules, 3 countries
  - Heterogeneity between 1 and 2, a shock from 3 moves the exchange rate between 1 and 2 because they respond differently to the shock
- Source of heterogeneity?
  - Monetary policy reaction functions
  - Duration of nominal contracts

$$\Delta s^i_{t+4} = \beta_1 \left(s^i_t + p^i_t - p_t\right) + \epsilon_{i,t} + \alpha_i$$

$$\Delta s^i_{t+4} = \beta_1 \left(s^i_t + p^i_t - p_t\right) + \beta_2 \left(s^{key}_t + p^{key}_t - p_t\right) + \epsilon_{i,t} + \alpha_i$$

Table 5: Monte Carlo Mean $\bar{R}^2$ from PPP Exchange Rate Regressions

		Deviation from PPP relative to	
		Country 1	Countries 1 and 3
Horizon	Environment	$\bar{R}^2$	$\bar{R}^2$
4	II	0.171	0.349
4	III	0.157	0.337
4	IV	0.140	0.345

$$\Delta s_{t+4}^{i} = \beta_1 \left(s_t^i + p_t^i - p_t\right) + \epsilon_{i,t} + \alpha_i$$

$$\Delta s_{t+4}^{i} = \beta_1 \left(s_t^i + p_t^i - p_t\right) + \beta_2 \left(s_t^{key} + p_t^{key} - p_t\right) + \epsilon_{i,t} + \alpha_i$$

Table 1: $\bar{R}^2$ of Deviation from PPP Exchange Rate Regressions

	Deviation from PPP relative to			
	USD	USD & euro	USD & yen	USD & SF
	(1)	(2)	(3)	(4)
Australia	-0.006	-0.024	**0.115***	**0.065***
Brazil	0.038	**0.488****	0.032	**0.429****
Canada	0.009	**0.042**	**0.013**	**0.100****
Denmark	0.070	**0.126**	**0.485****	0.062

Conclude

- Shows how global risks, stuff beyond bilateral country pair, matters for bilateral exchange rates
- Importance of cross-country heterogeneity
- Still doesn't solve the disconnect puzzle. Exchange rates on exchange rates
- Challenge for future work: Model global risks generated by exogenous shocks.
- There is contact between this paper and ongoing macro style research. Berg and Mark (2013), Evans (2012).
- Great paper.

$$\Delta s_{t+1} = \alpha + \beta(i_t^\star - i_t) + \gamma(i_t^\star - i_t)Carry_{t+1} + \delta Carry_{t+1} + \tau Dollar_{t+1} + \varepsilon_{t+1},$$

Table 2: Carry and Dollar Factors: Monthly Tests in Developed Countries

Country	α	β	γ	δ	τ	R^2	$R^2_{\$}$	$R^2_{no\ \$}$	W	N
Canada	-0.11	-0.02	-0.61	0.21	0.34	**19.38**	13.11	8.14	***	312
	(0.11)	(0.63)	(0.42)	(0.06)	(0.07)	[6.94]	[4.34]	[4.97]		
Denmark	-0.01	-0.20	0.53	-0.16	1.51	**86.08**	83.63	3.97	***	312
	(0.07)	(0.38)	(0.13)	(0.03)	(0.04)	[1.67]	[2.03]	[3.99]		

$$Var(\Delta s_{it}) = Var(\delta_{i,1}\Delta f_{1,t}) + Var(\delta_{i,2}\Delta f_{2,t}) + Var(\delta_{i,3}\Delta f_{3,t}) + Var(\Delta s^{o}_{i,t}).$$

	Nominal			
Country	First	Second	Third	Total
Australia	0.71	0.06	0.05	0.82
Brazil	0.19	0.39	0.00	0.57
Canada	0.45	0.08	0.07	0.60
Chile	0.29	0.23	0.01	0.52
Colombia	0.23	0.31	0.00	0.55
Czech	0.73	0.07	0.01	0.81
Denmark	0.81	0.11	0.00	0.93
Euro	0.81	0.11	0.00	0.93

Identification

- Where is Adrien's third factor?
  - Carry is dollar neutral: BR/Yen=BR/USD USD/Yen
  - SF and Yen are source currencies for carry trade.

GMSW Identification

(Greenaway-McGrevy, Mark, Sul and Wu (2012))

- Three factor model: monthly 1999 to 2010.

$$F_{i,t} = \sum_{j=1}^{p} \delta_{i,j} f_{j,t} \qquad s_{i,t} = F_{i,t} + s^{o}_{i,t}.$$

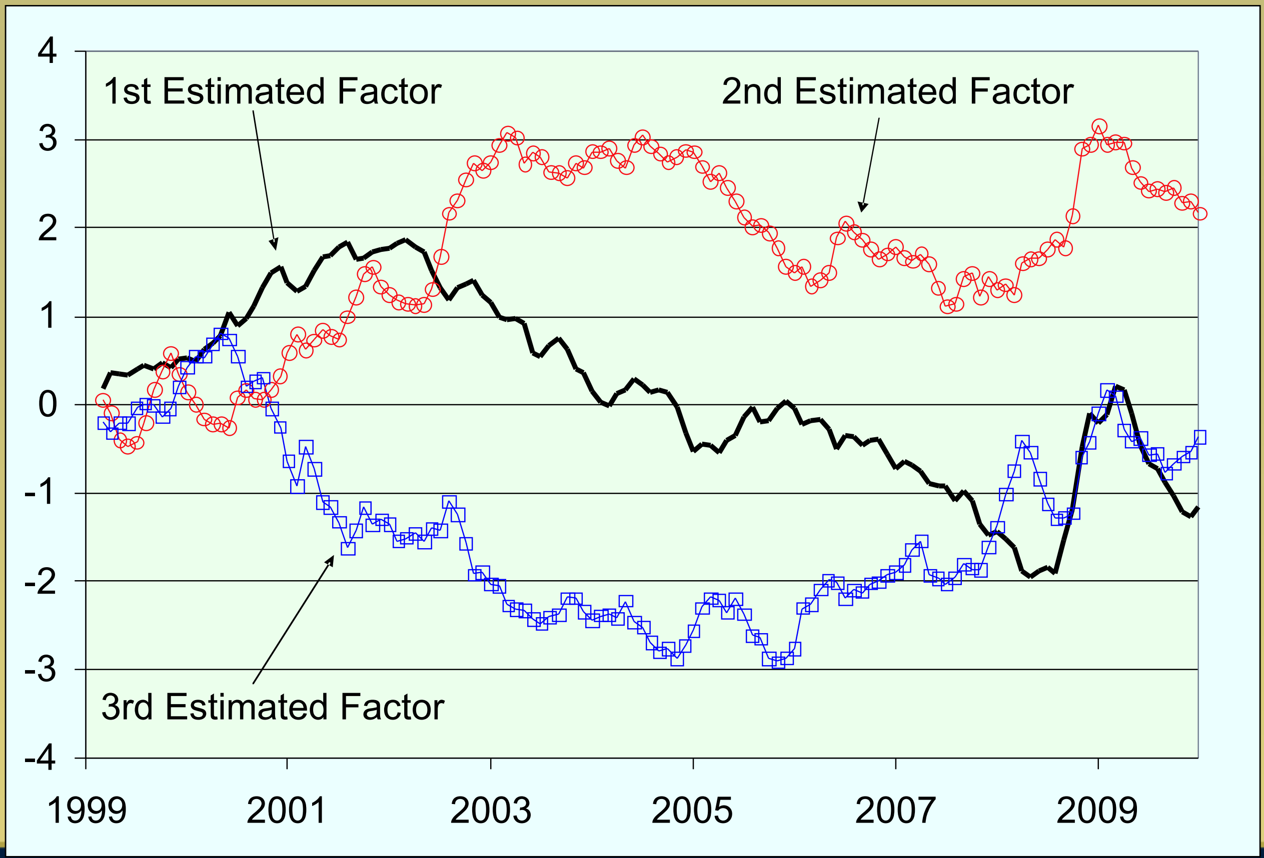
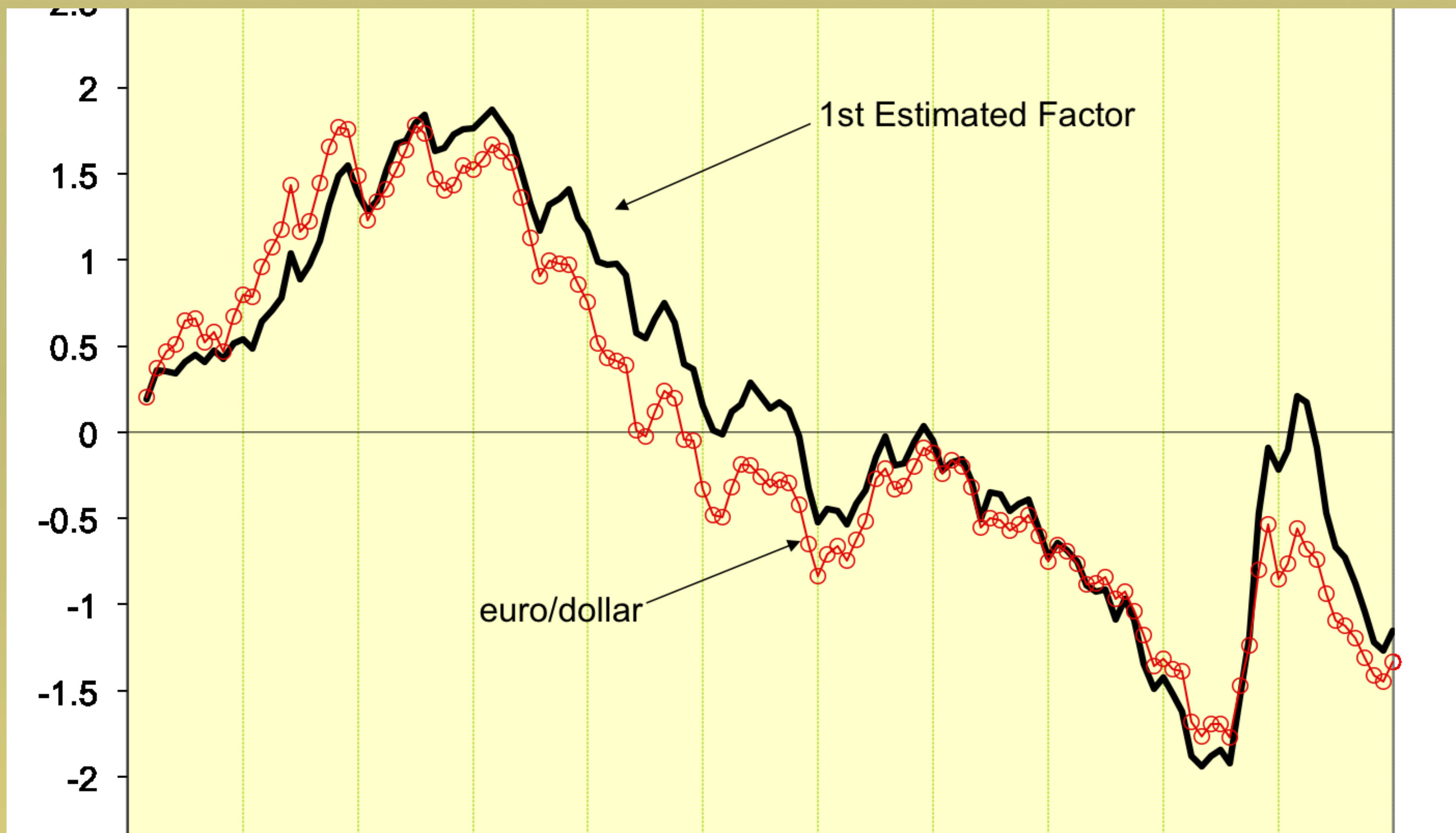


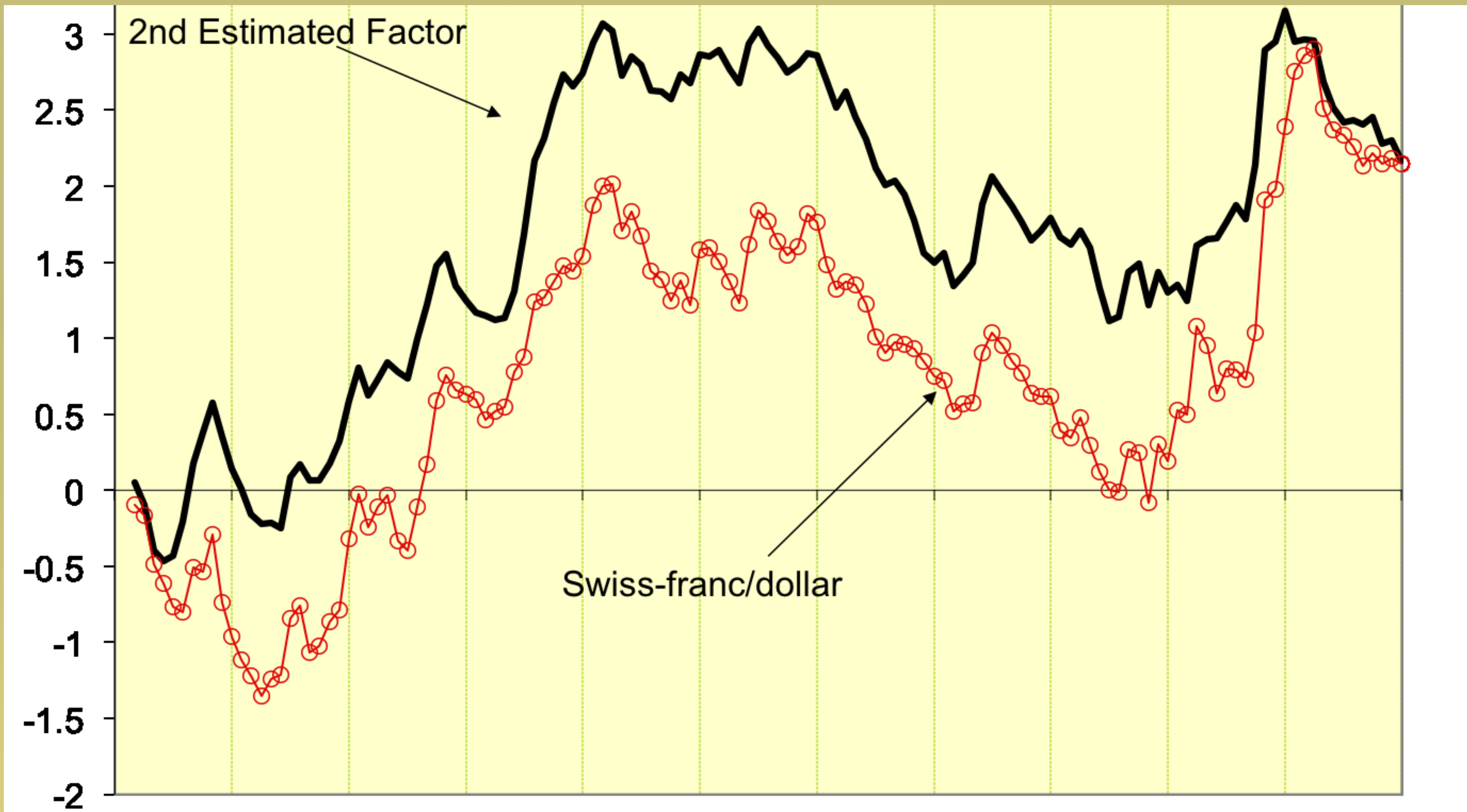
Figure 1. Integrated factors estimated from panel of depreciation rates.

GMSW Identification

Regress first factor on each exchange rate: select maximum R-square



Regress each remaining exchange rate on first and second factor. Swiss-franc has highest R-square



Regress each remaining exchange rate on first, second, and third factor. Yen has highest R-square