Global Portfolio Network and Currency Risk Premia

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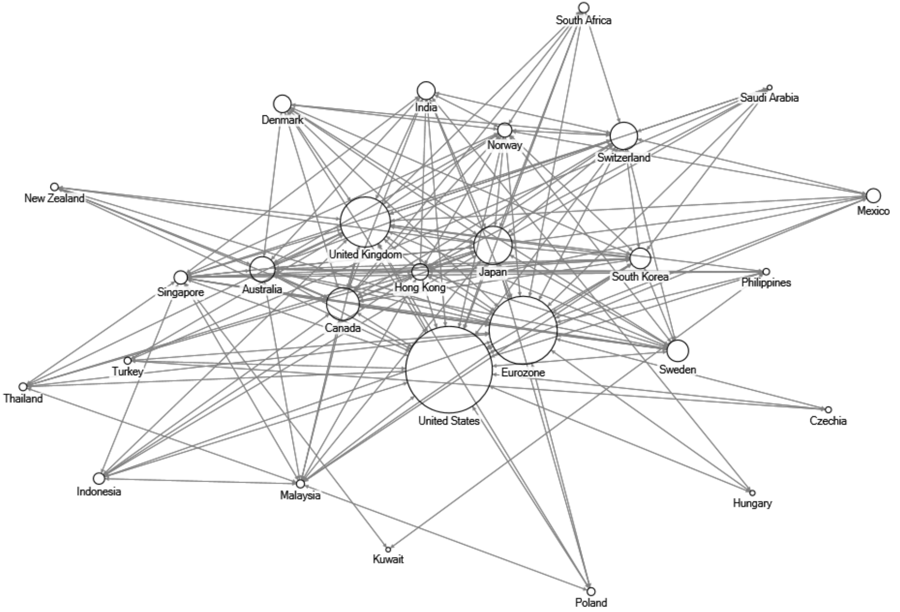
Global portfolio network in 2020

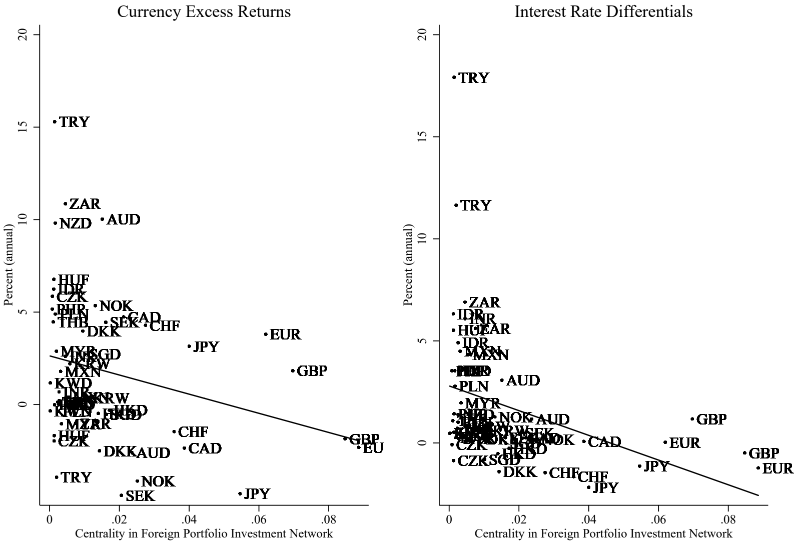


Do bilateral portfolio investments explain cross-sectional variation in currency risk premia?

What I do in a nutshell

- Analyze composition of **external portfolios**
- **Risky portfolio** $\rightarrow$ **high risk-free interest rate?**
- Here: riskiness measured by holdings of countries that are **important** for global portfolios $\Rightarrow$ **network centrality**

Negative relation between centrality and forward premia



Currency excess returns compensate for differences in countries' risk exposure

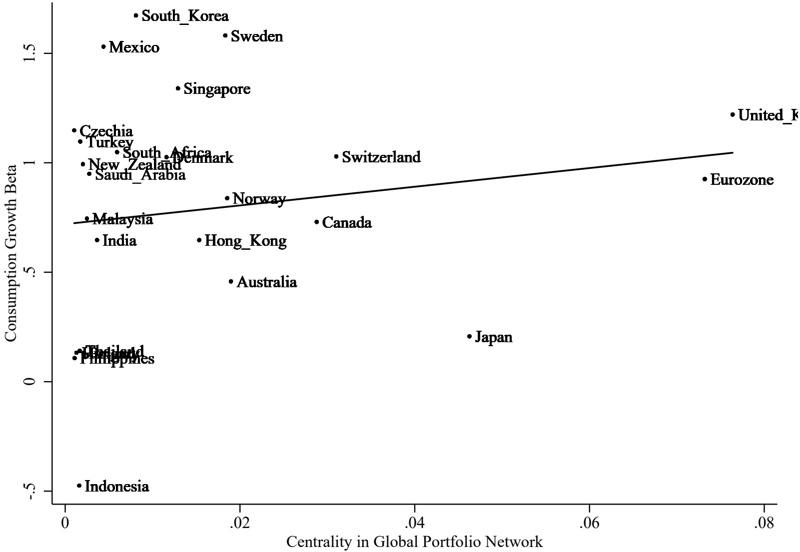
- **Violations of uncovered interest rate parity**
  Fama (1984); Lustig et al. (2011)

- **Economic fundamentals drive country risk**
  Richmond (2019); Hassan (2013); Hassan & Mano (2019)

- **Composition of external wealth**
  Della Corte et al. (2016); Caballero et al. (2008); Maggiori (2017); Gourinchas & Rey (2007)

- **Heterogeneity in consumption growth risk**
  Lustig & Verdelhan (2007); Colacito et al. (2018)

Central countries have higher consumption growth betas



Data overview

- Total of up to **26 currencies**

  Australia (AUD), Canada (CAD), Czechia (CZK), Denmark (DKK), Eurozone (EUR), Hong Kong (HKD), Hungary (HUF), India (INR), Indonesia (IDR), Japan (JPY), Kuwait (KWD), Malaysia (MYR) Mexico (MXN), New Zealand (NZD), Norway (NOK), Philippines (PHP), Poland (PLN), Saudi Arabia (SAR), Singapore (SGD), South Africa (ZAR), South Korea (KRW), Sweden (SEK), Switzerland (CHF), Thailand (THB), Turkey (TRY), United Kingdom (GBP)

- Sample: **January 2001 – August 2021**, monthly

- Annual **bilateral foreign equity and debt holdings** from IMFs Coordinated Portfolio Investment Survey

Currency excess returns

Log currency excess return of US investor on foreign currency i:

$$rx_{it+1} = f_{it} - s_{it+1} = f_{it} - s_{it} - \Delta s_{it+1}$$

- f_{it}: one-month forward rate of currency i (FCU per USD)
- s_{it}: spot rate of currency i

Under covered interest parity:

$$f_{it} - s_{it} \approx i^*_{it} - i_{USt}$$

- i^*_{it} and i_{USt}: foreign and US nominal interest rate

$$rx_{it+1} \approx \underbrace{i^*_{it} - i_{USt}}_{\text{IR Differential}} - \underbrace{\Delta s_{it+1}}_{\text{depreciation FCU}}$$

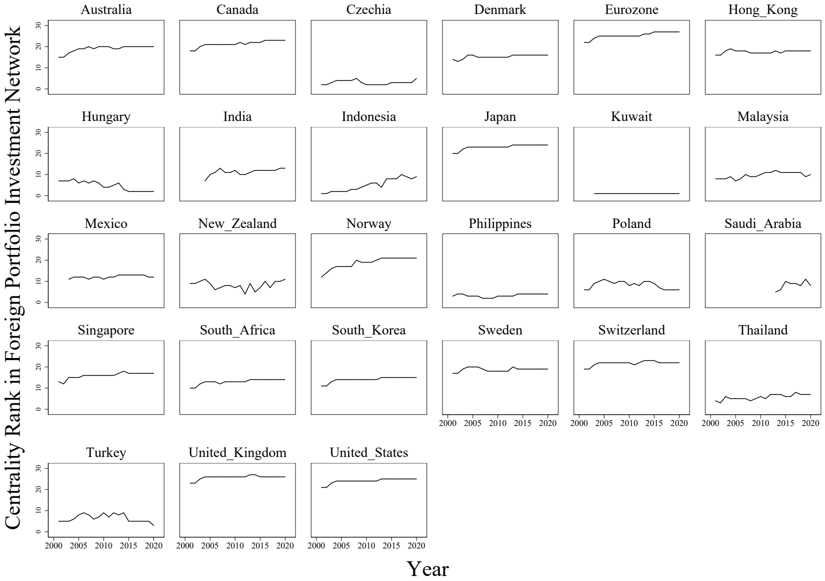
Central countries are integrated with important countries

Network centrality (borrowed from Richmond (2019)):

$$v_i = \sum_{j=1}^{N} \left(\frac{A_{ij} + A_{ji}}{G_i + G_j} \right) \cdot s_j$$

- A_{ij} and A_{ji}: bilateral asset holdings between country i and country j
- G_i and G_j: GDP of country i and country j
- s_j: share of assets from country j relative to total foreign asset supply of all countries $\frac{\sum_{i=1}^{N} A_{ij}}{\sum_{i=1}^{N}\sum_{j=1}^{N} A_{ij}}$ $\Rightarrow$ **importance in global portfolios**

Centrality rankings are persistent



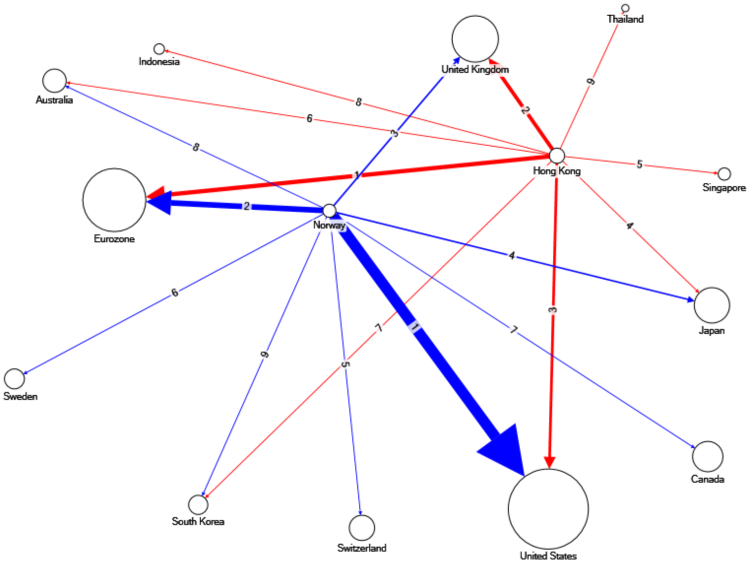
Work in progress: including domestic portfolio investments

Alternative centrality measure:

$$v_i = \sum_{j=1}^{N} \left(\frac{A_{ij}}{\sum_{j=1}^{N} A_{ij} + A_i^d} \right) \cdot s_j = \sum_{j=1}^{N} \alpha_{ij} \cdot s_j$$

- A_i^d: domestic asset holdings
- α_{ij}: portfolio weight invested in country j
- s_j: share in world market capitalization

Example Norway vs Hong Kong



Central countries have lower currency excess returns and interest rates

	rx	*rx*	*rx*	*rx*
Investment centrality	-0.93***	-0.89**	-0.73***	-0.58*
	(0.27)	(0.32)	(0.19)	(0.28)
GDP share		-0.05		
		(0.30)		
Investments/GDP			-0.55***	
			(0.18)	
Trade centrality				-0.66*
				(0.38)
Num. obs.	5,728	5,728	5,728	5,728
R^2	0.46	0.46	0.46	0.46

▸ Model ▸ Interest rates

Sorting currencies on signals generates cross section of currency portfolios

1. Build **four** currency portfolios conditioned on lagged characteristics
2. At each month, **rank** countries by centrality and allocate currencies in equal-weighted portfolios
3. **Long-short** strategies based on tradeable risk factors
   here: peripheral (PF1) minus central (PF4) = CEN

Composition of currency portfolios

Network centrality portfolios							
PF1	Freq.	**PF2**	Freq.	**PF3**	Freq.	**PF4**	Freq.
CZK	0.15	MXN	0.15	HKD	0.17	CHF	0.17
PHP	0.15	INR	0.14	DKK	0.16	EUR	0.17
THB	0.14	MYR	0.13	SGD	0.16	GBP	0.17
KWD	0.13	ZAR	0.12	KRW	0.14	JPY	0.17
HUF	0.13	NZD	0.11	AUD	0.14	CAD	0.17
TRY	0.10	PLN	0.10	SEK	0.10	NOK	0.08

Long-short strategy yields Sharpe ratio of 0.54

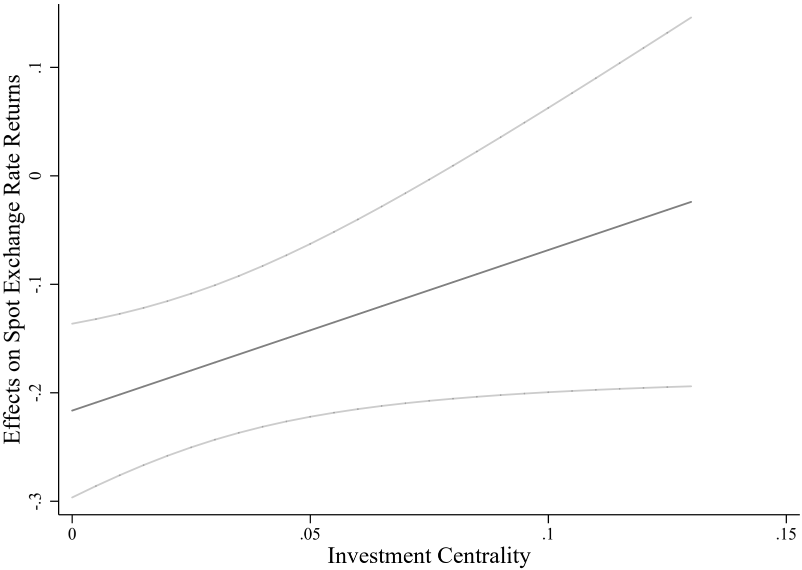
	A. Investment Centrality				
	PF1	PF2	PF3	PF4	*CEN*
Previous centrality					
mean	0.12	0.36	1.40	4.80	-4.68
Currency excess returns					
mean	3.03	3.44	1.40	0.58	2.45
std	7.10	8.83	7.34	7.34	4.50
Forward discount					
mean	3.41	3.86	0.47	-0.43	3.84
Sharpe ratio					
mean	0.43	0.39	0.19	0.08	0.54

In bad times, central countries' currencies appreciate

	Δs	Δs
Investment centrality	-1.61	-5.25**
	(3.66)	(2.53)
Δ VIX	-0.22***	
	(0.04)	
Investment centrality $\times \Delta$VIX	1.48*	
	(0.75)	
ΔVIX dummy		-2.61***
		(0.67)
Investment centrality $\times \Delta$VIX dummy		16.95*
		(9.29)
Num. obs.	5,728	5,728
Adj. R^2	0.14	0.09

Model

Depreciation rate decreases with centrality



Heterogeneity in exposure to global shocks

1. N countries, one good, two periods [0, 1]

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2. Payoff on assets from country j at time 1

$$X_j = 1 + \epsilon_j + \theta_j \epsilon_g$$

$\theta_j \in (0, 1)$: share in world market capitalization
ϵ_j, $\epsilon_g \sim N(0, \sigma^2)$: country-specific and global shock

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3. Returns on foreign asset $R_j = \frac{X_j}{P_j}$ and domestic risk-free bond $R_f = \frac{1}{P_f}$

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4. Portfolio return of household in country i at time 1

$$R_i^P = \sum_{j=1}^{N} \alpha_{ij} R_j + (1 - \sum_{j=1}^{N} \alpha_{ij}) R_f$$

Low consumption states are high 'M-states'

5. Households in country i derive utility

$$U(C_{i0}, C_{i1}) = \frac{(C_{i0})^{1-\gamma}}{1-\gamma} + E[\beta \frac{(C_{i1})^{1-\gamma}}{1-\gamma}]$$

with subject to

$$C_{i0} = Y_{i0} - \sum_{j=1}^{N} \xi_{ij} P_{j0} - \xi_{if} P_{f0}$$

$$C_{i1} = Y_{i1} + R_{i1}^{P}$$

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6. Intertemporal marginal rate of substitution

$$M_{i1} = \beta \left(\frac{C_{i1}}{C_{i0}} \right)^{-\gamma}$$

Central currencies have higher consumption growth risk

7. Change in exchange rate equals differences in consumption growth

$$\frac{Q_{ij1}}{Q_{ij0}} = \frac{M_{i1}}{M_{j1}} \Rightarrow \Delta q_{ij1} = m_{i1} - m_{j1}$$

Central currencies have higher consumption growth risk

7. Change in exchange rate equals differences in consumption growth

$$\frac{Q_{ij1}}{Q_{ij0}} = \frac{M_{i1}}{M_{j1}} \Rightarrow \Delta q_{ij1} = m_{i1} - m_{j1}$$

8. Network centrality of country i

$$v_i = \sum_{j=1}^{N} \alpha_{ij} \theta_j$$

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9. Assume $v_i > v_j$: when $\epsilon_g < 0 \rightarrow m_{i1} > m_{j1} \rightarrow \Delta q_{ij1} > 0$ currency of country i appreciates

Network centrality as a safe haven characteristic

Key findings

- Currency risk premia **decrease** in countries' network centrality
- Differences across centralities are priced in the cross section
- Returns compensate for **time-varying risk exposure**

  → Premium for holding currencies of peripheral countries *because* they depreciate stronger in bad times

Network centrality as a safe haven characteristic

Key findings

- Currency risk premia **decrease** in countries' network centrality
- Differences across centralities are priced in the cross section
- Returns compensate for **time-varying risk exposure**
  $\rightarrow$ Premium for holding currencies of peripheral countries *because* they depreciate stronger in bad times

Thank you!

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Model Figure 2

Regression of per capita log consumption growth on world consumption growth using 20-year rolling windows ($\tau = t - 19, ..., t$) on a constant term, and time fixed-effects, and standard errors clustered by country

$$\Delta \tilde{c}_{it} = \alpha_{it} + \beta_{it} \Delta \tilde{c}_{W\tau} + \epsilon_{i\tau} \quad (1)$$

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Model Table 1

Regressions of currency excess returns and forward discounts on one-year lagged FPI network centrality and a set of controls, a constant term, and time fixed-effects

$$rx_{it} = \alpha + \delta_t + \beta v_{it-12} + X_{it-12} + \epsilon_{it} \quad (2)$$

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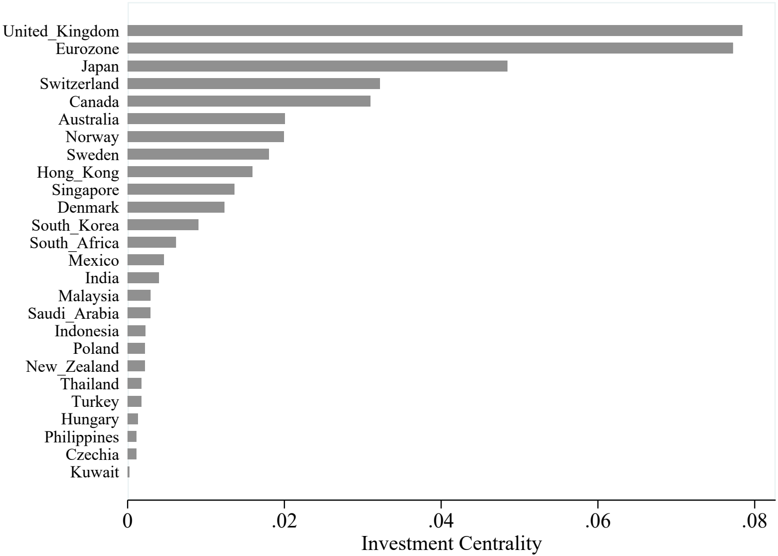
Central countries have lower interest rates

	fd	*fd*	*fd*	*fd*
Investment centrality	-1.29**	-1.61*	-0.87**	-0.79*
	(0.48)	(0.80)	(0.36)	(0.41)
GDP share		0.44		
		(0.51)		
Investments/GDP			-1.14***	
			(0.41)	
Trade centrality				-0.95*
				(0.52)
Num. obs.	5,728	5,728	5,728	5,728
R^2	0.17	0.17	0.22	0.20

Model Back

Average investment centralities



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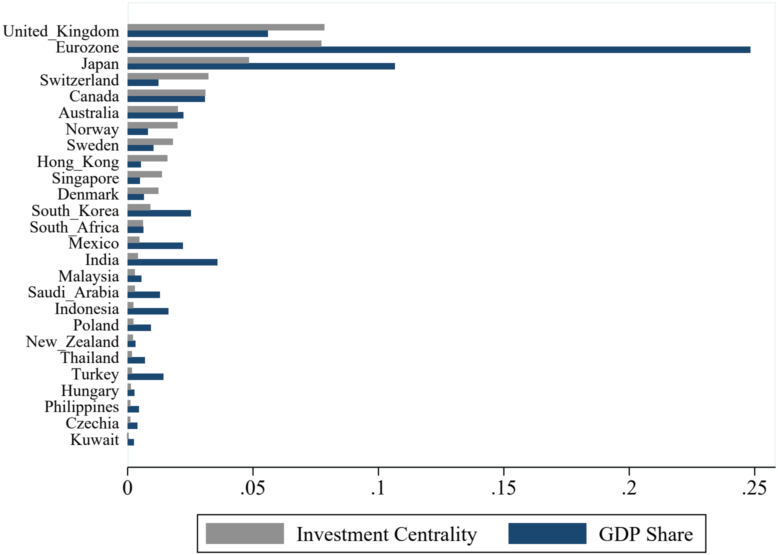
Investment centrality vs. Country size



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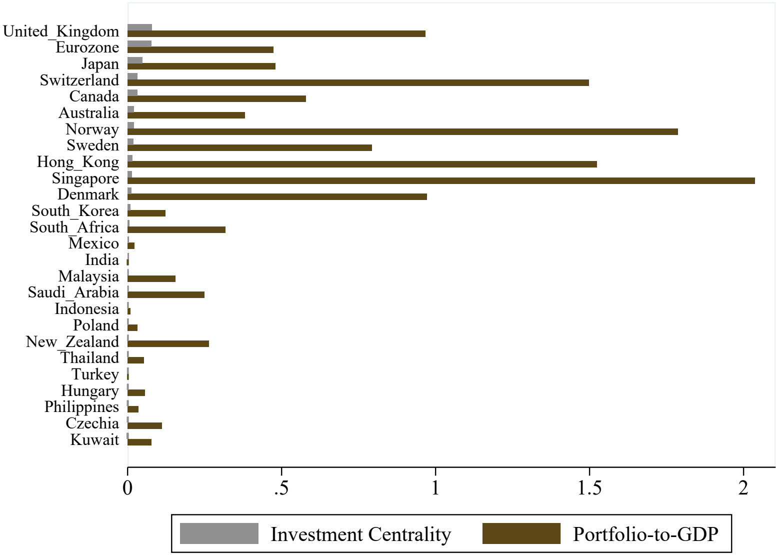
Investment centrality vs. Financial openness



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Correlation of macro variables

	IC	GDP share	Portfolio/GDP	TC
IC	1			
GDP share	0.72	1		
Portfolio/GDP	0.38	-0.03	1	
TC	0.52	0.37	0.42	1

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Other investment strategies

	Panel B: Carry Trade Portfolios				
	PF1	PF2	PF3	PF4	HML_{FX}
Previous fd					
mean	-1.19	0.11	1.52	6.41	7.60
Currency excess returns					
mean	-0.47	1.88	2.29	4.61	5.08
std	6.57	7.25	7.72	9.45	7.49
Forward discount					
mean	-1.24	0.09	1.49	6.46	7.70
Sharpe ratio					
mean	-0.07	0.26	0.30	0.49	0.68

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Other investment strategies

	Panel C: Trade Centrality Portfolios				
	PF1	PF2	PF3	PF4	CEN_X
Previous centrality					
mean	0.19	0.35	0.57	0.94	-0.75
Currency excess returns					
mean	4.32	1.88	1.62	0.66	3.66
std	8.76	8.83	6.93	5.68	5.09
Forward discount					
mean	4.09	2.48	0.47	0.20	3.89
Sharpe ratio					
mean	0.49	0.21	0.23	0.12	0.72

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Return profile of *CEN* factor exhibits low crash risk

	CEN	HML_{FX}	CEN_X	DOL
Mean	2.45	5.08	3.66	2.18
SD	4.50	7.49	5.09	7.12
Sharpe ratio	0.54	0.68	0.72	0.31
Skewness	-0.18	-0.64	-0.15	-0.65
Excess kurtosis	1.44	1.81	2.02	2.01
N	236	236	236	236

Correlation

Correlation of investment strategies

	CEN	HML_{FX}	CEN_X	DOL
CEN	1			
HML_{FX}	0.56	1		
CEN_X	0.42	0.68	1	
DOL	-0.02	0.39	0.59	1

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Standard asset pricing framework

Stochastic discount factor (SDF) approach (e.g., Cochrane (2009))

$$\mathbb{E}\left[M_{t+1} RX^k_{t+1}\right] = 0, \tag{3}$$

with a SDF linear in the factors

$$M_{t+1} = 1 - b'(f_{t+1} - \mu). \tag{4}$$

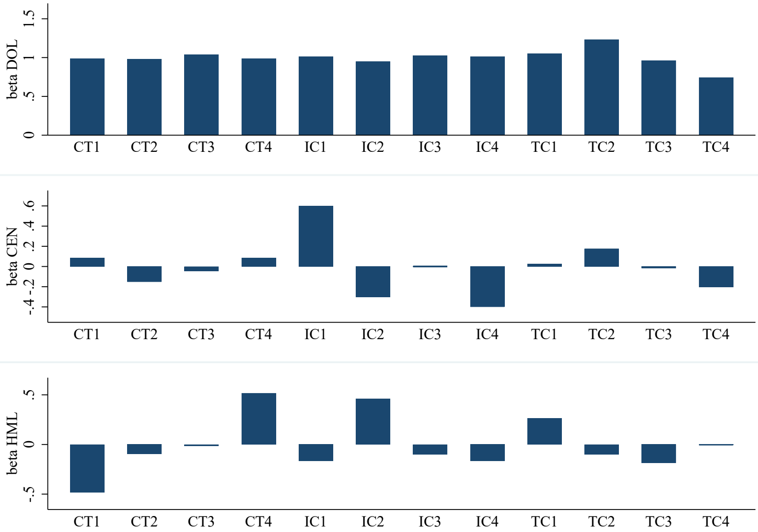
Eq. (3) implies beta pricing model where expected excess returns equal factor risk prices λ times risk quantities β^k

$$\mathbb{E}\left[RX^k\right] = \lambda' \beta^k, \tag{5}$$

<u>Three-factor model:</u>

$$M_{t+1} = 1 - b_{DOL}(DOL_{t+1} - \mu_{DOL}) - b_{HML}(HML_{t+1} - \mu_{HML}) - b_{CEN}(CEN_{t+1} - \mu_{CEN}) \tag{6}$$

Currency portfolios load on *CEN* and HML_{FX} factor

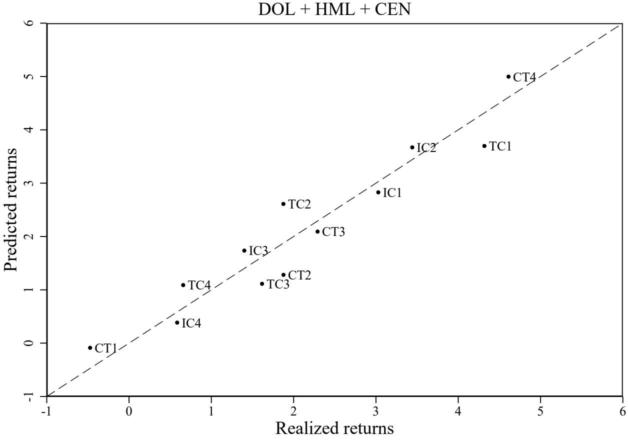


Positive estimate of factor risk price λ^{CEN}

Factor Prices				
	DOL	*CEN*	HML_{FX}	R^2
	0.18	0.28***		0.38
	(0.15)	(0.10)		
	0.18		0.42***	0.42
FMB	(0.15)		(0.16)	
	0.18	0.19**	0.42***	0.53
	(0.15)	(0.08)	(0.16)	

$\Rightarrow$ Currency returns that positivley comove with investment centrality factor pay higher risk premia

Three-factor model captures spread between realized and predicted returns



⇒ Currency excess returns compensate for investment centrality risk

Model Table 2

Panel regressions of monthly spot exchange rate returns Δs_{it} on the one-year lagged FPI network centrality variable v_{it-12}, the change in the VIX index ΔVIX_t, and an interaction term between both variables

$$\Delta s_{it} = \alpha_i + \delta_t + \beta_1 v_{it-12} + \beta_2 \Delta VIX_t + \beta_3 \Delta VIX_t \times v_{it-12} + \epsilon_{it} \qquad (7)$$

Back