Rethinking Exchange Rate Exposure in Equity Markets Through International Trade Networks

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How do currency fluctuations affect stock returns?

- Classical trade theory (e.g., Sharpiro 1975; Dumas 1978): domestic currency appreciation impacts firms through two opposing channels:
  - Exporters: Firms value should decrease because they lose competitiveness
  - Importers: Firm value should increase, as inputs become cheaper

  $\Rightarrow$ If the average firm is a net exporter, equity and currency values should be negatively correlated.

- The empirical evidence is notoriously weak. (e.g, Jorion 1991, . . .)
  - A common view: Investment flow is an important determinant of the joint dynamics of stock and currency returns.
  - e.g., Hau and Rey (2006), Camanho, Hau, and Rey (2022), Rey, Stavrakeva, and Tang (2024) and many more

Challenging the Trade-Based View

- Hau and Rey (2006, RFS):

  "The empirical literature has unambiguously shown that goods market variables do not explain exchange rate movements at short- to medium-run frequencies."

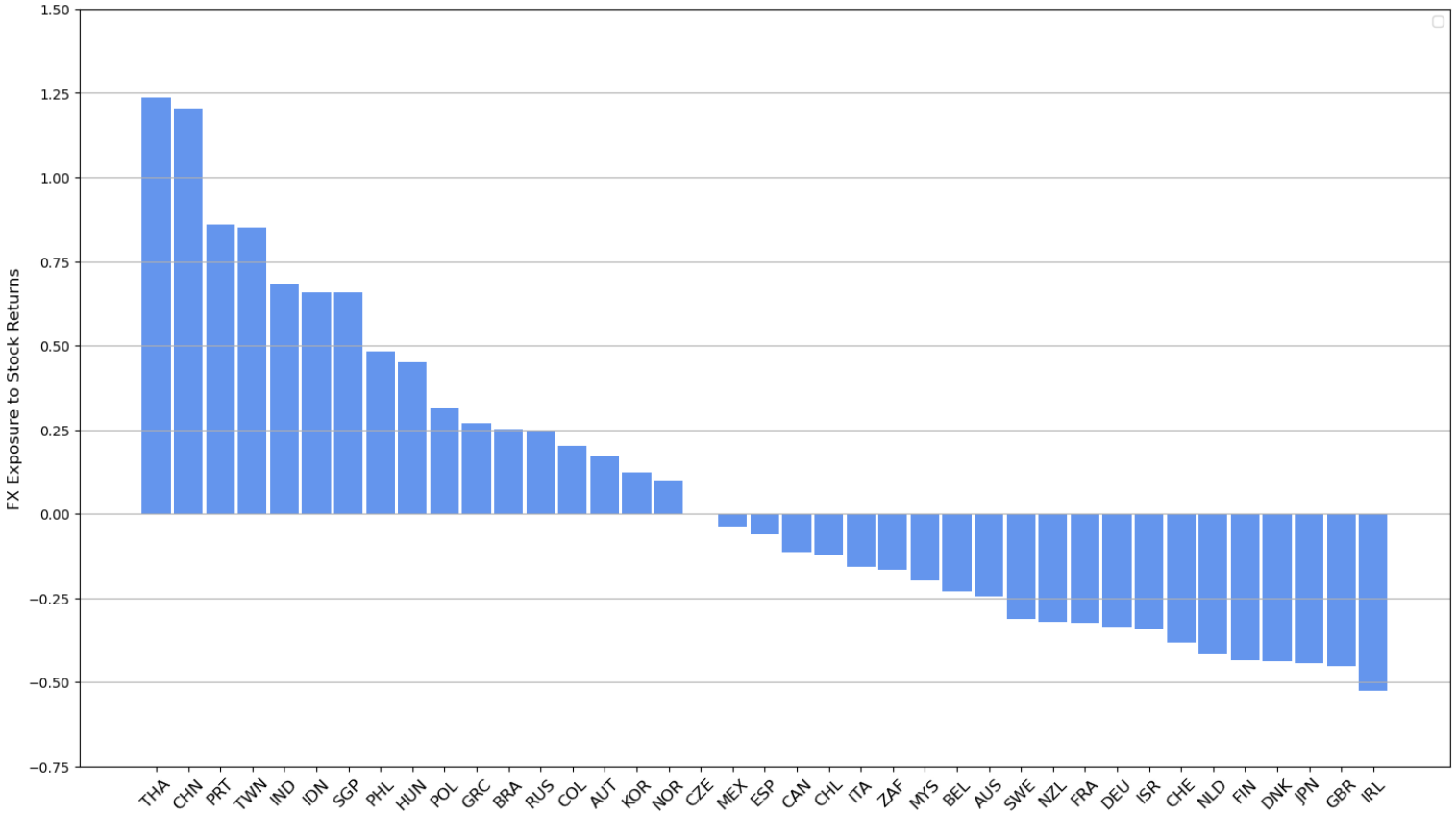
- Cenedese, Payne, Sarno, and Valente (2016, RF):

  "We find that exchange rate movements are, in fact, unrelated to differentials in country-level equity returns."

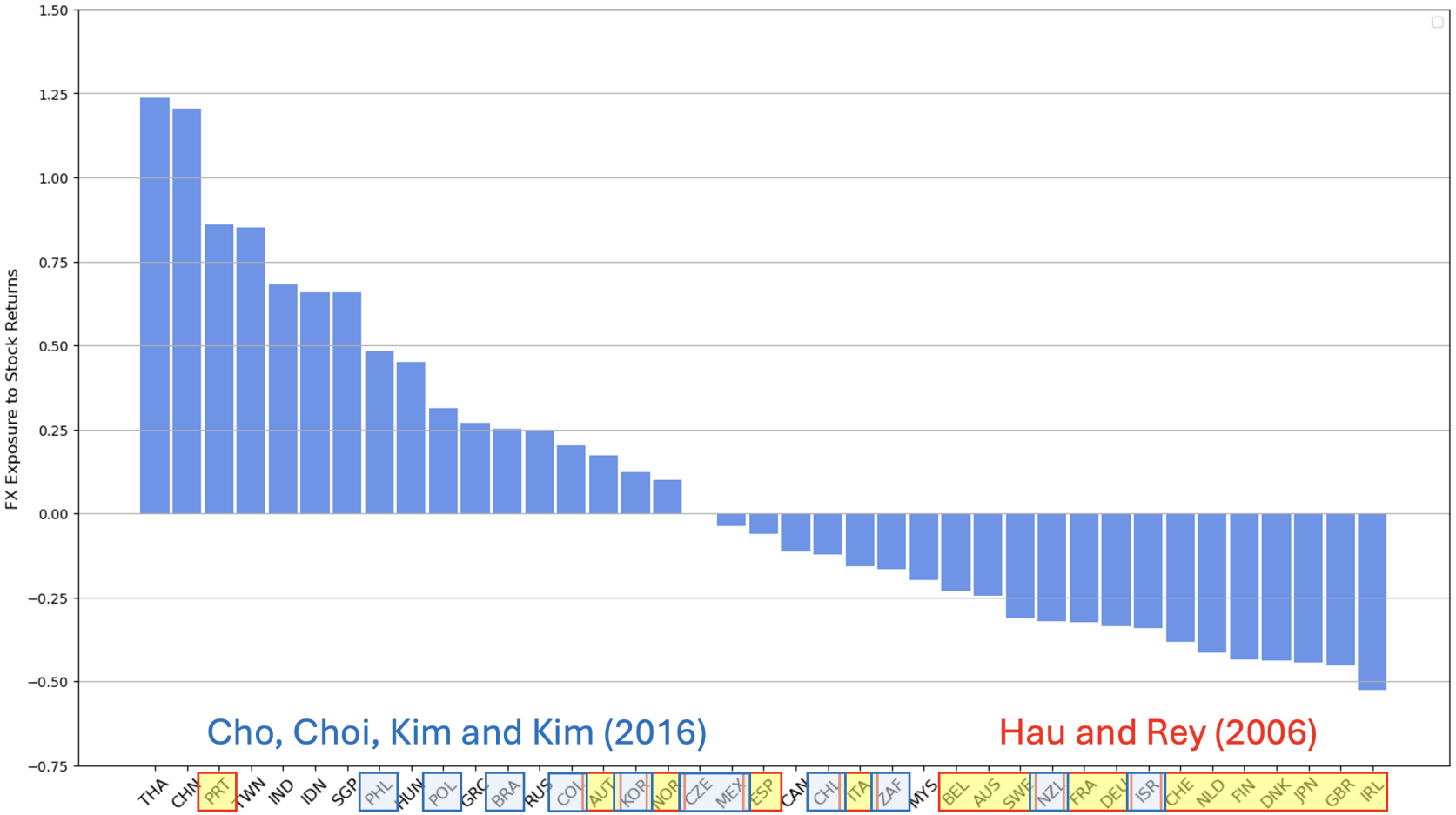
$\Rightarrow$ We challenge this view and argue that the trade channel is important and economically significant, but has been obscured by measurement error.

$\Rightarrow$ We argue that whether a currency appreciation is good or bad depends on who you are appreciating against.

$$R_t^i - R_t^{US} = a^i + b^i FX_{i,t}^{USD} + e_t^i$$



Developed/emerging market



- ▷ HR explain the negative side via portfolio rebalancing – investor pulling out from outperforming markets
- ▷ This relationship is positive for emerging markets and negative for emerging markets, because the portfolio flow depends on global economic condition.

We ask the following:

- ▷ Is there a fundamental real-economy mechanism driving this?
  - Our approach: trade-weighted exchange rates computed separately for export and import partners.
    - ✓ Different from using trade-weighted currency returns
  - We hypothesize that these two currency returns affect stock returns in opposite directions as predicted by standard economic theory.
  - We also study if revenue and cost changes with the two constructed currency returns
- ▷ Revisit the cross-country heterogeneity of the dollar beta

Literature Review

Stock Returns and Exchange Rates

- Jorion (1991); Bartov & Bodnar (1994); Dominguez & Tesar (2006): (mixed evidence), Hau & Rey (2006); Camanho et al. (2022): Negative relationship (rebalancing)

Transmission Through International Trade Network

- Forbes & Rigobon (2002); Griffin & Stulz (2000), Albuquerque et al. (2015); Pyun & Sulaeman (2025)

Real Effects of Exchange Rates

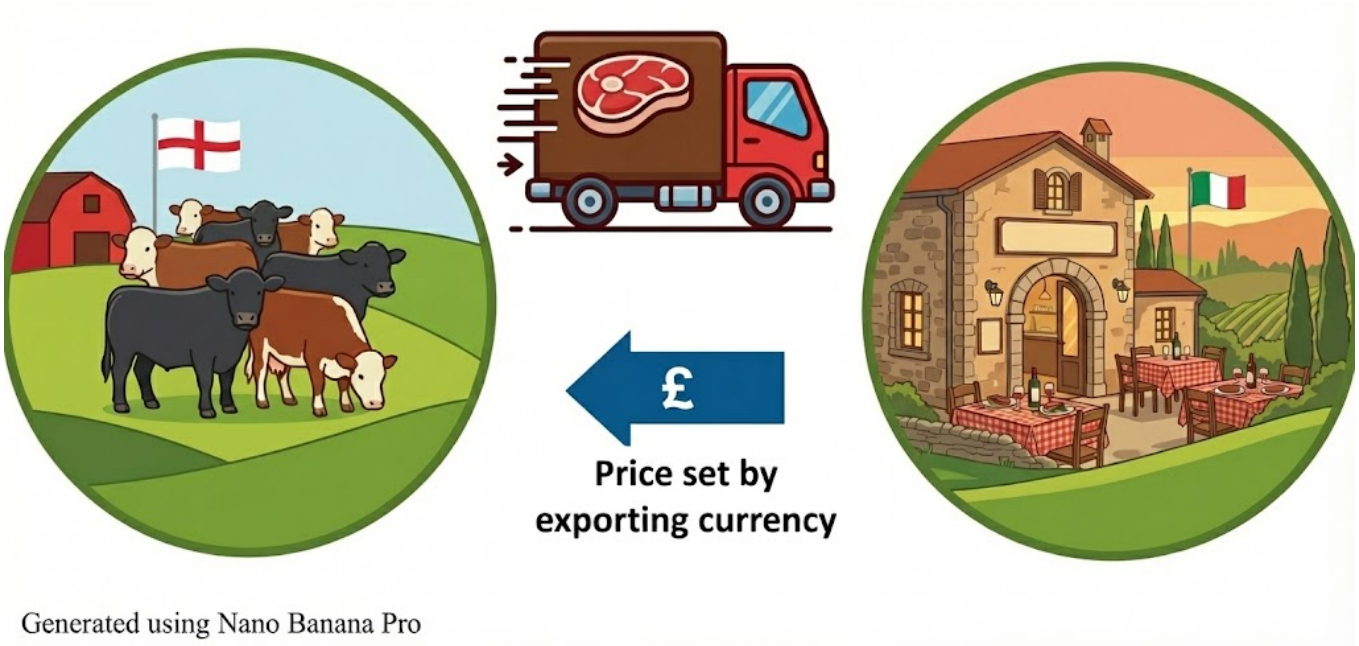
- Welch & Zhou (2024), Adams & Verdelhan (2022)
- We link real effects to the relationship between stock prices and exchange rates.

International Asset Allocation

- Adler and Dumas (1983), Perold and Schulman (1988), Jorion (1989), and Jorion (1993)
- Bräuer & Hau (2024); Sialm & Zhu (2024) (fixed income), Kremens (2024); Hau & Rey (2006); Rey et al. (2024) (hedge funds)

A Stylized Model of Bilateral Trade

Consider a simple world with two countries, one (monopolistic) firm for each country:



Main question: How do fluctuations in the bilateral exchange rate (EUR/GBP) affect the profits of both firms?

Producer Currency Pricing (PCP)

We follow the standard New Keynesian framework (e.g., Obstfeld and Rogoff 1995) and assume Producer Currency Pricing (PCP):

- ▷ Price of beef is "sticky" in the producer's currency.
  - P(£) = constant markup (m) $\times$ marginal cost (w)
- ▷ Exchange rate fluctuations are entirely passed through to the importer's costs.
- ▷ If the Pound (£) appreciates 10% against the Euro (€), the Italian restaurant's input cost (in €) will rise by 10%.

Assuming linear demand in final good we can derive the maximized profit:

$$P_F = a - b \cdot Q_S$$

Model Solution: Firm Profits & Exchange Rates

Importer (Italy)

$$\Pi_I^* = \frac{1}{4b}\left(a - \frac{m \cdot w \cdot e_{EX}}{e_{IM}}\right)^2$$

- ▷ Local currency appreciation (€↑) lowers input costs (increasing profitability)

Exporter (England)

$$\Pi_E^* = \frac{(m-1)w}{2b}\left(a - \frac{m \cdot w \cdot e_{EX}}{e_{IM}}\right)$$

- ▷ Cheaper beef leads to lower steak prices and higher volume.
- ▷ Therefore, local currency depreciation (€↑) leads to increased revenue

1) The profitability is linked to the bilateral exchange rate $\left(\frac{e_{EX}}{e_{IM}}\right)$
2) A depreciation of the local currency benefits exporters (revenue channel), but harms importers (cost channel).

Decomposing the Currency Beta (β_q)

We can decompose the currency beta (with respect to some benchmark currency), which is determined by the trade-off between two channels:

$$\beta_{c,q} \equiv \frac{1}{P_c}\frac{\partial \Pi_c}{\partial q_c} = \underbrace{\frac{S_c}{P_c}}_{\substack{\text{Sales-to-Price}\\ \text{Ratio}}} \left(\underbrace{\left(\frac{1}{S_c}\frac{\partial S_c}{\partial q_c}\right)}_{\substack{\text{Revenue}\\ \text{Channel}<0}} - \underbrace{\left(\frac{C_c}{S_c}\right)}_{\substack{\text{Inverse}\\ \text{Profit Margin}}} \underbrace{\left(\frac{1}{C_c}\frac{\partial C_c}{\partial q_c}\right)}_{\substack{\text{Cost}\\ \text{Channel}<0}} \right)$$

S_c and C_c denote the sales (revenue) and costs of the firm in c.

- ▷ The beta may be *negative* for
  - firms with higher export dependency
  - firms with high profit margin.
- ▷ The beta may be positive in the opposite case

Empirical Implications

This two main empirical tests we consider:

1) **Directional Asymmetry:**
   Do currency movements against *import-weighted* vs. *export-weighted* baskets have opposing effects on stock returns?

2) **Firm/Industry Heterogeneity:**
   Can firm or industry-level characteristics (profit margins, trade intensity) explain the *cross-section* of currency betas?

Data Overview

- Trade Data: OECD Input-Output Tables (1995–2020)
  - 2023 version covers 45 industries and 77 countries
  - Includes input/output of service industries
- Market data: Datastream (1996-2021)
  - Currency returns: filter annualized volatility $> 40\%$
  - Country-level: MSCI total return indices
- Accounting data: Worldscope
- Final sample:
  - 42 countries, aggregated to industry level (ISIC classification)
  - 474,475 unique country-industry-year observations

Trade-Weighted Currency Returns

- For each country-industry pair (c, i), we construct export- and import-weighted currency returns:

$$FX^{\text{EX}}_{c,i,t} = FX^{\text{USD}}_{c,t} - \sum_d w^{\text{EX}}_{c,i,d} FX^{\text{USD}}_{d,t}$$

$$FX^{\text{IM}}_{c,i,t} = FX^{\text{USD}}_{c,t} - \sum_d w^{\text{IM}}_{c,i,d} FX^{\text{USD}}_{d,t}$$

- FX^{USD} is the currency return against the USD. Weights w^{EX} and w^{IM} are based on export and import shares of partner country d at the industry level.
- A positive value always indicates a focal country's currency appreciation.
- Focus on value-weighted returns (EW results in the paper)

FX exposure of country industries

$$R_{c,i,t} = \alpha_{c,i} + \beta FX^{EX}_{c,i,t} + \gamma FX^{IM}_{c,i,t} + \text{Controls}_{c,i,t} + \epsilon_{c,i,t}$$

- We expect $\beta < 0$ and $\gamma > 0$
- We also replace $FX^{EX/IM}$ with $FX^{XM} = FX^{IM} - FX^{EX}$ export-to-import currency value and return against USD (FX^{USD}).

Panel A. Value-weighted country-industry returns

	Dependent Variable: $R_{c,i,t}$					
$FX^{EX}_{c,i,t}$	−0.072	−0.074	−0.076			
	(−5.14)	(−5.26)	(−5.39)			
$FX^{IM}_{c,i,t}$	0.065	0.078	0.079			
	(4.57)	(5.49)	(5.57)			
$FX^{USD}_{c,t}$				−0.116	−0.111	−0.111
				(−31.94)	(−30.39)	(−30.52)
$FX^{XM}_{c,i,t}$				0.075	0.081	0.083
				(5.41)	(5.82)	(5.93)
$R_{WLD,t}$	0.842	0.842	0.842	0.872	0.871	0.871
	(372.36)	(372.65)	(372.57)	(359.12)	(359.03)	(358.98)
Country FE	N	Y	N	N	Y	N
Industry FE	N	Y	N	N	Y	N
Country × Industry FE	N	N	Y	N	N	Y
Adj-R^2	0.230	0.232	0.228	0.232	0.233	0.230
N	474,475	474,475	474,475	474,475	474,475	474,475

FX exposure of country industries and trade intensity

$$R_{c,i,t} = \alpha_{c,i} + \beta FX^{EX}_{c,i,t} \times TrdShr^{-}_{c,i,t} + \gamma FX^{IM}_{c,i,t} \times TrdShr^{-}_{c,i,t} + \text{Controls}_{c,i,t} + \epsilon_{c,i,t}$$

	Dependent Variable: $R^{VW}_{c,i,t}$					
$FX^{EX}_{c,i,t} \times TrdShr^{-}_{c,i,t}$	−0.658	−0.662	−0.655			
	(−6.91)	(−6.96)	(−6.88)			
$FX^{IM}_{c,i,t} \times TrdShr^{-}_{c,i,t}$	0.361	0.353	0.338			
	(3.68)	(3.60)	(3.45)			
$FX^{XM}_{c,i,t} \times TrdShr^{-}_{c,i,t}$				0.352	0.360	0.348
				(3.70)	(3.78)	(3.66)
$FX^{USD}_{c,t} \times TrdShr^{-}_{c,i,t}$				−0.200	−0.210	−0.214
				(−8.40)	(−8.82)	(−9.03)
$FX^{EX}_{c,i,t}$	0.039	0.038	0.035			
	(1.84)	(1.79)	(1.62)			
$FX^{IM}_{c,i,t}$	−0.003	0.011	0.015			
	(−0.16)	(0.49)	(0.68)			
$FX^{XM}_{c,i,t}$				−0.081	−0.074	−0.074
				(−14.19)	(−12.96)	(−12.99)
$FX^{USD}_{c,t}$				0.004	0.008	0.012
				(0.21)	(0.38)	(0.58)
$TrdShr^{-}_{c,i,t}$	0.001	0.001	−0.004	0.001	0.001	−0.004
	(0.94)	(1.33)	(−1.88)	(1.06)	(1.33)	(−1.77)
$R_{WLD,t}$	0.843	0.843	0.843	0.873	0.872	0.872
	(374.36)	(374.70)	(375.32)	(360.32)	(360.44)	(361.12)
Country FE	N	Y	N	N	Y	N
Industry FE	N	Y	N	N	Y	N
Country × Industry FE	N	N	Y	N	N	Y
Adj-R^2	0.230	0.232	0.229	0.232	0.234	0.230
N	474,475	474,475	474,475	474,475	474,475	474,475

$$\textbf{TrdShr} = \frac{\textbf{Exp + Imp}}{\textbf{In + Out}}$$

Trade network and the sign of the US dollar beta

Is the dollar beta negative if an industry exports more/imports less?

$$R_{c,i,t} = \alpha_{c,i} + \beta FX^{USD}_{c,i,t} \times FracExp^{-}_{c,i,t} + \gamma FX^{USD}_{c,i,t} \times FracImp^{-}_{c,i,t} + \text{Controls}_{c,i,t} + \epsilon_{c,i,t}$$

	Dependent Variable: Value-weighted country-industry returns					
$FX^{USD}_{c,t}$	0.404	0.351	0.353	0.399	−0.113	−0.109
	(74.55)	(46.47)	(46.81)	(98.24)	(−28.40)	(−27.40)
$FX^{USD}_{c,t} \times FracExp^{-}_{c,i,t}$	−0.046		−0.166			
	(−2.13)		(−6.44)			
$FX^{USD}_{c,t} \times FracImp^{-}_{c,i,t}$		0.236	0.372			
		(7.09)	(9.26)			
$FX^{USD}_{c,t} \times NetExp^{-}_{c,i,t}$				−0.068	−0.055	−0.055
				(−8.80)	(−7.77)	(−7.87)
$NetExp^{-}_{c,i,t}$				0.001	0.001	0.005
				(3.37)	(4.74)	(6.70)
$FracExp^{-}_{c,i,t}$	0.001		0.002			
	(1.06)		(3.61)			
$FracImp^{-}_{c,i,t}$		−0.004	−0.006			
		(−4.21)	(−5.38)			
$R_{WLD,t}$					0.872	0.871
					(360.42)	(361.24)
Country FE	N	N	N	N	Y	N
Industry FE	N	N	N	N	Y	N
Country × Industry FE	N	N	N	N	N	Y
Adj-R^2	0.023	0.023	0.023	0.023	0.232	0.230
N	474,475	474,475	474,475	474,475	474,475	474,475

$FracExp^{-}_{c,i,t}$ =Export/Output

$FracImp^{-}_{c,i,t}$ = Import/Input

Evidence from firm operation

Firm operations should respond to currency appreciation through the two channels.

Revenue Channel
(Exposure to Export Destinations)

- ▷ Home currency appreciation relative to *export* partners

⇒ Lower Revenue

Cost Channel
(Exposure to Import Sources)

- ▷ Home currency appreciation relative to *import* partners

⇒ Lower Cost

- ▷ Profitability rises when:

  Export currency appreciates more than Import currency value

Firm-level regression results

- ▷ We expect:
  - Revenue and cost decrease with currency appreciation
  - The profit depends on the relative currency value of export and import partners.

	Δ revenue		Δ cost	
$FX^{USD}_{c,t}$		−0.088		−0.076
		(−3.54)		(−4.25)
$FX^{EX,Firm}_{c,j,t}$	−0.137		0.108	
	(−1.40)		(1.55)	
$FX^{IM,Firm}_{c,j,t}$	0.113		−0.155	
	(1.13)		(−2.18)	
World Δ revenue	0.155	0.145		
	(19.80)	(19.48)		
World Δ cost			0.149	0.143
			(25.52)	(25.50)
Country FE	Y	Y	Y	Y
Adj-R^2	−0.178	−0.166	−0.175	−0.163
N	115,459	125,602	115,459	125,602

	Δ revenue - Δ cost			
$FX^{USD}_{c,t}$			−0.014	−0.013
			(−0.61)	(−0.52)
$FX^{EX,Firm}_{c,j,t}$	−0.215	−0.236		
	(−2.49)	(−2.48)		
$FX^{IM,Firm}_{c,j,t}$	0.257	0.260		
	(2.93)	(2.69)		
$FX^{XM,Firm}_{c,j,t}$			0.228	0.241
			(2.65)	(2.54)
World Δ revenue −Δ cost	0.134	0.126	0.135	0.126
	(8.00)	(7.15)	(8.05)	(7.19)
Firm FE	N	Y	N	Y
Adj-R^2	0.001	−0.182	0.001	−0.182
N	115,459	115,459	115,459	115,459

- ▷ Worldscope matches firms to multiple industries, we assume homogeneous currency exposure at the country-industry level

From Industry to Country-Level Evidence

- Next, we test whether similar relationships hold at the aggregate country level.

$$R_{c,t} = \alpha_c + \beta FX^{EX}_{c,t} + \gamma FX^{IM}_{c,t} + \text{Controls}_{c,i,t} + \epsilon_{c,i,t}$$

$$R_{c,t} = \alpha_c + \beta FX^{EX}_{c,t} \times TrdShr_{c,t} + \gamma FX^{IM}_{c,t} \times TrdShr_{c,t} + \text{Controls}_{c,i,t} + \epsilon_{c,i,t}$$

	Dependent variable: Country index returns					
$FX^{EX}_{c,t}$	−0.507	0.570	0.539	−0.513	0.521	0.518
	(−2.38)	(1.06)	(1.00)	(−2.41)	(0.96)	0.957
$FX^{IM}_{c,t}$	0.520	−0.633	−0.601	0.540	−0.558	−0.554
	(2.40)	(−1.16)	(−1.10)	(2.50)	(−1.02)	(−1.01)
$FX^{EX}_{c,t} \times TrdShr^{-}_{c,t}$		−5.387	−5.242		−5.193	−5.209
		(−1.97)	(−1.93)		(−1.91)	(−1.91)
$FX^{IM}_{c,t} \times TrdShr^{-}_{c,t}$		5.881	5.736		5.603	5.622
		(2.14)	(2.09)		(2.04)	(2.04)
$TrdShr^{-}_{c,t}$			−0.016			−0.029
			(−3.09)			(−2.01)
$R_{WLD,t}$	0.911	0.907	0.907	0.911	0.907	0.907
	(63.70)	(64.31)	(64.33)	(64.01)	(64.59)	(64.59)
Country FE	N	N	N	Y	Y	Y
Adj-R^2	0.386	0.386	0.387	0.387	0.388	0.388
N	12,174	12,174	12,174	12,174	12,174	12,174

Currency exposure of country index returns

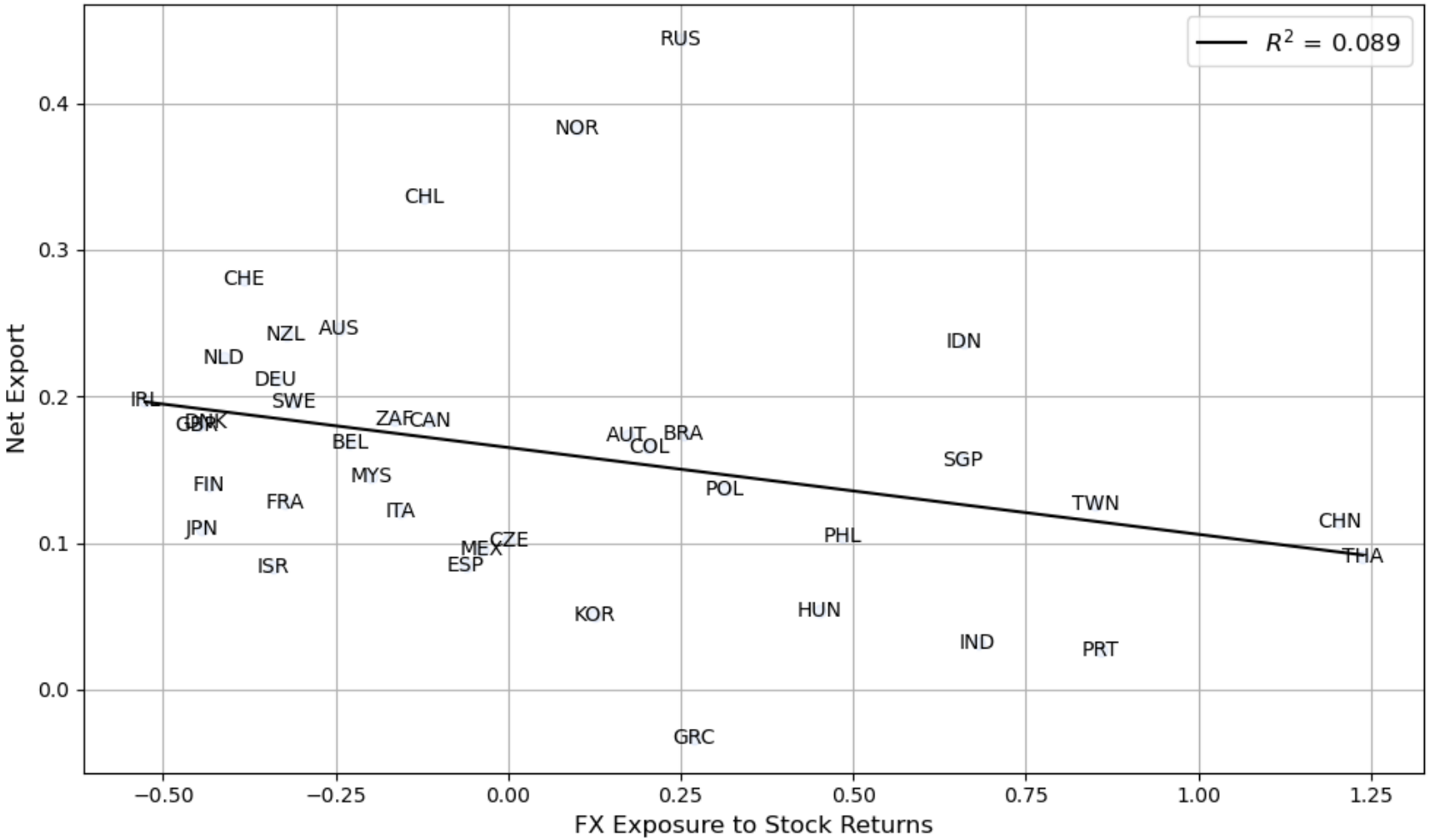
We also test for significance of the export-to-import currency returns.

	Dependent variable: Country index returns					
$FX^{XM}_{c,t}$	0.452	−0.844	−0.836	0.468	−0.778	−0.804
	(2.09)	(−1.57)	(−1.56)	(2.17)	(−1.44)	−1.493
$FX^{USD}_{c,t}$	−0.077	−0.081	−0.050	−0.070	−0.074	−0.034
	(−3.31)	(−3.51)	(−0.80)	(−3.05)	(−3.25)	(−0.53)
$FX^{XM}_{c,t} \times TrdShr^{-}_{c,t}$		6.638	6.673		6.377	6.627
		(2.43)	(2.48)		(2.34)	(2.45)
$FX^{USD}_{c,t} \times TrdShr^{-}_{c,t}$			−0.174			−0.233
			(−0.55)			(−0.73)
$TrdShr^{-}_{c,t}$			−0.015			−0.028
			(−3.01)			(−1.95)
$R_{WLD,t}$	0.932	0.929	0.929	0.931	0.928	0.929
	(61.99)	(62.08)	(62.68)	(62.40)	(62.49)	(62.99)
Country FE	N	N	N	Y	Y	Y
Adj-R^2	0.387	0.388	0.388	0.388	0.389	0.389
N	12,174	12,174	12,174	12,174	12,174	12,174

What determines the dollar beta?- Net export

	Dependent variable: Country index returns					
$FX^{USD}_{c,t}$	−0.081	−0.097	0.036	0.035	−0.083	0.038
	(−3.52)	(−1.49)	(0.79)	(0.76)	(−1.29)	(0.84)
$FX^{USD}_{c,t} \times FracExp^{-}_{c,t}$		−1.978			−2.001	
		(−3.25)			(−3.28)	
$FX^{USD}_{c,t} \times FracImp^{-}_{c,t}$		1.702			1.677	
		(3.01)			(2.97)	
$FX^{USD}_{c,t} \times NetExp^{-}_{c,t}$			−0.689	−0.679		−0.661
			(−3.28)	(−3.25)		(−3.19)
$FracExp^{-}_{c,t}$		0.014			0.093	
		(1.03)			(2.40)	
$FracImp^{-}_{c,t}$		−0.029			−0.112	
		(−2.13)			(−3.22)	
$NetExp^{-}_{c,t}$				0.008		0.017
				(1.44)		(1.44)
$R_{WLD,t}$	0.930	0.930	0.929	0.929	0.930	0.928
	(61.67)	(62.32)	(61.26)	(61.27)	(62.57)	(61.63)
Country FE	N	N	N	N	Y	Y
Adj-R^2	0.387	0.388	0.388	0.388	0.389	0.389
N	12,174	12,174	12,174	12,174	12,174	12,174

What determines the dollar beta?- Net export



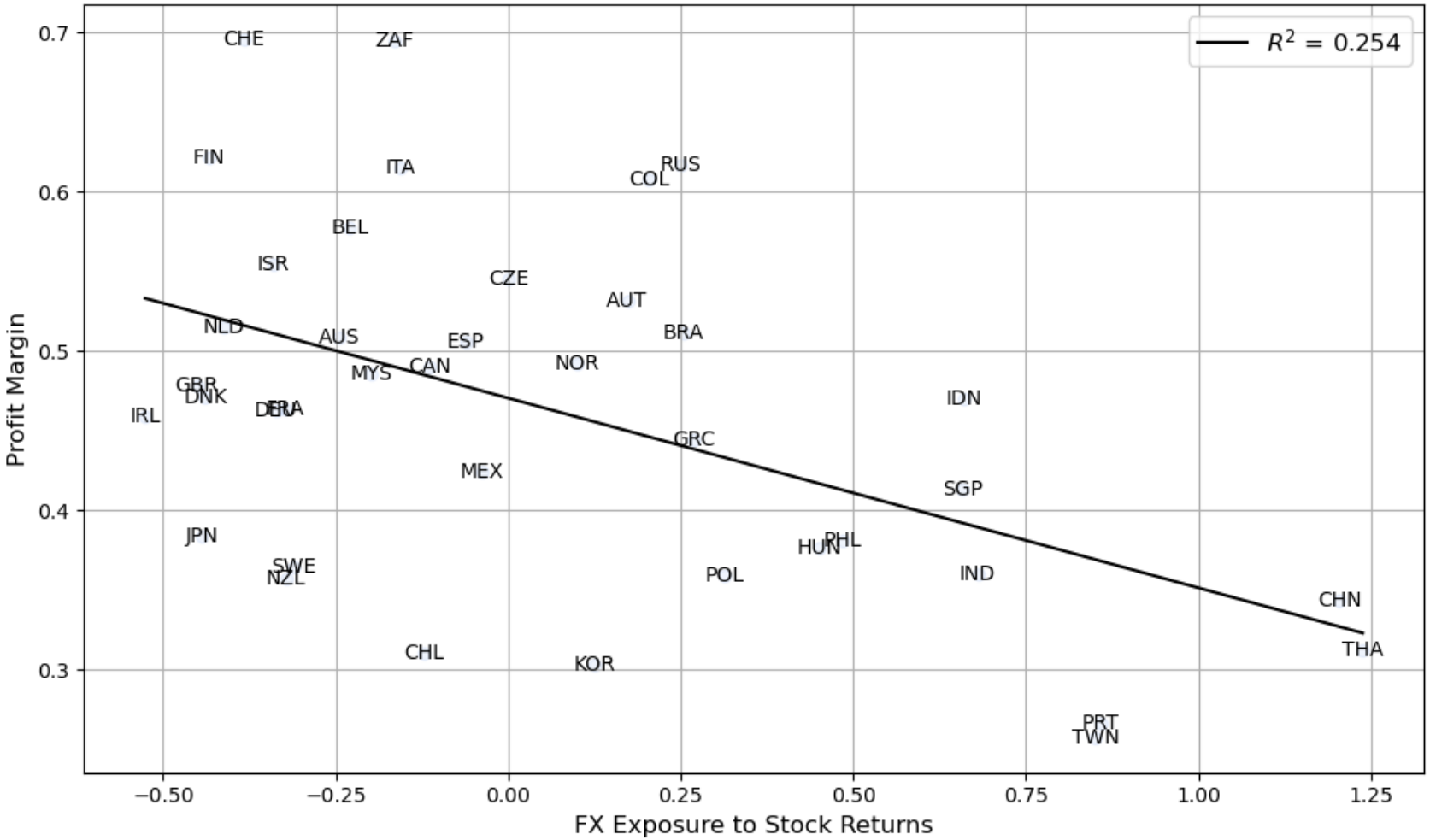
Determinants of the dollar beta?- Profit margin

Profit margin may be related to the dollar beta:

Dollar beta = Sales/P (Revenue channel + Profit Margin^{-1} × Cost channel)

	Dependent variable: Country index returns				
$FX^{USD}_{c,t} \times PM^{-}_{c,t}$	−0.261	−0.246	−0.271	−0.223	−0.249
	(−2.88)	(−2.73)	(−3.09)	(−2.40)	(−2.77)
$FX^{USD}_{c,t} \times NetExp^{-}_{c,t}$				−0.631	−0.604
				(−3.01)	(−2.93)
$FX^{USD}_{c,t}$	0.062	0.053	0.073	0.148	0.164
	(1.10)	(0.95)	(1.36)	(2.48)	(2.77)
$PM^{-}_{c,t}$		0.008	0.012	0.008	0.012
		(3.88)	(4.37)	(3.71)	(4.39)
$NetExp^{-}_{c,t}$				0.005	0.018
				(1.00)	(1.51)
$R_{WLD,t}$	0.926	0.927	0.926	0.926	0.926
	(61.18)	(61.27)	(61.85)	(61.10)	(61.68)
Country FE	N	N	Y	N	Y
Adj-R^2	0.388	0.388	0.390	0.389	0.391
N	12,174	12,174	12,174	12,174	12,174

Determinants of the dollar beta?- Profit margin



Conclusion and Contributions

- Historical weakness in the exchange rate-stock return link was driven by using a single currency basket
- Main Findings:
  - Local currency appreciation can lower or increase stock returns depending on the benchmark basket
    - ✓ Appreciation vs. export partners → lower stock returns
    - ✓ Appreciation vs. import partners → higher stock returns
  - Stock returns react to changes in FX values as predicted by goods market theory.
- Contribution
  - Importance of trade channel as a determinant of currency beta
  - Net export and profit margin are potentially meaningful variables.