

# 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
- ⇒ 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):

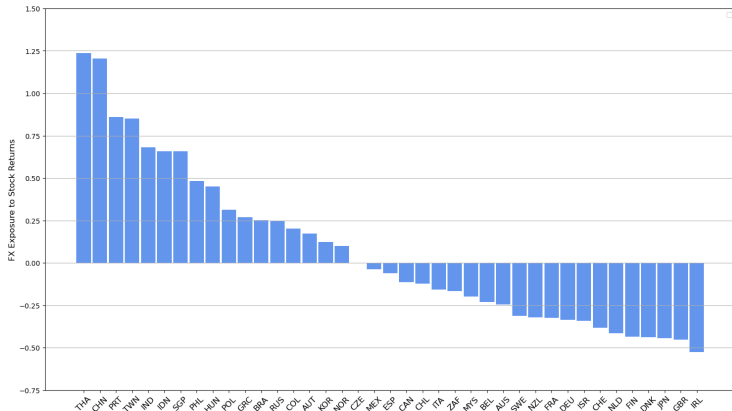
*"The empirical literature has unambiguously shown that goods market variables **do not** explain exchange rate movements at short- to medium-run frequencies."*

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

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

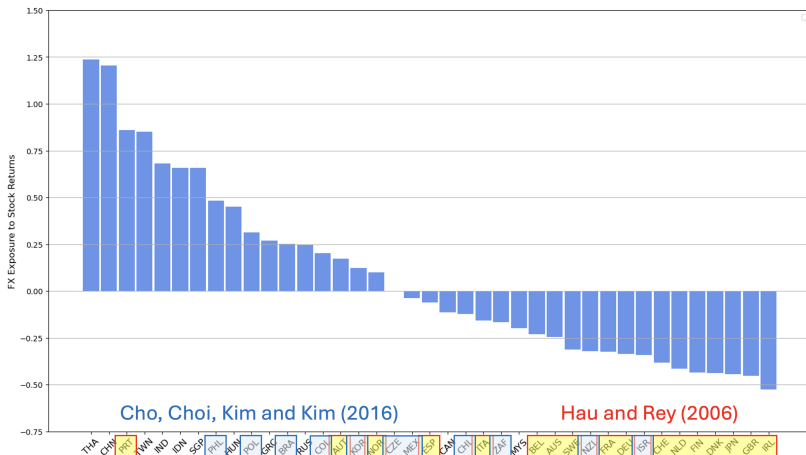
- ⇒ We challenge this view and argue that the trade channel is important and economically significant, but has been obscured by measurement error.
- ⇒ We argue that whether a currency appreciation is good or bad depends on who you are appreciating against.

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



- ▷ Regression using monthly returns at the market level, where High  $FX_i^{USD}$  means appreciation of currency  $i$
- ▷ Country/markets are sorted by  $b^i$

# 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 developed 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/market 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:



Generated using Nano Banana Pro

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.
  - $P(\pounds) = \text{constant markup } (m) \times \text{marginal cost } (w)$
- ▷ 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 ( $\beta_q$ )

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

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

$S_c$  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/market-level: MSCI total return indices
- ▷ Accounting data: Worldscope
- ▷ Final sample:
  - 42 countries, aggregated to industry level (ISIC classification)
  - 474,475 unique country/market-industry-year observations

# Trade-Weighted Currency Returns

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

$$FX_{c,i,t}^{\text{EX}} = FX_{c,t}^{\text{USD}} - \sum_d w_{c,i,d}^{\text{EX}} FX_{d,t}^{\text{USD}}$$
$$FX_{c,i,t}^{\text{IM}} = FX_{c,t}^{\text{USD}} - \sum_d w_{c,i,d}^{\text{IM}} FX_{d,t}^{\text{USD}}$$

- ▷  $FX^{\text{USD}}$  is the currency return against the USD. Weights  $w^{\text{EX}}$  and  $w^{\text{IM}}$  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

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

- ▷ 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: $R_{c,i,t}$						
$FX_{c,i,t}^{EX}$	-0.072 (-5.14)	-0.074 (-5.26)	-0.076 (-5.39)			
$FX_{c,i,t}^{IM}$	0.065 (4.57)	0.078 (5.49)	0.079 (5.57)			
$FX_{c,t}^{USD}$				-0.116 (-31.94)	-0.111 (-30.39)	-0.111 (-30.52)
$FX_{c,i,t}^{XM}$				0.075 (5.41)	0.081 (5.82)	0.083 (5.93)
$R_{WLD,t}$	0.842 (372.36)	0.842 (372.65)	0.842 (372.57)	0.872 (359.12)	0.871 (359.03)	0.871 (358.98)
Country FE	N	Y	N	N	Y	N
Industry FE	N	Y	N	N	Y	N
Country $\times$ Industry FE	N	N	Y	N	N	Y
Adj-R <sup>2</sup>	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

$$R_{c,i,t} = \alpha_{c,i} + \beta FX_{c,i,t}^{EX} \times TrdShr_{c,i,t}^{-} + \gamma FX_{c,i,t}^{IM} \times TrdShr_{c,i,t}^{-} + Controls_{c,i,t} + \epsilon_{c,i,t}$$

Dependent Variable: $R_{c,i,t}^{VW}$						
$FX_{c,i,t}^{EX} \times TrdShr_{c,i,t}^{-}$	-0.658 (-6.91)	-0.662 (-6.96)	-0.655 (-6.88)			
$FX_{c,i,t}^{IM} \times TrdShr_{c,i,t}^{-}$	0.361 (3.68)	0.353 (3.60)	0.338 (3.45)			
$FX_{c,i,t}^{XM} \times TrdShr_{c,i,t}^{-}$				0.352 (3.70)	0.360 (3.78)	0.348 (3.66)
$FX_{c,i,t}^{USD} \times TrdShr_{c,i,t}^{-}$				-0.200 (-8.40)	-0.210 (-8.82)	-0.214 (-9.03)
$FX_{c,i,t}^{EX}$	0.039 (1.84)	0.038 (1.79)	0.035 (1.62)			
$FX_{c,i,t}^{IM}$	-0.003 (-0.16)	0.011 (0.49)	0.015 (0.68)			
$FX_{c,i,t}^{XM}$				-0.081 (-14.19)	-0.074 (-12.96)	-0.074 (-12.99)
$FX_{c,i,t}^{USD}$				0.004 (0.21)	0.008 (0.38)	0.012 (0.58)
$TrdShr_{c,i,t}^{-}$	0.001 (0.94)	0.001 (1.33)	-0.004 (-1.88)	0.001 (1.06)	0.001 (1.33)	-0.004 (-1.77)
$R_{WLD,t}$	0.843 (374.36)	0.843 (374.70)	0.843 (375.32)	0.873 (360.32)	0.872 (360.44)	0.872 (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 <sup>2</sup>	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

Exp + Imp  
TrdShr = -----  
In + Out



# Trade network and the sign of the US dollar beta

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

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

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

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

$\text{FracImp}_{c,i,t}^{-}$   
= 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.

	$\Delta$ revenue		$\Delta$ cost			$\Delta$ revenue - $\Delta$ cost			
$FX_{c,t}^{USD}$		-0.088 (-3.54)		-0.076 (-4.25)	$FX_{c,t}^{USD}$		-0.014 (-0.61)	-0.013 (-0.52)	
$FX_{c,j,t}^{EX,Firm}$	-0.137 (-1.40)		0.108 (1.55)		$FX_{c,j,t}^{EX,Firm}$	-0.215 (-2.49)	-0.236 (-2.48)		
$FX_{c,j,t}^{IM,Firm}$	0.113 (1.13)		-0.155 (-2.18)		$FX_{c,j,t}^{IM,Firm}$	0.257 (2.93)	0.260 (2.69)		
World $\Delta$ revenue	0.155 (19.80)	0.145 (19.48)			$FX_{c,j,t}^{XM,Firm}$			0.228 (2.65)	0.241 (2.54)
World $\Delta$ cost			0.149 (25.52)	0.143 (25.50)	World $\Delta$ revenue - $\Delta$ cost	0.134 (8.00)	0.126 (7.15)	0.135 (8.05)	0.126 (7.19)
Country FE	Y	Y	Y	Y	Firm FE	N	Y	N	Y
Adj-R <sup>2</sup>	-0.178	-0.166	-0.175	-0.163	Adj-R <sup>2</sup>	0.001	-0.182	0.001	-0.182
N	115,459	125,602	115,459	125,602	N	115,459	115,459	115,459	115,459

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

# From Industry to Country/Market-Level Evidence

- ▷ We test whether similar relationships hold at the aggregate level.
- ▷ We remove input/import of end users

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

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

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

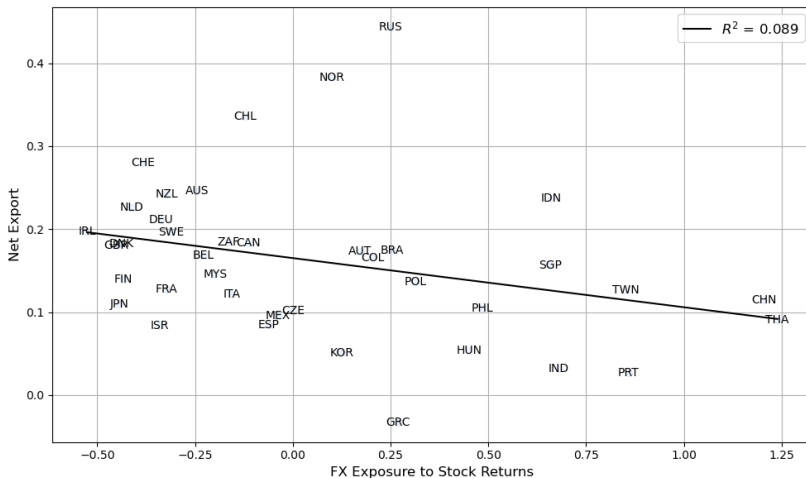
We also test for significance of the export-to-import currency returns.

Dependent variable: Country index returns						
$FX_{c,t}^{XM}$	0.452 (2.09)	-0.844 (-1.57)	-0.836 (-1.56)	0.468 (2.17)	-0.778 (-1.44)	-0.804 (-1.493)
$FX_{c,t}^{USD}$	-0.077 (-3.31)	-0.081 (-3.51)	-0.050 (-0.80)	-0.070 (-3.05)	-0.074 (-3.25)	-0.034 (-0.53)
$FX_{c,t}^{XM} \times TrdShr_{c,t}^-$		6.638 (2.43)	6.673 (2.48)		6.377 (2.34)	6.627 (2.45)
$FX_{c,t}^{USD} \times TrdShr_{c,t}^-$			-0.174 (-0.55)			-0.233 (-0.73)
$TrdShr_{c,t}^-$			-0.015 (-3.01)			-0.028 (-1.95)
$R_{WLD,t}$	0.932 (61.99)	0.929 (62.08)	0.929 (62.68)	0.931 (62.40)	0.928 (62.49)	0.929 (62.99)
Country FE	N	N	N	Y	Y	Y
Adj-R <sup>2</sup>	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					
$FX_{c,t}^{USD}$	-0.081 (-3.52)	-0.097 (-1.49)	0.036 (0.79)	0.035 (0.76)	-0.083 (-1.29)	0.038 (0.84)
$FX_{c,t}^{USD} \times FracExp_{c,t}^-$		-1.978 (-3.25)			-2.001 (-3.28)	
$FX_{c,t}^{USD} \times FracImp_{c,t}^-$		1.702 (3.01)			1.677 (2.97)	
$FX_{c,t}^{USD} \times NetExp_{c,t}^-$			-0.689 (-3.28)	-0.679 (-3.25)		-0.661 (-3.19)
$FracExp_{c,t}^-$		0.014 (1.03)			0.093 (2.40)	
$FracImp_{c,t}^-$		-0.029 (-2.13)			-0.112 (-3.22)	
$NetExp_{c,t}^-$				0.008 (1.44)		0.017 (1.44)
$R_{WLD,t}$	0.930 (61.67)	0.930 (62.32)	0.929 (61.26)	0.929 (61.27)	0.930 (62.57)	0.928 (61.63)
Country FE	N	N	N	N	Y	Y
Adj-R <sup>2</sup>	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

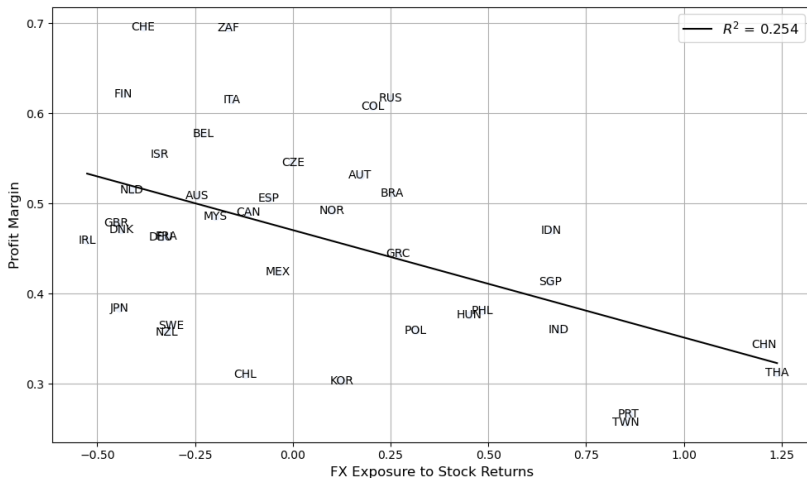
Profit margin may be related to the dollar beta:

Dollar beta = Sales/P (Revenue channel – Profit Margin<sup>-1</sup> × Cost channel)

	Dependent variable: Country index returns				
$FX_{c,t}^{USD} \times PM_{c,t}^-$	-0.261 (-2.88)	-0.246 (-2.73)	-0.271 (-3.09)	-0.223 (-2.40)	-0.249 (-2.77)
$FX_{c,t}^{USD} \times NetExp_{c,t}^-$				-0.631 (-3.01)	-0.604 (-2.93)
$FX_{c,t}^{USD}$	0.062 (1.10)	0.053 (0.95)	0.073 (1.36)	0.148 (2.48)	0.164 (2.77)
$PM_{c,t}^-$		0.008 (3.88)	0.012 (4.37)	0.008 (3.71)	0.012 (4.39)
$NetExp_{c,t}^-$				0.005 (1.00)	0.018 (1.51)
$R_{WLD,t}$	0.926 (61.18)	0.927 (61.27)	0.926 (61.85)	0.926 (61.10)	0.926 (61.68)
Country FE	N	N	Y	N	Y
Adj-R <sup>2</sup>	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.