Exchange rate shocks and equity prices: the role of currency denomination

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SCHWEIZERISCHE NATIONALBANK
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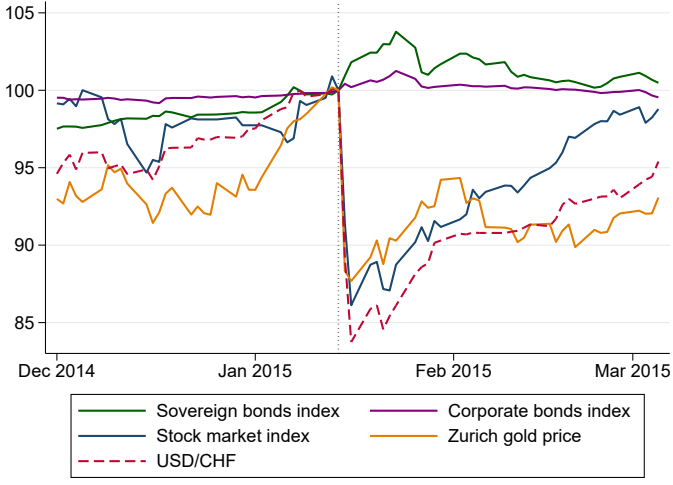
Motivation I

January 2015: Exogenous appreciation of the Swiss franc following the EUR/CHF floor discontinuity



Motivation II

We study how Swiss asset prices (stocks, bonds, gold) react to domestic FX movements:

- What are the **transmission mechanisms**?
- What are the **differences between asset classes**, and why?
- What are the **differences between stocks**, and why?
- How important are **dual listings**? Does the **law of one price** hold?

Abstract

We explore two different hypotheses for these differences:

- **Economic condition hypothesis**: FX shocks impact domestic macroeconomic conditions, and thus domestic asset prices (via HH, clients, suppliers, international trade...)
  $\rightarrow$ Movements reflect a macroeconomic shock

- **Currency denomination hypothesis**: FX shock impact the international relative value of cash flows and equity, and thus the domestic asset prices need to be corrected to reflect their new international value
  $\rightarrow$ Movements reflect an international parity

Empirically: we show that the **currency denomination hypothesis** is the main transmission mechanisms of FX shocks to asset prices

Contribution to the literature

- Large literature on the impact of asset prices on exchange rates (*exchange rate determination*): Hau et al. (2010); Pavlova and Rigobon (2007); Hau and Rey (2006, 2004); Gavin (1989); Stulz (1987)
- Some literature on the impact of exchange rates on the real economy: Auer et al. (2021); Freitag and Lein (2023); Oktay (2022); Efing et al. (2022); Eugster and Donato (2022)
- Exchange rate 'shocks' are typically absent from international macroeconomic models since FX is pinned down by other variables (see, e.g., Backus et al., 1992; Gali and Monacelli, 2005; Obstfeld and Rogoff, 1995)
- Financial literature typically observes the correlation, but research on the transmission channels of exchange rate shocks to stock prices is rare

We thus document a **new international perspective on asset pricing** (as suggested by Brunnermeier et al., 2021) and uncover a **new transmission channel** for macroeconomic policies in small open economy.

Outline

Exchange rate shocks and impulse responses

Firm heterogeneity

Causal identification

Exchange rate shocks and impulse responses

Data

Switzerland provides the perfect framework to study the impact of FX shocks:

- Small open economy (SOE)
- Large movements of the Swiss franc
- Large international firms that rely heavily on the exchange rate
- Our qualitative result may be extrapolated to other SOE and highly-integrated markets

Our data on Swiss financial prices cover:

- 2000-2022
- 212 stocks including 54 that are cross-listed in the US via American Depositary Receipts (96% of the main stock market index)
- Domestic listings (+ dividends) are in Swiss franc, cross-listings (+ dividends) are in US dollars
- Cross-listings may be converted back and forth between currencies, making them highly subsitutable

Methodology I

Identification of exchange rate shocks:

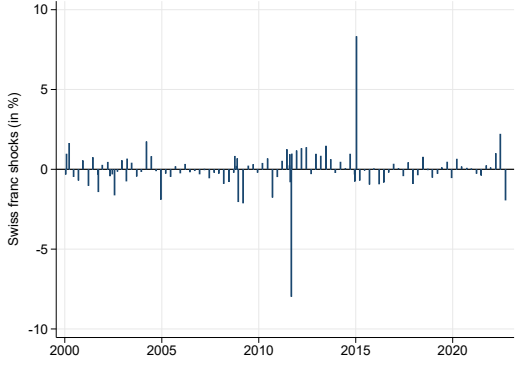
- FX movements are mixed with other macro shocks
- Solution: use FX movements on days where other macro shocks are identified
- We use Swiss monetary policy announcement (MPA) days and control for:
  - Foreign FX movements using the USD NEER
  - Monetary policy shocks (high-frequency identification by Koeniger et al., 2022)
  - Information effects shocks (identification through heteroskedasticity based on Bu et al., 2021; Ciminelli et al., 2022)

The residuals z_t are the exchange rate shocks:

$$\Delta \text{USDCHF}_t = \alpha + \beta_1 \Delta \text{NEER}_t + \beta_2 \Delta \text{MoPo}_t + \beta_3 \Delta \text{Info}_t + z_t \,.$$

Methodology II

Identified exchange rate shocks:

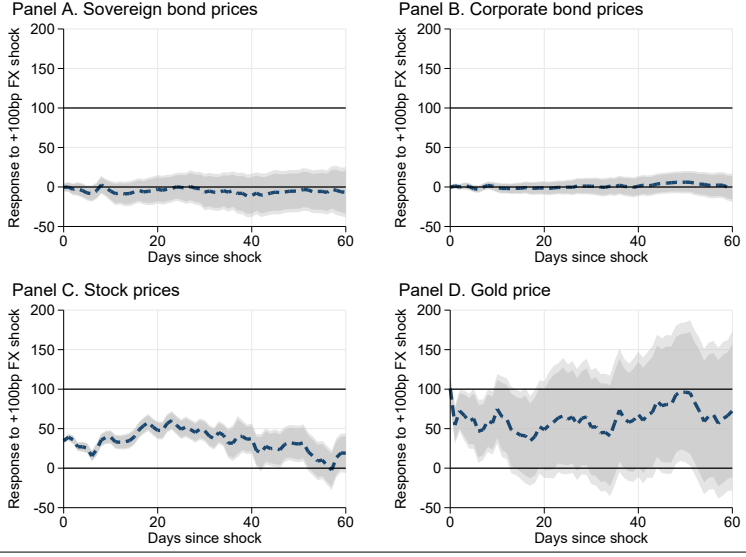


We analyze how asset prices react to FX shocks using impulse response via local projections (Jordà, 2005):

$$\Delta p_{t+h} = \alpha_h + \beta_h z_t + \Gamma_h' X_{t+h} + \varepsilon_{t+h}, \quad \forall h \in \{1, ..., 60\}.$$

Effect of FX shocks on asset prices

Sensitivity of asset prices to a 100 bp exchange rate shock (depreciation):



Heterogeneity in asset classes

Can we explain this heterogeneity with the currency denomination hypothesis?

- **Gold**: value from holding, no cash-flows
  - Many local quotes such that the **law of one price** should hold:

$$p_t^{CHF} = p_t^{USD} \times USDCHF_t$$

  - As such: $USDCHF \downarrow \implies p_t^{CHF} \downarrow$ and/or $p_t^{USD} \uparrow$
- **Bonds**: value derived from a claim on future nominal cash-flows in domestic currency
  - Future coupons are worth more internationally after an appreciation, but so does the price
  - FX may impact the credit risk of the debtor
  - Empirically, we find that this effect is negligible
- **Stocks**: mix of the two (real assets + cash-flows in various currencies)

Firm heterogeneity

Stock prices reaction to FX shocks

Large heterogeneity between stocks in their sensitivity to FX shocks. ▸▸ example

Why?

- **Economic conditions hypothesis**: for an exporting small-open economy

  Swiss franc $\uparrow \Longrightarrow$ exports $\downarrow \Longrightarrow L, I \downarrow \Longrightarrow$ ... $\Longrightarrow$ CHF and USD stock prices $\downarrow$

- **Currency denomination hypothesis**:
  - **Denomination of cash-flows**: if a company produces domestically and exports, it suffers a currency conversion loss (profits $\downarrow$ = stock price $\downarrow$)
  - **Denomination of equity**: by the law of one price,

    $$p_t^{CHF} = p_t^{USD} \times USDCHF_t$$

    Such that $USDCHF \downarrow \Longrightarrow p_t^{CHF} \downarrow$ and/or $p_t^{USD} \uparrow$

Empirical findings I

To analyze the non-linear heterogeneous aspects of stock price sensitivity to FX shocks, we divide the data in J groups based on some observed dimension and regress:

$$\Delta p_{i,t} = \alpha + \sum_{j=1}^{J} \beta_j \left(\mathbb{1}_{i \in j} \times z_t \right) + \sum_{j=1}^{J-1} \alpha_j \mathbb{1}_{i \in j} + \varepsilon_{i,t} \,,$$

Doing so, we show that the most sensitive stocks are the firms that:

- Have a higher share of foreign-denominated cash-flows ⏩ plot
- Have a larger market capitalization ⏩ plot
- Are in specific sectors (health, tourism, retail) ⏩ plot
- Sell products with a higher exchange rate pass-through ⏩ plot
- Are cross-listed in the US ⏩ plot

Empirical findings II

We further study the excess returns of Swiss stocks listed in the US with respect to the sectoral indices s of the S&P500:

$$\left(\Delta p_{i,t}^{US} - \Delta p_{s,t}^{US}\right) = \alpha_s + \beta_s z_t + \varepsilon_{i,t}\,,$$

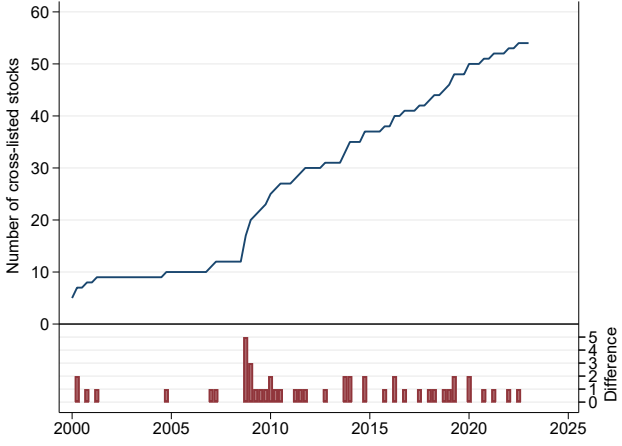
- When the Swiss franc appreciates: Swiss stocks in USD outperform the S&P
- When the Swiss franc depreciates: Swiss stocks in USD underperform the S&P
- Under the economic conditions hypothesis, we should observe the inverse:
  - Swiss franc is overvalued
  - Swiss franc appreciation = negative effect on aggregate demand
  - Negative impact on Swiss firms $\rightarrow$ stock price should decrease in both CHF and USD
- Empirical evidence thus point towards the **currency denomination** hypotheses

▸▸ detailed plot

Causal identification

Identification strategy I

Under the currency denomination hypothesis, a stock listed on multiple markets should react more to FX shocks because of the law of one price (like gold).
Staggered introduction of cross-listings in Switzerland:



Identification strategy II

We thus use a difference-in-differences approach looking at the effect of cross-listing on the sensitivity of stock prices to FX shocks.

Issues:

- Staggered introduction of cross-listings (Goodman-Bacon, 2021)
- Heterogeneous treatment effects (Sun and Abraham, 2021)
- Parallel trend assumption impossible to test for 55 treated units

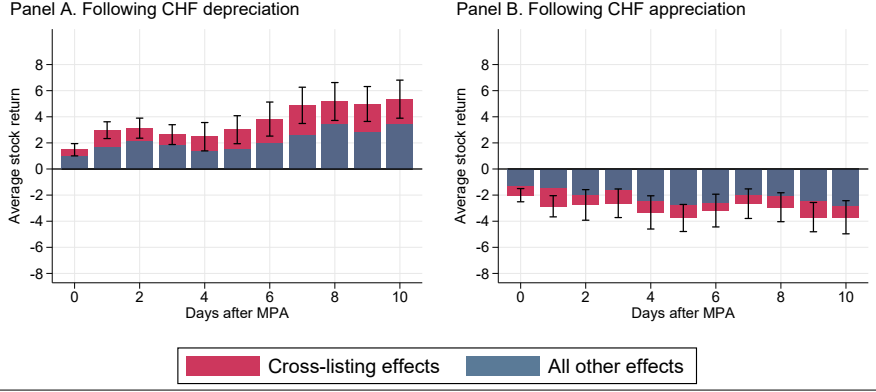
We solve all of these issues by using a synthetic DID following Arkhangelsky et al. (2021), optimally weighting control units and time periods in a TWFE:

$$\left\{\hat{\mu}_h, \hat{\gamma}_h, \hat{\delta}_h, \hat{\beta}_h\right\}_{h\in H} = \underset{\mu,\beta,\gamma,\delta}{\arg\min} \sum_{i\in I}\sum_{t\in M} \left(\Delta p_{i,t+h} - \mu - \gamma_i - \delta_t - \text{treat}_{it}\beta\right) \hat{\omega}_{i,h}\hat{\lambda}_{t,h}\,,$$

Causal identification I

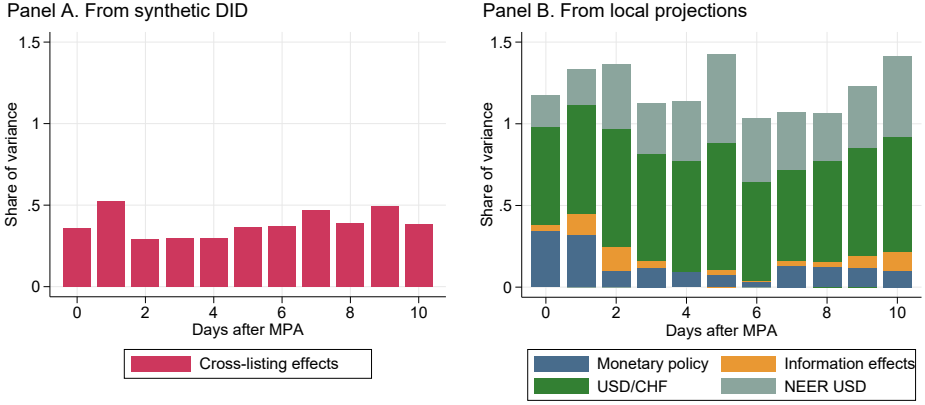
We estimate that **cross-listing explains one third of Swiss stock returns following FX shocks**.

- Symmetric effect for appreciations and depreciation
- Cross-listing **doubles** the sensitivity of stocks to FX shocks, proving that the **currency** of equity matters tremendously for the transmission of FX shocks



Causal identification II

Using a variance decomposition, we further show that this effect is sizable.
Cross-listing effects are comparable in magnitude to the effect of monetary policy shocks + central banks information effects:



Main contributions

We show that:

- The exchange rate is a **key driver of asset returns** in a small-open economy
- The main transmission mechanism is the so-called **currency denomination hypothesis**: exchange rate shocks mechanically change the relative value of cash-flows and equity, leading to law of one price arbitrage and substitution effects
- This causes a large **heterogeneity** between asset classes and individual stocks
- A **significant and sizable share of stock returns** in SOE can be attributed to these international adjustments of the law of one price
- The effect of macroeconomic shocks in SOE should be interpreted with caution: they might reflect **purely mechanical parity movements** due to changes in the relative value of the currency rather than en economic effect

Appendix

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Stock prices I

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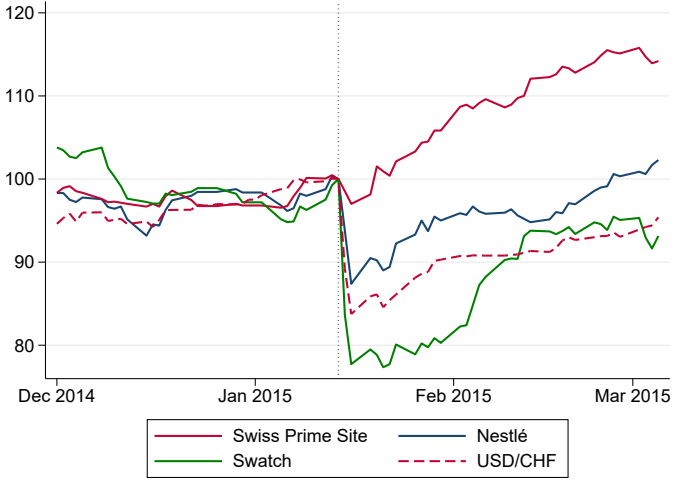


Stock prices II

Swiss Prime Site:

- Purely domestic firm
- Should be impacted via the **economic conditions hypothesis**
- Empirically: close to no reaction

Nestlé:

- Purely international firm
- Should be impacted via the **asset price denomination hypothesis**
- Empirically: medium reaction

Swatch:

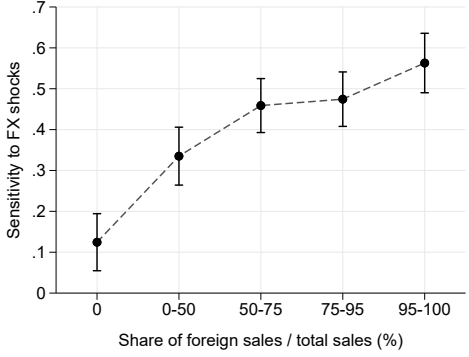
- In-between: domestic production but foreign sales
- Should be impacted via the **economic conditions hypothesis** + **cash-flow denomination hypothesis** + **asset price denomination hypothesis**
- Empirically: largest reaction

go back

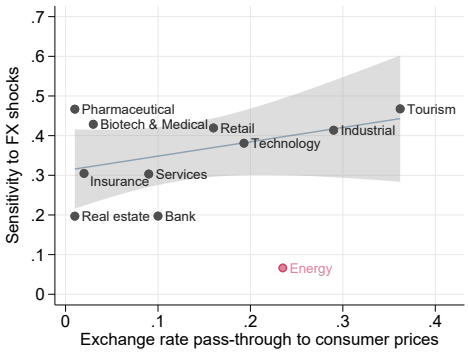
Empirical results I

$$\Delta p_{i,t} = \alpha + \sum_{j=1}^{J} \beta_j \left(\mathbb{1}_{i \in j} \times z_t \right) + \sum_{j=1}^{J-1} \alpha_j \mathbb{1}_{i \in j} + \varepsilon_{i,t} \,,$$

Panel A. By share of foreign sales



Panel B. By sector



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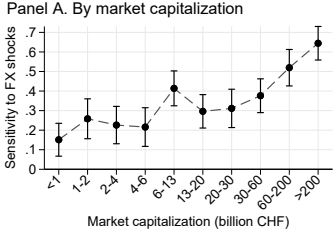
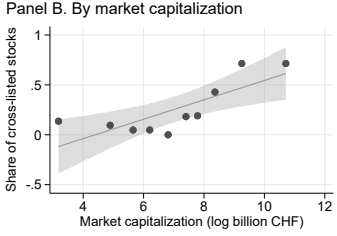
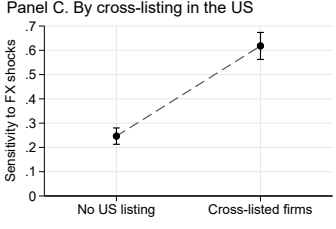
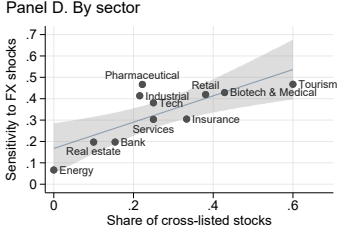
Empirical results II









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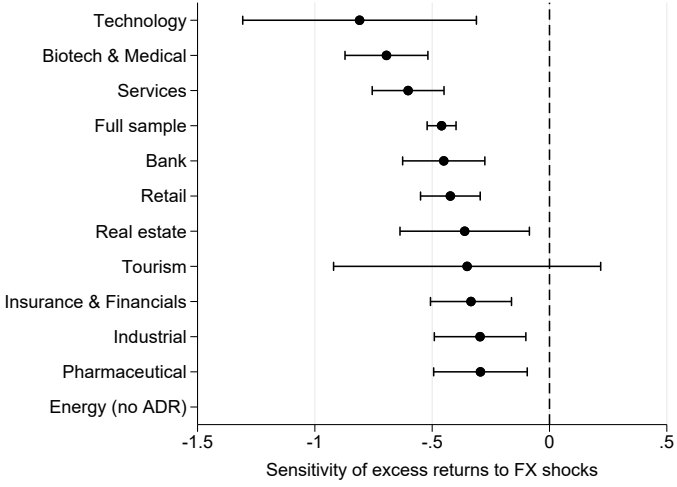
Empirical results III



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