Shorting The Dollar When Global Stock Markets Roar: The Equity Hedging Channel of Exchange Rate Determination

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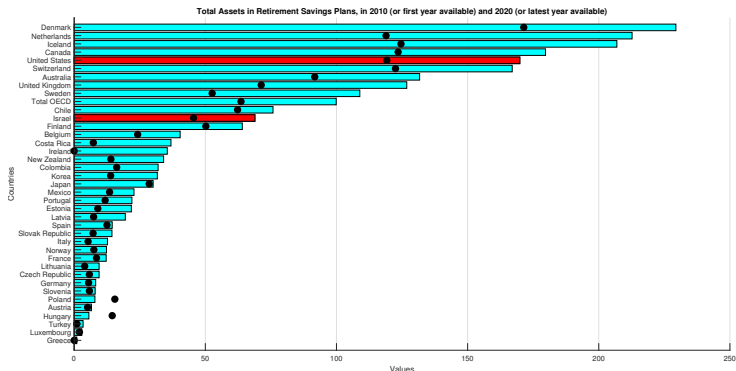
June 29, 2024

Motivation

Figure: Retirement Savings in OECD countries (in % of GDP)
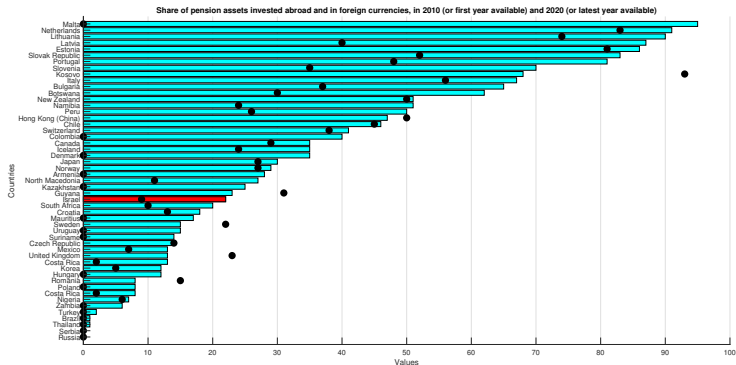
Motivation

Figure: Investment abroad (in % of total assets)

Motivation

- Institutional investors (IIs, Pension and Insurance funds) tend to hedge their FX risk exposure.

- According to the OECD 2019 Survey of Investment Regulation of Pension Funds, minimal hedge ratios are required for pension funds in Chile (50%), Colombia (50%–85%), Denmark (80%), Mexico (70%–100%), Norway (70%), Sweden (80%–100%), and Switzerland (70%).

- Mercer (2020) provides survey evidence for 2020 from 927 IIs across 12 countries (with a total asset value of over 1.1 trillion dollars) indicating that 42% of the surveyed IIs hedge over 60% of their FX exposure in listed equity portfolios.

The Equity Hedging Channel of Exchange Rate Determination

- **Research Question:** Does the hedging behavior of IIs affect the exchange rate? **Yes!** How?

- **Theoretical channel in a nutshell:**
  - The **equity hedging channel** of exchange rate determination speaks to investors' desire with a foreign equity asset position to hedge their FX risk by selling foreign currency in the forward market.
  - The increase in FX forward supply puts downward pressure on the forward rate which in turn translates to a decline in the spot rate.

- **The main objective of the paper:** study the existence and quantitative relevance of the equity hedging channel of exchange rate determination.

- **How are we going to do it:** Use novel *daily data* on FX forward flows of Israeli IIs for a recent 13-year sample period that saw little variation in local and foreign monetary policy rates.

Flavor of Results

- There is a positive and significant relationship between the sale of FX dollar forwards by II's and global equity shocks.
    - Consistent with the heding behavior of IIs.

- **We find that a one standard deviation increase in the II's supply of forward flows causes II's forward rate to appreciate by 0.53%.**
    - This translates to an appreciation of the spot rate in the same amount by no arbitrage.
    - We argue for causality using a novel identification strategy.

- The real Israeli sector takes the other side of the trade.

Literature Review

- The determinants of exchange rate behavior have long alluded researchers (Meese and Rogoff (1983)), with the data offering only a weak connection between exchange rates and macroeconomic aggregates, thus leading to the coining of the term **"exchange rate disconnect puzzle"**(Obstfeld and Rogoff (2000)).

- Advancement has been made on resolving this puzzle by turning to the relation between equity and credit markets and FX markets (Hau and Rey (2004, 2006), Lilley et al. (2019), Avdjiev et al. (2019), and Camanho et al. (2020)).

- There are two papers that are close to ours (Melvin and Prins (2015) and Liao and Zhang (2020)).

The Economic Mechanism

- We lay out a simple model to fix ideas about the *economic mechanism.*

- The framework is a partial equilibrium of the FX forward market:
    - Two time periods (t and $t + 1$)
    - Three agents:
        - Local II who sells foreign currency forwards to hedge FX position in equity markets.
        - Local importer (IM) who demands foreign currency forwards for its import activity.
        - Global arbitrageur (GA)

Theoretical Motivation: Local Institutional Investors

- A local II hedges a share h of the FX risk of its period t foreign equity position, denoted by A_t.

- In particular, this hedging is done by the local II through the selling of $FCF_{t,II} = hA_t$ foreign currency forwards on the forward market to an importer at FX forward rate $F_{t,t+1}$.

- $FCF_{t,II} = hA_t$ represents local II's (perfectly inelastic) supply of foreign currency forwards.

- A positive shock to global stock prices induces a rightward shift in the supply of foreign currency forwards because it produces a rise in A_t.

Theoretical Motivation: Local Importers

- The demand side of the forward market is governed by a local importer (IM) who buys $FCF_{t,IM} = P_{t,W} Q_{t,IM}$ foreign currency forwards to fund the purchase of its imports of intermediate input quantity $Q_{t,IM}$ at foreign price $P_{t,W}$.

- The local IM's imported intermediate inputs are in turn used to produce and sell output quantity $M(Q_{t,IM})$ at local price $P_{t,L}$ (in local currency units) in the local economy, where $M(Q_{t,IM})$ is an increasing and concave function.

Theoretical Motivation

- Given the setting described above, we can write local IM's profit as

$$\Pi_{t,IM} = P_{t,L}M(Q_{t,IM}) - P_{t,W}Q_{t,IM}F_{t,t+1}. \tag{1}$$

- The FOC of this problem is

$$P_{t,L}M'(Q_{t,IM}) = P_{t,W}F_{t,t+1}. \tag{2}$$

- $Q_{t,IM}$ is decreasing in $F_{t,t+1}$ and hence so is $FCF_{t,IM} = P_{t,W}Q_{t,IM}$.

Theoretical Motivation

- A global arbitrager ensures the existence of the CIP condition through a cross-currency swap:

$$\frac{S_t}{F_{t,t+1}} = \frac{1 + i_{t+1,W}}{1 + i_{t+1,L}}. \tag{3}$$

- The sign of the FX spot rate's response to changes in foreign stock market performance is the same as that of the forward rate.
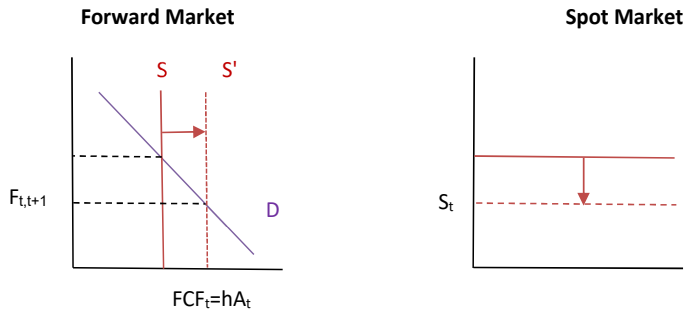
Theoretical Motivation: Summary

Figure: Equilibrium in the spot and forward market

Institutional Background

- IIs are broadly defined as financial intermediaries who pool funds from numerous investors and invest these funds in various financial assets on behalf of investors.

- The BOI's definition of IIs in Israel includes: pension funds, provident funds, severance pay funds, advanced training funds, and life insurance policies.

- IIs are important players in the Israeli financial market, managing $607.7 billion on behalf of the public as of December 2020, which is 44% of the public's entire financial asset portfolio and 141% of GDP.

The Structure of the FX Market

FX OTC Market

Centralized Market

Dealer   Investor   Central Counterparty
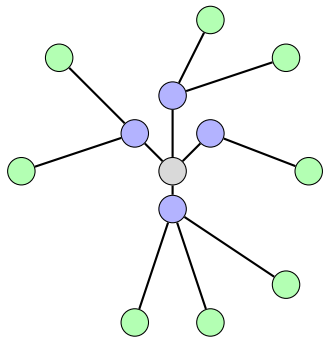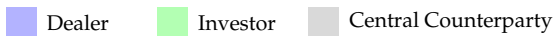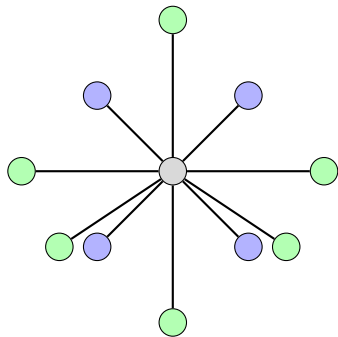
The Israeli FX Market

- The Israeli FX market is a decentralized OTC market where FX transactions are conducted between dealers and investors.

- All the major international dealers are active in the Israeli FX market, including Citi, Barclays, and HSBC for a total of 46 foreign dealers.

- According to the BIS, the Israeli FX market is the 23rd largest in the world (the median), with a daily turnover of $31 billion in 2022.

- In recent years it has become an international currency and liquid (e.g., the ILS/USD pairs bid-ask spread 0.07%). See Slide .

Data

- Our data is daily and covers the period 4/26/2011-8/18/2021.

- It covers FX flows and prices by type (spot, forward, swap, and option) and sectors.

    - There's a total of 13 IIs fund *families* which correspond to the universe of pension and insurance companies that manage the public's long-term savings.

    - The real sector includes Israeli exporters/importers, the banking sector includes Israeli commercial banks, the financial sector includes Israeli mutual funds, ETFs, hedge funds, and proprietary trading firms, and the foreign sector includes all types of foreign economic units.

- The forward FX flows variable measures (in dollars) the daily net transaction flow from buying and selling U.S. dollars on the FX forward market.

    - 80% of II's average daily volume in the FX market is done in dollars.

    - We also include the remaining 20% of the flows in the analysis with their corresponding flows and prices being transformed into dollar terms.

Other Data

- **Macro-Financial Data:** Aggregate daily frequency variables from Bloomberg.

  - **MSCI ACWI IMI Index:** Global stock prices covering developed and emerging markets.
  - **Interest Rates:** Changes in 3- and 12-month Libor.
  - **FTSE US Gov. Bond Index:** Performance of fixed-rate US government bonds.
  - **Broad Dollar Index:** Trade-weighted value of the dollar relative to other currencies.
  - **Excess Bond Premium:** Daily EBP shock variable for global credit supply shocks.

- **S&P 500 Constituent Data:**

  - Historical data from CRSP with 774 constituents.
  - Used for extracting individual stock price return shocks and constructing size weights.

Descriptive Statistics for IIs' Forward and Spot Flows and Rates

Variable	Forward Return	Spot Return	Forward Flows	Spot Flows
Mean	-0.002%	-0.002%	-35.1	25.1
Standard Deviation	0.4%	0.4%	135.4	84.2
Obs	2,042	2,042	2,042	2,042

Accumulated Spot and Forward Flows by II's
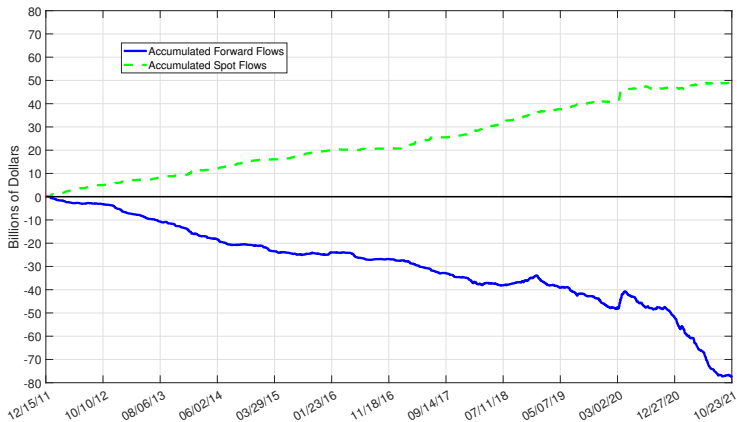
Accumulated FX Forward Flows by Sector
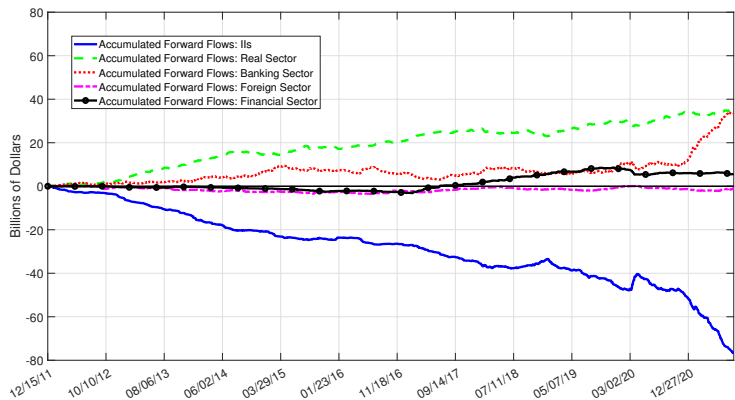
IIs' Foreign Assets, Foreign Equities, Hedge Ratio and USD/ILS Spot Rate

Estimation Method Overview

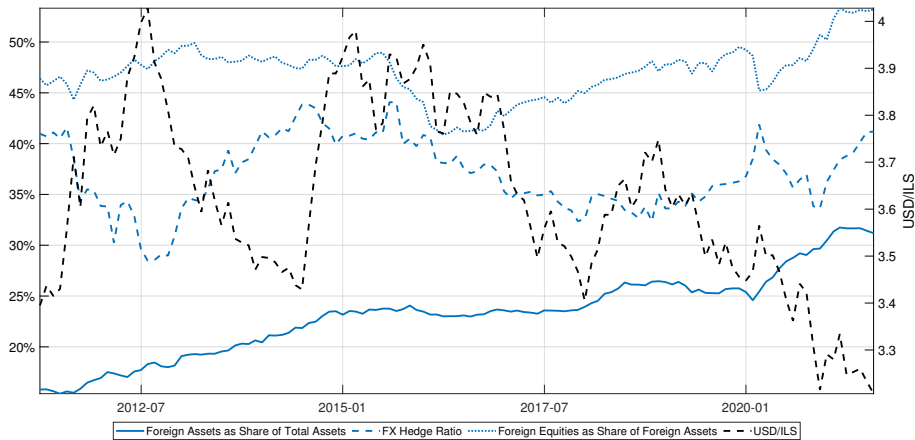- **Goal:** Estimate the effect of MSCI shocks on IIs' FX flows and then on the USD/ILS forward rate.

  - Causality goes from MSCI $\rightarrow$ FX forward flows $\rightarrow$ Forward Rate.

- **Threat to Identification:** Endogeneity due to unobserved common shocks that affect both the MSCI shocks and the FX market.

- **Two-Step Estimation Process:**

  - **Step 1:** Constituent-level regressions
  - **Step 2:** Construction of GIV and Bartik shock instruments and 2SLS estimation

- Our granular econometric approach to the equity hedging channel relies on granular constituent-level residuals and GIV construction to generate global equity market value variation driven by idiosyncratic shocks from large companies, not macro forces.

Constituent-Level Specification

- **Model:** 774 OLS regressions for each constituent
- **Equation:**

$$\Delta SP_{i,t} = \mathbb{C}'_t \gamma_i + v_{i,t}, \tag{4}$$

- **Variables:**
    - $\Delta SP_{i,t}$: Log-first-difference of stock price
    - $\mathbb{C}_t$: Vector of observable controls (fixed effects, time trends, day dummies, lagged returns, exogenous controls)
    - $v_{i,t}$: Residuals ($v_{i,t} = \eta_t + \epsilon_{i,t}$ representing an unobserved common shock and idiosyncratic value shock, respectively)

GIV and Bartik Shocks

- **GIV Shock:**

$$\varrho_{GIV,t} = \sum_{i=1}^{774} \hat{\epsilon}_{i,t} w_{i,t-1} - \sum_{i=1}^{774} \hat{\epsilon}_{i,t} v_i \tag{5}$$

- **Bartik Shock:**

$$\varrho_{Bartik,t} = \sum_{i=1}^{774} \hat{v}_{i,t} \frac{1}{774} \tag{6}$$

- **Purpose:** Both instruments aim to capture exogenous idiosyncratic variation, but GIV is preferred due to its ability to remove common components.

Econometric Model Estimation

- **First Stage Regressions:**

$$ff_t = \alpha_0 + \alpha_1 \mathbb{T}_t + \Omega IV_t + u_t, \tag{7}$$

- **Second Stage Regressions:**

$$\Delta fr_t = \delta_0 + \delta_1 \mathbb{T}_t + \theta \overline{ff}_t + e_t. \tag{8}$$

- **Reduced Form Regressions:**

$$\Delta fr_t = \beta_0 + \beta_1 \mathbb{T}_t + \Xi IV_t + z_t, \tag{9}$$

- ff_t: IIs' aggregate forward flows
- $\overline{ff}_t$: IIs' aggregate forward flows
- Δfr_t: Log-first-difference of IIs' aggregate forward rate
- IV_t: $\varrho_{Bartik,t}$ or $\varrho_{GIV,t}$

GIV Value Shocks Estimation Results

		GIV Shock		
Response	OLS	2SLS 1st Stage	2SLS 2nd Stage	Reduced Form
IIs' Forward Rate	0.09***		0.53***	-0.07***
	(0.02)		(0.10)	(0.01)
IIs' Forward Flows		-0.13***		
		(0.03)		
F-Stat		**18.98**		
R^2	2.91%	8.92%		1.81%
Obs	2,042	2,042	2,042	2,042

Spot Rate, Spot Flows, and Basis Responses to GIV Value Shock

	Spot Rate	Spot Flows	Basis
Response	-0.07***	-0.02	0.66
	(0.02)	(0.03)	(0.72)
R^2	2.04%	8.27%	0.13%
Obs	2,042	2,042	2,042

Sectoral Forward Flows Responses to the GIV Value Shock

	IIs	Real	Banks	Foreign	Financial
Response	-0.13***	0.08***	0.06**	0.00	-0.02**
	(0.03)	(0.02)	(0.03)	(0.01)	(0.01)
R^2	8.92%	4.31%	2.98%	0.06%	0.77%
Obs	2,042	2,042	2,042	2,042	2,042

S&P 500 and MSCI Responses to GIV Value Shock

	S&P 500	MSCI
Response	0.99***	0.71***
	(0.05)	(0.04)
R^2	66.64%	44.89%
Obs	2,042	2,042

Ruling out other potential explanations

- We test the baseline results' robustness along several dimensions:

  1 To alleviate concerns of confounding factors, we
  - Control for risk premium shocks by including risk-appetite measure from Gilchrist et al. (2021).
  - Data is daily. Other macro factors that work in lower frequencies are irrelevant.

  2 Ruling out the Portfolio Rebalancing Channel (Hau and Rey, 2006). See Slide .

  3 We rule out it is a debt hedging channel.

  4 We rule out that the results are driven by interest rate chaneges.

  5 We replace the MSCI return series with actual aggregate IIs' foreign equity return using micro data on IIs' regional portfolio weights.

  6 We replace the MSCI return series with the S&P 500 index return series.

  7 We truncate the baseline sample at 02/28/20.

  8 We experiment with alternative lag specifications.

Conditions Needed for External Validity

- **Smallness Condition:** economy at hand needs to be sufficiently small such that foreign IIs' FX exposure to these economies' currencies is negligible and hence does not motivate foreign IIs to pursue the same hedging activity that is done by these economies' IIs.

- **Meaningful Foreign Equity Position:** IIs in the economy at hand also need to hold a meaningful share of their assets in foreign equities.

- **Meaningful Hedging:** IIs need to hedge a meaningful part of their foreign equity position.

International Evidence for Conditions

- A recent report from Yazdani (2020) documents a 18.5% average share of foreign equities in total pension funds' assets across several small economies.

- According to the OECD 2019 Survey of Investment Regulation of Pension Funds, minimal hedge ratios are required for pension funds in Chile (50%), Colombia (50%–85%), Denmark (80%), Mexico (70%–100%), Norway (70%), Sweden (80%-100%), and Switzerland (70%).

- Mercer (2020) provides survey evidence for 2020 from 927 IIs across 12 countries (with a total asset value of over 1.1 trillion dollars) indicating that 42% of the surveyed IIs hedge over 60% of their FX exposure in listed equity portfolios.

Conclusions

- We have argued that FX hedging by local investors is an important driver of exchange rates.

- Using an IV, we find that a one standard deviation in FF supply by institutional investors leads to a 53 basis point appreciation of the shekel against the dollar.

- We argue this is a causal relationship.

Hedging vs Rebalancing

- **Concern:** IIs' forward selling of dollars might act as rebalancing-induced spot dollar selling.

- Instead of acting as a hedging device, II's might use forward transactions as a substitute for spot transactions.

- Goal: Alleviate concerns in a twofold manner.

- Challenge: Lack of direct data on foreign equity holdings of IIs.

- Approach: Use a secondary method to address the concern.

# IIs' Forward Contracts' Maturity Distribution

- IIs' choose contracts with long maturity.

- Volume-weighted average maturity: 52 days.

- Median maturity: 25 days.

- Implication: Not just a method for portfolio rebalancing.

Econometric Specification

- Method: Panel regression analysis at the fund level.

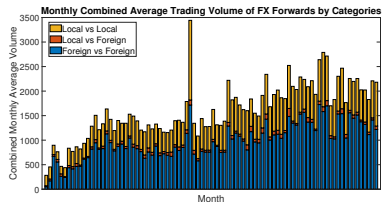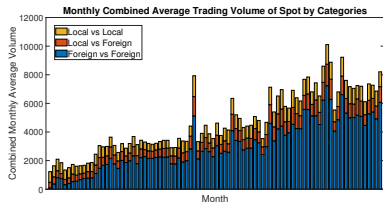- Data: Transaction-level dataset comprising 175 funds.

- Specification:

$$FX\,SWAP_{i,t} = \alpha_i + \sum_{l=-7}^{7} \beta_l FF_{i,t+l} + \epsilon_{i,t}.$$

The Relation between FX Forwards and FX Swaps
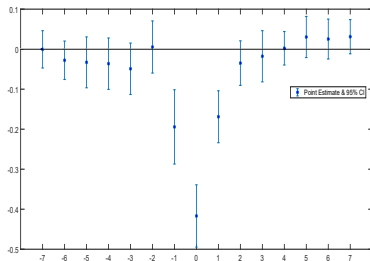
- Findings: Significant relationship between FX swaps and forward contracts.
- Implication: IIs maintain exposure to assets using FX forwards, indicating limited foreign equity rebalancing.
- Back.

Trading Volume of Spot and FX Forwards

Monthly Combined Average Trading Volume of Spot by Categories

Monthly Combined Average Trading Volume of FX Forwards by Categories

Back.