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# Pension fund flows, exchange rates, and covered interest rate parity ☆

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ABSTRACT

Frequent, yet uninformed, market timing recommendations by a financial advisory firm generate significant flows for Chilean pension funds. These flows induce substantial changes in the Chilean foreign exchange rate due to the funds' high allocation to international securities. Local banks provide liquidity to pension funds in the spot market and their hedging transactions propagate the demand fluctuations from the spot to the forward market, resulting in deviations from covered interest rate parity. Using bank balance sheet data, we confirm that banks' risk bearing constraints create limits to arbitrage.

## 1. Introduction

In a world with imperfect financial markets, non-fundamental capital flows can have an impact on asset prices, exchange rates, and arbitrage relationships such as the covered interest rate parity (CIP) (Maggiori, 2022). It is an empirical challenge to disentangle informed from uninformed flows, and to separately identify their effects on asset prices.

In this paper we take advantage of large flows triggered by the frequent market timing recommendations of a financial advisory firm in Chile. These recommendations induce sizable flows in the Chilean pension system as investors reallocate their savings between equity and bond funds. Given the high degree of international diversification of the equity funds, rebalancing generates large sales and purchases of foreign currency as an unintended consequence of the reallocations. Thus, we are able to identify demand changes in the spot market that are largely

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unrelated to foreign exchange fundamentals. Demand fluctuations are accommodated by local banks mainly through borrowing or lending foreign currency abroad. Due to banks' hedging activities, demand fluctuations in the spot market propagate to the forward currency market, which results in deviations from the CIP (Du et al., 2018).

The Chilean pension system allows retirement savers to allocate their investments across funds with different asset allocations (from funds mostly invested in global stocks to funds mostly invested in Chilean fixed income). A financial advisory firm called Felices y Forrados (FyF, which translates to "Happy and Loaded") was founded in 2011 to cater to the demand of individual investors to time the market. Between 2011 and 2020, FyF made 82 reallocation recommendations, which corresponds to a change in recommendation every five weeks, on average. These recommendations resulted in large inflows and outflows to different pension funds. Da et al. (2018) show that these recommendations, while not random or exogenous, are largely uninformative in the sense that they do not generate excess returns over buy-and-hold strategies on a consistent basis, and their timing is unpredictable. We confirm their result during our expanded sample. In addition, using data on individual daily transfers between funds, we confirm that FyF-induced flows reflect a large number of transfers by small retail investors rather than a few transfers by wealthy sophisticated investors.

Fund reallocations do not just impact Chilean stock and bond markets (Da et al. 2018 and Bernhardt and Cuevas 2023), but also the Chilean foreign exchange market. The most risky fund invests around 75% of its portfolio in international assets while the safest fund holds mostly assets denominated in Chilean pesos, consistent with the "home-currency bias" in bond portfolios (Maggiori et al. 2020, and Sialm and Zhu 2024). Hence, a FyF recommendation to switch between bond and stock funds results in a need to trade almost US$850 million in the spot market. We document that these portfolio reallocations move the exchange rate of the Chilean peso relative to the U.S. dollar by 0.59% over five trading days.

By examining trading imbalances of the local banking sector, we confirm that domestic banks provide liquidity to the pension funds in the spot market. This is not surprising as the Chilean peso is a non-deliverable currency during our sample period, which effectively leads to a segmentation between the spot and the forward markets.[1] If pension funds need to buy foreign currency, then banks borrow foreign currency abroad and sell it to the pension funds. The local banks subsequently hedge their currency exposure by taking offsetting positions in the forward market against foreigners. For instance, after a recommendation to move from bond to stock funds, local banks buy forward U.S. dollars representing close to 2% of their equity capital. Thus, local banks propagate the flow-induced shocks from the spot market to the forward market due to their hedging needs.

We find that the forward premium (i.e, the difference between forward and spot prices) moves according to whether local banks need to buy or sell in the forward market. This is consistent with local banks being the intermediary between the spot and forward markets, or ultimately between domestic pension funds and foreign investors. Fluctuations in the forward spread translate into CIP deviations. For example, the cross-currency basis (CCB), which measures deviations from CIP in the foreign exchange market, falls by an annualized 23 basis points after a recommendation to move from bond to stock funds. We confirm that changes in the forward spread are not compensated by changes in interest rate differentials, which could be derived from time-varying default risk, among other factors. Interestingly, whereas the spot and forward exchange rates react immediately to the FyF announcements, the CCB price effect is delayed by at least three days. This delay is likely due to the fact that the currency spot and forward transactions occur with an execution delay arising from institutional features of the pension system.

We find that CIP deviations survive due to limits to arbitrage. Local banks should be in a good position to arbitrage away the deviations. However, regulatory requirements on capital and liquidity impose costs for balance-sheet-intensive strategies such as trading against CIP violations. Consistent with such balance-sheet costs, we find that FyF's recommendations cause greater price effects in the spot and forward markets around quarter ends (Du et al., 2018). We also find that price effects are stronger when banks recently experienced a tightening capital constraint, consistent with the role of intermediaries in other markets (see He et al. 2017, Du et al. 2023).

Our paper contributes to several strands in the literature. First, it contributes to the literature that studies the origins of CIP violations (Du et al., 2018). We show that the hedging demand by local banks propagates the shocks from the spot market to the forward market, and that their intermediary role between markets is related to CIP violations. Our data uniquely allows us to quantify banks' hedging demand and CIP violations at the daily frequency. Our findings provide direct support to the recent work on hedging demands by Borio et al. (2016, 2018), Liao and Zhang (2021), and Bräuer and Hau (2022). Keller (2024) studies whether CIP violations can affect bank lending in an emerging economy. She shows that banks shift the lending currency according to CIP-related arbitrage activity.

The main advantage of our setup is that we can identify uninformed, significant, yet clearly sourced shocks to the foreign exchange market. First, FyF's recommendations are high-frequency shocks, happening at irregular time intervals, in multiple directions, and with varying degrees of intensity. Therefore, it is unlikely that the results are driven by omitted fundamental variables. Standard predictive variables in the foreign exchange market, like those in Rossi (2013), are unrelated to FyF recommendations. Moreover, the timing of FyF recommendations is largely unpredictable. Second, despite their lack of fundamental content, the flows that we study are large and have an impact on financial markets. Finally, the source of the flows is clearly identified as the market timing recommendations by an advisory firm, highlighting the increasingly relevant role of advisors in financial markets.[2]

Relatedly, our paper contributes to the understanding of limits to arbitrage (Shleifer and Vishny, 1997). The recent paper by Itskhoki and Mukhin (2021) highlights the importance of noise traders, risk averse intermediaries, and limits to arbitrage in the currency market. Our unique setting and detailed data offer a rare opportunity to showcase the interaction between noise traders (pension fund investors acting on FyF's recommendations) and financial intermediaries (local banks). According to Du and Schreger (2022), the role of large non-bank investors has received little attention in the literature on CIP violations. Limits to arbitrage arising from regulatory constraints and banks' risk bearing capacity explain why demand fluctuations can result in persistent CIP violations. Our findings complement those in Cenedese et al. (2021), Jiang et al. (2021), Wallen (2022), Hertrich and Nathan (2023), and Ben Zeev and Nathan (2024), regarding how supply restrictions, often arising from banking regulations, interact with demand imbalances to produce deviations from arbitrage relationships in currency markets.

Finally, our results also contribute to the large literature that examines the impact of financial flows on spot exchange rates.[3] More broadly

[1] Appendix A provides more institutional details of the Chilean foreign exchange market. Other countries have non-deliverable currencies, such as the Korean won, the Indian rupee, the Brazilian real, or the Argentinian peso.

[2] Several papers study the role of advisors in financial markets. See, for example, Bergstresser et al. (2009), Lusardi and Mitchell (2011), Bhattacharya et al. (2012), Inderst and Ottaviani (2012), Christoffersen et al. (2013), Mitchell and Smetters (2013), Gennaioli et al. (2015), Von Gaudecker (2015), Jenkinson et al. (2016), Dahlquist et al. (2017), Foerster et al. (2017), Egan et al. (2019), Chalmers and Reuter (2020), and Hoechle et al. (2024).

[3] See, for example, Evans and Lyons (2002), Hau and Rey (2006), Mancini et al. (2013), Gabaix and Maggiori (2015), Karnaukh et al. (2015), Verdelhan (2018), Camanho et al. (2022), Hasbrouck and Levich (2019), Ranaldo and Somogyi (2021), and Jiang et al. (2022). Maggiori (2022) provides a comprehensive review of the literature.

speaking, our paper belongs to the literature that estimates the slope of financial demand curves by taking advantage of relatively exogenous and uninformed demand shocks.[4] A popular empirical strategy to identify demand shocks uses changes in the composition of international equity and bond indexes (see Hau et al. 2010, Pandolfi and Williams 2019, Broner et al. 2021). Another approach is to conduct structural estimations, as illustrated by Koijen and Yogo (2020). In a contemporaneous paper, Pinto-Avalos et al. (2022) also study the impact of FyF recommendations on the Chilean spot foreign exchange market, although they do not study the forward market nor CIP violations.

The rest of the paper is organized as follows. Section 2 describes the data sources and the institutional setting. Section 3 explains the empirical strategy and reports the results on fund flows. Section 4 studies the impact on the spot exchange rate. Section 5 studies the transmission of the recommendations through banking imbalances, and Section 6 investigates their impact on CIP deviations. Section 7 concludes.

## 2. Data and institutional design

Our analysis combines multiple data sources. We divide the presentation of the data into five subsections: pension funds, the advisory firm FyF, prices and interest rates, the balance sheet of the banking system, and trading volume and banking imbalances.

### 2.1. Pension funds

Private pension fund administrators (AFPs, from their acronym in Spanish) are regulated and supervised by the Superintendencia de Pensiones (SP). There are between six and seven AFPs operating during our sample period. Each AFP has to offer five types of funds, labeled A through E, with different asset allocations set by regulation. For example, the maximum equity allocation in fund A is 80%, 40% in fund C, and 5% in fund E. Equity investments above those thresholds are only permitted under special circumstances. There is also a limit (80% since 2011) on foreign asset holdings for the aggregate portfolio of all funds managed by each AFP. From the SP website (www.spensiones.cl), we obtain at the monthly level the portfolio composition for each type of fund (i.e., A to E), both in terms of broad asset classes and the split between foreign and domestic investments, together with some demographic information about investors.

Table 1 shows the average size of the five funds offered by the pension system in our sample period (2011–2020). The total assets under management, amounting to approximately US$175 billion, represent close to 65% of Chilean GDP. There are close to 11 million individual fund investments in the pension fund system. On average, 84.5% of individuals between 20 and 65 years old are investors in the pension fund system throughout our sample.[5] Fund C, which started earlier than the other funds, is the largest with US$65 billion assets under management.

At the system level, close to 42% of the assets under management are invested in foreign assets, on average. The average share of foreign investments equals 75% for fund A and decreases monotonically to only 6% of fund E. Thus, portfolio reallocations between different funds generate not just flows between equity and bond markets, but also in currency markets. Around two-thirds of foreign currency investments are held in equity securities (i.e., 28.05%/41.58%) and around 70% of all equity investments are invested in foreign equities (i.e., 28.05%/39.83%).

At the daily level ($t$), we get the fund share price ($P_{ikt}$) and assets under management ($AUM_{ikt}$) for each fund type $i$ (A–E) offered by each AFP $k$. From there we define the daily flow as:

$$Flow_{ikt} = \frac{AUM_{ikt}}{AUM_{ikt-1}} - \frac{P_{ikt}}{P_{ikt-1}}. \quad (1)$$

According to Chilean regulations, investors are free to request a transfer of their savings between funds.[6] These requests are typically filed online. The AFP has to reallocate the investor's balance between funds four days after the request (i.e., day $t+4$), although the transfer is executed at share prices on day $t+2$. For example, an investor with $N^A$ shares of fund A who requests a transfer to fund E will be able to buy $N^A \times \frac{P^A_{t+2}}{P^E_{t+2}}$ shares of fund E. This pricing rule is a protection against destabilizing flows due to strategic complementarities (Chen et al., 2010a). The AFP has to delay reallocations between funds when the volume of transfers is especially large. In particular, the excess flow above 5% of $AUM_{ikt}$ has to be postponed until the next day. For example, an outflow of 20% of the $AUM_{ikt}$ takes four days to be fully implemented. Transfers are organized on a first-come, first-served basis.

### 2.2. Felices y Forrados

The advisory firm FyF provided asset allocation recommendations to their paying subscribers from 2011 until they were forced to discontinue their advisory service in 2021 due to the introduction of new financial regulations.[7] FyF recommended types of funds (A through E, or combinations of them) instead of particular AFPs. Table A.1 in the Appendix shows the 82 recommendations that FyF issued between July 2011 and February 2020. There was a new recommendation approximately every six weeks between 2011 and 2017. The frequency increased in 2018 to approximately one recommendation every two weeks. Most recommendations corresponded to dramatic changes in asset allocation. After learning about a recommendation, investors could request their AFP to implement the switch. The request had to be filed on the platform of each AFP and not on a centralized FyF platform.

Fig. 1 shows the flows to all the A funds aggregated across all providers in the Chilean pension system. The aggregated fund flow is an AUM-weighted average of the flows of the individual A funds. The vertical lines mark dates of FyF recommendations. Dotted vertical lines mark days where FyF recommends a move towards fund A, and solid lines correspond to dates where FyF recommends a move away from fund A. Most spikes in flows are preceded by FyF recommendations with the correct sign: recommendations to move towards fund A precede large inflows and conversely for recommendations away from fund A. We can also see a small time gap between the recommendations

[4] We need large aggregate shocks to estimate macro elasticities and move beyond micro elasticities. Papers estimating micro-elasticities on the broad literature of flows and asset prices include, for example, Shleifer (1986), Wurgler and Zhuravskaya (2002), and Duffie (2010). A large number of papers study the impact of fund flows, including Warther (1995), Edelen and Warner (2001), Frazzini and Lamont (2008), Chen et al. (2010a), Ben-David et al. (2012), Ben-Rephael et al. (2012), Lou (2012), Ben-David et al. (2022), Dou et al. (2022), and Jansen (2025). The "inelastic market hypothesis", recently proposed by Gabaix and Koijen (2021), predicts that asset prices, even at the macro-level, respond to day-to-day flows.

[5] Investors can decide to split their investment into multiple funds, so 11 million fund investments corresponds to fewer than 11 million investors. The 84.5% reported above adjusts for this double counting as some people are invested in multiple funds.

[6] Beyond voluntary transfers, there are transfers between funds that are triggered by the age of the investor if the investor has always taken the default option defined by regulation. For example, fund B is the default option for participants up to 35 years old. Their savings are moved to fund C when they turn 36. Funds A and E are not default options under the Chilean regulation, hence flows to and from these funds need to be initiated by the investor.

[7] Subscribers received an email telling them to sign into the FyF website (www.felicesyforrados.cl) when a new recommendation was issued, although many more followed FyF on social media. By 2020, FyF had 130,000 subscribers (paying approximately USD 3 per month) and 690,000 followers on Facebook.

**Table 1**
Characteristics of Chilean pension funds.

| | Fund A | Fund B | Fund C | Fund D | Fund E | Total |
|---|---|---|---|---|---|---|
| *Panel A: Pension system characteristics* | | | | | | |
| AUM average (million US$) | 27,587 | 29,099 | 65,187 | 28,289 | 24,783 | 174,945 |
| AUM as % of GDP | 10.33 | 10.88 | 24.38 | 10.56 | 9.22 | 65.38 |
| AUM as % of total AUM in all funds | 15.97 | 16.74 | 37.45 | 16.05 | 13.79 | 100 |
| Investors total (thousands) | 1320 | 4111 | 3776 | 1232 | 554 | 10,992 |
| Investors as % total investors in all funds | 12.08 | 37.40 | 34.43 | 11.16 | 4.92 | 100 |
| *Panel B: Portfolio characteristics* | | | | | | |
| Foreign investment (% of total AUM) | | | | | | |
| Mean | 75.17 | 56.29 | 40.62 | 25.98 | 6.19 | 41.58 |
| Median | 76.42 | 58.18 | 42.26 | 26.89 | 6.50 | 41.70 |
| Min | 64.99 | 44.85 | 30.30 | 17.38 | 1.08 | 35.39 |
| Max | 84.71 | 67.94 | 50.49 | 30.94 | 11.14 | 47.79 |
| Foreign equity investment (% of total AUM) | | | | | | |
| Mean | 61.19 | 41.18 | 24.57 | 12.10 | 2.29 | 28.05 |
| Median | 61.59 | 42.38 | 25.80 | 13.14 | 2.39 | 28.70 |
| Min | 54.71 | 32.92 | 16.26 | 5.98 | 0.23 | 23.45 |
| Max | 66.33 | 48.09 | 31.77 | 16.83 | 4.36 | 32.78 |
| Total equity investment (% of total AUM) | | | | | | |
| Mean | 78.36 | 58.21 | 37.93 | 17.81 | 3.63 | 39.83 |
| Median | 78.48 | 58.58 | 38.55 | 18.47 | 4.00 | 40.30 |
| Min | 74.59 | 53.75 | 32.93 | 13.80 | 0.96 | 32.92 |
| Max | 80.73 | 60.08 | 40.53 | 20.86 | 5.05 | 48.38 |

This table reports averages for total assets under management (AUM), investors, and portfolio characteristics by type of fund (A–E) offered by the Chilean pension system. Individual funds of each type are value-weighted into a single aggregate fund. Averages are computed for each aggregate fund over all months in our sample. Foreign investment refers to non-Chilean assets. The data are collected from administrative records published by the Central Bank of Chile and the pension fund regulator (SAFP).

and the extreme flows, which corresponds to the four days that the AFPs have to transfer money between funds. Daily flows after FyF recommendations can be as high as 3% (e.g., after November 11, 2019), while the average flow is close to zero on non-recommendation dates. This illustrates the high popularity of FyF, most of which was achieved using effective social media campaigns.

The pension regulator spoke about the dangers of frequent transfers between pension funds as early as 2013. In 2021, FyF had to discontinue its operations as it was unable to meet the new capital requirements set up by the regulator for pension advisors. These requirements were put in place largely to drive pension advisors such as FyF out of the market. We only study FyF recommendations and their potential market impact up to the end of February 2020. The more recent period is excluded for two reasons that change the nature of the experiment. First, the tension between FyF and the authorities escalated during 2020, both in terms of tone and public notoriety.[8] Second, and more importantly, the Chilean pension system faced three big withdrawals (in July 2020, December 2020, and April 2021) allowed by regulators to smooth the financial consequences of the Covid crisis (see Díaz and Hansen 2023, and Fuentes et al. 2025). These withdrawals amounted to more than US$ 50 billion (30% of the AUM of the pension system). Pension funds started selling foreign assets in advance to prepare for these massive withdrawals.

FyF never disclosed the model – statistical or conceptual – behind their recommendations. Their marketing material only argued that the recommendations were tailored to avoid losses such as those incurred during the Great Financial Crisis. FyF recommendations related to the asset allocation decision across balanced funds of equity and fixed income securities. The reallocation between domestic and international securities and the potential consequences for foreign exchange markets were largely an unintended consequence of their recommendations.

While FyF recommendations were not random, they were largely unpredictable. In order to assess this claim, in Table 2 we report a regression model that estimates the likelihood of switches towards fund A by FyF. The dependent variable takes values between 1 (i.e., a move from fund E to fund A) and −1 (i.e., a move from fund A to fund E). Partial moves are represented by fractional changes. For example, suppose FyF switched from an allocation of 50% in A and 50% in E to an allocation of 100% in A. In this case, the dependent variable takes a value of 0.5. We use as explanatory variables the past returns and volatilities of funds A and E, the foreign exchange rate, and the price of copper. We also include changes in relevant macroeconomic series such as interest rate differentials between Chile and the U.S., the forward discount, Chilean and U.S. inflation, and the Chilean GDP growth rate. These are some of the standard predictive variables of foreign exchange rates studied in the literature (Rossi, 2013).

We report in Table 2 that past returns of fund A predict recommendations. FyF seem to follow a short-term momentum strategy, moving towards the risky fund after a week of strong returns. None of the foreign exchange fundamentals have significant power to explain FyF recommendations. This is consistent with the idea that the objective of the FyF model is to bet on the future performance of stocks against bonds, more than the foreign exchange rate. The Chilean peso can be considered a commodity currency due to the importance of copper exports, as discussed in Chen et al. (2010b). However, movements in the price of copper have only limited power in explaining FyF's

[8] On top of the concerns from the pension regulator, the Chilean consumer protection agency (SERNAC) sued FyF for false advertising arguing that their alleged market-timing abilities were not verifiable. In July 2023, the Chilean courts found FyF guilty of false advertising and fined them approximately US$40,000 (a high number for such cases in Chile). The courts said that FyF "provided biased and incomplete information by using only the best historical returns". Overall, "FyF manipulated information for their own convenience". The court's decision is currently under appeal.

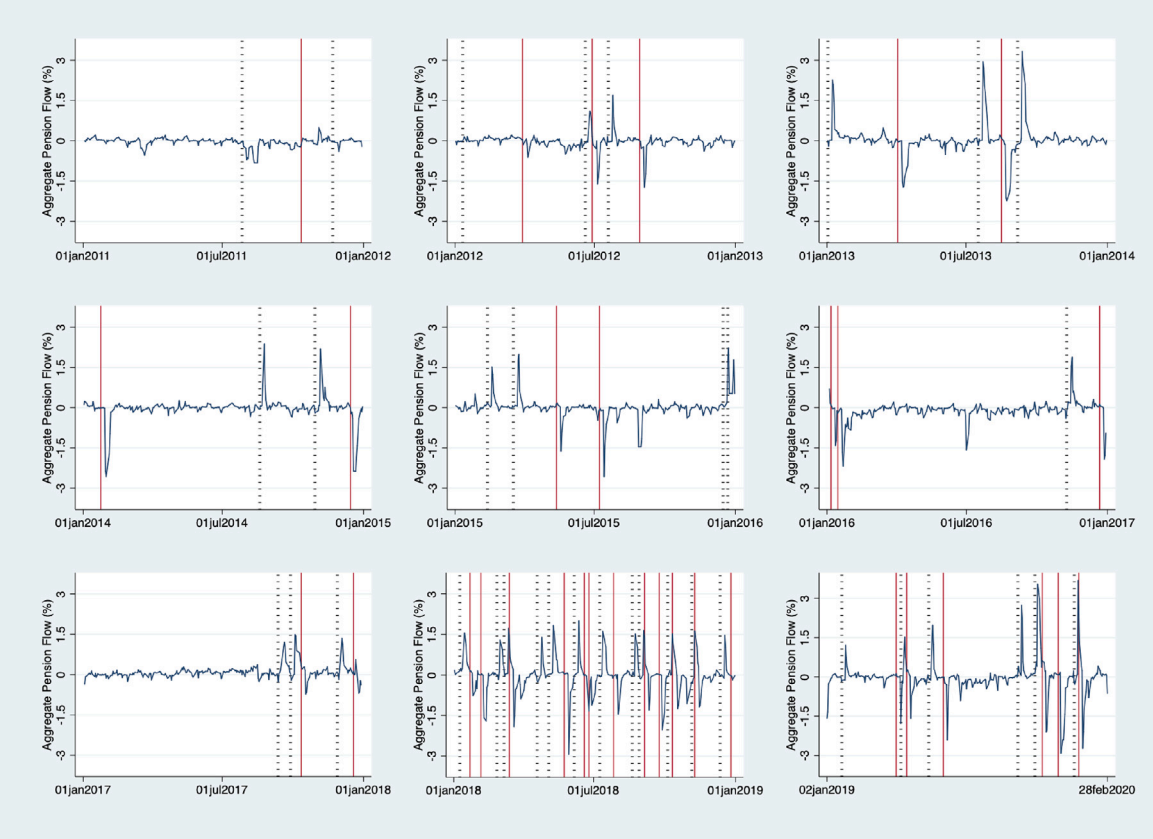



**Fig. 1.** Daily flows to pension Fund A (2011–2020).
Daily flows (in percentage of AUM) for the aggregate pension fund A in Chile. Dotted (solid) vertical lines mark days of FyF emails that recommend a move towards (away from) fund A. Daily data for the sample that covers the period from January 3, 2011 to February 29, 2020.

recommendations, as indicated by the low coefficient of determination. The highest R-squared across all of the regressions in Table 2 is just 2%. Overall, changes in FyF recommendations came as surprises to market participants.[9]

The regulator questioned the ability of FyF to deliver superior returns almost from FyF's inception. FyF responded that the cumulative performance from their first recommendation was superior to buy-and-hold strategies of any of the other funds. However, their response did not address the statistical significance of the return differences nor the fact that most subscribers started following FyF later than the first recommendation. Panel A of Table 3 reports returns for investors who followed FyF recommendations in comparison to buy-and-hold returns for funds A, C, and E. We assume investors request a switch of their pension fund the same day that the FyF recommendation is issued, and that the switch is implemented at the prices on day $t+2$ as defined by regulation.

In 2011 and 2012, investors who followed FyF exhibited superior performance than investors who passively invested in funds A, C, or E. The outperformance of FyF was especially pronounced in 2011, the year of their founding, when the return of following FyF was 11.44% higher than the return of fund A. This high initial performance contributed to the popularity of FyF. The performance differences are, however, far from being statistically significant, as reported by the $t$-statistics in parentheses. Additionally, the experience of subscribers who started following FyF in later years is frequently negative. For example, in six of the eight years after 2012 the FyF portfolio underperformed fund A, although the return differences are often not statistically significant.

In Panel B of Table 3 we report the Sharpe ratios of FyF recommendations since part of FyF's appeal might be to deliver a better risk-return trade-off. We find no consistent advantage of FyF compared to buy-and-hold strategies of the other funds. Over the entire sample period, the less risky funds (D and E) have higher Sharpe ratios than the FyF strategy, which has a Sharpe ratio of 1.005. An alternative passive benchmark can be a portfolio that invests 60% in fund A and 40% in fund E, since FyF recommends these funds 60% and 40% of the time, on average. This passive portfolio benchmark has a Sharpe ratio of 1.109, which is insignificantly higher than that of the FyF strategy.

Overall, we find no support for the claim that FyF had market-timing skills to consistently beat the market. Their recommendations were largely unpredictable, and crucially for our empirical strategy, they were orthogonal to standard predictive variables that capture fundamentals in the foreign exchange market. Thus, we consider FyF-induced flows as uninformed demand shocks to this market.

We also obtain data on individual daily transfers between pension funds for the years 2014–2020. These data include the gender, age, account balance, and the history of personal transfers of those individuals that are transferring on a given day.[10] We cannot identify

[9] In Figure A.1 of the Appendix we perform a complementary analysis to illustrate how hard it is to predict the timing of FyF recommendations. We present the results of two logit models, in which we estimate the likelihood of FyF recommending an increase (or decrease) in equity holdings. The figure shows the estimated probabilities around the actual dates of recommendations. We find that the estimated likelihood of receiving a recommendation is never above 10%, and there is no material increase in that likelihood around actual FyF dates. In short, getting the timing of recommendations right is extremely difficult.

[10] Figure A.2 in the Appendix shows the number of net transfers towards fund A from 2014 to 2020. The general pattern is very similar to flows based on assets under management depicted in Fig. 1.

**Table 2**
Drivers of changes in FyF recommendations.

| | (1) Net move A | (2) Net move A | (3) Net move A | (4) Net move A |
|---|---|---|---|---|
| Fund A return week -1 | 0.68*** | | | 0.62** |
| | (0.25) | | | (0.25) |
| Fund A return week -2 | −0.33* | | | −0.25 |
| | (0.18) | | | (0.19) |
| Fund E return week -1 | −1.03 | | | −1.02 |
| | (0.78) | | | (0.82) |
| Fund E return week -2 | 0.89 | | | 1.40* |
| | (0.75) | | | (0.82) |
| Fund A volatility week -1 | 0.26 | | | −0.37 |
| | (1.32) | | | (1.33) |
| Fund A volatility week -2 | 0.50 | | | −0.05 |
| | (1.25) | | | (1.41) |
| Fund E volatility week -1 | −2.31 | | | −0.89 |
| | (1.52) | | | (1.55) |
| Fund E volatility week -2 | −0.80 | | | 0.01 |
| | (0.98) | | | (1.09) |
| FX rate change week -1 | | −0.16 | | −0.27 |
| | | (0.25) | | (0.27) |
| FX rate change week -2 | | −0.34 | | −0.39 |
| | | (0.23) | | (0.27) |
| FX volatility week -1 | | 0.01 | | −0.32 |
| | | (0.96) | | (1.01) |
| FX volatility week -2 | | −0.91 | | −0.42 |
| | | (1.02) | | (1.14) |
| Copper price change week -1 | | 0.11 | | −0.07 |
| | | (0.11) | | (0.12) |
| Copper price change week -2 | | −0.19* | | −0.21* |
| | | (0.10) | | (0.11) |
| Copper price volatility week -1 | | 0.86* | | 0.97* |
| | | (0.45) | | (0.52) |
| Copper price volatility week -2 | | −0.01 | | −0.16 |
| | | (0.64) | | (0.68) |
| Interest rate diff. (weekly change) | | | 0.00 | 0.00 |
| | | | (0.00) | (0.00) |
| Forward discount 1m (weekly change) | | | 0.00 | 0.00 |
| | | | (0.00) | (0.00) |
| Forward discount 3m (weekly change) | | | 0.00 | 0.00 |
| | | | (0.00) | (0.00) |
| Lagged inflation change CL | | | 0.01* | 0.01* |
| | | | (0.01) | (0.01) |
| Lagged inflation change US | | | 0.02 | 0.03* |
| | | | (0.01) | (0.01) |
| Lagged GDP growth CL | | | −0.00 | −0.00 |
| | | | (0.00) | (0.00) |
| Constant | −0.00 | −0.00 | −0.00 | −0.00 |
| | (0.01) | (0.01) | (0.00) | (0.01) |
| Observations | 1904 | 1886 | 1849 | 1832 |
| $R^2$ | 0.01 | 0.01 | 0.00 | 0.02 |

This table shows regressions examining the factors driving FyF's recommendations. The dependent variable in all columns is the change in the fraction of the portfolio that FyF recommends to invest in fund A. This variable takes values between 1 and −1 on days when there was an email and zero on all other days. For example, if the previous FyF email recommended 50% to be invested in fund A and 50% in fund E, and the current email recommends to invest is 100% in fund A, then this variable takes a value of 0.5. The explanatory variables include past returns and volatilities of Funds A and E, of the exchange rate, and of the price of copper, together with changes in the interest rate differential between Chile and the US, the 1m and 3m forward discounts, lagged Chilean and U.S. inflation, and lagged Chilean GDP growth. The sample covers the period from July 27, 2011 (first FyF recommendation) to February 29, 2020. Robust standard errors are in parentheses.

*** p<0.01.

** p<0.05.

* p<0.1.

FyF subscribers directly, but we can study who behaves in a manner that is consistent with FyF recommendations. We define flows that are "consistent" with FyF recommendations as transfers that occur between the funds recommended by FyF (e.g., from fund E to fund A) and between days $t + 4$ and $t + 17$ after a recommendation. This window starts on day $t + 4$ because transfers are registered in the system four days after the initial request is made. We allow for two weeks after the recommendation since not all FyF followers might transfer on the same day. Also, funds cannot transfer more than 5% of assets under management each day, and so large flows can be delayed by several days. Between March 2014 and February 2020, 45% of transfers (3.6 million transfers) are consistent with FyF recommendations according to our definition. In Table A.2 in the Appendix we show that the transfers that are consistent with FyF are made by younger individuals (40.1 vs. 44.9 years), male participants, (71% vs. 64%), individuals with smaller account balances (USD 22,476 vs. USD 39,508), and

**Table 3**
FyF performance.

| | Panel A: Returns | | | | | | |
|---|---|---|---|---|---|---|---|
| | FyF-A | t-stat | FyF-C | t-stat | FyF-E | t-stat | N trading days |
| 2011 | 11.44 | (1.10) | 6.22 | (1.10) | 0.79 | (0.14) | 104 |
| 2012 | 2.60 | (0.47) | 4.11 | (1.13) | 5.32 | (1.13) | 248 |
| 2013 | −0.73 | (−0.14) | 1.52 | (0.44) | 1.43 | (0.34) | 249 |
| 2014 | −6.48 | (−1.57) | −6.51*** | (−2.97) | −4.54 | (−1.31) | 250 |
| 2015 | −2.17 | (−0.33) | −0.59 | (−0.19) | 1.45 | (0.37) | 250 |
| 2016 | 0.60 | (0.09) | −1.77 | (−0.60) | −3.62 | (−1.61) | 251 |
| 2017 | −11.47** | (−2.30) | −4.32* | (−1.75) | 2.05 | (0.84) | 247 |
| 2018 | 7.03 | (1.16) | 2.16 | (0.72) | −1.82 | (−0.54) | 246 |
| 2019 | −0.55 | (−0.10) | 1.34 | (0.32) | 6.35 | (0.86) | 249 |
| 2020 | −1.69 | (−0.37) | −0.85 | (−0.42) | 0.02 | (0.02) | 42 |
| All years | −0.15 | (−0.07) | 0.16 | (0.12) | 0.86 | (0.56) | 2136 |

| | Panel B: Annualized Sharpe Ratios | | | | | | |
|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | FyF | N trading days |
| All years | 0.541 | 0.658 | 0.975 | 1.249 | 1.362 | 1.005 | 2136 |

This table shows the difference in returns and Sharpe ratios between following FyF recommendations and passive strategies. In panel A the passive strategies correspond to buy-and-hold returns for funds A, C, or E. Each row shows the cumulative return differential for different years. The last column shows the number of trading days in each case. The last row (All years) shows the annualized average return difference for an investor who followed FyF recommendations for the whole period. Return differentials are reported as percentage points. Panel B presents the annualized Sharpe ratios computed from daily returns for funds A, B, C, D, E, and for a portfolio that follows FyF recommendations. We assume investors request a switch in their pension fund portfolio the same day that the recommendation is issued and that the switch is implemented at day $t+2$ prices according to Chilean regulations. The sample covers the period from August 1, 2011 (two business days after first FyF recommendation) to February 29, 2020. We report in parentheses the $t$-statistics for the difference based on daily returns.

*** p<0.01.

** p<0.05.

* p<0.1.

individuals that in general make more transfers between funds (40.9 vs. 22.6). Individuals with FyF-consistent transfers are more likely to have more of their other transfers also consistent with FyF (70.5% vs. 27.3%).[11] Overall, FyF-induced pension flows seem to reflect many transfers by small retail investors rather than a few transfers by wealthy investors.

### 2.3. Prices and interest rates

We get most of the market data from Bloomberg. The daily spot exchange rate ($S$) is measured in Chilean pesos per U.S. dollar. The one-month forward exchange rate ($F_{1m}$) is measured at closing and corresponds to the mid-point price on over-the-counter forward contracts of Chilean pesos per U.S. dollar. These contracts can be opened any day. All forward contracts are non-deliverable, meaning that they have to be settled in dollars and not in Chilean pesos. Interest rates correspond to the 30-day LIBOR rate in U.S. dollars ($R_{US}$) and the local 30-day interbank interest rate in Chilean pesos ($R_{Chile}$).[12]

Table A.3 shows summary statistics for the main variables in our analysis. The average spot exchange rate over our sample period is approximately 595 pesos per dollar. The average daily change in the spot rate is 0.02%, with a standard deviation of 0.62%. The average Chilean 30-day interest rate is 4.13% and the average U.S. LIBOR rate is 0.71%. The average spread between the U.S. and the Chilean rate is −3.42%, with a standard deviation of 1.92%.

[11] Figure A.3 in the Appendix shows the fraction of transfers consistent with FyF as the individual makes more transfers. The figure shows that around 60% of transfers are consistent with FyF for individuals making 40 or more transfers.

[12] Bloomberg tickers are as follows: CLP BGN Curncy (spot), CHN1M Curncy (forward), US0001M Index (LIBOR), and CLTN30DN Index (Chilean interest rate). All interest rates and spreads are reported in annual terms in our analysis. As is standard practice, monthly rates and spreads are multiplied by 360/30.

### 2.4. Balance sheet of the domestic banking system

The CMF (Comision para el Mercado Financiero) is the regulator of financial markets in Chile. It regulates banks, insurance companies, exchanges, and issuers of financial securities. At the monthly level, it reports on its website (www.cmfchile.cl) the amount of equity (CET1 or common equity tier 1) and the ratio of equity to risk-weighted assets of the aggregate balance sheet of the Chilean banking system. Chilean law requires banks to maintain a ratio of equity to risk-weighted assets of at least 8%. The CMF together with the Central Bank can decide to increase this minimum by up to 2.5% in stress situations. Banks that fall short of the required minimum face limitations on the dividends that can be paid to shareholders. Net positions in foreign currency (sum of spot and forward) enter the computation of risk-weighted assets, with weights that are comparable to those of high yield bonds (i.e., bonds with credit ratings below BBB-). Thus, the regulation incentivizes banks to hedge any imbalance in the spot market through the forward market.

### 2.5. Trading volume and banking imbalances

The Central Bank of Chile reports trading volumes in the spot and forward markets. At the monthly level, it reports the total amount bought and sold of foreign currencies between banks (and other authorized dealers in the foreign exchange market) and various counterparties: pension plans, insurance companies, mutual funds, foreigners, firms, and others. All foreign currencies are aggregated into a single amount, but U.S. dollars represent the lion's share of the volume. The trading volume in the forward market is between 1.5 and 2 times larger than the trading volume in the spot market. The spot and forward markets are partially segmented because of the non-deliverable feature of the Chilean peso. Trading on the spot market requires opening accounts in Chilean pesos at a local bank. Therefore, many foreigners trade exclusively on the forward market where contracts are settled in

U.S. dollars. In fact, foreigners account for most of the trading in the forward market (Villena and Hynes, 2020).

At the daily level, the Central Bank reports the total amounts bought and sold of foreign currencies between the banking sector and the rest of the market. The daily data is not split by counterparty like the monthly data. We define the daily imbalances of the banking sector as the difference between the amounts bought and sold in each market. The average imbalances are 0.01% of the equity of the banking sector in the spot market and −0.23% in the forward market (see Table A.3). The average net imbalance is obtained simply by adding the imbalances in the spot and forward markets.

The Central Bank also reports data for the net positions of the banking system at the daily frequency. These are accounting measures of the *stock* of foreign currency spot and forward contracts in the banking sector, while the previous imbalances measure flows. The net spot position is the difference between assets and liabilities in foreign currency, hence, a negative net spot position implies that banks are borrowing foreign currency. The net position in the forward market encompasses the notional value of all open contracts at each point in time. Changes of the net position in the spot and forward markets correspond basically to the daily imbalances defined in the previous paragraph (i.e., the daily amount bought minus the amount sold by banks in each market). This is exactly the case in the spot market. The net forward position also varies with the expiration or closing of previous contracts, and not only with the origination of buy and sell contracts.[13]

Besides the CMF, the Central Bank also imposes constraints on banks. For our purposes, the most relevant liquidity restriction is that the difference between inflows and outflows of foreign exchange operations with a maturity of up to 30 days cannot exceed bank equity. This requires active liquidity management from the banking system.

## 3. Pension fund flows

We study in this section the impact of FyF recommendations on fund flows. We run the following time-series regression for each type of fund $i$ (i.e., fund A–E) at the aggregate level:

$$Flow_{it} = \sum_{\tau=1}^{10} \beta_\tau RecDay_\tau + \epsilon_{it} \tag{2}$$

The variable $RecDay_\tau$ captures the direction and the magnitude of FyF recommendations that have been issued $\tau \in [1, 10]$ days ago.[14] Specifically, $RecDay_\tau$ corresponds to the change in the FyF portfolio recommendation ($\Delta\omega_i^{FyF}$) times the investment in foreign assets in each aggregate pension fund with a 90-day lag ($\lambda_{i,t-90}$):

$$RecDay_\tau = \begin{cases} \sum_{i=A}^{E} \lambda_{i,t-90} \Delta\omega_i^{FyF} & \text{for days } \tau \in [1, 10] \text{ after a} \\ & \text{recommendation of FyF} \\ 0 & \text{otherwise} \end{cases} \tag{3}$$

For example, suppose that fund A invested 75% in foreign securities at the end of the prior quarter, while fund E invested only 6% in foreign securities (see Table 1). If FyF recommends a switch from a portfolio that is 50% in fund A and 50% in fund E to a portfolio that is 100% in fund A, then $RecDay_\tau = \lambda_{A,t-90} \times \Delta\omega_A^{FyF} + \lambda_{E,t-90} \times \Delta\omega_E^{FyF} = 0.75\times0.5 - 0.06\times0.5 = 0.345$. The measure is positive for switches towards fund A and increases in absolute magnitude for more extreme switches. The definition of $RecDay_\tau$ takes into account all recommendations, and not only those that involve fund A.

The results for regression (2) are summarized in Table 4. We show the impact of the recommendations on the flows towards A, C, and E aggregated across AFPs. The coefficients for $RecDay_\tau$ over the first three days are small, which is consistent with the delay of four days that regulations give AFPs to implement switching requests. On day 4 we find a positive and significant coefficient of 3.58 for fund A (column 1), and a negative and significant coefficient of −6.19 for fund E (column 3). The impact on fund C is smaller in magnitude (column 2) since it is not typically affected by FyF recommendations. These coefficients imply that a recommendation of FyF to switch from 100% fund E (with international holdings of 6%) to 100% fund A (with international holdings of 75%) produces an inflow towards fund A of 2.47% (=3.58×(0.75 − 0.06)) and an outflow from fund E of 4.27% (=−6.19 × (0.75 − 0.06)) on the fourth day after the recommendation. Given the average sizes of funds A and E, these flows amount to close to US$700 and −US$1000 million, respectively. Columns (4)–(6) repeat the analyses in columns (1)–(3) adding five lags of flows and returns as control variables. Controlling for past flows and returns reduces the persistence of the recommendation-induced flows, but leaves the immediate impact of FyF recommendations mostly unaffected.

Significant flows towards fund A and away from fund E continue for several days, which can be expected if investors react slowly to FyF recommendations. The bottom panel of Table 4 shows the cumulative coefficient for $RecDay_\tau$ on the first five days ($CUM[1-5)]$) and the subsequent five days ($CUM[6-10)]$). In column (1), the cumulative effect on fund A over the first five days is 6.54, while it is 3.23 over the next five days. In columns (4)–(6), we see that the cumulative effect on the next five days is reduced when we control for the persistence associated with lagged flows and returns. Overall, unusual flows at the system level are mostly observed over the first week following a recommendation from FyF.

In Table A.4 in the Appendix we show the effects of FyF recommendations on the funds of Modelo, a small AFP that started in 2007. Modelo has a relatively young investor base because it was awarded the first government auction for the portfolios of workers who entered the labor market.[15] By having young and internet-savvy investors this AFP is more likely to be affected by FyF recommendations. The estimated coefficients on $RecDay_\tau$ are almost twice as large for Modelo when compared to the system aggregate on Table 4. We also explore the impact of FyF recommendations on the likelihood of experiencing flows of 5%, which is the upper bound on daily flows allowed by regulation. This constraint is likely to bind only for small AFPs like Modelo. We find that 5%-flows to fund A are 16.5% more likely on the fourth day after a recommendation that requires an increase in foreign holdings of 50%, while there is little effect on the other days. Similarly, 5%-flows away from fund E are 35.5% more likely on the fourth day after such a recommendation.

Overall, large flows occur shortly after FyF recommendations and reflect the direction of those recommendations. Flows are exceptionally large in comparison to the average flow on other days. For instance, the 5% upper bound is frequently hit in small AFPs. Excess flows are observed during a relatively short window, which fits well with the constraints imposed by pension fund regulation.

[13] Rather than settling an open contract, banks can trade contracts in the opposite direction in order to effectively close out their positions.

[14] In a few cases there is an overlap in the post-recommendation window for two consecutive FyF emails. In terms of the variable for post-recommendation days, the second email takes precedence. For example, a recommendation might be issued on day 8 after a previous recommendation. Under our definition, the next day is labeled as day 1 instead of day 9.

[15] Every two years, the government auctions portfolios of new clients to pension fund administrators. These new clients are workers entering the labor market, and they need to stay for at least 24 months with the pension fund administrator that wins the auction (by offering the lowest commissions). There is a one-time spike in flows when new investors are allocated to pension funds through this auction system. For Table A.4 we impose a 10% threshold in flows to exclude jumps produced by auctions from the data. Note that the 10% threshold does not exclude FyF flows since flows related to voluntary transfers are capped at 5% daily (e.g., a theoretical 10% flow takes two days to implement).

**Table 4**
Aggregate daily pension fund flows and FyF recommendations.

| Variables | Flow to fund | | | | | |
|---|---|---|---|---|---|---|
| | A | C | E | A | C | E |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| RecDay 1 | −0.11 | −0.05** | 0.29* | 0.08* | 0.00 | −0.13** |
| | (0.10) | (0.02) | (0.15) | (0.05) | (0.01) | (0.07) |
| RecDay 2 | 0.03 | 0.01 | 0.05 | 0.05 | 0.03 | −0.13* |
| | (0.05) | (0.02) | (0.09) | (0.04) | (0.02) | (0.07) |
| RecDay 3 | 0.10** | 0.00 | −0.05 | 0.01 | −0.01 | −0.07 |
| | (0.05) | (0.02) | (0.10) | (0.04) | (0.02) | (0.07) |
| RecDay 4 | 3.58*** | 0.22*** | −6.19*** | 3.45*** | 0.21*** | −6.14*** |
| | (0.29) | (0.07) | (0.42) | (0.28) | (0.07) | (0.40) |
| RecDay 5 | 2.95*** | 0.18*** | −5.36*** | 0.62*** | 0.05** | −0.90*** |
| | (0.24) | (0.05) | (0.37) | (0.14) | (0.02) | (0.30) |
| RecDay 6 | 1.54*** | 0.10*** | −2.90*** | 0.04 | 0.02 | 0.34 |
| | (0.18) | (0.03) | (0.37) | (0.13) | (0.02) | (0.30) |
| RecDay 7 | 0.94*** | 0.07*** | −1.73*** | 0.04 | 0.02 | 0.29 |
| | (0.16) | (0.02) | (0.32) | (0.10) | (0.02) | (0.22) |
| RecDay 8 | 0.43*** | 0.03 | −0.89*** | −0.05 | −0.01 | 0.17 |
| | (0.12) | (0.02) | (0.26) | (0.08) | (0.02) | (0.15) |
| RecDay 9 | 0.20*** | 0.02 | −0.47** | −0.07 | 0.02 | 0.30* |
| | (0.07) | (0.02) | (0.19) | (0.10) | (0.02) | (0.16) |
| RecDay 10 | 0.12** | 0.01 | −0.37** | −0.07 | 0.01 | 0.13 |
| | (0.06) | (0.03) | (0.16) | (0.07) | (0.03) | (0.14) |
| Controls | No | No | No | Yes | Yes | Yes |
| Observations | 2277 | 2277 | 2277 | 2272 | 2272 | 2272 |
| R-squared | 0.631 | 0.041 | 0.597 | 0.786 | 0.320 | 0.810 |
| *Cumulative evidence* | | | | | | |
| CUM [1–5] | 6.54*** | 0.37*** | −11.25*** | 4.20*** | 0.29*** | −7.37*** |
| p-value | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| CUM [6–10] | 3.23*** | 0.23*** | −6.37*** | −0.11 | 0.05 | 1.23*** |
| p-value | 0.00 | 0.00 | 0.00 | 0.66 | 0.28 | 0.01 |

This table shows time-series regressions of daily pension fund flows at the system level. The main independent variables capturing the impact of the recommendations at different daily lags are explained in Eq. (3) of the main text. Results for funds A, C, and E are reported separately. Controls include five lags of daily flows and fund returns. In the bottom panel, CUM[1–5] and CUM[6–10] report the cumulative effects over the first five trading days and the next five trading days respectively. The sample covers the period from January 3, 2011 to February 29, 2020. Robust standard errors are in parentheses.

*** p<0.01.

** p<0.05.

* p<0.1.

## 4. Foreign exchange rates

In this section, we study the impact of FyF's recommendations on the spot foreign exchange rate.

### 4.1. Event study

In Fig. 2 we report the results from an event study for the effect on the spot foreign exchange rate of the 82 recommendations issued by FyF. Day 0 in the figure is the day that FyF sends an email to subscribers with the new recommendation. We plot the subsequent cumulative depreciation of the foreign exchange rate. The event study is shown from the perspective of emails that recommend a reallocation towards foreign assets, and hence imply buying pressure of foreign currency. Buy and sell recommendations lead to opposite trades and potentially to opposite exchange rate movements. To depict both types of recommendations in a single graph, we multiply the price changes by −1 when the recommendation is to sell foreign assets (e.g., move from funds A to E). We then average across all events for each day.[16]

We find that the exchange rate depreciates quickly and significantly after a recommendation that implies buying foreign assets. By the second day after a recommendation the depreciation is approximately 0.40% and increases to around 0.50% over the first ten days. The reversal is relatively slow in terms of point estimates, although the statistical significance of the effect disappears after ten days. Given that FyF recommendations are uncorrelated with standard fundamentals, as documented in Table 2, the results in Fig. 2 can be interpreted as the impact of uninformed demand shocks in the foreign exchange market.

### 4.2. Time-series regressions

To study the relation between FyF recommendations and exchange rate changes more closely, we run the following times-series regression:

$$\Delta FX_t = \sum_{\tau=1}^{10} \beta_\tau RecDay_\tau + \Gamma' X_t + \xi_t \quad (4)$$

The dependent variable is the daily percentage change in the foreign exchange rate. Our main interest is in the coefficients for $RecDay_\tau$ as defined in Eq. (3). In some regressions we also include five lags of the dependent variable and a vector $X_t$ with several control variables: 30-day lags of the domestic and U.S. inflation rates, domestic and U.S. three-month interest rates, the size of the balance of the Chilean Central Bank, indicator variables for Mondays and Fridays, and the daily percentage change in the international price of copper.[17] It is worth

[16] We show up to 30 event days in Fig. 2, which can imply overlapping event windows in the case of frequent recommendations. The time-series regressions in Table 5 do not use overlapping data.

[17] These control variables adjust for returns on the carry trade (e.g., Fama 1984, Brunnermeier et al. 2008, Burnside et al. 2011, Lustig et al. 2011, 2014; and Koijen et al. 2018), currency momentum (e.g., Moskowitz et al.

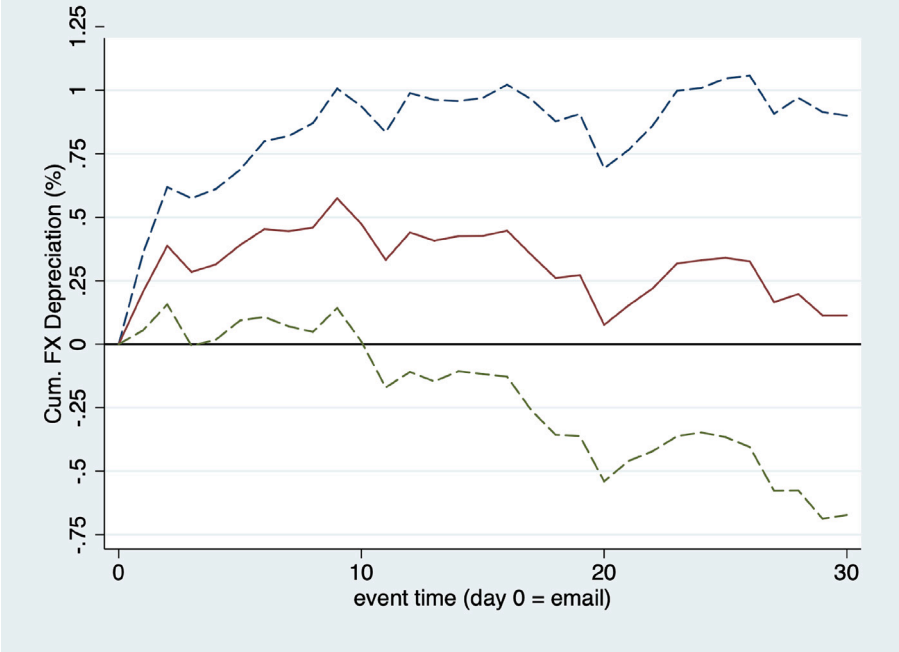



**Fig. 2.** The foreign exchange rate after FyF recommendations.
The event study uses all 82 FyF emails from 2011 to Feb 2020. The perspective is of FyF emails that recommend a move towards foreign assets (following the last column in Table A.1 in the Appendix). Thus, the effects after an email with a recommendation to move away from foreign assets are multiplied by −1. Foreign exchange data is from Bloomberg. The figure does not adjust for overlapping events. Confidence bands based on robust standard errors are at the 95% level.

mentioning that the literature finds almost no short-term predictability in foreign exchange rates, and only some predictability at the quarterly or annual horizons (Rossi, 2013).

In column (1) of Table 5 we run the regression without controls and find a strong foreign exchange depreciation on the first two days after a recommendation. The cumulative effect over the first five days amounts to 0.85, which implies that a recommendation to move from fund E to fund A is associated with a depreciation of the foreign exchange rate of 0.59% ($= 0.85 \times (0.75 - 0.06)$). The cumulative effect on the subsequent five days (days 6–10) is positive, but not statistically significant. Hence, we do not find a reversal over the ten-day window.

While the pension flows in Table 4 are delayed by four days, the foreign exchange rate reacts immediately on days 1 and 2. The four-day delay in flows is explained by institutional features of the system, which require pension funds to transfer the flows on the fourth day after participants submit their requests. Furthermore, the exact amount to be transferred is known on the second day after a request has been submitted, given that the exchange ratio is determined by the fund prices on that day. Due to these institutional features, assets under management only change from the fourth day after FyF recommendations. The immediate reaction of prices can be explained by pension funds starting to trade immediately after a recommendation. Other market participants are also aware of the recommendations and can start trading to front-run pension funds, consistent with previous evidence for the Chilean stock market and the spot foreign exchange market (see Da et al. 2018, Bernhardt and Cuevas 2023, and Pinto-Avalos et al. 2022). Thus, in line with market efficiency, prices move immediately after the recommendation is announced, and ahead of the actual implementation of the transfers.

The effects are not sensitive to adding different controls or restricting the sample to when the forward price is available, which for the most part excludes days where the U.S. market is closed because of holidays. Finally, column (7) shows that the results are robust to controlling for the average daily change in a basket of 17 currencies of emerging markets excluding Chile (from Du and Schreger 2016).

In Table 6 we investigate several sample splits to better understand the effects of FyF recommendations.[18] First, we compare the effects after buy and sell emails, where buy (sell) refer to FyF recommendations to increase (decrease) foreign investments and therefore to buy (sell) foreign currency. The variable $RecDay_\tau$ takes into account the direction of the recommendations and, therefore, the coefficients can be compared across columns. In columns (1) and (2) we find that the five-day effect on the foreign exchange rate is similar after buy and sell recommendations. The effect after sell emails is delayed by one day, from the first day to the second day following the recommendation.

Second, we split the sample into the early years of FyF (2011–2015) and the later years (2016–2020). FyF was more active (higher email frequency) and more popular (more followers) in the later years. Not surprisingly, the effects on the exchange rate are stronger in the later part of the sample. For example, the five-day effect is 0.48 in the early sample and 1.68 in the late sample.

Third, we focus on FyF recommendations that are sent near the end of a quarter, specifically, we look at the two weeks around the ends in March, June, September, and December. The end of the quarter can be relevant if constraints on the balance sheets of banks are more binding during these days (Du et al., 2018).[19] The five-day depreciation of the

2012, Menkhoff et al. 2012, Burnside et al. 2011, and Zhang 2022); and commodity prices (e.g., Ready et al. 2017).

[18] Table A.5 in the Appendix shows the effects of FyF recommendations on pension fund flows in these sample splits.

[19] Du et al. (2018), and Cenedese et al. (2021) argue that non-risk-weighted capital requirements introduced with Basel III are responsible for quarter-end effects in CIP deviations. These capital requirements are not mandatory in Chile during our sample period. However, since 2013 the local banking regulator has introduced guidelines and an implementation calendar to move towards Basel III. The local banks voluntarily comply with these recommendations. Even if local banks are not more constrained at the end of the quarter than on other days, global banks and other institutions providing funding to the Chilean banks can be more constrained. As long as the counterparties of Chilean banks face more binding constraints from their own jurisdictions at

**Table 5**
Foreign exchange rates and FyF recommendations.

| Variables | $\Delta FX$ (1) | $\Delta FX$ (2) | $\Delta FX$ (3) | $\Delta FX$ (4) | $\Delta FX$ (5) | $\Delta FX$ (6) | $\Delta FX$ (7) |
|---|---|---|---|---|---|---|---|
| RecDay 1 | 0.45** | 0.49*** | 0.45** | 0.49*** | 0.48** | 0.50*** | 0.40*** |
| | (0.21) | (0.18) | (0.21) | (0.19) | (0.21) | (0.19) | (0.14) |
| RecDay 2 | 0.54*** | 0.50*** | 0.52*** | 0.48*** | 0.49*** | 0.47*** | 0.29** |
| | (0.17) | (0.17) | (0.18) | (0.17) | (0.18) | (0.17) | (0.14) |
| RecDay 3 | −0.29 | −0.28 | −0.22 | −0.20 | −0.28 | −0.24 | −0.14 |
| | (0.17) | (0.17) | (0.18) | (0.17) | (0.19) | (0.18) | (0.15) |
| RecDay 4 | 0.09 | 0.07 | 0.06 | 0.05 | 0.05 | 0.03 | 0.14 |
| | (0.18) | (0.16) | (0.20) | (0.17) | (0.19) | (0.17) | (0.14) |
| RecDay 5 | 0.06 | 0.17 | 0.05 | 0.14 | 0.08 | 0.18 | 0.03 |
| | (0.19) | (0.18) | (0.20) | (0.20) | (0.20) | (0.19) | (0.16) |
| Sample | All | All | F1m avail. | F1m avail. | F1m avail. | F1m avail. | F1m avail. |
| Macro Controls | No | Yes | No | Yes | No | Yes | Yes |
| Lagged DV | No | Yes | No | No | Yes | Yes | Yes |
| Avg EM $\Delta FX$ | No | No | No | No | No | No | Yes |
| Observations | 2277 | 2181 | 2041 | 2041 | 2041 | 2041 | 2041 |
| $R^2$ | 0.020 | 0.145 | 0.020 | 0.138 | 0.031 | 0.142 | 0.417 |
| *Cumulative evidence* | | | | | | | |
| CUM [1–5] | 0.85** | 0.96** | 0.87** | 0.96** | 0.81* | 0.94** | 0.72** |
| p-value | 0.04 | 0.01 | 0.05 | 0.02 | 0.06 | 0.02 | 0.03 |
| CUM [6–10] | 0.28 | 0.39 | 0.39 | 0.42 | 0.37 | 0.44 | 0.36 |
| p-value | 0.50 | 0.32 | 0.38 | 0.29 | 0.39 | 0.28 | 0.28 |

This table shows time-series regressions for the daily depreciation of the spot foreign exchange rate. The main independent variables capturing the impact of the recommendations at different daily lags are explained in Eq. (3) of the main text. We report the coefficients for the first five days, but we omit the individual coefficients for days 6–10. CUM[1–5] and CUM[6–10] report the cumulative effects over the first five trading days and the next five trading days respectively. The dependent variable is expressed in percentage points. Macroeconomic controls include the daily change in the price of copper, 30-day lags of Chilean and U.S. inflation, three-month Chilean and LIBOR interest rates, the size of the Chilean central bank balance sheet as a fraction of GDP, and dummies for Mondays and Fridays. The lagged dependent variable (DV) includes five lags of the foreign exchange rate depreciation. The average change in the currencies of 17 emerging markets without counting Chile (Avg EM $\Delta FX$) is included as a control in column (7). The sample covers the period from January 3, 2011 to February 29, 2020 and in columns (3)–(7) is restricted by the availability of a one-month forward price in Bloomberg. Robust standard errors are in parentheses.

*** p<0.01.

** p<0.05.

* p<0.1.

foreign exchange rate is similar at the end of the quarter than on other days (1.09 vs. 0.84).

Finally, in column (7) we exclude periods when the Central Bank of Chile officially intervened in the foreign exchange market. The foreign exchange rate is typically free to float, but during the entire year 2011 and between November 29, 2019 and the end of our sample the central bank intervened in a pre-announced fashion. The motives for the two interventions were different. During 2011, the objective was to increase the exchange rate and alleviate the pressure from exporters, while the objective in 2019 was to reduce the exchange rate after a period of unusually high uncertainty from social unrest. Excluding both of these periods does not change our conclusions.

### 4.3. Price elasticity of the demand for money

The large and frequent trading in currency markets induced by uninformed pension flows provides a unique setting to estimate the price elasticity of the demand for the Chilean peso. For concreteness, we focus on the effect of a portfolio switch from fund E to fund A (i.e., $RecDay_\tau = 0.69$). The resulting depreciation of the Chilean peso over the first five days, according to column (1) of Table 5 (CUM[1–5]), is 0.59% (= 0.85% × 0.69). The foreign currency trade associated with this portfolio switch is US$858 million, which can be obtained by multiplying: (a) Fund A's average AUM of US$27,587 million (Table 1 Panel A), (b) 4.51% (= 6.54% × 0.69) flow towards fund A over the first five days (from CUM[1–5] in column 1 of Table 4), and (c) 69% extra foreign investment in fund A compared to fund E (Table 1 Panel B). Hence, our results imply that uninformed purchases of US$1 billion produce a depreciation of the Chilean peso of 0.69%. For comparison, Evans and Lyons (2002) find that purchases of US$1 billion increase the Deutsche mark exchange rate by 0.50%.

In order to compute an elasticity we need to put the flow in relation to the stock of money available. Analogously, in the literature on downward-sloping demand for stocks (see Shleifer 1986, or Wurgler and Zhuravskaya 2002), the flow is compared to the supply of shares outstanding. In our setup there is no unambiguous measure of the supply of money in the economy, so we compute the elasticity with respect to different averages of monetary aggregates for the Chilean economy over 2011–2020. For example, the flow of US$858 million represents 1.95% of M1, 0.49% of M2, and 0.29% of M3. Alternatively, this flow represents 1.12% of the international reserves of the Central Bank of Chile over this period.

With these numbers in mind, the price elasticity of the Chilean peso can be estimated to be −0.49 (= −0.29%/0.59%) for the case of M3 and −3.30 (= −1.95%/0.59%) for the case of M1. The estimates with M2 and reserves (−0.83 and −1.90 respectively) are in between these two extremes.[20] Although the range of estimates seems wide, it is far from the frictionless markets' benchmark elasticity of −∞. Our estimates imply a relatively inelastic demand curve for foreign currency, in line

the end of the quarter, the effects can spill over to the local foreign exchange market.

[20] The elasticities over a ten-day window are similar to the elasticities over the five-day window that we report. In particular, elasticities range between −0.55 for the case of M3 and −3.74 for the case of M1.

**Table 6**
Foreign exchange regressions in sub-samples.

| Sample | Buy Emails (1) | Sell Emails (2) | 2011–15 (3) | 2016–20 (4) | Q-end (5) | Not Q-end (6) | Free float (7) |
|---|---|---|---|---|---|---|---|
| RecDay 1 | 0.84*** | 0.16 | 0.26 | 0.87** | 0.66* | 0.46** | 0.50** |
| | (0.30) | (0.22) | (0.20) | (0.34) | (0.39) | (0.21) | (0.20) |
| RecDay 2 | 0.27 | 0.64*** | 0.37* | 0.64* | 0.65** | 0.42** | 0.56*** |
| | (0.28) | (0.20) | (0.20) | (0.34) | (0.32) | (0.19) | (0.18) |
| RecDay 3 | −0.18 | −0.32 | −0.25 | −0.22 | −0.57** | −0.19 | −0.27 |
| | (0.28) | (0.23) | (0.17) | (0.38) | (0.29) | (0.20) | (0.20) |
| RecDay 4 | −0.03 | 0.05 | 0.17 | −0.25 | 0.28 | −0.02 | −0.05 |
| | (0.31) | (0.15) | (0.15) | (0.36) | (0.53) | (0.18) | (0.18) |
| RecDay 5 | −0.06 | 0.35 | −0.06 | 0.63 | 0.07 | 0.17 | 0.13 |
| | (0.27) | (0.29) | (0.20) | (0.39) | (0.27) | (0.23) | (0.20) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1715 | 1741 | 1189 | 852 | 268 | 1773 | 1749 |
| R-squared | 0.145 | 0.149 | 0.199 | 0.107 | 0.198 | 0.140 | 0.125 |
| *Cumulative evidence* | | | | | | | |
| CUM [1–5] | 0.84 | 0.89* | 0.48 | 1.68** | 1.09 | 0.84* | 0.87** |
| *p*-value | 0.20 | 0.09 | 0.25 | 0.04 | 0.23 | 0.07 | 0.04 |
| CUM [6–10] | 0.60 | 0.17 | 0.18 | 1.11 | 0.17 | 0.43 | 0.48 |
| p-value | 0.30 | 0.77 | 0.70 | 0.18 | 0.94 | 0.30 | 0.23 |

This table follows the style of Table 5. The sample is restricted by the availability of the one-month forward price in Bloomberg (2041 observations). Buy (sell) emails in column 1 (2) refer to emails that recommend increasing (decreasing) the allocation to foreign assets. The sample in the case of the buy (sell) column includes the 10 days that follow buy (sell) emails plus non-recommendation days (days that do not immediately follow any recommendation). Buy and sell samples add up to more days than the full sample since they both include non-recommendation days. The sample splits between 2011–2015 (column 3) and 2016–2020 (column 4) divide the 2041 observations in two samples without overlap. The end-of-quarter sample includes trading days in the last week of March, June, September, and December and, in order to estimate post-event effects, trading days in the first week of January, April, July, and October. The end-of-quarter sample (column 5) and the not-end-of-quarter sample (column 6) also divide the 2041 observations in two samples without overlap. The free float sample (column 7) excludes periods of central bank intervention in the foreign exchange market (the year 2011 and from November 29, 2019 up to the end of our sample on February 29, 2020). Robust standard errors are in parentheses.

*** p<0.01.

** p<0.05.

* p<0.1.

with what can be inferred from Hau et al. (2010) and Pandolfi and Williams (2019). For comparison, Da et al. (2018) document a price elasticity of −0.45 in the Chilean stock market. Both estimates support the inelastic market hypothesis proposed by Gabaix and Koijen (2021). Currency markets are among the largest and most liquid markets in the world, so it is perhaps not surprising that currency demand, although still inelastic, is more elastic than the demand in the local stock market.

## 5. Banking imbalances

This section studies how FyF's recommendations affect the position of banks in forward and spot currency markets. Fig. 3 shows the outstanding net positions of the banking system in the spot and forward markets. The net position in the spot market is negative, which indicates that local banks are borrowing dollars. As emphasized by Ivashina et al. (2015) and Du and Schreger (2022), non-U.S. banks generally do not have an ample base of dollar deposits, and they tend to borrow dollars by selling commercial paper to U.S. money market funds, or drawing on credit lines at global banks. Because of the non-deliverable feature of the Chilean peso, banks cannot exchange pesos for dollars outside the on-shore market. Deliverable currencies, such as the U.S. dollar or the Euro, can be freely exchanged in international markets. For instance, European banks can use Euros sourced from local depositors to buy spot U.S. dollars abroad. This is not an option for Chilean banks looking to exchange pesos for U.S. dollars, hence their need to borrow U.S. dollars abroad.

The hedging demand of banks follows naturally once we consider that they need to borrow dollars: local banks need to buy dollars forward to reduce their overall currency exposure. As seen in Fig. 3, the net position in the forward market is positive and almost a mirror image of the spot position. This behavior suggests that the effects of FyF recommendations can be transmitted from the spot market to the forward market through the local banks. Hedging follows from risk management practices and is also required by regulation. The overall net exposure is close to zero. Carrying over an unhedged position is expensive in the sense that it uses some of the banks' balance-sheet capacity.

In Fig. 4 we show the monthly amount bought minus the amount sold of foreign currency from the local banks by various counterparties (i.e., pension funds, foreign entities, brokers, insurance companies, mutual funds, firms, others). Given that this data is only reported at the end of each month (unlike the daily data we use in the rest of the tables and figures), we focus on the net change in FyF's recommendations for fund A during each month. Dark blue (light red) bars correspond to months with recommendations to decrease (increase) allocations to fund A. We subtract from each bar the average banking imbalance with each counterparty during months without changes in FyF recommendations.

In Panel A of Fig. 4 we see that pension funds are selling (buying) approximately US$600 (US$750) million to banks in the spot market in months with a net decrease (increase) in fund A. The imbalances with other counterparties are small. Thus, the months with FyF recommendations are not months with broad-based buying or selling in the spot market. Also, the other counterparties are not providing much liquidity to accommodate FyF flows. In Panel B we see the mirror image in the forward market, where foreigners are buying (selling) approximately US$700 (US$1300) million from local banks in months with a net decrease (increase) in fund A. Foreigners operate in the forward market but typically not in the spot market.

Our preferred interpretation is that foreigners provide liquidity to meet the hedging needs of local banks. In addition to liquidity provision, there can be foreign arbitrageurs who actively bet on dollar

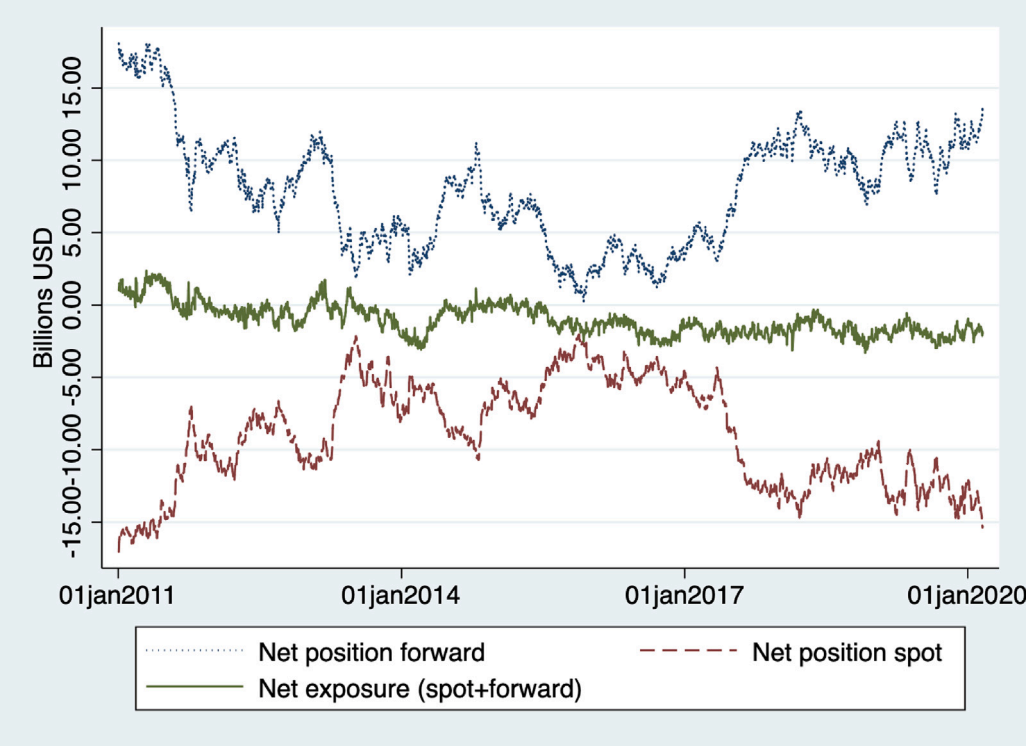



**Fig. 3.** Banks' daily net position in forward and spot markets.
The figure presents the banks' daily net position in spot and forward markets as reported by the Central Bank of Chile.

depreciation or appreciation. In fact, there seems to be more volume in the forward market than the volume directly implied by the imbalance in the spot market. It is worth noting that pension funds are not very active in the forward market after FyF recommendations.[21]

Fig. 5 shows in stylized form the flows that FyF recommendations induce. A recommendation to move towards fund A increases the demand of foreign currency by pension funds in the spot market. Local banks absorb this demand by selling foreign currency in the spot market. Banks borrow abroad to have foreign currency to sell to pension funds. In order to hedge their foreign currency liabilities, banks turn to the derivatives market where they buy foreign currency forward from foreign entities. Eventually, foreigners absorb the excess demand of foreign currency from the pension funds, but this is done indirectly through the local banks. Most foreigners do not provide liquidity directly to pension funds since they do not participate in the spot market.

Although the volume data by counterparty is informative, it is only available at a monthly frequency. At a low frequency we run the risk of ignoring confounding variables that potentially drive both currency flows and foreign exchange rates. In contrast, it is less plausible that this relation is driven by reverse causality at a daily frequency. In particular, the frequent, back-and-forth trading associated with FyF recommendations is unlikely to coincide with slow-moving foreign exchange fundamentals.

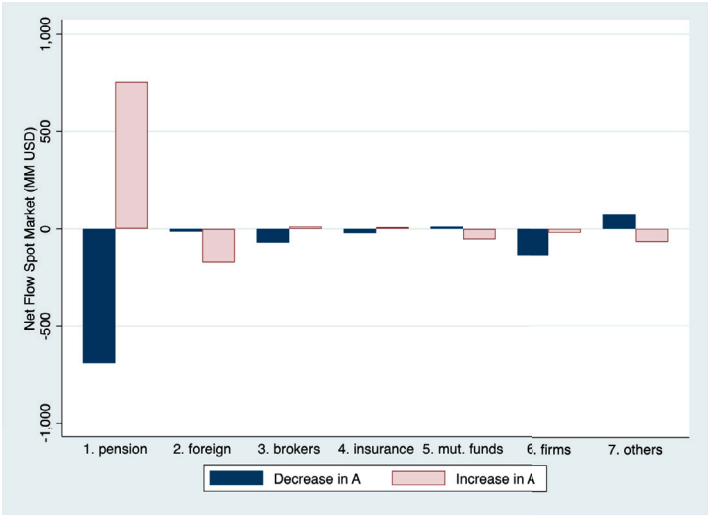
At a daily frequency we can compute the total imbalance of the banking sector and link the effects more directly to the timing of FyF recommendations.[22] Fig. 6 shows the cumulative daily imbalance (i.e., buys minus sells) of the banking sector in the spot and forward markets after FyF recommendations. In the top panel we show the effects in millions of U.S. dollars, and in the lower panel we show the effects in terms of the equity of the banking sector. We find that banks sell foreign currency in the spot market by approximately US$600 million (1.8% of their equity) in the ten days that follow a recommendation to increase foreign assets. At the same time, banks buy approximately US$700 million (2% of equity) in the forward market.[23]

Table 7 shows the time-series regressions with daily banking imbalances as dependent variables. The spot imbalance decreases significantly on days 3 and 4 after a recommendation, implying that banks are selling foreign currency in the spot market. The cumulative five-day effect is −2.32% of bank equity. The forward imbalance increases strongly over the same days, and the cumulative five-day effect is 2.43% of bank equity, which is slightly stronger than the spot market. The total imbalance (spot plus forward) in the first five days is not statistically different from zero (column 3). Therefore, banks are almost perfectly hedged. The change in the net position in column (4) adds to

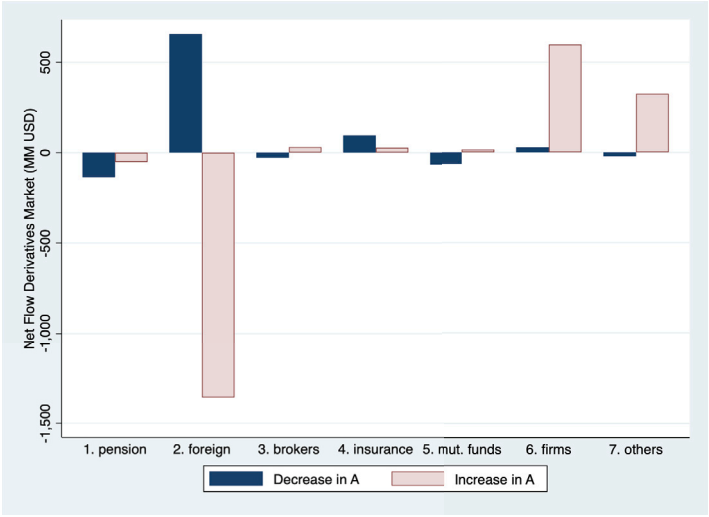
[21] Table A.6 in the Appendix shows regressions with the log of pension funds (or foreigners) buy and sell amounts of derivatives as dependent variables. We find that the derivatives trading of pension funds does not significantly respond to FyF recommendations. Because of regulatory requirements, pension funds have to hedge part of their exposure to foreign currency fluctuations. However, they have up to 90 days to adjust the excess or shortfall of currency exposure. The derivatives trading of foreigners reacts significantly to FyF recommendations. For instance, foreigners buy (sell) 14.8% (13.8%) more forward when there are recommendations to decrease (increase) fund A by 100% (i.e., when banks need to hedge the dollars they bought from (sold to) pension funds in the spot market).

[22] Daily transactions are recorded when each order is placed, and not at settlement.

[23] Although we do not know the exact counterparty at the daily level, we can find traces of the role of local banks in absorbing FyF-induced spot flows. For Figure A.4 in the Appendix we compute the implied daily foreign exchange flow of pension funds as the multiplication of the daily flow to or from each fund times the fraction invested in foreign assets in each fund. We add this up over the ten days that follow a recommendation from FyF. We then correlate this implied foreign exchange flow with the net sales of banks over the same ten days. The estimated slope of the relationship is 0.57, suggesting a strong role for banks as liquidity providers to pension funds in the spot market.




(a) Spot Market




(b) Forward Market

**Fig. 4.** Monthly trading volume in the spot and forward markets by counterparty.
The figures show the monthly average of the net flow (buy–sell) of different counterparties with the formal exchange market (mainly banks) for months with FyF recommendations to increase or decrease the portfolio allocation to fund A. Panel (a) shows net flows for the spot market and Panel (b) for the forward market. We subtract the monthly average of the net flow for each counterparty in months with no change in the FyF recommendation about fund A. All values are in millions of U.S. dollars. A positive number represents an increase in the purchases of foreign currency by each counterparty from banks. Blue (dark-colored) bars are for months with FyF emails that result in a net decrease in fund A and red bars (light-colored) are for months with FyF emails that result in a net increase in fund A. The category "others" includes households, the government, the central bank, and financial institutions not included in the previous categories. The sample covers the period from January 2011 to February 2020. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

the total imbalance of column (3) the expiration or closing of previous forward contracts. The cumulative five-day effect on the net position is 1.34% of bank equity, and it is statistically significant. This suggests that banks let forward selling contracts expire so the net position increases more than the net origination of forward contracts.

Underlying our analysis is the idea that the flow induced by FyF recommendations is sufficiently large that it cannot be accommodated solely by market participants and pushes banks to borrow U.S. dollars abroad. An indication of the size of the shock can be seen in columns (5) through (7) of Table 7 where we study the daily trading volume after FyF recommendations in spot and derivatives markets. The data is the same that we use to compute banking imbalances. We define trading volume as $(buy + sell)/MA(buy + sell)$, where the numerator is the sum of buy and sell transactions by banks in the foreign exchange market, and the denominator is the average of the sum of buy and sell transactions over the last 100 days.[24] We run regressions of trading volume on the $RecDay_\tau$ variable in absolute value since volume is always positive by definition. The coefficients in this regression can be interpreted as abnormal volume relative to the average of the last 100 days. Column (5) shows that spot volume is 54% higher in the five days that follow FyF recommendations (i.e., the FyF shock adds close to half a day of extra volume). In the next five days, spot volume decreases by 9%, which is not statistically significant. Derivatives volume (column 6) is 12% higher in the first five days and 18% higher in the next five days, although the estimates are noisy. Overall, total abnormal volume

[24] Buy volume is not equal to sell volume because banks act as market makers holding inventory on their balance sheets. Interbank volume is not included in our calculations.

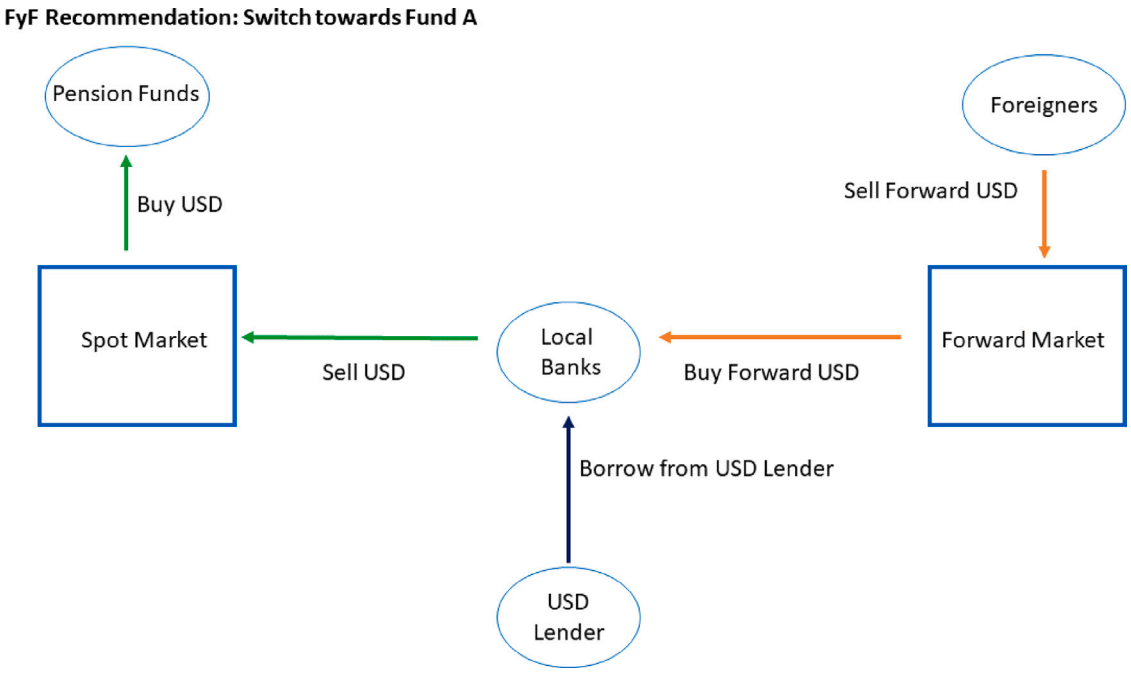



**Fig. 5.** Flows in the spot and forward markets in response to FyF recommendation.

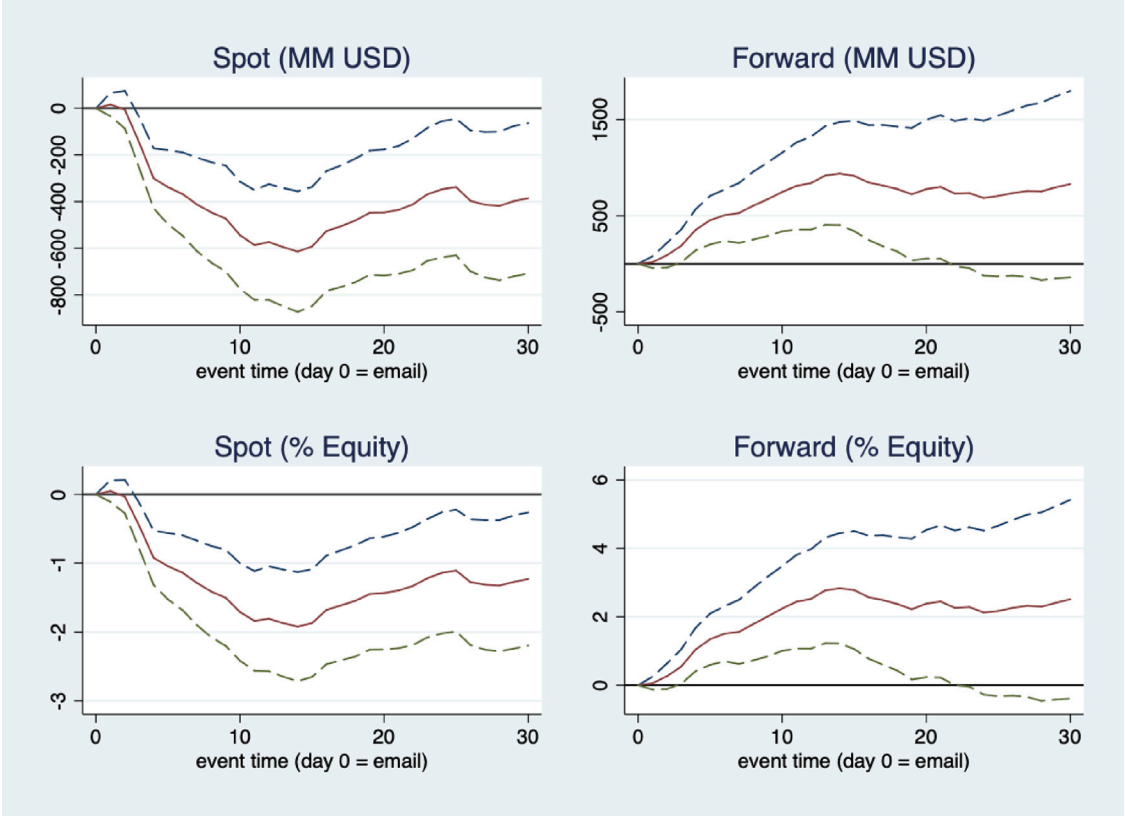



**Fig. 6.** Banking sector imbalances after FyF recommendations.
The event study uses all 82 emails from 2011 to Feb 2020. The perspective is of FyF emails that recommend a move towards foreign assets (following the last column in Table A.1 in the Appendix). Thus, the effects after an email with a recommendation to move away from foreign assets are multiplied by −1. The banking imbalance is defined as buys minus sells by the Chilean banking sector in the daily spot market or the forward market. The top row shows results in millions of U.S. dollars, while the bottom row normalizes by the total equity of the Chilean banking system, which is lagged by 30 days. The data is from the Central Bank of Chile. Confidence bands based on robust standard errors are at the 95% level.

**Table 7**
Daily banking imbalances, trading volume, and FyF recommendations.

| | Banking Imbalances | | | | Trading Volume | | |
|---|---|---|---|---|---|---|---|
| | Spot | Deriv. | Spot + Deriv. | Δ Net Position | Spot | Deriv. | Spot + Deriv. |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| RecDay 1 | 0.31 | 0.09 | 0.39* | 0.50** | | | |
| | (0.24) | (0.26) | (0.22) | (0.23) | | | |
| RecDay 2 | −0.36* | 0.37 | 0.10 | 0.11 | | | |
| | (0.20) | (0.39) | (0.40) | (0.23) | | | |
| RecDay 3 | −0.88*** | 0.54* | −0.31 | 0.41 | | | |
| | (0.27) | (0.30) | (0.32) | (0.25) | | | |
| RecDay 4 | −1.13*** | 1.06*** | −0.16 | 0.19 | | | |
| | (0.25) | (0.38) | (0.30) | (0.27) | | | |
| RecDay 5 | −0.26 | 0.37 | 0.00 | 0.14 | | | |
| | (0.30) | (0.35) | (0.33) | (0.26) | | | |
| abs(RecDay 1) | | | | | 0.03 | 0.05 | 0.04 |
| | | | | | (0.05) | (0.05) | (0.04) |
| abs(RecDay 2) | | | | | 0.04 | −0.03 | −0.00 |
| | | | | | (0.05) | (0.06) | (0.05) |
| abs(RecDay 3) | | | | | 0.15** | 0.02 | 0.06 |
| | | | | | (0.07) | (0.07) | (0.05) |
| abs(RecDay 4) | | | | | 0.16** | 0.00 | 0.06 |
| | | | | | (0.06) | (0.06) | (0.05) |
| abs(RecDay 5) | | | | | 0.15** | 0.08 | 0.11** |
| | | | | | (0.06) | (0.05) | (0.05) |
| controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2029 | 2029 | 2029 | 2028 | 2041 | 2041 | 2041 |
| $R^2$ | 0.117 | 0.082 | 0.057 | 0.143 | 0.260 | 0.222 | 0.278 |
| *Cumulative evidence* | | | | | | | |
| CUM [1–5] | −2.33*** | 2.43*** | 0.02 | 1.35** | 0.54*** | 0.12 | 0.27** |
| p-value | 0.00 | 0.0 | 0.98 | 0.02 | 0.00 | 0.38 | 0.02 |
| CUM [6–10] | −1.40*** | 1.34 | 0.15 | −0.13 | −0.09 | 0.18 | 0.06 |
| p-value | 0.01 | 0.12 | 0.85 | 0.85 | 0.60 | 0.28 | 0.64 |

This table shows time-series regressions for daily banking sector imbalances, and for the daily traded volume in the spot and derivatives markets. Net imbalance in the spot and forward markets in columns (1) and (2) are defined as the amount bought minus the amount sold by banks to third parties, divided by the 30-day lagged equity of the banking sector. Spot+Forward in column (3) corresponds to the sum of the net imbalances in the both markets. In column (4) we use the daily change in a bank's net exposure (spot position + forward position). The dependent variables in columns (5) to (7) are computed as the ratio of the daily traded volume (buy+sell) in each market over the 100-day moving average of the same variable. Since volume is always positive, the daily shocks for columns (5) to (7) are computed by replacing $\Delta\omega_i^{FyF}$ in Eq. (3) with the absolute value of this variable: $abs(\Delta\omega_i^{FyF})$. We report the coefficients for the first five days, but we omit the individual coefficients for days 6–10. CUM[1–5] and CUM[6–10] report the cumulative effects over the first five trading days and the next five trading days, respectively. Columns (5) and (6) presents the results for the traded volume in the spot and derivatives markets, and their sum in Column (7). Interbank trading is not included. Controls include the daily change in the price of copper, 30-day lags of Chilean and U.S. inflation, three-month Chilean and LIBOR interest rates, the size of the Chilean central bank balance sheet as a fraction of GDP, dummies for Mondays and Fridays, and five lags of the dependent variable. The sample covers the period from January 3, 2011 to February 29, 2020. Robust standard errors are in parentheses.

*** p<0.01.

** p<0.05.

* p<0.1.

(column 7) is 27% higher in the first five days, thus it is unlikely that it can be quickly accommodated by regular market participants.

## 6. Covered interest parity deviations

In this section we study whether the FyF recommendations have an impact on CIP deviations.

### 6.1. Cross-currency basis

Using the spot foreign exchange rate $S$, the forward exchange rate $F_{1m}$, and the interest rates $R_{US}$ and $R_{Chile}$ we can define the one-month cross-currency basis ($CCB_{1m}$) as:

$$CCB_{1m} = (1 + R_{US}) - (1 + R_{Chile})\frac{S}{F_{1m}} \quad (5)$$

We define CCBs at other horizons analogously. All CCBs are expressed in annual terms as is customary in the literature (Du et al., 2018).[25] In a frictionless world the CCBs should be zero at all times due to arbitrage. This is not the case in practice, although we can expect to find a non-zero CCB due to default and other risks and not necessarily because of a failure of arbitrage. The average (median) one-month CCB in our sample is −0.36% (−0.29%) (see Figure A.5 in the Appendix). A negative CCB implies that it is more profitable for an investor with U.S. dollars to exchange the dollars into Chilean pesos, take a deposit in

[25] We construct the one-month CCB using Bloomberg data. We get the CCB at the three and six month horizons from the Central Bank of Chile. All Central Bank data can be downloaded from https://si3.bcentral.cl/siete. We are able to match the three-month CCB reported by the Central Bank with Bloomberg data, but there is no data available in Bloomberg to compute the six-month CCB. The Central Bank does not report the one-month CCB. Most of our tests deal with the one-month CCB since this is the most liquid forward contract available. A shown by Villena and Hynes (2020), more than 50% of FX derivatives in the Chilean market have a maturity of 30 days or less.

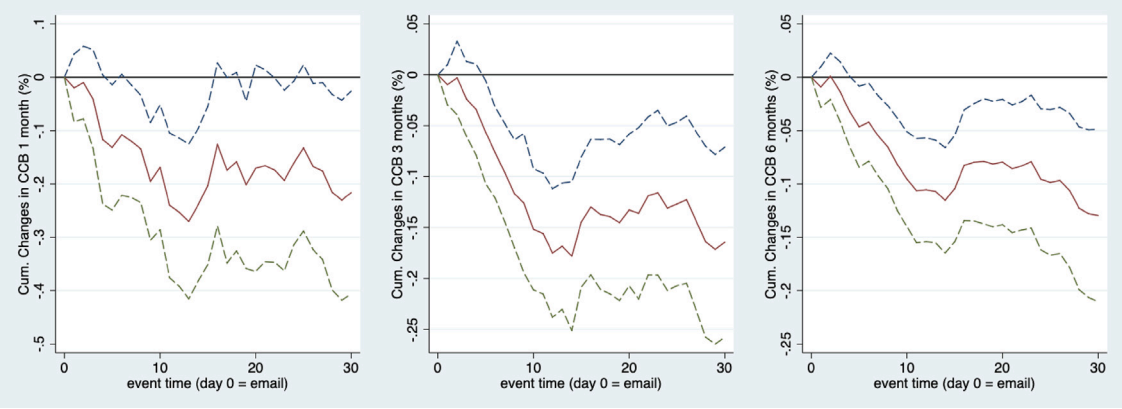



**Fig. 7.** Cross currency basis after FyF recommendations.
The event study uses all 82 emails from 2011 to Feb 2020. The perspective is of FyF emails that recommend a move towards foreign assets (following the last column in Table A.1 in the Appendix). Thus, the effects after an email with a recommendation to move away from foreign assets are multiplied by −1. CCB data is from Bloomberg for the one-month CCB and from the Central Bank of Chile for the 3-month and 6-month CCBs. The figure does not adjust for overlapping events. Confidence bands based on robust standard errors are at the 95% level.

Chilean pesos, and hedge them back to U.S. dollars than to take a U.S. dollar deposit directly at the LIBOR rate.

The forward premium, or the safe return associated with carrying dollars for one month, is one element of the CCB, which can be more easily seen if the CCB is defined in logarithms:

$$ccb_{1m} = (r_{US} - r_{Chile}) + (f_{1m} - s) \tag{6}$$

The log-CCB can be expressed in terms of two spreads: the log-interest rate spread between the foreign and the domestic rate ($r_{US} - r_{Chile}$), and the log-forward premium ($f_{1m} - s$). In levels, the *Forward Premium* is defined as:

$$Forward\ Premium = \frac{F_{1m} - S}{S} \tag{7}$$

The average annualized forward premium in our sample is 3.06%, with a standard deviation of 2.17% (see Table A.3).

### 6.2. Time-series regressions

To investigate whether the recommendations by FyF have an impact on the CCB, we first run an event study. Fig. 7 shows the CCB changes after the FyF recommendations at the one-, three-, and six-month horizons. As in Fig. 2, we multiply by −1 the changes that occur after recommendations to move away from foreign assets. This allows us to average across all recommendations and showcase the effects in a single figure. The one-month CCB falls by around 25 bps after ten days of FyF recommendations. The magnitudes are more muted at the three- and six-month horizons.

To illustrate the sources of variation in the CCB after FyF recommendations, we plot in Fig. 8 the cumulative changes of spot prices, forward prices, and interest rates. In the first row we show that the forward price increases slightly less than the spot price in response to a buy recommendation from FyF. The difference between the spot and forward prices following the first ten days after a recommendation is relatively small (i.e., around 2 bps for the one-month contract), but it is statistically significant.[26] This muted reaction of the forward price implies a decrease in the forward premium and consequently in the CCB. The bottom panel of Fig. 8 shows the behavior of Chilean and international interest rates following FyF recommendations. We find that rates, and their differential, do not move significantly after FyF recommendations.[27]

In Table 8 we show time-series regressions using the change in the one-month CCB as the dependent variable. The effect of FyF recommendations on the CCB is spread out over the first few days after the recommendation. The cumulative effect is −0.34% over the first five trading days and −0.21% over the next five trading days (column 1). The effect is statistically significant only for the first five days. If we focus on the effect of a portfolio switch from fund E to fund A (i.e., $RecDay_{\tau} = 0.69$), the decrease in the CCB over the first five days is 0.23% (= $0.34\% \times 0.69$). The effect remains strong if we control for macro variables (column 2), and for average changes in the CCBs of other emerging markets (column 3).

The CCB effect in Table 8 is delayed by at least three days, in contrast to the timing of the foreign exchange changes in Table 5. Transactions in the spot and forward market can be delayed because the pension transfers are only executed four days after the investors submit their reallocation requests. This delay is consistent with the delay in the banking sector imbalances and trading volumes shown in Table 7.

In columns (4)–(7) we split the change of the CCB into two parts: the change in the forward premium and the change in the interest rate spread. We find that most of the effect is seen in the forward premium and not in interest rates. The five-day cumulative effect on the forward premium is −0.51% (column 5), while it is a mere 0.03% on interest rate differentials (column 7). Hence, the market for forward contracts, and not the market for deposits, is most affected by FyF recommendations.

Our interpretation of the pricing effects in the spot and forward markets is that banks and foreigners are getting compensation for providing liquidity. For example, following Fig. 5, consider the case where, after a recommendation to switch towards fund A, local banks sell dollars spot to pension funds and foreigners sell dollars forward to local banks (who need to hedge). Both the spot and the forward prices increase to reflect the overall increase in demand for foreign currency. When local banks sell spot, they do it at a higher spot price than before the FyF recommendation, and similarly when foreigners sell forward, they do it at a higher forward price than before the FyF recommendation. The effects are symmetric after a recommendation to switch away from fund A: local banks buy spot from pension funds at a

[26] Notice that, in line with the international finance literature, we report the CCB in annual terms, which implies multiplying differentials in monthly forward contracts by a factor of 12 (=360/30). Therefore, the change in the annualized forward premium that we estimate after ten days in Fig. 8 is around 25 basis points, which is in line with the magnitudes shown in Table 8 and Fig. 7.

[27] We find that our results are robust using AMERIBOR (American Interbank Offered Rate) instead of LIBOR. AMERIBOR is based on overnight transactions between U.S. banks, and it was developed in 2015 as an alternative benchmark rate in response to the LIBOR scandals.

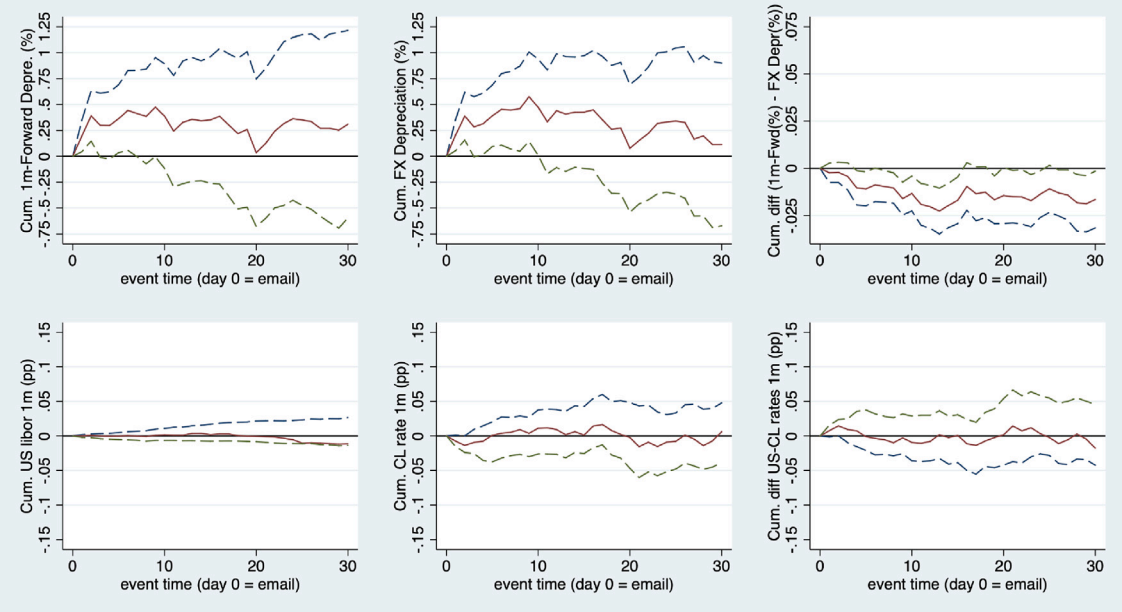



**Fig. 8.** Decomposition of CCB after FyF recommendations.
The top row presents the cumulative change in the one-month forward, foreign exchange rate, and the difference between the cumulative changes of the foreign exchange rate and one-month forward. The bottom row presents the cumulative change in the U.S. LIBOR one-month rate, the Chilean one-month rate and the difference between these cumulative rate changes after FyF recommendations. The event study uses all 82 emails from 2011 to February 2020. The perspective is of FyF emails that recommend a move towards foreign assets. Thus, the effects after an email with a recommendation to move away from foreign assets are multiplied by −1. Foreign exchange data is from Bloomberg. The figure does not adjust for overlapping events. Note that the bottom panel uses a different scale for the y-axis. Confidence bands based on robust standard errors are at the 95% level.

**Table 8**
Cross currency basis and FyF recommendations.

| Variables | $\Delta CCB1m$ (1) | $\Delta CCB1m$ (2) | $\Delta CCB1m$ (3) | $\Delta Fwd\,Prem$ (4) | $\Delta Fwd\,Prem$ (5) | $\Delta Rates$ (6) | $\Delta Rates$ (7) |
|---|---|---|---|---|---|---|---|
| RecDay 1 | −0.05 | −0.07 | −0.07 | −0.07 | −0.10 | 0.02** | 0.02** |
| | (0.09) | (0.08) | (0.08) | (0.09) | (0.08) | (0.01) | (0.01) |
| RecDay 2 | 0.04 | −0.02 | −0.02 | 0.02 | −0.05 | 0.02 | 0.02 |
| | (0.06) | (0.06) | (0.06) | (0.07) | (0.06) | (0.01) | (0.01) |
| RecDay 3 | −0.03 | −0.04 | −0.04 | −0.02 | −0.03 | −0.02 | −0.01 |
| | (0.07) | (0.08) | (0.08) | (0.07) | (0.08) | (0.01) | (0.02) |
| RecDay 4 | −0.18** | −0.18** | −0.18** | −0.18** | −0.19** | 0.01 | 0.01 |
| | (0.08) | (0.09) | (0.09) | (0.08) | (0.08) | (0.02) | (0.02) |
| RecDay 5 | −0.12** | −0.14** | −0.15*** | −0.12** | −0.14** | −0.00 | −0.01 |
| | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.02) | (0.02) |
| Sample | F 1m avail. | F 1m avail. | F 1m avail. | F 1m avail. | F 1m avail. | F 1m avail. | F 1m avail. |
| Controls | No | Yes | Yes | No | Yes | No | Yes |
| Avg EM $\Delta CCB$ | No | No | Yes | No | No | No | No |
| Observations | 2041 | 2041 | 2041 | 2041 | 2041 | 2041 | 2041 |
| R-squared | 0.056 | 0.131 | 0.137 | 0.057 | 0.146 | 0.009 | 0.024 |
| *Cumulative evidence* | | | | | | | |
| CUM [1–5] | −0.34** | −0.45*** | −0.46*** | −0.37** | −0.51*** | 0.03 | 0.03 |
| p-value | 0.04 | 0.01 | 0.01 | 0.02 | 0.00 | 0.32 | 0.38 |
| CUM [6–10] | −0.21 | −0.31* | −0.34* | −0.17 | −0.27 | −0.03 | −0.03 |
| p-value | 0.28 | 0.09 | 0.07 | 0.33 | 0.12 | 0.38 | 0.43 |

This table shows regressions for the change of the one-month cross-currency basis ($\Delta CCB1m$), the change of the forward premium ($\Delta Fwd\,Premium$), and the change of the spread between the one-month LIBOR rate and the local rate ($\Delta Rates$). The average change in the cross-currency basis of 17 emerging markets without counting Chile (Avg EM $\Delta CCB$) is included as a control in column (3). All of these variables are annualized. The rest of the table follows the style of Table 5. Robust standard errors are in parentheses.
*** p<0.01.
** p<0.05.
* p<0.1.

lower spot price than before the recommendation, and foreigners buy forward at a lower forward price than before the recommendation.

The CCB reflects the difference in premia across the two markets. We find that the CCB decreases due to the reduction in the forward premium. The forward price does not go as high as it should according to the CIP condition. Banks, due to their privileged position as intermediaries between both markets, are able to charge a larger premium to pension funds in the spot market than what they pay to foreigners in the forward market. The effects are symmetric when local banks buy spot from pension funds and sell forward to foreigners: the forward price

**Table 9**
Cross currency basis regressions in sub-samples.

| Sample | Buy Emails (1) | Sell Emails (2) | 2011–15 (3) | 2016–20 (4) | Q-end (5) | Not Q-end (6) | Free Float (7) |
|---|---|---|---|---|---|---|---|
| RecDay 1 | −0.09 | −0.04 | 0.08 | −0.28** | −0.04 | −0.07 | −0.07 |
| | (0.15) | (0.08) | (0.09) | (0.14) | (0.15) | (0.10) | (0.09) |
| RecDay 2 | −0.16* | 0.12 | −0.03 | 0.04 | 0.05 | −0.04 | −0.01 |
| | (0.09) | (0.08) | (0.09) | (0.08) | (0.18) | (0.06) | (0.07) |
| RecDay 3 | −0.10 | 0.05 | −0.02 | −0.07 | −0.00 | −0.04 | −0.10 |
| | (0.13) | (0.09) | (0.11) | (0.12) | (0.21) | (0.08) | (0.08) |
| RecDay 4 | −0.27* | −0.07 | −0.06 | −0.38** | −0.65*** | −0.09 | −0.20** |
| | (0.15) | (0.09) | (0.09) | (0.15) | (0.16) | (0.09) | (0.09) |
| RecDay 5 | −0.22** | −0.08 | −0.20*** | −0.01 | −0.28** | −0.12* | −0.16** |
| | (0.11) | (0.05) | (0.07) | (0.10) | (0.13) | (0.06) | (0.07) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1715 | 1741 | 1189 | 852 | 268 | 1773 | 1749 |
| R-squared | 0.141 | 0.155 | 0.206 | 0.077 | 0.211 | 0.138 | 0.157 |
| *Cumulative evidence* | | | | | | | |
| CUM [1–5] | −0.85*** | −0.03 | −0.22 | −0.70** | −0.92** | −0.36** | −0.54*** |
| p-value | 0.00 | 0.89 | 0.26 | 0.01 | 0.03 | 0.04 | 0.00 |
| CUM [6–10] | 0.20 | −0.73*** | −0.25 | −0.27 | 0.70 | −0.25 | −0.16 |
| p-value | 0.46 | 0.01 | 0.23 | 0.36 | 0.22 | 0.20 | 0.38 |

This table follows the style of Table 6 for changes of the one-month cross-currency basis as the dependent variable. Robust standard errors are in parentheses.
*** p<0.01.
** p<0.05.
* p<0.1.

does not decrease as much as the spot price (adjusted for rates). In both cases the forward premium moves in favor of local banks. Overall, the CCB is compensation for the intermediary role of banks between the spot and forward markets (see Borio et al. 2016, 2018, Liao and Zhang 2021, Du and Schreger 2022, Wallen 2022).[28]

In Table 9 we perform sample splits to study the heterogeneity of the CCB results. The five-day cumulative effect on the CCB is stronger after buy recommendations (−0.85%) than after sell recommendations (−0.03%). The effect after sell emails is delayed, as it is in the spot market (Table 6), which can be seen in the large effect for days 6–10 (−0.73%). Quick changes in the CCB after buy emails could be due to the fact that the banking system is systematically short of dollars, as implied by Fig. 3.

The impact of FyF's recommendations is more pronounced during the second half of our sample (2016–2020) than during the first half (2011–2015) (−0.70% vs. −0.22%), which is related to the increasing attention to FyF's recommendations over time. Furthermore, the impact is also stronger at the end of quarters (−0.92% vs. −0.36%), which points towards balance-sheet constraints of banks as one driver of the results (Du et al., 2018). Finally, column (7) shows that the results are robust to excluding periods when the Central Bank of Chile intervened in the foreign exchange market.

### 6.3. Intermediary capital

In Table 10 we explore the heterogeneity of our results to the risk-bearing capacity of the banking system. We identify periods when there is a decrease in the risk-weighted equity ratio of the banking system relative to the regulatory minimum (the "capital slack" of the system). As pointed out by He et al. (2017), and Du et al. (2023), this indicates a diminished ability and willingness of banks to absorb shocks. We can expect price effects to be larger when banks have less capital to intermediate.

**Table 10**
Cross currency basis regressions with banking interactions.

| Variables | $\Delta CCB1m$ (1) | $\Delta CCB3m$ (2) | $\Delta CCB6m$ (3) |
|---|---|---|---|
| RecDay [1–10] | −0.06 | −0.16 | −0.12 |
| | (0.31) | (0.15) | (0.12) |
| RecDay [1–10] * Decrease in Capital Slack | −1.21** | −0.52*** | −0.28* |
| | (0.50) | (0.20) | (0.17) |
| Decrease in Capital Slack | 0.01 | 0.00 | 0.00 |
| | (0.01) | (0.00) | (0.00) |
| Controls | Yes | Yes | Yes |
| Observations | 2004 | 2004 | 2004 |
| R-squared | 0.132 | 0.039 | 0.038 |

This table shows regressions in the style of Table 8 for changes of the cross-currency basis at one, three, and six months. The main independent variable (RecDay[1–10]) corresponds to the aggregation of $RecDay_\tau$ (see Eq. (3)) for the first ten days that follow an email from FyF. We divide this variable by 10, so the coefficient is the cumulative effect over the ten days. This variable is interacted with an indicator for days when bank capital slack decreased over 30 days in the previous month ($Decrease\,in\,Capital\,Slack$). Bank capital slack is defined as the difference between banking equity as a fraction of total assets and the regulatory limit for this ratio. Robust standard errors are in parentheses.
*** p<0.01.
** p<0.05.
* p<0.1.

We run a more compact version of our regression by combining the cumulative effect of the $RecDay_\tau$ variables into a single variable $RecDay[1-10]$. We then interact this cumulative variable with an indicator for decreases in the capital slack, which is lagged by 30 days. We find that the interaction of $RecDay[1-10]$ and the indicator for decreases in the capital slack is negative for all CCBs and larger in magnitude than the coefficient for $RecDay[1-10]$. The magnitude of the interaction coefficient is decreasing with the CCB horizon. The interaction is statistically significant for all horizons, showing that our results are stronger when banks experience a decrease in their capital slack.

[28] Underlying our interpretation is the assumption that other variables that could impact the CCB do not correlate with FyF recommendations. For example, an alternative scenario would be that some omitted variable drives both purchases of foreign currency and default risk. CCB movements would then represent a change in default risk. In Table A.7 in the Appendix we show that FyF recommendations do not correlate with the five-year Chilean Credit Default Swap (CDS) spread, which suggests that we are not capturing changes in default risk.

Our results are consistent with the idea that CIP deviations are related to limits to arbitrage (Shleifer and Vishny, 1997), and in particular to the limited capital of the local banking system. Price movements in the foreign exchange market are compensation for banks to be intermediaries, which is more challenging when they have less capital.

## 7. Conclusions

Taking advantage of large and frequent trading arising from uninformed fund flows in the Chilean pension system, we are able to quantify the impact of demand imbalances in the foreign exchange market. Our unique bank data sheds new light on the origins of covered interest rate parity violations. Local banks that provide liquidity to pension funds in the spot market subsequently hedge their exposure by taking offsetting positions in the forward market. This hedging demand, together with limits of arbitrage, result in deviations from covered interest rate parity (Du et al., 2018). Supporting the findings of He et al. (2017), and Du et al. (2023), we show that limits to arbitrage can arise from the risk bearing constraints of intermediaries. Overall, our unique setting and detailed data offer a rare opportunity to showcase the interaction between noise traders and financial intermediaries in the foreign exchange market.

## CRediT authorship contribution statement

**Felipe Aldunate:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Zhi Da:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Borja Larrain:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Clemens Sialm:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization.

## Declaration of competing interest

**Felipe Aldunate, ESE-Universidad de los Andes, Chile**

Felipe Aldunate is a board member at AFP UNO (a Chilean pension fund administrator) since April 2019. AFP UNO did not provide any support to this study whether financial or in-kind. This paper uses only publicly available data. AFP UNO had no rights to review or edit this research at any point before or after circulation, nor will it have such rights in the future. Felipe Aldunate acknowledges funding from research grant ANID/CONICYT FONDECYT Regular #1220012.

**Zhi Da, University of Notre Dame**

Zhi Da acknowledges the generous support from the ND-UC Chile Luksic Scholars Research Awards.

**Borja Larrain, PUC Chile**

Borja Larrain is academic advisor and board member at Larrain Vial (a Chilean investment bank). Larrain Vial is a family firm where two of Borja Larrain's brothers also serve as board members, and another brother is the CEO. Larrain Vial did not provide any support to this study whether financial or in-kind. This paper uses only publicly available data. Larrain Vial had no rights to review or edit this research at any point before or after circulation, nor will it have such rights in the future. Borja Larrain acknowledges funding from research grant ANID/CONICYT FONDECYT Regular #1220012 and ND-UC|Chile Luksic Scholars Research Awards.

**Clemens Sialm, University of Texas-Austin**

Clemens Sialm has been a consultant with AQR Capital Management and The Jeffrey Company. AQR and The Jeffrey Company did not provide any support to this study whether financial or in-kind. This paper uses only publicly available data. These two firms had no rights to review or edit this research at any point before or after circulation, nor will they have such rights in the future.

## Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jfineco.2025.104075.

## Data availability

Data and Code (Original data) (Mendeley Data)

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