Speculator Risk

Betting with Price Impact in Currency Markets*

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Preliminary

Abstract

The correlations of exchange rates with equity markets vary considerably over time. At the same time, currencies are popular targets for directional bets by speculators. These speculative positions tend to be highly levered and are commonly unwound when the market environment deteriorates. Currencies in which speculators hold long positions comove more positively with equity markets. This link emerges after the global financial crisis, when speculative positions have become more sensitive to equity market shocks. It does not exist for the positions of institutional investors, which are insensitive to such shocks.

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Market participants often label market environments with large price movements as "risk-off" or "risk-on". In a risk-off market, global equity markets, high yield bonds, and emerging market currencies suffer, while so-called safe-haven assets like US Treasuries, gold, or typically the Japanese yen gain along with the VIX and other measures of implied market volatility. Hedge funds and other speculators place levered directional bets in different asset markets. In currency futures markets, the counterparty to these bets is typically a large intermediary, which hedges the currency exposure from these futures positions in other markets. I find that, after the global financial crisis, hedge funds reduce the scale of their directional currency positions when the S&P 500 falls and the VIX rises, that is, when markets are hit by risk-off shocks. On the other side of the market, intermediaries scale down their hedges as they unwind the futures positions vis-à-vis the hedge funds.

A large empirical literature has linked the comovement of different asset classes to the role of financial intermediaries as marginal investors in different markets.[1] A second strand of literature following Kyle and Xiong (2001) has linked the comovement of different individual assets to their common ownership and the price impact of synchronous trades.[2] I provide evidence that a similar mechanism plays out in one of the most liquid markets we know: the currency market. At times when a given currency trade is particularly popular among speculators, its unwinding in a risk-off scenario may exert price pressure sufficient to move spot exchange rates. An asset that is held long as part of the bet experiences selling pressure and depreciates as a result, and vice versa for assets held short. As a result, assets held long become positively correlated with equity markets and other risky assets.

Consider the US dollar vis-à-vis the euro in 2014-2015, when many hedge funds were involved in a particular form of the carry trade, commonly referred to as the "divergence trade". This bet on diverging monetary policies between the Federal Reserve and the ECB involved a long position in the dollar against a short position in the euro. Over the course of 2015, the dollar—historically a typical safe haven asset—became positively correlated with equity markets. The euro started to behave like a "safe-haven" currency

[1] Following the theoretical work of He and Krishnamurthy (2013), recent empirical contributions include He et al. (2017), Haddad and Muir (2017), and Miranda-Agrippino and Rey (2019).

[2] Including, but not limited to, Barberis et al. (2005), Antón and Polk (2014), Gromb and Vayanos (2018), Kondor and Vayanos (2019), and Lou and Polk (2019).

relative to the US dollar, and this was commonly attributed to speculative flows out of the dollar and into the euro during particularly bad market times:

"Is the euro the new safe haven?"

(CNBC, August 2015)[3]

"The euro is looking like the yen—where money tends to come home when the world is a scary place"

(Société Générale, September 2015)

"The euro isn't a haven, but is acting like one because of its role in the carry trade. The distinction is important because it means the link will diminish as these positions, or shorts, are unwound."

(Pioneer Investments, September 2015)[4]

Currency futures are a particularly interesting setting to study the dynamics of speculative positions, because these markets are dominated by hedge funds on one side of the market and broker-dealers on the other, with weekly positions observable for both types of traders. Broker-dealers intermediate the speculators' demand for exposure to exchange rate movements and hedge the resulting futures positions in other markets. The net positions of the two groups are strongly negatively correlated and account for the vast majority of open interest in most USD currency futures.

To illustrate the logic of price impact in the spot market from changes in futures (or forward) positions, Figure 1 depicts the stylized chain of flows across the two different currency markets. In the example, an investor enters into an unhedged position in the futures market (long €, short \$). Since futures are in zero net-supply, the investor requires a counterparty, and if no other investor wants to take the opposite unhedged position, an intermediary will step in. The intermediary can then hedge its futures position (long \$, short €) with the opposite position in the spot market, thereby passing the futures market flow from the speculator's position directly on to the spot market, where this flow may have an impact on the spot exchange rate. The reverse flows occur when the speculator unwinds the original position. Price impact plausibly

[3]cnbc.com/2015/08/24/is-the-euro-the-new-safe-haven.html

[4]independent.ie/business/world/euro-is-gaining-safehaven-status-among-traders-at-worst-time-for-draghi-31559999.html

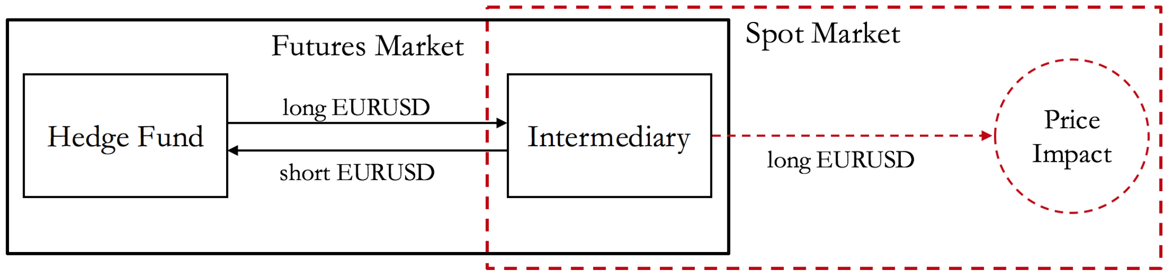

Figure 1: Trading flows across FX markets

depends on the size of the flows hitting the market at any point in time, and will be particularly large if many speculators are prompted to unwind similar positions at the same time. The choice of counterparty is important, since positions in zero net-supply derivatives with unhedged speculators on either side can be synchronously unwound without ever touching the spot market.

When do speculators unwind their positions involuntarily? The literature on the limits of arbitrage goes back to the contributions of Long et al. (1990), Shleifer and Vishny (1997), and Gromb and Vayanos (2002). While even a long-only position may be fire-sold due to fund outflows (Coval and Stafford, 2007), levered strategies are particularly exposed to the risk of deteriorating funding conditions and increasing margin requirements, and that this mechanism leads to asset comovement (e.g., Brunnermeier and Pedersen, 2009; Bian et al., 2017; Kahraman and Tookes, 2019). In Kyle and Xiong (2001), the unwinding is induced by a wealth effect from a fall in other asset prices. I document that in the period following the financial crisis, negative S&P returns and increases in the VIX are associated with unwinding of futures positions held by speculators and intermediaries across a sample of 9 currencies. This link does not exist for other institutional investors. In the post-crisis period, speculators' positions in these currencies predict stronger covariation with the S&P (more positive correlations and betas) and the VIX (more negative correlations) at weekly horizons. The positions of institutional investors, which make up a much smaller fraction of the futures market, have no such predictive power.

Inferring a link between the comovement of currencies with equity markets and the VIX to the unwinding of speculative positions suffers from an obvious endogeneity problem: if covariation with the S&P or VIX is (i) predictable and (ii) compensated with a risk-premium, one would expect risk-tolerant market participants to load up on this risk, and maybe hedge funds are more inclined to do so than other institutional investors. This is particularly plausible since Lilley and Rinaldi (2019) show that carry trades—while profitable before and after the financial crisis—have had a much larger equity beta afterwards. I find that interest differentials and speculator positions are uncorrelated; while both predict comovement with S&P and VIX, they do so in opposite directions: a currency's equity correlation falls after an increase in its interest rate vis-à-vis the dollar has made it more attractive to carry traders. Further, changes in equity betas and correlations do not predict changes in positions at the weekly level.

I further find that a trading strategy that buys (sells) currencies that hedge funds have just sold (bought) during a fall in equity markets is highly profitable. This result is consistent with the conjecture that forced unwinding has a transitory price impact on exchange rates. The strategy itself is exposed to equity market risk, that is, it works particularly well when a recovering equity market prevents *further* unwinding of speculative positions, thus allowing the previous price impact to revert. I outline this trading strategy in more detail in Subsection 2.3.

Related literature.—The price impact of intermediated cross-currency flows is consistent with the model of Gabaix and Maggiori (2015), where capital-constrained intermediaries are counterparty to a net cross-currency flow from investors and therefore bear exchange rate risk. In equilibrium, net cross-currency flows which require an intermediary counterparty, that is, are not "balanced" by an unhedged position in the other direction, have price impact.

My results relate closely to Cho (forthcoming), who finds that the cross-sectional equity strategies which are likely to be subject to heavy hedge fund trading comove with shocks to the leverage of the broker-dealers financing the hedge funds. In a similar vein, I find that hedge fund trading in a given currency relates to the exchange rate exposure to movements in equity markets and the VIX. Since currency futures positions are observable at a weekly frequency, this setting allows me to consider the link between hedge fund trading and asset comovement at shorter horizons. Rather than looking at quarterly broker-dealer leverage (Adrian et al., 2014), I consider the S&P 500 and the VIX and find that these two variables correlated strongly with the unwinding of speculative futures positions. Brunnermeier et al. (2008) note that increases in the VIX are associated with the unwinding of carry trade positions in currency futures and predict low carry trade returns. They also find that futures positions of "non-commercial traders" predict negative skewness in currency returns. Motivated by this observation, they link the crash risk in the carry trade to its profitability. My findings complement their study of speculation-driven currency risk along three dimensions.

Firstly, I separate speculative trading from the carry trade. While hedge funds are *on average* long the currencies of Australia and New Zealand, and short the yen, their positions have diverted from typical carry trades for substantial parts of the post-crisis period. Hedge funds are short AUD 34% of the time (24% for NZD) since the start of 2010. Over the same period, they were long the yen and, respectively, the Swiss franc 40% and 48% of the time. Across the panel, the correlation of weekly hedge fund positions and forward discounts is -0.13 (where a negative forward discount indicates a high interest rate). The largest carry trade after the crisis appears to be the euro-funded "divergence trade" with the US dollar as the investment currency. Other trades, such as in the Mexican peso or the British pound, appear to be driven by political events.

Secondly, my findings relate to currency risk in the sense of comovement with markets more broadly, rather than in the sense of skewness, which may well be idiosyncratic. Exposure to broad market risk has been considered an important element in pricing currencies, both in the form of consumption risk (Lustig and Verdelhan, 2007; Verdelhan, 2010; Burnside, 2011) and equity market risk (Campbell et al., 2010; Lustig et al., 2011; Lettau et al., 2014). Kremens and Martin (2019) show that long horizon *risk-neutral* currency-equity covariances predict long-horizon currency returns in a post-crisis sample. Lilley and Rinaldi (2019) highlight the rise in relevance of equity betas in currencies since the financial crisis. On the importance of market risk in relation to hedge fund strategies, Duarte et al. (2007) show that the returns to swap spread arbitrage predominantly constitute compensation for exposure to equity markets. I provide evidence that a short-horizon component of equity market risk in currencies arises endogenously from the unwinding of speculative positions.

Lastly, and perhaps less importantly, the CFTC reports the group of non-commercial traders separately as "Leveraged Funds" (i.e., hedge funds) and "Asset Managers" (i.e., institutional investors) after 2006. I find that out of those two subgroups, only hedge funds unwind positions with S&P drops / VIX increases, and that only their positions predict exchange rate comovement with those two indices. I describe the data in detail in the next section.

1 Data

I obtain currency futures positions from the U.S. Commodity Futures Trading Commission (CFTC) which reports weekly commitments of traders in financial futures traded on the Chicago Mercantile Exchange. The data span observations from June 2006 to June 2017 for USD futures and exchange rates versus 9 currencies: Australian dollar (AUD), Brazilian real (BRL), Canadian dollar (CAD), Swiss franc (CHF), euro (EUR), pound Sterling (GBP), Japanese yen (JPY), Mexican peso (MXN), and New Zealand dollar (NZD). Each exchange rate is expressed in terms of USD per unit of foreign currency, such that a positive net return reflects an appreciation of the respective currency against the US dollar. Traders are categorized by the CFTC into four groups:

1. "Dealer/Intermediary" (I will refer to these as *intermediaries*),
2. "Asset Manager/Institutional" (*institutional investors*),
3. "Leveraged Funds" (*hedge funds*),
4. "Other reportables" (*others*).

Group 1 includes large banks, which "typically [...] are dealers and intermediaries that earn commissions on selling financial products, capturing bid/offer spreads and otherwise accommodating clients."[5] The second group contains "institutional investors, including pension funds, endowments, insurance companies, mutual funds and those portfolio/investment managers whose clients are predominantly institutional." Group 3 includes hedge funds, and their strategies "involve taking outright positions". These traders "may be engaged in [...] conducting proprietary futures trading and trading on behalf of speculative clients." The final group (others), naturally, contains any remaining types of traders, which mostly use markets "to hedge business risk, whether that risk is related to foreign exchange, equities or interest rates, including [...] corporate treasuries, central banks, smaller banks, mortgage [and] credit unions".

I denote by $nhf_{i,t}$ the net exposure—long positions minus short positions—of *Leveraged Funds* (who I will refer to as hedge funds) to currency i versus the US dollar at time t. The net exposures of institutional investors and intermediaries are analogously

[5]The full CFTC explanatory notes are available at cftc.gov/idc/groups/public/@commitmentsoftraders/documents/file/tfmexplanatorynotes.pdf.

denoted by $nii_{i,t}$ and $ndi_{i,t}$, respectively. I will also use a scaled version of this variable, denoted by $\widetilde{nhf}_{i,t} = nhf_{i,t}/oi_{i,t}$ (and again analogously for nii and ndi), where $oi_{i,t}$ denotes the open interest in currency i reported by the CFTC. Table 1 reports all cross-correlations between the four groups. The positions of hedge funds and intermediaries are strongly negatively correlated ($\rho < -0.8$ for any of the variables), suggesting that intermediaries act as counterparties for the outright positions of hedge funds. In contrast, institutional investors appear to account for a substantially smaller part of intermediaries' positions with a correlation of -0.43.

Table 2 reports the average net position of all four groups by currency, along with the respective standard deviations and autocorrelations. Group 4 ("Others") is by far the one with the smallest and least volatile positions for most currencies. Hedge funds and intermediaries account for the majority of trading in most currencies, but institutional investors hold average positions of notable size in some currencies, such as GBP, JPY, and MXN. While the positions of all four groups are highly autocorrelated from week to week, they all exhibit a considerable amount of within-currency time-variation. The bottom three rows of each panel in Table 2 show that this time-series variation far outweighs the cross-sectional variation in the composition of the total panel variation. Figure 2 shows the scale and time-variation of each group visually (omitting group 4 to make the graph more readable). The graphs show time-variation in the direction of speculative trade: hedge funds change from being net long to net short several times over the sample period for all currencies.

2 Currency comovement with equity markets

Does the positioning of hedge funds in a given currency help describe time-series variations in currency betas? I run time-series regressions of daily currency returns on S&P returns and an interaction of S&P returns and the $\widetilde{nhf}$ variable, which captures the positioning of hedge funds scaled by open interest. Denote by $r_t^{S\&P} = S\&P_t/S\&P_{t-1} - 1$ the return on the index from day $t-1$ to day t. As $\widetilde{nhf}$ is only observed weekly, I use the last available observation prior to day t to interact with the daily return. Introducing some further notation, I will denote by $r_{i,t} = e_{i,t}/e_{i,t-1} - 1$, the net currency return i versus the US dollar from time $t-1$ to t. I then run the regressions

$$r_{i,t} = \alpha_i + \beta_i r_t^{S\&P} + \beta_i^* r_t^{S\&P} \cdot \widetilde{nhf}_{i,t} + \varepsilon_{i,t}. \tag{1}$$

The conventional beta is estimated as a time-invariant characteristic of each currency, but the coefficient β_i^* on the interaction term reflects time-variation in the beta that is related to the positioning of hedge funds in the currency. The sign of the positioning is reflected in $\widetilde{nhf}$. If unwinding by hedge funds leads to endogenous covariation with equity markets, β_i^* will therefore be positive even if the currency's fundamental beta is not. It is not clear a priori whether the magnitude of β_i^* would differ by currency under this explanation. I also estimate a *joint* coefficient β^* from a pooled regression.

Results are reported in Table 3: Over the full sample, β^* is positive for 6 out of 9 currencies and significantly so for 4 (CAD, CHF, JPY, NZD). While the pooled coefficient is positive, the null of $\beta_0^* = 0$ is not rejected at conventional levels with a p-value of 0.12. However, the effect predominantly occurs in the years following the financial crisis (2010-2017). In this post-crisis sample, $\hat{\beta}_i^*$ is positive for all currencies except GBP, and statistically significant for AUD, CAD, CHF, JPY, and NZD. The joint estimate $\hat{\beta}^*$ is positive at 0.186 and statistically significant at the 5% level. In each sample period, the standard market betas take signs consistent with conventional wisdom and previous literature on currency risk: all currencies are "risky" relative to the US dollar in terms of their positive covariance with equity markets, with the exception of the Japanese yen, which is commonly seen as a "safe haven" and has a significantly negative beta, and the Swiss franc, which is on-par with the US dollar in terms of its equity market risk exposure (zero beta).

These regressions decompose equity market risk into a baseline exposure, estimated like the conventional time-invariant beta, and an exposure that is (statistically) explained by hedge fund positioning. For instance, $\beta_€$ may be positive, but nonetheless, the euro may correlate negatively with equity markets in times when $\widetilde{nhf}_€$ is particularly negative—as during the "divergence trade" in 2014-2015—due to $\beta_€^* > 0$. It is worth noting that the association of currency-equity comovement with hedge fund positioning emerges particularly in the post-crisis sample from 2010 onwards.

2.1 Futures positions and equity market shocks

When do which traders unwind their positions? I divide realizations of market risk into "risk-off" (bad) and "risk-on" (good) shocks: Other than the S&P 500 as a headline equity market gauge, the VIX is a natural proxy for "risk-on" and "risk-off" movements in financial markets and Brunnermeier et al. (2008) show that VIX-increases are associated with smaller positions. Let $\Delta VIX_t = VIX_t - VIX_{t-1}$. The two weekly market risk measures, $r_t^{S\&P}$ and ΔVIX_t, are strongly negatively correlated with $\rho(r^{S\&P}, \Delta VIX) = -0.80$ over the full sample period.

To capture the asymmetric effects of positive and negative shocks, I define two truncated weekly S&P-return variables, $r_t^{S\&P+} = \max(0, r_t^{S\&P})$ and $r_t^{S\&P-} = \min(0, r_t^{S\&P})$. Similarly, $\Delta VIX_t^+ = \max(0, \Delta VIX_t)$ and $\Delta VIX_t^- = \min(0, \Delta VIX_t)$ denote the weekly truncated changes in the VIX. The risk-*off* proxies are $r^{S\&P-}$ and ΔVIX^+. To measure the unwinding of futures positions regardless of whether they were long or short, the dependent variables are the weekly changes in the absolute net exposures of the different trader groups, that is, $y_{i,t} = \{\Delta|ndi|, \Delta|nhf|, \Delta|nii|\}$.

$$y_{i,t} = \alpha_i + \eta r_t^{S\&P-} + \gamma r_t^{S\&P+} + \delta\, r_{i,t-1} + \varepsilon_{i,t} \tag{2}$$

$$y_{i,t} = \alpha_i + \eta \Delta VIX_t^+ + \gamma \Delta VIX_t^- + \delta\, r_{i,t-1} + \varepsilon_{i,t} \tag{3}$$

I report the results in Table 4 separately for the 2006-2009 period and for the post-crisis period (2010-2017). In the 2006-2009 period, hedge fund and intermediary positions are not significantly exposed to the "risk-off" shocks, $r^{S\&P-}$ and ΔVIX^+. The coefficient for negative S&P returns is negative (but lacks significance), indicating that positions *expand* over weeks with negative S&P returns.

For the post-crisis period, however, the positions of intermediaries and hedge funds *contract* with risk-off shocks, that is, with negative S&P returns and spikes in the VIX, and do so with statistical significance at conventional levels. The magnitudes of the effects are several times larger than during the earlier sample period. The discrepancies between the two periods line up with the above results for currency betas: unwinding is associated with risk-off shocks in the post-crisis period, when—as shown in Table 3—hedge fund positions help explain the time-variation in the equity market risk exposures of currencies.[6] This sensitivity to risk-off shocks is not present for institutional investors.

2.2 Realized betas are predictable

If the relationship between positioning and equity market exposure is the result of a direct mechanism, realized exposures should be predictable using hedge fund positions. I define the following variables measuring the comovement of currency i with equity markets over the week following the observed positioning at date t: $\rho^{SPX}_{i,t\to t+1}$, the correlation of daily exchange rate movements with daily S&P 500 returns; $\beta^{MKT}_{i,t\to t+1} = \frac{\rho^{SPX}_{i,t\to t+1}\sigma_{i,t\to t+1}}{\sigma^{SPX}_{t\to t+1}}$, the beta of daily exchange rate movements with respect to the S&P 500; and $\rho^{VIX}_{i,t\to t+1}$, the correlation of daily exchange rate movements with daily VIX changes between t and $t+1$. Table 5 reports the averages, standard deviations, and autocorrelations of these variables by currency. At the weekly horizon, the average autocorrelations are low at 0.24, 0.11, and 0.19, respectively.[7] To test the predictive power of futures positions for these beta measures of a currency's equity market risk exposure, I run the forecasting regressions, controlling for interest rates (forward discounts) and lagged returns.

$$\Delta y_{i,t\to t+1} = \alpha + \eta\, \Delta\widetilde{nhf}_{i,t} + \delta\, r_{i,t} + \phi\, \Delta f d^{w}_{i,t} + \varepsilon_{i,t+1}, \tag{4}$$

where $y_{i,t\to t+1} = \{\rho^{SPX}_{i,t\to t+1}, \beta^{MKT}_{i,t\to t+1}, \rho^{VIX}_{i,t\to t+1}\}$. Results are reported in Table 6 for the two subsamples 2006-2009 and 2010-2017 (right panels). The hedge fund positioning is a significant and positive predictor of weekly equity market risk as captured by all three measures: currencies that are heavily bought by hedge funds in the futures market, have higher correlations and betas with the S&P 500 over the subsequent week, but the more negative correlations with the VIX fall just short of the 10% significance level. None of these relationships is present in the earlier sample period, when—recalling Table 4—hedge fund and intermediary positions are largely invariant to equity market shocks. The result holds within-currency (with currency fixed effects, shown in Panel

[6] Futures positions are not available for BRL in the 2006-2009 sample. The results for the 2010-2017 period do not change materially once BRL is dropped from the sample.

[7] Computing the beta variables over a time horizon as short as one week with daily data inevitably renders these measures noisy. I choose the weekly horizon in order to avoid overlapping observations and make better use of the weekly futures data, rather than, for instance, forecast monthly correlations.

A) and across currencies (Panel B).

In the post-crisis period, changes in interest rates also predict risk exposures, but with a somewhat surprising sign: a negative forward discount reflects a high interest rate relative to the dollar. An increase in the foreign interest rate predicts a lower equity market exposure. This result and its absence prior to 2010 are broadly consistent with the findings of Lilley and Rinaldi (2019). It does not, however, impact the performance of futures positions. Forward discounts and hedge fund positions are essentially uncorrelated in the panel and within each currency, and the results do not change materially without forward discounts on the right-hand side.

On average, a unit change in $\widetilde{nhf}$ (around three standard deviations for the average currency) is associated with an increase in the currency's exposure to the S&P by 0.33 (beta) to 0.37 (correlation), close to the magnitude of the unconditional exposures for the most exposed currencies (around -0.3 for the yen and 0.3 to 0.4 for AUD, BRL, MXN, and NZD). The magnitudes are similar (with the opposite sign) for VIX-exposures, but lack statistical significance.

As a "placebo" test, I predict equity market exposures using the positions of institutional investors. Unlike hedge funds, institutional investors do not unwind positions with risk-off shocks. As shown in Table 7, their positions do not predict currency risk exposures.

2.3 A contrarian trading strategy

I now construct a trading strategy as a test of the economic significance of the link between equity market returns and the unwinding of futures positions by hedge funds. The strategy is implementable in real time, rebalanced weekly, and designed to exploit any potential temporary price dislocations which may result from such unwinding. The strategy is active following weeks of poor S&P returns, in the opposite direction of changes in hedge fund positioning over that week.

Specifically, the strategy takes positions at time t if $r_t^{S\&P} < x$, that is, if the S&P return over the week between $t-1$ and t is below a certain threshold x. It then takes a position in currency i against the dollar if two conditions are jointly satisfied: (i) hedge funds have reduced their positions in currency i, $|nhf_{i,t}| < |nhf_{i,t-1}|$, and (ii) currency i has moved in the direction of the change in the net hedge fund position, that is, sign($r_{i,t}$) = sign($\Delta nhf_{i,t}$). The first condition identifies unwinding, while the second seeks to separate plausibly flow-induced currency movements from fundamental news.

I formulate two versions of this strategy. In the *contract-weighted* version of this strategy, the positions taken in different currencies in any given week are scaled to be proportional in size to the change in hedge fund positions: Let $\Omega_{i,t}^{CW}$ denote the strategy's number of futures contracts in currency i against the dollar at time t:

$$\Omega_{i,t}^{CW} = \frac{\omega_{i,t}^{CW}}{\sum_j |\omega_{j,t}^{CW}| e_{j,t} n_j}, \text{ and } \omega_{i,t}^{CW} = -\Delta nhf_{i,t}\ \mathbb{1}_{\{r_t^{S\&P}<x\}}\ \mathbb{1}_{\{\Delta|nhf|_{i,t}<0\}}\ \mathbb{1}_{\{s(\Delta nhf_{i,t})=s(r_{i,t})\}}$$

where $\mathbb{1}_{\{\cdot\}}$ is the indicator function which takes value 1 if $\cdot$ is true, and 0 otherwise, and $s(\cdot)$ is the sign function. Given the exchange rate $e_{i,t}$ and contract size n_i in units of foreign currency, $e_{i,t}n_i$ expresses the dollar notional of each contract and the denominator therefore scales the positions to ensure that the gross notional of the total position is constant through time at \$1.

The *equal-weighted* version of the strategy fixes the dollar notional of each individual position, such that all non-zero positions taken at any point in time have the same absolute dollar exposure. Denote by $\Omega_{i,t}^{EW}$ the dollar notional amount in futures contracts of currency i against the dollar, then

$$\Omega_{i,t}^{EW} = \frac{\omega_{i,t}^{EW}}{\sum_j |\omega_{j,t}^{EW}|}, \text{ and } \omega_{i,t}^{EW} = -s(\Delta nhf_{i,t})\ \mathbb{1}_{\{r_t^{S\&P}<x\}}\ \mathbb{1}_{\{\Delta|nhf|_{i,t}<0\}}\ \mathbb{1}_{\{s(\Delta nhf_{i,t})=s(r_{i,t})\}}.$$

Table 8 reports the key return characteristics of this strategy for the threshold levels $x = 0$, $x = -3\%$, and no threshold at all. Figure 3 plots the cumulative returns since 2010. Since the strategy relies on a negative previous S&P return, it is only active in a subset of the weeks in the sample from January 2010 until June 2017. For the zero-threshold, this subset includes 138 out of 389 weeks in the sample. The strategy enters positions based on 1-week forward exchange rates (obtained from Bloomberg), and accounts for transaction costs by implementing long (short) positions at the ask (bid) price. Measuring performance over the active weeks, both versions of the strategy are economically profitable, with unlevered mean returns of 12bps (contract-weighted) and 15bps (equal-weighted) per week and annualized Sharpe ratios of 0.74 and 0.97, respectively. Over those 138 weeks, the strategy achieves a cumulative unlevered return of 17.22% (contract-weighted) and 22.29% (equal-weighted).

Under a stricter conditioning rule, where the strategy only becomes active if the previous week's S&P return was below -3%, the strategy only trades in 18 weeks, average returns rise to, respectively, 38bps and 35bps per week, and the annualized Sharpe ratios rise to 2.06 and 1.97, respectively.[8] For comparison, the unconditional strategy—which takes FX positions in the opposite direction of previous hedge fund flows irrespective of whether or not these flows occurred in a deteriorating market environment—yields weekly excess returns close to 0, with Sharpe ratios of only 0.23 and 0.04, respectively. This comparison suggests, that hedge fund flows are only associated with temporary price dislocations that revert quickly (within the next week), when these flows occur during times, when risky assets sell off.

3 Empirical concerns

Is this strong relationship between hedge fund positioning and market risk exposures really driven by the price impact of unwinding positions in "risk-off" states, when equity markets are down? For instance, one might expect hedge fund positions to reflect unobservable signals about conditional risk premia. If these risk premia are related to market risk, positions would predict betas, not because one is driving the other but because both are driven by underlying fundamental risk profiles. Given the size of the futures market relative to total FX trading, another important question is whether futures positions are a relevant measure of the overall positioning of different groups of market participants. This section tries to address these questions in turn, starting with the latter.

3.1 Flows and returns

For hedge fund positions to be the driver of time-varying currency betas, the unwinding of these positions must have price impact. An important concern when looking at futures data is that the futures market covers only a small fraction of currency trading; most trades are done over-the-counter in the forward market and will therefore not be reported to the CFTC. Nonetheless, the futures data are the best publicly available indication of the overall positioning of market participants, and it is unclear why and

[8] Accounting for all inactive periods in the annualization, Sharpe ratios range from 0.42 to 0.58.

how positioning in the forward market would differ systematically from that in the futures market. Accordingly, the direction of any potential bias in the empirical results is unclear. As empirical support for the relevance of the futures data, I can test whether exchange rates move with the hedge fund positions in the futures market.

Price impact implies a systematic contemporaneous association between changes in the positions of traders (i.e., portfolio flows of hedge funds) and exchange rate movements. I regress net currency movements, $r_{i,t} = e_{i,t}/e_{i,t-1} - 1$, on the changes in nhf and $\widetilde{nhf}$. This first set of regressions merely serves as a simple test of whether or not the futures data are consistent with this prediction. A lack of contemporaneous association between flows and returns would cast doubt on the interpretation of the link between currency betas and futures positions. For each currency, I run

$$r_{i,t} = \alpha_i + \eta_i \Delta nhf_{i,t} + \gamma_i \Delta nii_{i,t} + \varepsilon_{i,t} \tag{5}$$

$$r_{i,t} = \alpha_i + \eta_i \Delta \widetilde{nhf}_{i,t} + \gamma_i \Delta \widetilde{nii}_{i,t} + \varepsilon_{i,t}, \tag{6}$$

where $\Delta nhf_{i,t} = nhf_{i,t} - nhf_{i,t-1}$ is the week-on-week change in the net long position of "Leveraged Funds" in currency i versus the US dollar (similarly for the scaled variable $\widetilde{nhf}$). The results are reported in Table 9: for both regressions the estimates for η_i are positive and significant at 1% for all currencies. The statistical significance of this result is slightly less pervasive for institutional investors, where most estimates, $\hat{\gamma}_i$, are positive, but only significant for 5 out of 9 currencies at conventional confidence levels. The observable futures data are therefore consistent with price impact from hedge fund portfolio flows. Yet, the results from these contemporaneous regressions are equally consistent with the reverse interpretation that investor positions "chase" returns rather than "driving" them, as long as the within-week returns precede the unobservable within-week flows. The result does not present evidence of causality but is meant to provide a sense-check of the futures data as these are used as a proxy for the unobservable OTC positions, which make up the majority of total FX trading.

3.2 Anticipation of risk premia

The second empirical concern in this setting is the endogeneity of positions. Do positions predict betas because unwinding has price impact, or do the anticipated betas lead hedge funds to position themselves in the way they do? The question boils down to whether the weekly variations in *fundamental* currency correlations with equity markets and the VIX are predictable by hedge funds when they choose their positions.

Risk exposures do not predict hedge fund positions.—I repeat the forecasting regressions from Subsection 2.2 but using changes in equity market exposures to predict changes in hedge fund positioning. Table 10 shows that the forecasting relationship does not hold in reverse: much to the contrary, the S&P-correlations and betas *negatively* predict futures positions, while more positive VIX correlations predict long hedge fund positions—the exact opposite of the forecasting power of positions for correlations. Given that the comovement variables are positively autocorrelated, albeit weakly, this is inconsistent with the alternative explanation that speculators extrapolate risk exposures and enter positions to collect risk premia. The two variables that strongly predict hedge fund positioning are forward discounts and past returns. Hedge funds buy currencies that have appreciated and in which interest rates have risen relative to the dollar. However, as seen in Table 6, returns are weak predictors of correlations, and higher interest rates predict lower equity market exposures. Consequently, hedge funds do not predict risk exposures and risk premia based on these two variables, either.

Beta predictability is not driven by scheduled FOMC announcements.—There are, however, instances in which risk premia (and potentially also currency betas) may reasonably be predictable, even at a weekly horizon, and not based on observable fundamentals such as lagged risk exposures or forward discounts. One such predictable premium may stem from the exposure to scheduled FOMC announcements. Savor and Wilson (2014) and Mueller et al. (2017) find that these announcements are accompanied by substantial excess returns of foreign currencies against the US dollar, and interpret these returns as compensation for monetary policy uncertainty. To test whether the results reported so far are driven by a strong relationship between hedge fund positioning and realized currency betas around a scheduled FOMC announcement, I consider those weeks separately from non-announcement weeks. Table 11 shows the results for Regression (4) splitting the sample into FOMC announcement weeks and non-announcement weeks. The results show up only during non-announcement weeks, showing that scheduled announcement risk is not responsible for the headline results of this paper. I now provide some additional results in an attempt to further pin down the mechanism.

4 Inspecting the mechanism: silence of the dogs

What exactly drives the predictability of currency-equity comovement by hedge fund positioning? This section attempts to further pin down the mechanism by going through different possible explanations and providing additional results on each one.

Have positions become more vulnerable post-crisis?—The asset pricing literature has identified a number of new phenomena since the financial crisis, including large deviations from covered interest parity (see e.g., Du et al., 2018). Table 4 shows that hedge fund and intermediary positions do not unwind with bad equity market realizations during 2006-2009. It is conceivable that the market environment for leveraged positions has become more fickle in the post-crisis world. However, there are periods prior to the crisis where the unwinding result shows up: this non-result in Table 4 is driven by the crisis years 2008 and 2009. Over 2006 and 2007, hedge fund and intermediary positions both unwind significantly with negative S&P shocks (though, not with VIX increases). Yet, hedge fund positions do not predict currency-equity comovement during those years. Unwinding associated with equity-market shocks did not transmit to exchange rates pre-crisis, but has done so since 2010.

Wealth or margins?—Unwinding could be triggered by tightening margin conditions (Brunnermeier et al., 2008; Brunnermeier and Pedersen, 2009), or wealth effects à la Kyle and Xiong (2001). Unwinding and predictability results are both stronger for the S&P than for the VIX as a risk-off proxy. Results are comparable for an index of financial stocks instead of the S&P (weekly index returns have a correlation coefficient of 0.88, slightly stronger than between each index and the VIX). While speculator and intermediary wealth are likely to be closely related to funding conditions and leverage availability in equilibrium, the two factors are worth considering separately. For instance, regulatory leverage constraints imply that intermediary wealth plays a key role for equilibrium leverage availability, independently from other factors such as conditional volatility. Since equilibrium margins are likely a function of conditional risk, Brunnermeier et al. (2008) interpret the VIX as a proxy for funding conditions. The differential results for measures of intermediary wealth and implied volatility suggest that balance sheet considerations play a more important role than variation in the leverage capacity of a given dollar of trader equity.

Have hedge fund positions become more concentrated?—If speculators' bets have become more coordinated, we might expect them to have more price impact when they unwind. However, net exposures have of hedge funds have become smaller relative to gross positioning. While in 2006-2007, the average net exposure amounts to 62% of gross speculator positions, this number falls to 41% in 2010-2017. Speculators more frequently bet directly against each other, thus requiring less intermediation pushing price impact into the spot market. Speculator positions also make up a smaller fraction of the overall market in the post-crisis period: the average absolute value of $\widetilde{nhf}$ is lower in the 2010-2017 period at 0.25 than in 2006-2007 (0.34), and this reduction occurs across all sample currencies. The reduced reliance on intermediation also translates into a slightly weaker correlation between speculator and intermediary positioning: the correlation between weekly changes in $\widetilde{nhf}$ and $\widetilde{ndi}$ drops from -0.94 in 2006-2007 to -0.80 in the 2010-2017 period.

Unwinding with equity market shocks is not purely a post-crisis phenomenon, and hedge fund trading does not appear to have changed in a way that would rationalize an increased transmission of unwinding into exchange rates. None of the above results provide damning evidence in favor of the respective candidate explanation. Recalling the schematic flow diagram in Figure 1, however, a key link in the endogenous risk story is that the counterparties of speculators hedge their futures exposure, thereby transmiting speculator positioning to the spot market. This hedging behavior is difficult to observe, so a direct test of this hypothesis remains elusive. Yet, it is conceivable that the crucial difference of the post-crisis period is an increase in hedging by the intermediaries on the other side of a speculative futures position. Unlike for Cochrane (2008) or Sherlock Holmes, the list of explanations is not collectively exhaustive and the canine testimony therefore does not convict by omission.

5 Concluding remarks

This paper documents a close link between the positioning of leveraged market participants and currency betas since the financial crisis. A currency is more exposed to movements in the S&P when hedge funds hold long positions in that currency. Hedge fund positions in the futures market, which are observable at weekly frequencies, predict realized exposures over the subsequent week, both in the cross section and within-currency. At the same time, the size of open positions held by hedge funds and intermediaries, decreases following a negative shock to the S&P. The positions of institutional investors do not show a similar vulnerability, nor do they forecast currency-equity comovement.

Speculative positions do not appear to be driven by a currency's conditional equity market risk: predictable comovement is not a result of scheduled FOMC announcements, nor does realized comovement predict hedge fund positioning. The predictability result emerges after the financial crisis, and this finding is consistent with the interpretation that the intermediaries acting as counterparties to speculators transmit hedge fund positioning to the spot market by hedging their futures exposures. When speculators and intermediaries unwind their futures positions following adverse equity market shocks, currency spot markets fail to absorb the resulting flows, and unwinding has price impact. As a result, currencies involved in speculative trading become endogenously exposed to equity market risk.

I design a trading strategy to exploit the temporary price dislocations in currency markets associated with unwinding hedge fund positions. The strategy provides liquidity by trading in the opposite direction of the unwinding. It is highly economically attractive with an annualized Sharpe ratio of up to 2.

The recent emergence of the link between currency-equity comovement and hedge fund positions is in line with a broad literature in asset pricing on post-crisis phenomena in financial markets (e.g., Du et al., 2018; Lilley and Rinaldi, 2019). I do not find evidence that it is driven by a more prominent role of speculators in the futures market since 2010. I cannot rule out that it is instead driven by stronger transmission channel between futures and spot markets, based on an increase in intermediary hedging across the two markets. I intend to further pursue this hypothesis going forward.

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A Tables and Figures

Table 1: Correlations of futures positions

This table reports the correlations of net positions of different trader groups, measured in contracts (shown in the left panel), and percentage of open interest (right panel).

	ndi	nhf	nii	no	$\widetilde{ndi}$	$\widetilde{nhf}$	$\widetilde{nii}$	$\widetilde{no}$	
Net positions									
ndi	1				1				$\widetilde{ndi}$
nhf	-0.881	1			-0.869	1			$\widetilde{nhf}$
nii	-0.427	0.042	1		-0.372	0.021	1		$\widetilde{nii}$
no	0.137	-0.325	-0.113	1	-0.108	-0.161	-0.052	1	$\widetilde{no}$
Weekly changes in net positions									
ndi	1				1				$\widetilde{ndi}$
nhf	-0.870	1			-0.839	1			$\widetilde{nhf}$
nii	-0.214	-0.109	1		-0.189	-0.140	1		$\widetilde{nii}$
no	-0.145	-0.125	-0.064	1	0.107	-0.107	-0.030	1	$\widetilde{no}$

Table 2: Summary statistics of futures positions

This table reports the means, standard deviations, and autocorrelations of net positions, in thousands of contracts (unscaled, Panel A) and shares of open interest (Panel B), of intermediaries ($ndi/\widetilde{ndi}$), hedge funds ($nhf/\widetilde{nhf}$), institutional investors ($nii/\widetilde{nii}$), and others ($no/\widetilde{no}$). The bottom three rows of each panel report, respectively, the average time-series standard deviation (averaged across currencies), the cross-sectional standard-deviation of the within-currency means, and the total panel standard deviation.

Panel A: Unscaled	$\mu(ndi)$	$\mu(nhf)$	$\mu(nii)$	$\mu(no)$	$\sigma(ndi)$	$\sigma(nhf)$	$\sigma(nii)$	$\sigma(no)$	$\rho(ndi)$	$\rho(nhf)$	$\rho(nii)$	$\rho(no)$
AUD	-16.32	24.17	-7.29	-4.27	62.29	36.81	19.31	9.30	0.98	0.96	0.99	0.96
BRL	-7.64	5.00	2.44	0.02	13.91	7.32	2.79	11.15	0.96	0.94	0.98	0.96
CAD	-11.94	-2.95	2.58	6.17	48.37	35.72	12.97	6.80	0.97	0.97	0.98	0.91
CHF	5.74	-4.08	-0.63	0.47	22.91	15.50	1.10	2.86	0.94	0.91	0.87	0.91
EUR	27.16	-27.61	-2.25	9.48	82.10	62.41	25.45	17.69	0.98	0.98	0.98	0.93
GBP	25.93	8.42	-24.52	-7.08	72.64	48.09	25.48	10.50	0.98	0.97	0.99	0.94
JPY	19.44	-20.98	10.29	3.14	63.90	52.32	23.39	18.13	0.96	0.96	0.99	0.95
MXN	-32.75	14.71	18.78	-2.39	44.68	47.76	17.06	5.39	0.96	0.96	0.90	0.92
NZD	-5.93	7.93	-2.32	-0.30	11.75	9.37	5.90	1.35	0.97	0.96	0.99	0.89
Time-series	0.41	0.51	-0.32	0.58	46.95	35.03	14.83	9.24	0.97	0.96	0.96	0.93
Cross section					20.60	16.52	11.92	5.11				
Pooled					57.93	43.97	21.31	12.00				

Panel B: Scaled	$\mu(\widetilde{ndi})$	$\mu(\widetilde{nhf})$	$\mu(\widetilde{nii})$	$\mu(\widetilde{no})$	$\sigma(\widetilde{ndi})$	$\sigma(\widetilde{nhf})$	$\sigma(\widetilde{nii})$	$\sigma(\widetilde{no})$	$\rho(\widetilde{ndi})$	$\rho(\widetilde{nhf})$	$\rho(\widetilde{nii})$	$\rho(\widetilde{no})$
AUD	-0.18	0.21	-0.05	-0.03	0.49	0.29	0.14	0.08	0.98	0.96	0.97	0.94
BRL	-0.19	0.16	0.09	-0.07	0.44	0.25	0.11	0.29	0.96	0.94	0.96	0.96
CAD	-0.12	-0.02	0.03	0.05	0.36	0.26	0.11	0.06	0.97	0.96	0.97	0.91
CHF	0.08	-0.05	-0.01	0.01	0.38	0.24	0.02	0.07	0.94	0.91	0.86	0.93
EUR	0.04	-0.06	-0.01	0.03	0.30	0.21	0.08	0.05	0.97	0.96	0.97	0.91
GBP	0.14	0.07	-0.14	-0.05	0.40	0.27	0.13	0.07	0.97	0.96	0.97	0.94
JPY	0.04	-0.06	0.08	0.01	0.35	0.26	0.15	0.10	0.96	0.96	0.98	0.94
MXN	-0.26	0.12	0.14	-0.02	0.34	0.37	0.11	0.05	0.95	0.95	0.88	0.91
NZD	-0.22	0.26	-0.06	-0.01	0.41	0.30	0.15	0.05	0.97	0.96	0.97	0.87
Time-series	-0.07	0.07	0.01	-0.01	0.38	0.27	0.11	0.09	0.97	0.95	0.95	0.92
Cross section					0.15	0.13	0.09	0.04				
Pooled					0.41	0.30	0.14	0.10				

Table 3: The interaction of futures bets and currency betas

This table reports the estimates ant t-statistics for time-series regressions of daily currency returns on S&P 500 returns and its interaction with the relative positioning of hedge funds $(\widetilde{nhf})$.

$$r_{i,t} = \alpha_i + \beta_i r_t^{S\&P} + \beta_i^* r_t^{S\&P} \cdot \widetilde{nhf}_{i,t-1} + \varepsilon_{i,t}, \tag{1}$$

where $r_{i,t}$ and $r_t^{S\&P}$ denote the currency return of currency i and the return on the S&P 500 from day $t-1$ to day t, respectively. The last column shows the estimate of β^* obtained from the pooled regression. The standard errors for the pooled regression are clustered at the currency level.

	AUD	**BRL**	**CAD**	**CHF**	**EUR**	**GBP**	**JPY**	**MXN**	**NZD**	**pooled**
Panel A: Full sample: 2006 - 2017										
α_i	-0.013	-0.056	-0.015	0.009	-0.007	-0.017	0.013	-0.028	-0.008	
	(-0.98)	(-2.18)	(-1.58)	(0.64)	(-0.64)	(-1.50)	(1.14)	(-2.31)	(-0.60)	
β_i	0.421	0.388	0.302	0.017	0.129	0.142	-0.244	0.389	0.371	
	(15.07)	(11.60)	(25.55)	(0.91)	(10.22)	(10.56)	(-16.86)	(20.36)	(23.50)	
β_i^*	0.028	0.009	0.268	0.211	-0.068	-0.074	0.300	-0.067	0.132	0.082
	(0.35)	(0.06)	(6.25)	(2.74)	(-0.96)	(-1.64)	(5.31)	(-1.74)	(3.31)	(1.73)
R^2 in %	35.76	11.21	33.56	0.61	7.23	8.83	18.34	35.56	29.27	21.50
Obs.	2,864	1,334	2,864	2,864	2,864	2,864	2,864	2,864	2,864	24,232
Panel B: Pre-Crisis / Crisis: 2006 - 2009										
α_i	0.025		0.005	0.020	0.017	-0.012	0.028	-0.013	0.015	
	(0.83)		(0.23)	(0.84)	(0.78)	(-0.53)	(1.30)	(-0.60)	(0.51)	
β_i	0.430		0.270	0.001	0.108	0.125	-0.255	0.338	0.383	
	(11.56)		(15.45)	(0.03)	(6.21)	(7.03)	(-12.05)	(11.33)	(19.18)	
β_i^*	-0.140		0.190	0.143	-0.050	-0.047	0.125	-0.110	0.111	0.012
	(-1.18)		(2.84)	(1.87)	(-0.39)	(-0.70)	(1.41)	(-2.20)	(1.99)	(0.22)
R^2 in %	39.64		31.32	0.78	7.79	9.59	28.30	41.70	35.11	28.47
Obs.	923		923	923	923	923	923	923	923	7,370
Panel C: Post-Crisis: 2010 - 2017										
α_i	-0.029	-0.056	-0.026	0.005	-0.021	-0.020	0.003	-0.039	-0.017	
	(-2.18)	(-2.17)	(-2.73)	(0.24)	(-1.57)	(-1.64)	(0.21)	(-2.75)	(-1.16)	
β_i	0.378	0.388	0.347	0.027	0.194	0.172	-0.195	0.473	0.317	
	(17.75)	(11.60)	(28.09)	(0.89)	(8.40)	(8.37)	(-10.48)	(25.18)	(10.23)	
β_i^*	0.274	0.009	0.319	0.266	0.123	-0.123	0.462	0.013	0.251	0.186
	(4.59)	(0.06)	(6.58)	(1.85)	(1.18)	(-2.23)	(6.35)	(0.27)	(3.54)	(2.79)
R^2 in %	32.41	11.21	37.09	0.63	7.66	8.74	12.39	33.85	23.83	17.72
Obs.	1,940	1,334	1,940	1,940	1,940	1,940	1,940	1,940	1,940	16,854

Table 4: Futures positions and equity market risk

This table reports the results for pooled panel regressions of changes in the absolute size of futures positions by each trader group on contemporaneous shocks to "risk-on" and "risk-off" shocks, represented by the S&P 500 and the VIX. Negative (positive) changes in the size of futures positions ($\Delta|ndi|$, $\Delta|nhf|$, and $\Delta|nii|$) reflect contractions (expansions) of the outstanding bets of each trader group. To measure asymmetric shocks to the market risk-taking environment, I define $r_t^{S\&P^+} = [r_t^{S\&P}]^+$, $r_t^{S\&P^-} = [r_t^{S\&P}]^-$, $\Delta VIX^+ = [\Delta VIX_t]^+$, and $\Delta VIX^- = [\Delta VIX_t]^-$ (note that $r^{S\&P^-}$ and ΔVIX^+ represent the "risk-off" shock proxies). I then run the following contemporaneous regressions.

$$y_{i,t} = \alpha_i + \eta r_t^{S\&P^-} + \gamma r_t^{S\&P^+} + \delta\, r_{i,t-1} + \varepsilon_{i,t} \tag{2}$$

$$y_{i,t} = \alpha_i + \eta \Delta VIX_t^+ + \gamma \Delta VIX_t^- + \delta\, r_{i,t-1} + \varepsilon_{i,t}, \tag{3}$$

for $y_{i,t} = \{\Delta|ndi|, \Delta|nhf|, \Delta|nii|\}$, and where $r_{i,t}$ denotes the currency return of currency i from week $t-1$ to week t. Standard errors are clustered at the currency level and t-statistics reported in parentheses.

	Pre-Crisis / Crisis: 2006 - 2009						*Post-Crisis: 2010 - 2017*					
	Intermediaries		Hedge Funds		Asset Managers		Intermediaries		Hedge Funds		Asset Managers	
$r^{S\&P^-}$	-13.67		-8.25		2.67		70.91		35.30		-16.57	
	(-0.81)		(-0.60)		(1.01)		(2.31)		(1.99)		(-1.33)	
$r^{S\&P^+}$	1.63		11.07		-12.15		38.02		15.84		1.60	
	(0.12)		(0.83)		(-1.45)		(2.24)		(0.85)		(0.13)	
ΔVIX^+		-4.86		-10.88		5.40		-56.41		-23.10		12.95
		(-0.38)		(-0.90)		(1.88)		(-2.28)		(-1.96)		(1.13)
ΔVIX^-		33.86		22.57		0.42		-4.13		11.08		-1.80
		(3.83)		(2.29)		(0.12)		(-0.30)		(1.01)		(-0.23)
$r_{i,t-1}$	111.60	117.55	73.07	76.88	-8.00	-7.92	-45.67	-39.23	-8.25	-0.47	-8.00	-8.17
	(2.53)	(2.49)	(1.69)	(1.75)	(-3.38)	(-3.01)	(-1.09)	(-0.92)	(-0.23)	(-0.01)	(-0.72)	(-0.75)
R^2 in (%)	2.27	2.59	1.42	1.63	0.94	0.78	0.94	0.94	0.28	0.20	0.36	0.46
Currencies	8	8	8	8	8	8	9	9	9	9	9	9
Obs.	1,476	1,476	1,476	1,476	1,476	1,476	3,354	3,354	3,354	3,354	3,354	3,354

Table 5: Summary statistics of short-run currency comovement with equity markets

This table reports the mean, standard deviation, and autocorrelation of currency betas, $\beta^{MKT}_{i,t\to t+1}$, and correlations with the S&P 500 and the VIX, $\rho^{SPX}_{i,t\to t+1}$ and $\rho^{VIX}_{i,t\to t+1}$, respectively. The correlations and betas are computed using closing prices for the 5 trading days following date t to result in weekly observations over the full sample from January 2006 to June 2017.

	ρ^{SPX}			β^{SPX}			ρ^{VIX}		
	Mean	St. dev.	Autocorr.	Mean	St. dev.	Autocorr.	Mean	St. dev.	Autocorr.
AUD	0.39	0.57	0.32	0.33	0.67	0.17	-0.32	0.55	0.29
BRL	0.39	0.48	0.12	0.38	0.75	0.03	-0.34	0.48	0.10
CAD	0.42	0.49	0.32	0.28	0.45	0.14	-0.34	0.50	0.19
CHF	0.01	0.56	0.23	-0.01	0.66	0.10	0.01	0.54	0.19
EUR	0.17	0.56	0.25	0.11	0.52	0.18	-0.14	0.55	0.18
GBP	0.19	0.52	0.16	0.13	0.53	0.08	-0.16	0.51	0.19
JPY	-0.32	0.52	0.21	-0.24	0.58	0.11	0.26	0.53	0.15
MXN	0.51	0.45	0.20	0.40	0.55	0.05	-0.46	0.46	0.14
NZD	0.33	0.52	0.34	0.28	0.69	0.19	-0.28	0.53	0.26
Mean	0.23	0.52	0.24	0.18	0.60	0.11	-0.20	0.52	0.19

Table 6: Predicting equity risk exposures using hedge fund positioning

This table reports the estimates and t-statistics for pooled panel regressions of the realized correlations and betas of exchange rates with the S&P and the VIX on the scaled level of net positions of hedge funds, denoted by $\widetilde{nhf}$. The realized betas and correlations are computed using closing prices for the 5 trading days following date t. The data form an unbalanced panel for the two subsample periods 2006-2009 and 2010-2017. I run the following predictive regressions for $y_{i,t\to t+1} = \{\rho^{SPX}_{i,t\to t+1}, \beta^{MKT}_{i,t\to t+1}, \rho^{VIX}_{i,t\to t+1}\}$:

$$\Delta y_{i,t\to t+1} = \alpha_i + \eta\, \Delta\widetilde{nhf}_{i,t} + \delta\, r_{i,t} + \phi\, \Delta fd^w_{i,t} + \varepsilon_{i,t+1}, \tag{4}$$

where $fd^w_{i,t}$ and $r_{i,t}$ denote, respectively the 1-week forward discount and appreciation from $t-1$ to t of currency i versus the dollar. Standard errors are clustered at the currency level.

	2006-2009			*2010-2017*		
	ρ^{SPX}	β^{SPX}	ρ^{VIX}	ρ^{SPX}	β^{SPX}	ρ^{VIX}
Panel A: with currency fixed effects						
$\Delta\widetilde{nhf}$	-0.006	-0.045	-0.004	0.369	0.333	-0.352
	(-0.06)	(-0.39)	(-0.03)	(2.63)	(2.72)	(-1.70)
Δfd^w	-0.718	-1.172	1.031	0.077	0.084	-0.165
	(-0.79)	(-2.14)	(1.30)	(9.75)	(8.22)	(-18.99)
$r_{i,t-1}$	0.381	0.503	-1.687	-0.828	2.582	1.699
	(0.35)	(0.53)	(-2.45)	(-1.07)	(1.73)	(1.89)
R^2 in (%)	0.03	0.07	0.25	0.23	0.35	0.36
Panel B: without currency fixed effects						
$\Delta\widetilde{nhf}$	-0.006	-0.044	-0.005	0.369	0.333	-0.352
	(-0.06)	(-0.39)	(-0.03)	(2.63)	(2.72)	(-1.70)
Δfd^w	-0.718	-1.172	1.030	0.077	0.084	-0.165
	(-0.79)	(-2.14)	(1.30)	(9.74)	(8.25)	(-18.99)
$r_{i,t-1}$	0.383	0.503	-1.686	-0.829	2.582	1.698
	(0.35)	(0.53)	(-2.45)	(-1.07)	(1.73)	(1.89)
R^2 in (%)	0.03	0.07	0.25	0.23	0.35	0.36
Obs.	1476	1476	1476	3354	3354	3354

Table 7: Predicting equity risk exposures using institutional investor positioning

This table reports the results for pooled panel regressions of the realized correlations and betas of exchange rates with the S&P and the VIX on the scaled level of net positions of institutional investors, denoted by $\widetilde{nii}$. The realized betas and correlations are computed using closing prices for the 5 trading days following date t. The data form an unbalanced panel for the period 2010-2017. I run the following predictive regressions for $y_{i,t\to t+1} = \{\rho^{SPX}_{i,t\to t+1}, \beta^{MKT}_{i,t\to t+1}, \rho^{VIX}_{i,t\to t+1}\}$:

$$\Delta y_{i,t\to t+1} = \alpha_i + \eta\, \Delta\widetilde{nii}_{i,t} + \delta\, r_{i,t} + \phi\, \Delta f d^w_{i,t} + \varepsilon_{i,t+1}, \tag{4}$$

where $fd^w_{i,t}$ denotes the 1-week forward discount of currency i versus the dollar and $r_{i,t}$ denotes the currency return of currency i from week $t-1$ to week t. Standard errors are clustered at the currency level and t-statistics reported in parentheses.

	$\Delta\rho^{SPX}$	$\Delta\beta^{SPX}$	$\Delta\rho^{VIX}$	$\Delta\rho^{SPX}$	$\Delta\beta^{SPX}$	$\Delta\rho^{VIX}$
$\Delta\widetilde{nii}$	-0.017	-0.112	0.220	-0.017	-0.112	0.220
	(-0.07)	(-0.35)	(0.80)	(-0.05)	(-0.23)	(0.61)
Δfd^w	0.072	0.080	-0.160	0.072	0.080	-0.160
	(8.66)	(7.37)	(-18.35)	(1.05)	(0.75)	(-2.23)
$r_{i,t-1}$	-0.400	2.976	1.273	-0.404	2.975	1.273
	(-0.54)	(2.04)	(1.55)	(-0.55)	(1.50)	(1.71)
FE	Yes	Yes	Yes	No	No	No
R^2 in (%)	0.03	0.27	0.20	0.27	0.27	0.20
Currencies	9	9	9	9	9	9
Obs.	3354	3354	3354	3354	3354	3354

Table 8: A contrarian trading strategy

This table reports the returns to the trading strategy described in subsection 2.3 for different conditioning thresholds of the S&P return. The strategy is designed to exploit temporary dislocations in FX markets following the unwinding of futures positions by hedge funds. Let $\Omega_{i,t}^{CW}$ denote the *number of futures contracts* in currency i against the dollar, included in the strategy at time t:

$$\Omega_{i,t}^{CW} = \frac{\omega_{i,t}^{CW}}{\sum_j |\omega_{j,t}^{CW}| e_{i,t} s_i}, \text{ where } \omega_{i,t}^{CW} = -\Delta nhf_{i,t} \; \mathbb{1}_{\{r_t^{S\&P}<x\}} \; \mathbb{1}_{\{\Delta|nhf|_{i,t}<0\}} \; \mathbb{1}_{\{\text{sign}(\Delta nhf_{i,t})=\text{sign}(r_{i,t})\}}$$

where $\mathbb{1}_{\{\cdot\}}$ is the indicator function which takes value 1 if $\cdot$ is true, and 0 otherwise, $e_{i,t}$ denotes the exchange rate, and n_i the contract size in units of foreign currency, such that $e_{i,t}n_i$ expresses the dollar notional of each contract. Denote by $\Omega_{i,t}^{EW}$ the *dollar notional amount* in futures contracts of currency i against the dollar at time t

$$\Omega_{i,t}^{EW} = \frac{\omega_{i,t}^{EW}}{\sum_j |\omega_{j,t}^{EW}|}, \text{ where } \omega_{i,t}^{EW} = -\text{sign}(\Delta nhf_{i,t}) \; \mathbb{1}_{\{r_t^{S\&P}<x\}} \; \mathbb{1}_{\{\Delta|nhf|_{i,t}<0\}} \; \mathbb{1}_{\{\text{sign}(\Delta nhf_{i,t})=\text{sign}(r_{i,t})\}}.$$

The *contract-weighted* (CW) strategy is described by $\Omega_{i,t}^{CW}$ and takes positions, which are proportional in the cross section to the amount of positions unwound by hedge funds over the previous week. The *equal-weighted* (EW) strategy is described by $\Omega_{i,t}^{EW}$ and fixes the dollar notional of each individual position, such that all non-zero positions taken at any point in time have the same absolute dollar exposure. Both strategies have a gross dollar notional of $1 in each week, where the strategy is active. The below returns are based on 1-week forward exchange rates, with long (short) positions transacted at the ask (bid) price. Returns are unlevered and refer to positions formed weekly between January 5, 2010 and June 6, 2017. The strategy is inactive in week t, if $\Omega_{i,t} = 0 \, \forall \, i$.

Threshold (x)	$r^{S\&P} < 0$		$r^{S\&P} < -3\%$		None	
	CW	EW	CW	EW	CW	EW
Mean return p.w. (in %)	0.12	0.15	0.38	0.35	0.04	0.01
Std. deviation p.w. (in %)	1.19	1.14	1.33	1.27	1.16	1.07
Sharpe ratio p.a.	0.74	0.97	2.06	1.97	0.23	0.04
Total compound return (in %)	17.22	22.29	6.94	6.29	11.41	-0.02
Weeks total	389		389		389	
Weeks active	138		18		362	
Weeks active (in %)	35.48		4.63		93.06	

Table 9: Regression of currency movements on contemporaneous net futures flows

This table reports the results for a contemporaneous regression of exchange rate movements on weekly net flows in futures positions. I regress weekly returns on the contemporaneous change in the net long position of "Leveraged Funds" (nlf) and "Asset Managers" (nam), first in absolute terms and then scaled by open interest ($\widetilde{nhf}$, $\widetilde{nii}$).

$$r_{i,t} = \alpha_i + \eta_i \Delta nhf_{i,t} + \gamma_i \Delta nii_{i,t} + \varepsilon_{i,t} \tag{5}$$

$$r_{i,t} = \alpha_i + \eta_i \Delta \widetilde{nhf}_{i,t} + \gamma_i \Delta \widetilde{nii}_{i,t} + \varepsilon_{i,t} \tag{6}$$

where $r_{i,t} = e_{i,t}/e_{i,t-1} - 1$ denotes the currency return on currency i versus the US dollar from week $t-1$ to week t. $\Delta nhf_{i,t}$ and $\Delta nii_{i,t}$, respectively, denote the change in the net positions of hedge funds and institutional investors in currency i versus the US dollar from week $t-1$ to week t, while $\Delta \widetilde{nhf}_{i,t}$ and $\Delta \widetilde{nii}_{i,t}$ refer analogously to the positions scaled by open interest. All futures positions are expressed in thousands of contracts. The estimated coefficients for regressions (5) and (6) are reported below with their respective robust t-statistics in parentheses. The weekly exchange rate movements and forward discounts are expressed in %.

(5)	*AUD*	*BRL*	*CAD*	*CHF*	*EUR*	*GBP*	*JPY*	*MXN*	*NZD*
Δnhf	0.07	0.15	0.05	0.07	0.04	0.04	0.04	0.03	0.26
	(11.96)	(3.00)	(8.10)	(5.63)	(11.22)	(9.35)	(12.38)	(6.53)	(8.61)
Δnii	0.01	0.29	0.07	0.65	0.05	0.01	0.08	0.00	0.36
	(0.21)	(1.53)	(1.88)	(2.37)	(3.97)	(0.55)	(4.97)	(0.36)	(4.39)
intercept	0.03	-0.19	-0.01	0.06	-0.01	-0.05	0.03	-0.07	0.06
	(0.40)	(-1.46)	(-0.20)	(0.94)	(-0.22)	(-0.85)	(0.57)	(-1.01)	(0.79)
Obs.	573	250	573	573	573	573	573	573	569
R^2 in %	19.08	4.05	11.05	11.42	19.17	13.14	25.36	6.60	15.61
(6)	*AUD*	*BRL*	*CAD*	*CHF*	*EUR*	*GBP*	*JPY*	*MXN*	*NZD*
$\Delta \widetilde{nhf}$	9.27	3.68	5.17	3.58	8.84	6.01	7.70	4.01	6.03
	(9.76)	(2.43)	(6.61)	(4.39)	(9.34)	(9.99)	(11.61)	(6.17)	(5.64)
$\Delta \widetilde{nii}$	-1.03	0.42	7.49	28.75	9.71	-2.56	7.38	0.67	10.91
	(-0.29)	(0.09)	(1.94)	(2.21)	(2.81)	(-0.86)	(3.27)	(0.35)	(4.45)
intercept	0.03	-0.19	-0.02	0.06	-0.01	-0.05	0.02	-0.07	0.06
	(0.41)	(-1.43)	(-0.27)	(0.91)	(-0.12)	(-0.88)	(0.46)	(-0.99)	(0.76)
Obs.	573	250	573	573	573	573	573	573	569
R^2 in %	16.19	2.72	8.17	7.33	14.02	12.51	19.53	6.82	11.53

Table 10: Predicting futures positions using equity risk exposures

This table reports the results for pooled panel regressions of net hedge fund futures positions on previous correlations and betas of exchange rates with the S&P and the VIX. The realized betas and correlations are computed using closing prices for the 5 trading days preceding date t. I run the following forecasting regressions for $y_{i,t\to t+1} = \{\rho^{SPX}_{i,t\to t+1}, \beta^{MKT}_{i,t\to t+1}, \rho^{VIX}_{i,t\to t+1}\}$:

$$\Delta\widetilde{nhf}_{i,t+1} = \alpha_i + \eta\,\Delta y_{i,t-1\to t} + \delta\, r_{i,t} + \phi\,\Delta fd^w_{i,t} + \varepsilon_{i,t+1}, \tag{4}$$

where $fd^w_{i,t}$ denotes the 1-week forward discount of currency i versus the dollar and $r_{i,t}$ denotes the currency return of currency i from week $t-1$ to week t. Standard errors are clustered at the currency level and t-statistics reported in parentheses.

$\Delta\rho^{SPX}_{i,t-1}$	-0.003			-0.003		
	(-2.15)			(-1.34)		
$\Delta\beta^{SPX}_{i,t-1}$		-0.002			-0.002	
		(-2.14)			(-1.51)	
$\Delta\rho^{VIX}_{i,t-1}$			0.003			0.003
			(1.96)			(1.59)
$fd^w_{I,t-1}$	-0.005	-0.005	-0.005	-0.003	-0.319	-0.295
	(-4.60)	(-4.35)	(-4.39)	(-0.29)	(-0.28)	(-0.26)
$r_{i,t-1}$	1.467	1.474	1.464	1.466	1.473	1.463
	(7.77)	(7.89)	(7.77)	(13.26)	(13.51)	(13.24)
FE	Yes	Yes	Yes	No	No	No
R^2 in (%)	7.78	7.81	7.81	7.78	7.81	7.80
Currencies	9	9	9	9	9	9
Obs.	3354	3354	3354	3354	3354	3354

Table 11: Predicting risk using net futures positions – FOMC announcement weeks

This table reports the results for pooled panel regressions of the realized correlations and betas of exchange rates with the S&P and the VIX on the scaled level of net positions of hedge funds ("Leveraged Funds", denoted by $\widetilde{nhf}$). The realized betas and correlations are computed using closing prices for the 5 trading days following date t. The data form an unbalanced panel for the post-crisis 2010-2017. 58 of the 388 weeks in that period include a scheduled FOMC announcement, and the "Announcement" subsample contains 502 currency-week observations. I run the following predictive regressions for $y_{i,t\to t+1} = \{\rho^{SPX}_{i,t\to t+1}, \beta^{MKT}_{i,t\to t+1}, \rho^{VIX}_{i,t\to t+1}\}$:

$$\Delta y_{i,t\to t+1} = \alpha_i + \eta\, \Delta\widetilde{nhf}_{i,t} + \delta\, r_{i,t} + \phi\, \Delta f d^w_{i,t} + \varepsilon_{i,t+1}, \tag{4}$$

where $fd^w_{i,t}$ denotes the 1-week forward discount of currency i versus the dollar and $r_{i,t}$ denotes the currency return of currency i from week $t-1$ to week t. Standard errors are clustered at the currency level and t-statistics reported in parentheses. The panel entitled "Announcement" reports the results over all 58 weeks from 2010-2017 that contained a scheduled FOMC announcement, while the "Non-Announcement" panel reports the results for the remaining 330 weeks.

	Non-Announcement			*Announcement*		
	$\Delta\rho^{SPX}$	$\Delta\beta^{SPX}$	$\Delta\rho^{VIX}$	$\Delta\rho^{SPX}$	$\Delta\beta^{SPX}$	$\Delta\rho^{VIX}$
$\Delta\widetilde{nhf}$	0.421	0.382	-0.405	0.267	0.239	-0.186
	(3.56)	(3.68)	(-2.08)	(0.59)	(0.58)	(-0.37)
Δfd^w	0.098	-0.024	-0.219	0.034	0.214	-8.129
	(7.87)	(-1.50)	(-13.63)	(4.60)	(18.93)	(-9.48)
$r_{i,t-1}$	-0.749	2.658	1.501	-0.743	2.717	3.181
	(-0.97)	(1.40)	(1.77)	(-0.41)	(1.00)	(1.41)
Currency FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2 in (%)	0.26	0.35	0.37	0.15	0.86	0.53
Currencies	9	9	9	9	9	9
Obs.	2852	2852	2852	502	502	502

Figure 2: Time-variation in futures positions (in 000's of contracts): hedge funds (nhf, solid, blue), intermediaries (ndi, dotted, black), and institutional investors (nii, dashed, red).

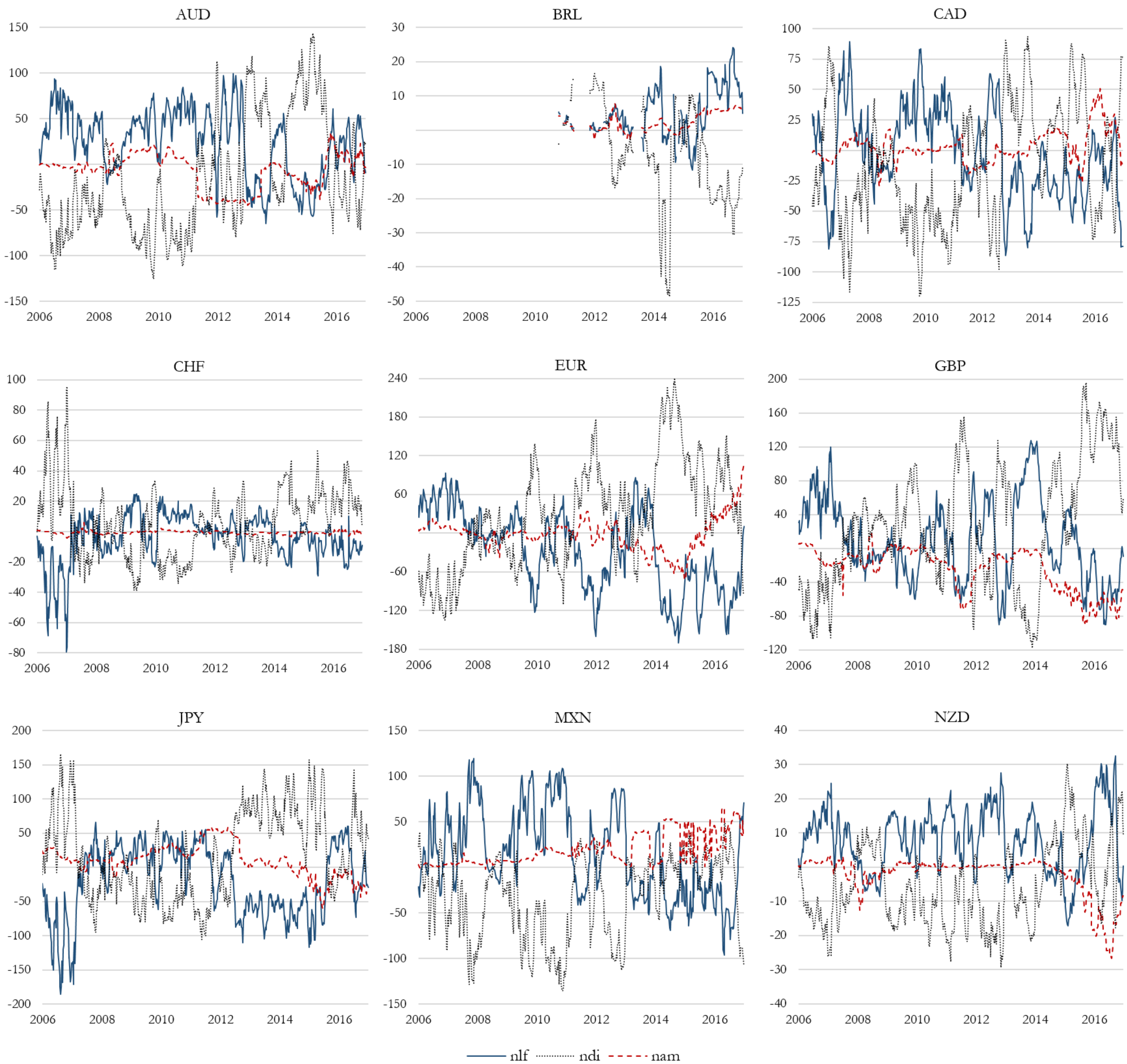

Figure 3: Cumulative returns