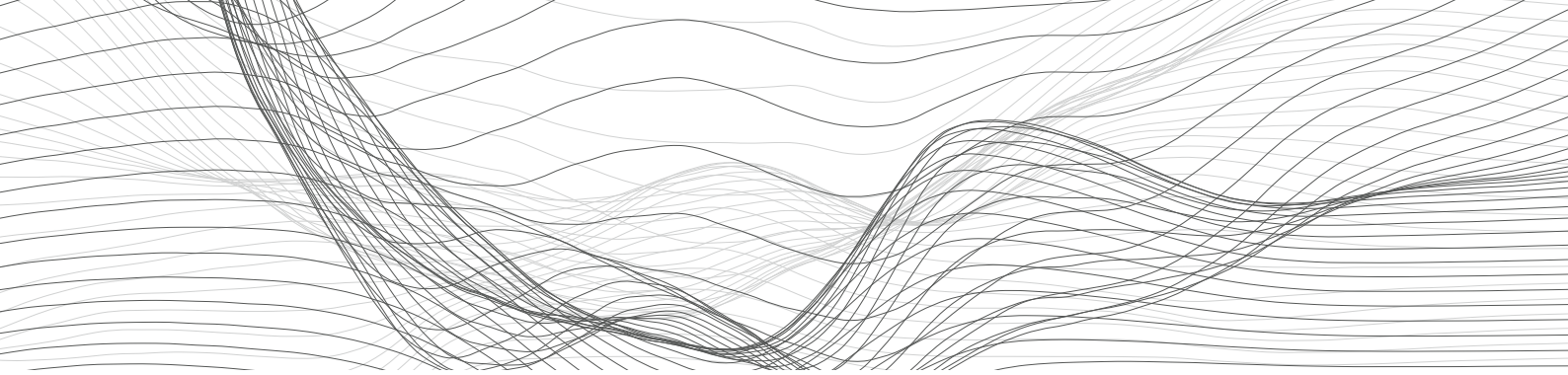

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The role of hedge funds in the Swiss franc foreign exchange market

Jessica Gentner*†

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Abstract

This paper investigates the role of hedge funds within the Swiss franc (CHF) foreign exchange (FX) market, using a novel and comprehensive flow dataset that covers a large proportion of the CHF FX market. Employing a two-stage-least-squares (2SLS) approach, I isolate the causal effect of hedge funds' net flow on CHF returns, taking into account reverse causality. The analysis reveals that hedge funds' net flow significantly impacts CHF returns, with a net buying of one billion leading to an approximate 0.4% increase in returns. In contrast, the net flow from other market participants has a negligible impact, even when potential reverse causality is dismissed. This influence of hedge funds' net flow becomes particularly noticeable on days when the Swiss National Bank (SNB) delivers contractionary monetary policy surprises. On such days, even a small surprise amplifies the impact of hedge funds' net flow significantly. The analysis of market participants' trading prices substantiates the hypothesis that hedge funds, due to their expertise in FX forecasting and best execution as well as superior transaction timing abilities, in aggregate tend to trade at more advantageous prices than other market participants.

JEL Classification: G12, G14, F31
Keywords: Swiss franc, market microstructure, asymmetric information, monetary policy shocks.

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1 Introduction

The foreign exchange (FX) market, with an average daily turnover of 7.5 trillion US dollars (USD), is the largest financial market in the world, playing a crucial role in the world economy. Among the major currencies traded, the Swiss Franc (CHF) ranks as the 8thth most traded currency, accounting for approximately 5% of the total daily turnover according to BIS (2022). The CHF FX market encompasses diverse participants, each exhibiting unique behaviors in the FX market and demonstrating different relationships between their trading activities and exchange rate returns. (e.g. Lyons, 2006; Menkhoff et al., 2016; Ranaldo and Somogyi, 2021). Hedge funds are known for their broad investment focus and high adaptability to quickly leverage upcoming investment opportunities (Getmansky et al., 2015); additionally, they are expected to be among the best-informed agents in the FX market (King et al., 2012; Osler & Vandrovych, 2009). Thus, their flow is expected to significantly impact exchange rates. Examining the role of hedge funds in the CHF FX market is crucial to comprehending its dynamics and understanding the potential ramifications of their actions on the financial landscape.

This study sheds light on the behavior of hedge funds in the CHF FX market and their impact on exchange rate movements by utilizing a unique dataset provided by the Continuous Linked Settlement Group (CLS). The dataset's extensive coverage of the CHF FX market over 13 years allows for a comprehensive examination of hedge funds' behavior and their influence on CHF exchange rate movements throughout the entire sample period and within different monetary policy regimes. To the best of my knowledge, this study is the first to examine hedge funds' net flow and behavior in the CHF FX market during times marked by different monetary policy regimes and monetary policy surprises. The research questions addressed are: What is the impact of hedge funds' net flow on CHF returns and how does the impact vary across different monetary policy regimes? Do hedge funds possess expertise in FX forecasting and best execution, as well as superior transaction timing abilities, allowing them to trade at better prices than other market participants? Findings point to a notable and positive influence of hedge funds' net flow on CHF returns, starkly contrasting with other market participants. This influence becomes especially marked in the wake of contractionary monetary policy surprises from the SNB. Furthermore, the investigation reveals that within a trading day, compared to other investors, hedge funds, in aggregate, execute their trades in both CHFEUR and CHFUSD at relatively more favorable prices, confirming that hedge funds have extensive expertise in FX forecasting and best execution as well as superior transaction timing abilities.

The framework outlined by Glosten and Milgrom (1985) and Kyle (1985) posits that certain market players hold superior information on the value of an asset. This private information finds its path into price-setting processes via order flow as demonstrated by Evans and Lyons, 2002b. Nevertheless, due to disparate characteristics, only some market participants are expected to possess superior information, thus leading to varied impacts on exchange rate returns (e.g. Lyons, 2006; Menkhoff et al., 2016; Ranaldo and Somogyi, 2021). The underlying study offers concrete evidence backing the proposed theories and sheds new light on the unique characteristics of hedge funds. By breaking down FX flow among various participants in the CHF FX market, I uncover that the market participant group of hedge funds is the only group with access to superior information and that informational disparities vary depending on the monetary policy regime.

The first contribution is to investigate the causal impact of hedge funds' flow on CHF returns. To address the potential issue of reverse causality, where hedge funds' net flow impacts CHF returns and vice versa, I implement a two-stage-least squares (2SLS) approach. The instrument I utilize in the 2SLS approach is derived from past observations of hedge funds' net flow, backed by its high autocorrelation in the dataset. By assuming that past net flow has no immediate influence on CHF returns, which is justified by hedge funds' fast response to newly released information, I can consistently estimate the impact of hedge funds' net flow on CHF returns. My analysis utilizes one-day lagged net flow as instrumental variables and measures CHF returns by creating a CHF index comprising the currency pairs that are settled via CLS and weighted according to the flow composition in the CLS dataset. I validate the robustness of the results by deploying different CHF return measures and instrumental variables. After studying the impact of hedge funds' net flow on CHF returns throughout the whole sample period, I examine the differences in the impact of hedge funds' net flow across multiple SNB policy regimes. Firstly, I study whether the impact differs within and outside the minimum exchange rate regime of the SNB[1], using a dummy variable in the 2SLS model. Secondly, I probe whether the impact of hedge funds' net flow on CHF returns differs on days characterized by contractionary or accommodating SNB monetary policy surprises. Thereby, contractionary (accommodative) surprises refer to days when the SNB unexpectedly adjusts its monetary policy by, for example, increasing (decreasing) interest rates. I identify those surprises by deploying a measure provided by Koeniger et al. (2022), who use data on the changes in financial market expectations to identify monetary policy surprises.

[1]From the 6^{th} of September, 2011 to the 15^{th} of January, 2015, the SNB maintained a EURCHF exchange rate floor of 1.20.

Results reveal that the impact of hedge funds' net flow on CHF returns is positive and of relevant economic size. A net buying of one billion leads to an approximate 0.4% increase in CHF returns. Results are robust to different CHF return measures and instrumental variables. Further, the CLS dataset's granularity enables us to compare the impact of hedge funds with control groups, such as asset managers, who may exhibit similar impacts and behaviors, and a residual group comprising all other market participants. Interestingly, even when I discard potential reverse causality, which could cause us to overestimate the impact of asset managers' and other market participants' net flow, their estimated impact on CHF returns remains negligible. These findings lead to the conclusion that hedge funds' net flow plays a pivotal role in driving CHF returns. When distinguishing different monetary policy regimes, findings reveal that the impact of hedge funds' net flow seems to be mainly driven by the time absence of the minimum exchange rate regime of the SNB. The lower volatility in CHF exchange rates during the minimum exchange rate regime results in a lower impact of hedge funds' net flow, which is plausible given the permanent and sizeable currency interventions of the SNB.[2] Furthermore, I find that the impact of hedge funds' net flow on the CHF is more pronounced on days with contractionary SNB monetary policy surprises. In fact, on such days, even a small surprise amplifies the impact of hedge funds' net flow significantly. As hedge funds are, on average, net CHF sellers during the sample period, they likely intend to close their short positions quickly on days with contractionary monetary policy shocks, amplifying their flows' impact.

The remainder of the research focuses on evaluating whether hedge funds in aggregate trade at more favorable prices than other investors. Results of the analysis confirm that the group of hedge funds indeed trades at more advantageous prices in both the CHFEUR and CHFUSD currency pairs. However, a deeper dive into the data reveals a more nuanced picture: while hedge funds in aggregate secure better prices when trading CHFUSD within as well as without the SNB's minimum exchange rate regime, they only secure favorable prices in CHFEUR within the SNB's minimum exchange rate regime and fail to do so when the regime is not in effect. This phenomenon may be attributed to the enhanced market stability and predictability fostered by the minimum exchange rate regime, which hedge funds might have leveraged to their advantage. When examining the group of asset managers, I find that they consistently trade at less favorable prices than other market participants, both within and outside the SNB's minimum exchange rate regime. These findings suggest that hedge funds, in aggregate, possess greater expertise in achieving best execution and contain superior transaction

[2] See Jordan (2015).

timing abilities, which enables them to capitalize on favorable market conditions.

Literature Review: This study aims to deepen the understanding of the role hedge funds play within the CHF FX market, thereby enriching the body of research related to market microstructure and asset pricing. Through a detailed analysis of how the net flow of various market participants influences CHF returns, this study builds upon and enriches the existing academic framework. Previous research advances have primarily focused on the relationship between interbank flow and exchange rate movements (e.g. Bjønnes and Rime, 2005; Breedon and Vitale, 2010; Evans, 2002; Evans and Lyons, 2008; Payne, 2003), leaving a gap in the comprehension of the relationship between the flows of different types of market participants and exchange rates. Some studies have begun to address this gap, highlighting the diverse behavior and relationship of the flows of different investor types and exchange rates (e.g. Cerrato et al., 2011; Menkhoff et al., 2016; Osler and Vandrovych, 2009; Ranaldo and Somogyi, 2021; Sager and Taylor, 2006). Cerrato et al. (2011) use a proprietary order flow dataset provided by UBS that distinguishes hedge funds from asset managers and other market participant groups. They find that hedge funds' and asset managers' order flow have a positive relationship with exchange rates in contrast to other market participants' order flow. A closer look at their results on the CHF indicates that hedge funds' order flow shows a more pronounced relationship with USDCHF than asset managers' order flow and only the relationship with hedge funds' order flow is statistically significant, which is not the case for asset managers' order flow. This indicates that hedge funds' order flow shows a more pronounced relationship with USDCHF than asset managers' order flow and that hedge funds are better informed than other investors.[3] However, as their results are based on a proprietary order flow dataset provided by UBS, the generalisability to the broader CHF FX market is questionable. More recently, Ranaldo and Somogyi (2021) present convincing evidence of heterogeneous superior information across agents, time, and currency pairs. They show, for example, that corporate entities typically experience a permanent price impact that is, on average, one to two basis points (BPS) lower across different currency pairs compared to funds, nonbank financial institutions, or banks, whose flows demonstrate positive autocorrelation. While their study is very insightful and based on a similar CLS flow dataset to the underlying study, their dataset does not allow a separation of hedge funds from other fund types in its analysis of CLS flow data, thus limiting the granularity of conclusions regarding the specific informational advantages of hedge funds. The underlying research contributes to the existing body of knowledge by analyzing the impact of hedge funds' net flow on

[3]Osler and Vandrovych (2009) find similar results underscoring that hedge funds are the only market participant group containing private information.

CHF returns utilizing a comprehensive dataset covering a significant share of the CHF FX market, supporting my findings' generalizability. I assess the impact of hedge funds' net flow on CHF returns in comparison to the net flow from other market participants, and I explore how this impact varies across different monetary policy regimes. The hedge funds in this study are distinguished by their leveraged investments and a wide-ranging focus that encompasses currency markets. This sets them apart from asset managers, including real-money pension funds, real-money nonpension funds, and insurance companies. Given their leveraged nature and broad investment scope, hedge funds are posited to leverage informational advantages more effectively than more regulated asset managers, such as insurance firms and pension funds, which are typically constrained to adopt more conservative investment strategies with lower leverage, as mandated by regulatory requirements. This conservative approach is expected to translate into a less pronounced impact on exchange rate movements compared to the more aggressive strategies employed by hedge funds. Highlighting these distinctions is crucial for a nuanced understanding of different market participants' varied roles and informational access. Informational disparities might be especially high on days with monetary policy surprises. As hedge funds are expected to react quickly toward new information (Eichengreen & Mathieson, 1999), I hypothesize that their flow is especially important on days marked by monetary policy surprises as hedge funds might enter a certain position shortly before the surprise and/or adjust their position quickly after the surprise. The importance of hedge funds' net flow is also expected to depend on the monetary policy regime. During the minimum exchange rate regime by the SNB, for example, I hypothesize that the impact of their net flow is less pronounced due to the permanent and sizeable currency interventions of the SNB.

Furthermore, this research contributes to the asset pricing literature by evaluating whether hedge funds can secure more favorable trading prices than other investors on specific trading days. Given hedge funds' expected timing ability arising from broader investment scopes and enhanced flexibility to capitalize on investment possibilities (Getmansky et al., 2015), these entities are expected to be uniquely positioned to leverage their advanced financial expertise to execute trades at more advantageous prices.[4] This hypothesis is grounded in the assumption that hedge funds, by virtue of their profound financial knowledge, are inherently more price sensitive and adept at navigating market dynamics to optimize trading outcomes. In contrast, other market participants, such as institutional investors whose primary focus lies outside the FX market, are anticipated to exhibit less price sensitivity. This reduced focus can be attributed to foreign exchange trading not being their core business

[4]See Getmansky et al. (2015) for a literature review on the timing ability of hedge funds.

activity, resulting in a lesser emphasis on securing the most favorable prices within the FX market. Such investors may prioritize other aspects of their investment strategies, potentially leading to less optimal trading decisions in the FX market compared to their hedge fund counterparts. By delving into these aspects, this study sheds new light on the competitive advantage hedge funds may hold in terms of their timing ability, contributing valuable perspectives to the ongoing discourse on asset pricing and market microstructure.

The remainder is organized as follows. A description of the data follows in section 2. Then, an analysis of the information content of hedge funds' net flow on CHF returns is presented in section 3. After that, a trading price analysis follows in section 4. The study is rounded off with a conclusion in section 5.

2 Data

2.1 FX flow data

The data employed in this study is sourced from a FX flow dataset provided by CLS, a leading FX settlement provider that aims to mitigate the so-called "Herstatt risk" by implementing a payment versus payment method.[5] The dataset spans an extensive time period, covering daily data from January 1, 2006, to December 31, 2018. This dataset is particularly valuable due to its extensive coverage and its ability to differentiate between various market participant groups, a feature that is often unavailable in other FX flow data sources due to the market's opaque nature and the prevalence of over-the-counter (OTC) trading (BIS, 2022). CLS covers eighteen currencies across forty currency pairs and three instruments (spot, outright forward, and swap), making it the world's largest single source of FX-executed data. According to CLS, it accounts for over 50% of global FX traded volume. The dataset used in this study focuses on FX flows in CHF exchange rates settled via CLS.

The tailoring of the dataset by CLS enables an extensive overview of CHF market participants, facilitating a nuanced analysis of their behavior and impact on CHF exchange rate returns. CLS classifies the flows into different market participant groups. The classification criteria are similar for all entities and consist of examining the entity name, researching the entity and, in some cases, reaching out to the firm directly to ascertain their category. This classification of the flows in the dataset allows a

[5]See Galati (2002), Hasbrouck and Levich (2019), Lindley (2008), and Ranaldo and Somogyi (2021), as well as the CLS website www.cls-group.com for more information on the functioning of the CLS Settlement System.

targeted focus on the group of hedge funds. CLS characterizes hedge funds by their specific investment strategies, use of leverage, being declared as an alternative investment, and investment in diverse asset portfolios, including real estate, private equity, currencies, derivatives, and equity and bonds. Real-money pension funds are identified as private sector funds distinct from other fund categories (such as pension funds, state bank funds, sovereign wealth funds, government funds, and hedge funds), and insurance firms are categorized as nonbank financial entities operating in the insurance space. A pension fund is defined as a fund that manages retirement income. I aim to compare the group of hedge funds to other market participant groups, such as asset managers (including real-money pension, real-money nonpension, and insurance firms), as well as a group named 'others' consisting of a broader set of market participants (including price-taking banks, corporates, private clients, official institutions and a residual group containing all other parties) to directly compare the varied behaviors and return impact of hedge funds, asset managers and other market participants.

Each transaction in the CLS dataset is categorized by a combination of factors: instrument type (spot), currency pair (USDCHF, EURCHF, GBPCHF, CHFJPY, and other CHF pairs aggregated), location (determined by the price-taking party's country code), market participant group (hedge funds, real money pension, real money nonpension, insurance firms, price-taking banks, corporates, private clients, official institutions, and a residual group containing all other market participants), and trade date. For each unique combination, the dataset provides several key metrics: daily gross volume (the total of amounts bought plus sold on a given trading day), volume weighted average price (VWAP), and the CHF amounts bought and sold against foreign currency. Data availability is contingent on the involvement of more than two parties in the specified combination of trade date, instrument, location, currency pair, and market participant group. Notably, 96.4% of the records present complete data across all attributes. For the remaining 3.6%, pertaining to scenarios with fewer than three parties, data is not available. I measure the net flow for each market participant group as the daily CHF net amount, derived by subtracting the total amount sold from the amount bought at day t. Each entry in the dataset signifies the date on which CLS receives settlement instructions, including weekends. To align the CLS dataset with FX return data, I shift the flows recorded on weekends and holidays to the subsequent business day. This correction ensures the synchronization of the data in relation to available CHF FX return data.

Trades are classified by CLS according to the perspective of the price taker using a network approach. In this network, each node is a trading party, and links between nodes signify trading relationships.

These links arise from trade interactions, with repeated trades between the same parties represented as a single link. The nodes are categorized into two groups based on 'coreness', a metric that identifies closely connected clusters in a network. A 'k-core' is the largest group of entities, and each is linked to at least 'k' others in the group. FX price makers are identified as nodes with consistently high coreness. All other parties are classified as price takers. This identification is conducted using the last 24 months of data for each currency pair, with the list of price makers updated monthly and showing considerable stability over time.

Overall, the customized CLS flow dataset provides a unique opportunity to analyze market participants' behavior in the CHF FX market. Its granularity, extensive coverage, and distinction between market participant groups offer valuable insights into the dynamics of the otherwise opaque CHF FX market, making it an ideal resource for in-depth analysis. Previous studies have utilized CLS volume data, available on Quandl.com, to investigate various aspects of the FX market[6]. However, CLS flow data has been less explored in the literature.

2.2 CHF returns

This section outlines the methodology employed to construct CHF returns. Sourced from Bloomberg, the CHF exchange rates are integrated into an index that reflects the nuanced distribution of the CLS sample dataset. The index construction is grounded in a weighted approach: 56.67% USDCHF, 38.40% EURCHF, 2.19% GBPCHF, 1.55% CHFJPY, aligning with the prevalence of each currency pair in the CLS dataset (see Figure A1). The remaining 1.19% is equally distributed among other CHF pairs that are settled via CLS[7] as I have no details about the share of these remaining currency pairs in the CLS dataset. This weighting strategy ensures that the CHF index is representative and highly indicative of actual market dynamics.

Daily returns for each currency pair c are calculated using the logarithmic difference between the closing prices at time t and $t-1$:

$$\Delta r_{c,t} = (ln(P_{c,t}) - ln(P_{c,t-1})) * 100 \tag{1}$$

An increase (decrease) in return indicates an appreciation (depreciation) of the CHF. The CHF index,

[6]CLS volume data is analyzed in Cespa et al. (2022), Fischer and Ranaldo (2011), Hasbrouck and Levich (2019), and Ranaldo and de Magistris (2022).

[7]The remaining currencies that are settled via CLS are MXN, CAD, ILS, KRW, DKK, HKD, HUF, SGD, NOK, AUD, NZD, ZAR and SEK.

representing the overall daily CHF movement against this weighted basket of currency pairs:

$$\Delta CHF_t = \sum_{c=1}^{N} w_c \Delta r_{c,t}, \tag{2}$$

where w_c represents the weight for each currency pair in the set of N=17 pairs. This comprehensive index serves as a robust, representative measure of CHF exchange rate movements, aligning closely with the actual market dynamics captured in the dataset.

2.3 Summary Statistics

In this subsection, I show the descriptive statistics for CHF returns and the CLS flow dataset. The descriptive metrics such as mean, standard deviation, minimum, maximum, and autocorrelations of the CHF returns measured by the CHF index as detailed in the previous subsection are illustrated in Table 1. The mean of the index is slightly positive, while the median is close to zero and the standard deviation is around 5 basis points, which aligns with standard daily FX data. The data presents a negligible dependency in daily returns, demonstrated by the minimal autocorrelations.

Table 1: Summary statistics for CHF returns

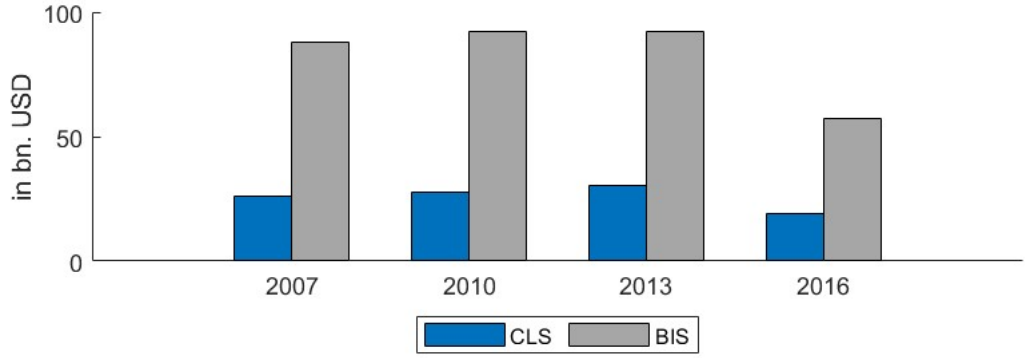
	Mean	Median	Std. Dev.	AC(1)	AC(5)	AC(10)
ΔCHF_t	0.09	-0.01	4.90	-0.15	0.62	-1.96

Note: This table demonstrates descriptive statistics for the CHF index. Metrics such as mean, median, and standard deviation are measured in basis points, whereas autocorrelations are expressed as percentages. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB.

To grasp the market coverage of the CLS dataset, I compare the coverage of CLS flow data with the BIS triennial surveys (BIS, 2007, 2010, 2013, 2016) in Figure 1.[8] The CLS spot data encapsulates a substantial share of the CHF FX market, with the proportion of CLS gross volume to BIS gross volume exceeding 29% across all overlapping years. The gap between the CLS flow dataset and the overall CHF FX market can be partly explained by small entities with small amounts of turnover rarely settling via CLS (Ranaldo & Somogyi, 2021). However, Hasbrouck and Levich (2019) illustrates that a significant portion of the trading volume reported by the BIS Triennial Survey pertains to interbank trading among desks and includes double-counting of prime-brokered trades. Thus, the CLS dataset's coverage is underestimated compared to the BIS Triennial Survey (Ranaldo & Somogyi, 2021).

[8]The BIS triennial survey serves as a proxy for the size of the FX market and is conducted every three years in April.

Figure 1: Comparison of CHF gross volume reported by BIS and CLS



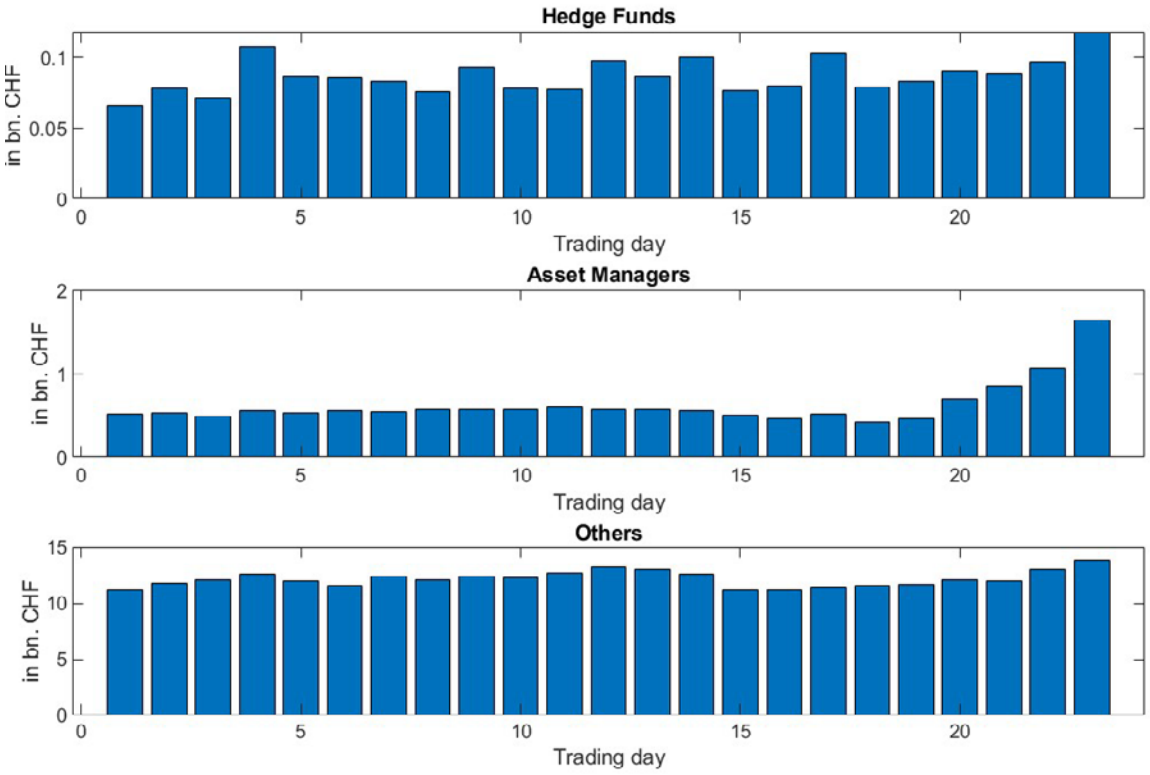
Note: This chart displays the daily average spot CHF gross volume reported by BIS compared to CLS in billion USD in April of each year. The coverage of CLS flows dataset is 29% in 2016, 30% in 2013, 33% in 2010, and 34% in 2007. Note that the CLS data in this chart includes all CLS flows, including interbank flows where no directional data is available.

When comparing the distribution of the flows by currency pair, I find that the distribution of CLS flow amongst different currency pairs appears to accurately represent the CHF FX market as per the BIS triennial surveys. Over half of the total gross volume is traded in USDCHF, with more than a third traded in EURCHF. Other currency pairs contribute to only 5% of the gross volume (see Figure A1). This distribution concurs with data from the BIS triennial surveys, wherein USDCHF averages a share of 56% and EURCHF a share of 36% across all overlapping years with the CLS dataset (BIS, 2007, 2010, 2013, 2016).

Additionally, the raw total gross volume alongside its 20-day moving average shows a consistent coverage throughout the entire sample duration (see Figure A2). In Figure 2, I showcase the monthly distribution of CLS gross volume. Notably, asset managers frequently increase their flows toward month-end, suggesting rebalancing actions. This rebalancing might be driven by the need to hedge currency risk, adhere to asset allocation strategies, comply with regulatory requirements, and adjust to market conditions. For example, Swiss asset managers are expected to hedge their currency risk by seeking CHF when their foreign assets rise in value, aiming to maintain a stable hedge ratio against CHF appreciation, typically rebalanced at month-end. This behavior aligns with findings by Hau and Rey (2004) that hedging excess returns from foreign markets often drives such rebalancing flows. This idea is further supported by Camanho et al. (2018), who demonstrate that rebalancing intensifies under higher FX volatility and is more pronounced when there's a larger gap between domestic and foreign returns. In contrast, hedge funds and other investors show only a slight uptick in month-end gross flows. Reasons for the low rebalancing activity at month-end could be hedge funds' higher risk tolerance, different investment objectives, and more flexible client mandates compared to asset

managers. Consequently, their engagement in CHF transactions is expected to be more investment-driven, with less emphasis on currency risk management. Moreover, it is important to note that hedge funds' flows in the sample are solely from entities based outside of Switzerland[9] who are expected to focus on the CHF as investment currency. Due to Switzerland's relatively modest size in the global financial market, it is unlikely that hedge funds based outside of Switzerland have a significant portion of their investments denoted in CHF. Consequently, their CHF rebalancing need is also expected to be limited, as their investment portfolios are not heavily weighted in CHF assets. The market participant group of other investors in the sample likely tends to engage in less frequent rebalancing as their main business lies outside financial markets.

Figure 2: Distribution of CLS gross volume over a month



Note: This charts shows the distribution of the CLS gross volume over a month. For the calculation of the distribution, I compute the average gross volume on each trading day over all months in all years available in the CLS dataset. Each month has at least 20 trading days such that days 1 to 20 occur 156 times in the sample. Day 21 occurs 138 times, day 22 occurs 92 times and day 23 only 39 times. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB.

After investigating the coverage of the CLS gross flows, I provide the summary statistics for daily net flows across hedge funds and control groups in Table 2. Other market participants have the largest absolute mean net flow, succeeded by asset managers. Hedge funds show the lowest absolute mean

[9]Only slightly more than half of the gross flows from asset managers originate from entities outside Switzerland, indicating a more geographically balanced distribution of their flows in the dataset compared to hedge funds.

net flow. All groups exhibit negative mean net flows, indicative of a general tendency toward selling CHF during the sample period. The median net flow for hedge funds and asset managers is zero, suggesting balanced buying and selling activities. Conversely, the negative median for other market participants reveals a more frequent selling of CHF. The standard deviation in the table provides a measure of the absolute dispersion of net flows within each group. The relatively higher standard deviation for other market participants compared to hedge funds and asset managers suggests a greater variability in their net flow. However, it is important to acknowledge the limitations of using standard deviation in this context. Given the differing mean values in the dataset, the standard deviation does not offer a normalized view of dispersion. Scaling the standard deviation by the absolute mean can provide a more comparative perspective of variability across groups. The variability pattern remains consistent even when scaling the standard deviation by the absolute mean. The percentile analysis further supports this interpretation. The 10^{th} and 90^{th} percentiles show a relatively narrower range for hedge funds and asset managers compared to other market participants.

Table 2: Summary statistics for daily net flow in bn. CHF

	Mean	Median	Std. Dev.	10^{th} Percentile	90^{th} Percentile
Hedge Funds	-0.01	0.00	0.07	-0.07	0.04
Asset Managers	-0.04	0.00	0.27	-0.29	0.17
Others	-0.05	-0.04	1.17	-1.32	1.21

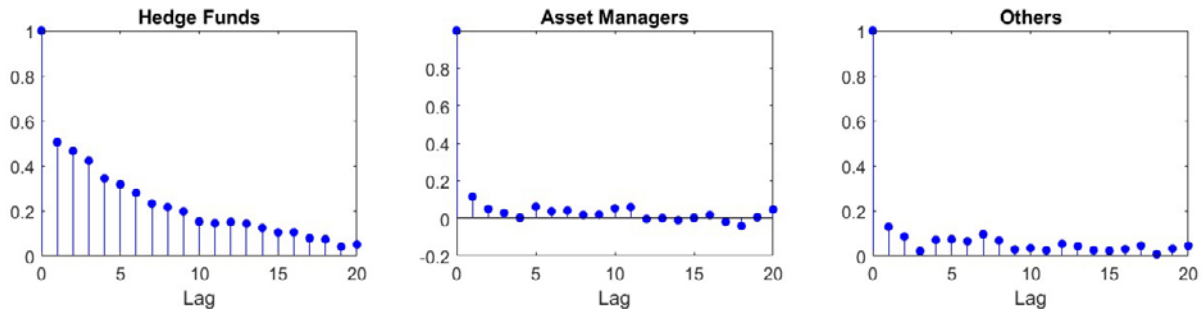
Note: This table displays the summary statistics for daily net flows in billion CHF. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB.

I additionally analyze the autocorrelation of net flow to increase the understanding of the trading behavior and trading patterns within the different market participant groups. Notably, hedge funds' net flow exhibits a high autocorrelation at small lags, with the autocorrelation decreasing as lags increase.[10] After 20 lags, the autocorrelation approaches zero. Given the adaptability and swift nature of hedge funds, I do not anticipate the high autocorrelation to result from order splitting over days. One possible explanation for this autocorrelation pattern is a data bias toward momentum traders in the market participant group of hedge funds. Momentum trading contributes to autocorrelation in hedge funds' net flow due to its reliance on historical performance trends for informing future trades. This leads to a pattern of repeated, similar transactions. Beyond momentum trading, other plausible explanations for the observed autocorrelation include responses to different market signals or news

[10]Both, the augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) test indicate that hedge funds' net flow is stationary.

on different trading days that lead to repeated, similar transactions. Although these reactions might manifest similarly in terms of buying or selling actions, they stem from unique information and decisions each day. These possible explanations for the high autocorrelation of hedge funds' net flow align with the agility and fast execution characteristic of hedge funds and, therefore, seem most plausible. The pattern for the other two market participant groups looks different. Only a minor autocorrelation is present in asset managers' and other market participants' net flow at a one-day lag, which rapidly decays upon further lagging.

Figure 3: Autocorrelation of net flows



Note: This chart displays the autocorrelation of the net flows of hedge funds, asset managers, and other market participants up to a lag of 20 days. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB.

Assessing the representativeness of hedge funds within the data sample is complex due to the anonymity of the underlying hedge funds. I encounter potential biases that warrant careful consideration. Firstly, some hedge funds may settle via prime brokers, and as such, the flows would be categorized as interbank transactions (Ranaldo & Somogyi, 2021) and not captured within the hedge funds market participant category. This potentially leads to an underrepresented view of hedge fund market participation. Another potential bias arises from the dataset's focus on participants settling via CLS, which may overlook smaller hedge funds and asset managers (Ranaldo & Somogyi, 2021). This oversight could lead to an incomplete understanding of market dynamics, as the aggregated data disproportionately reflects the trading patterns and strategies of larger market participants. Finally, the observed high autocorrelation in hedge fund net flows, indicative of the prevalence of specific trading patterns, suggests a third bias. This bias arises from an overrepresentation of specific trading behavior, potentially overshadowing other strategic approaches employed by hedge funds. The possible emphasis on momentum trading might neglect the diversity of hedge fund strategies that could differently affect market conditions. Recognizing and understanding these biases is crucial for interpreting this study's findings.

3 Information content of hedge funds' net flow on CHF returns

3.1 Methods

Order flow analysis and its relation to exchange rates dates back to Evans and Lyons (2002a) and has been adapted by Sager and Taylor (2008) who use ordinary-least-square (OLS) regressions to estimate the relationship between order flow and exchange rate returns. However, an important factor to consider is the potential for feedback trading or reverse causality, which is not accounted for in an OLS regression. In analyzing daily data, I intend to consider the possibility of mutual influence between hedge funds' net flow and the CHF exchange rate. As Danielsson and Love (2006) have pointed out, the FX price impact of order flow is substantially more pronounced when feedback trading is not ruled out.

With these considerations, the standard OLS approach falls short in estimating the causal impact of net flows on CHF returns due to the violation of the uncorrelated error terms assumption, leading to biased results. To navigate around this bias, I use instrumental variables to handle the endogenous variables. The requirements for these instruments include relevance (correlation with the endogenous variable) and exogeneity (no correlation with the error term and no direct effect on CHF returns). Past observations of net flows are appropriate candidates for these instruments. As highlighted in subsection 2.3, each market participant group's net flow displays autocorrelation at short lags, a feature that is especially pronounced in the case of hedge funds' net flow. This strong autocorrelation suggests that lagged net flow serves as an effective instrument for contemporaneous net flow. In fact, I utilize the one-day lagged net flow as the chosen instrument based on the assumption that the one-day lagged net flow does not directly influence contemporaneous CHF returns. This assumption seems reasonable as the analysis of CHF returns is based on closing prices, and I anticipate the effects of hedge funds' net flow to be realized within the same trading day. This anticipation stems from the understanding of hedge funds as typically agile and quick to react toward new information. Therefore, the impact of their net flow on CHF returns is expected to be mostly contained within that day itself, which justifies the choice of using one-day lagged net flow as an instrument in the analysis.

For the estimation I use the 2SLS procedure. I initially estimate the first stage as follows:

$$NF_t^{HF} = \beta_0 + \beta_1 NF_{t-1}^{HF} + \sum_{k=1}^{K} \delta_k a_{k,t} + u_t, \tag{3}$$

where NF_t^{HF} is the net flow of hedge funds at time t and $a_{k,t}$ refers to the k$^{\text{th}}$ control variable at time

t. By estimating Equation 3 I obtain the estimated coefficients and the predicted hedge funds' net flow as follows:

$$\widehat{NF}_t^{HF} = \widehat{\beta}_0 + \widehat{\beta}_1 NF_{t-1}^{HF} + \sum_{k=1}^{K} \widehat{\delta}_k a_{k,t}, \tag{4}$$

where the hats refer to the fitted values. Thereafter, I estimate the second stage using those fitted values:

$$\Delta CHF_t = \gamma_0 + \gamma_1 \widehat{NF}_t^{HF} + \sum_{k=1}^{K} \eta_k a_{k,t} + v_t, \tag{5}$$

As previous results indicate nothing about how the impact of hedge funds' net flow compares to the impact of other market participants, I repeat the 2SLS estimation by not only including hedge funds' net flow but also the net flow of asset managers and other market participants aggregated to compare the impact of the net flows of the different market participant groups. Due to the relatively low auto-correlation of the net flow of asset managers and other market participants compared to hedge funds (see Figure 3), I do not only re-estimate the regression using previous observations of net flows as instruments for each market participant groups' net flow but I also re-estimate the regression without instrumentalizing asset managers' and other market participants' net flows. The variables, including control variables, are described in Table 3.

Table 3: Description of regressors and control variables

Variable	Description	Transformation
NF_t^{HF}	Net flow of hedge funds at time t	bn. CHF
NF_t^{AM}	Net flow of asset managers at time t	bn. CHF
NF_t^{O}	Net flow of all market participant groups excluding hedge funds and asset managers aggregated at time t	bn. CHF
S&P 500	US equity index covering 500 large listed US companies	Logarithmic return
VIX	Expected volatility of the S&P500 Index	Logarithmic return
Euro Stoxx 50	European equity index covering 50 large listed European companies	Logarithmic return
V2X	Expected volatility of the Euro Stoxx 50 Index	Logarithmic return
Gold	Gold spot price in USD per troy ounce	Logarithmic return

Note: This table shows a description and transformation of the variables in the 2SLS model.

In the next step, I include a dummy variable in the model, which is 1 during the minimum exchange rate regime of the SNB and 0 otherwise. This provides additional insights about the consistency of the results during the time of the exchange rate floor compared to the time when the SNB was not defending a specific EURCHF exchange rate level.

Finally, I investigate whether the impact of hedge funds' net flows is more pronounced on days where contractionary or accommodative monetary policy surprises by the SNB occur. Thereby I identify monetary policy surprises by using the measure provided by Koeniger et al. (2022)[11] who use high-frequency data on the changes in financial market expectations to identify monetary policy surprises. Those policy rate expectations are measured by the prices of futures contracts for the 3-month CHF Libor, and the monetary policy surprises are retrieved by computing their daily changes on announcement days. I differentiate contractionary and accommodative monetary policy surprises. Contractionary (accommodative) surprises refer to more restrictive (expansionary) SNB monetary policy than expected. On nonannouncement dates, the surprise amount is 0. Importantly, the changes in the policy rates are at least partially expected and only the unexpected part is captured in this series. If markets expect a lower policy rate but the SNB keeps the policy rate unchanged, then this would be an example of a contractionary surprise. The accommodative surprises are more pronounced than the contractionary surprises in the sample period (see Figure A3). The most pronounced surprises are on 2008-11-06 and 2008-11-20 (global financial crisis), 2011-08-17 (intensification of measures against the strong CHF by the SNB), and 2015-01-15 (discontinuation of minimum exchange rate regime by the SNB). I re-estimate the 2SLS model and include the contractionary (MPS^{+}) and (absolute) accommodative (MPS^{-}) monetary policy surprises as well as their interactions with hedge funds' net flow.

3.2 Results

The analysis commences with the estimation of Equation 3 and Equation 5, employing one-day lagged net flows as instrumental variables as highlighted in subsection 3.1. Results are provided in Table 4. For conciseness, control variables are not displayed. The instrument's relevance is evidenced by the significant and positive coefficient of the one-day lagged net flow in the first stage, accounting for over 26% of the variation in NF_t^{HF}, as substantiated by the R^2 of the first stage in Table 4. The variation explained in the second stage is roughly 14%. The second-stage estimates reveal that hedge funds' net flow and control variables' substantially impact CHF returns, with the coefficient for $\widehat{NF_t^{HF}}$ being significantly positive. A net CHF purchase of one billion by hedge funds corresponds to an increase in CHF returns of approximately 0.4%, validating the hypothesis that hedge funds possess superior information, in line with the results presented by Cerrato et al. (2011).

[11] I use the raw series as opposed to the series purged from potential autocorrelation.

Table 4: 2SLS regression estimates with one-day lagged hedge fund net flows as instrument

	1^{st} stage	2^{nd} stage
	NF_t^{HF}	ΔCHF_t
Intercept	-0.0026^{**}	0.0080
	(0.0011)	(0.0081)
$\widehat{NF_t^{HF}}$		0.3842^{**}
		(0.1789)
NF_{t-1}^{HF}	0.5126^{***}	
	(0.0470)	
Controls	Yes	Yes
R^2	0.2636	0.1372
Adj. R^2	0.2622	0.1356

Note: This table shows the results of the first and second stage of the 2SLS regression estimating the impact of hedge funds' net flows on the CHF index using one-day lagged hedge funds' net flow as instrument. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB. Net flow is in bn. CHF. *, **, and *** denote significance on 10, 5 and 1 percent level, respectively. Newey-West standard errors in parentheses.

Subsequently, I introduce the net flow of asset managers and other market participants, aiming to compare their impacts on CHF returns to the estimated impact of hedge funds. Given the weak expected instrumentalization of one-day lagged net flows by asset managers and other participants as visible in the autocorrelation analysis in Figure 3, I estimate the regressions with and without instrumentalizing asset managers' and others' net flow. Results are presented in Table 5.

Table 5: 2SLS regression estimates including all market participants

	1st stage			2nd stage	1st stage	2nd stage
	NF_t^{HF}	NF_t^{AM}	NF_t^{O}	ΔCHF_t	NF_t^{HF}	ΔCHF_t
Intercept	−0.0029***	−0.0394***	−0.0405*	0.0025	−0.0028***	0.0099
	(0.0011)	(0.0049)	(0.0212)	(0.0131)	(0.0011)	(0.0082)
$\widehat{NF}_t^{HF}$				0.3646*		0.4078**
				(0.1954)		(0.1769)
$\widehat{NF}_t^{AM}$				−0.0880		
				(0.2238)		
$\widehat{NF}_t^{O}$				−0.0317		
				(0.0618)		
NF_t^{AM}					−0.0047	0.0634**
					(0.0073)	(0.0282)
NF_t^{O}					0.0006	−0.0202**
					(0.0009)	(0.0086)
NF_{t-1}^{HF}	0.5117***	−0.1363*	0.0989		0.5118***	
	(0.0471)	(0.0818)	(0.2492)		(0.0470)	
NF_{t-1}^{AM}	−0.0064	0.1176***	0.0822			
	(0.0073)	(0.0198)	(0.0720)			
NF_{t-1}^{O}	−0.0003	0.0011	0.1187***			
	(0.0008)	(0.0036)	(0.0228)			
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.2643	0.0183	0.0164	0.1374	0.2640	0.1407
Adj. R^2	0.2624	0.0159	0.0139	0.1352	0.2622	0.1386

Note: This table shows the results of the first and second stage of the 2SLS regression estimating the impact of hedge funds', asset managers' and others' net flow on the CHF index. The first four columns show the results instrumentalizing each market participant groups' net flow with 1-day lagged net flows while columns five and six show the results when only instrumentalizing hedge funds' net flow. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB. Net flow is in bn. CHF. *, **, and *** denote significance on 10, 5 and 1 percent level, respectively. Newey-West standard errors in parentheses.

Columns one to three of Table 5 show significantly positive coefficients for the lagged net flow of the dependent variable's market participant group in the first stages, indicating relevant instruments. However, the explained variation for asset managers' and other market participants' net flow is low (less than 2%), especially when compared to that of hedge funds' net flow (over 26%). Moreover, the inclusion of asset managers' and other market participants' net flow barely increases the second stage explained variation, and the coefficients for hedge funds' net flow are the only significantly positive coefficients in the second stage. When re-running the regression without instrumentalizing asset managers' and other market participants' net flow, as presented in columns five and six, both the coefficients for asset managers' and other market participants' net flow are very small and significant. While the coefficient for asset managers' net flow is marginally positive, the coefficient for other market participants' net flow is slightly negative. A one-billion buying by asset managers is associated with a 0.06% increase in CHF returns, an economically negligible magnitude. Hence, even after ignoring potential reverse causality, neither asset managers' nor other participants' net flow exhibits an economically significant impact on CHF returns, starkly contrasting with hedge funds. Cumulatively, these findings are in line with past literature (Cerrato et al., 2011; Osler & Vandrovych, 2009) and affirm the superior information theory of hedge funds compared to other market participants, as proposed in section 1.

The dataset used in this study includes structural breaks due to the SNB's minimum exchange rate regime. I introduce a dummy variable to evaluate the influence of hedge funds' net flow during and outside this regime. The results, as presented in Table 6, indicate that the effect of hedge funds' net flow is largely driven by periods outside the minimum exchange rate regime. The lower volatility in CHF exchange rates during the minimum exchange rate regime results in a lower impact of hedge funds' net flow, which is plausible given the permanent and sizeable currency interventions of the SNB. Yet, it is not possible to confirm a significant difference in the impact across the different regimes due to the insignificance of the coefficient for $\widehat{d_t^{MER} \cdot NF_t^{HF}}$.

I further scrutinize the investigation to elucidate the differential impacts of hedge funds' net flow on CHF returns under the prevalence of SNB monetary policy surprises. The analysis, as presented in Table 7, again intentionally omits the days marking the introduction and discontinuation of the minimum exchange rate regime by the SNB. An intriguing pattern emerges from the data analysis. During days marked by contractionary monetary policy surprises (for example, an unanticipated hike in interest rates by the SNB), the impact of hedge funds' net flow on CHF returns is higher com-

Table 6: 2SLS regression estimates with minimum exchange rate regime dummy

	1st stage		2nd stage
	NF_t^{HF}	$d_t^{MER} \cdot NF_t^{HF}$	ΔCHF_t
Intercept	-0.0040^{***}	0.0000	0.0127
	(0.0012)	(0.0000)	(0.0100)
d_t^{MER}	0.0050^{**}	0.0009	−0.0133
	(0.0025)	(0.0022)	(0.0166)
$\widehat{NF_t^{HF}}$			0.5785^{***}
			(0.2197)
$\widehat{d_t^{MER} \cdot NF_t^{HF}}$			−0.5671
			(0.3958)
NF_{t-1}^{HF}	0.4987^{***}	−0.0001	
	(0.0591)	(0.0003)	
$d_t^{MER} \cdot NF_{t-1}^{HF}$	0.0389	0.5379^{***}	
	(0.0936)	(0.0723)	
Controls	Yes	Yes	Yes
R^2	0.2649	0.2907	0.1376
Adj. R^2	0.2630	0.2890	0.1355

Note: This table shows the results of the first and second stage of the 2SLS regression estimating the impact of hedge funds' net flows on CHF returns using one-day lagged net flows as instruments and including a dummy which is 1 during the minimum exchange rate regime of the SNB and 0 otherwise. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB. Net flow is in bn. CHF. *, **, and *** denote significance on 10, 5 and 1 percent level, respectively. Newey-West standard errors in parentheses.

pared to nonsurprise days. Precisely, a contractionary surprise of only one basis point translates to a magnified effect of hedge funds' net flow, yielding a higher CHF return impact of 2.2% compared to nonsurprise days. In contrast, during days marked by accommodative surprises (exemplified by unanticipated rate cuts by the SNB), the effect is much weaker and the coefficient is insignificant. In fact, on days with a one basis point accommodative surprise, the impact of hedge funds' net flow is only 0.1% higher than nonsurprise days. However, the contractionary surprises are much smaller in the sample, being slightly over 2 basis points, on average, and ranging from 1 to 7 basis points, while the accommodative shocks in the sample are much bigger and, on average, almost 9 basis points ranging from 1 to 63 basis points (see Figure A3). As in most of the sample period, the monetary policy regime was predominantly accommodative, markets might have become more sensitive toward contractionary surprises. Thus, I re-estimate the model and only include the accommodative shocks that are 10 basis points or larger. The interaction coefficient for $MPS_t^{-} \cdot NF_{t-1}^{HF}$ turns highly signifi-

Table 7: 2SLS regression estimates with monetary policy surprises

	1st stage			2nd stage
	NF_t^{HF}	$MPS_t^+ \cdot NF_t^{HF}$	$MPS_t^- \cdot NF_t^{HF}$	ΔCHF_t
Intercept	−0.0026**	0.0002*	−0.0005	0.0091
	(0.0011)	(0.0001)	(0.0004)	(0.0080)
MPS_t^+	−0.0033	−0.0252***	−0.0001	0.0561
	(0.0042)	(0.0086)	(0.0004)	(0.0544)
MPS_t^-	0.0012	−0.0001	0.0355***	−0.0262***
	(0.0008)	(0.0000)	(0.0051)	(0.0039)
$\widehat{NF_t^{HF}}$				0.3748**
				(0.1783)
$\widehat{MPS_t^+ \cdot NF_t^{HF}}$				2.1708**
				(0.9993)
$\widehat{MPS_t^- \cdot NF_t^{HF}}$				0.1064
				(0.0860)
NF_{t-1}^{HF}	0.5149***	−0.0005	0.0055	
	(0.0474)	(0.0012)	(0.0058)	
$MPS_t^+ \cdot NF_{t-1}^{HF}$	−0.0972**	0.1965*	−0.0032	
	(0.0424)	(0.1037)	(0.0039)	
$MPS_t^- \cdot NF_{t-1}^{HF}$	−0.1759***	0.0029	−4.1712***	
	(0.0649)	(0.0030)	(0.5013)	
Controls	Yes	Yes	Yes	Yes
R^2	0.2653	0.2576	0.7068	0.1418
Adj. R^2	0.2630	0.2553	0.7059	0.1391

Note: This table shows the results of the first and second stage of the 2SLS regression estimating the impact of hedge funds' net flows on CHF returns using one-day lagged net flows as instruments including variables measuring the impact when contractionary or accommodative monetary policy surprises occur. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB. Net flow is in bn. CHF. *, **, and *** denote significance on 10, 5 and 1 percent level, respectively. Newey-West standard errors in parentheses.

cant; however, its magnitude is much smaller than the interaction coefficient for $MPS_t^+ \cdot NF_{t-1}^{HF}$ (see Table B3). This suggests a disproportionately significant role of hedge funds' net flow in driving CHF returns during contractionary monetary policy surprises.

Widespread trading strategies in currency markets by hedge funds that historically yield a positive

return are momentum and carry trade strategies.[12] Although I have no information on the specific strategies and individual hedge funds in the sample, the high autocorrelation of hedge funds' net flows in the sample points toward the presence of momentum strategies (see subsection 2.3). In contrast, the high impact on days with contractionary monetary policy surprises likely indicates the presence of elevated short positions, for example, due to carry trades that need to be closed if the CHF appreciates due to contractionary monetary policy surprises.[13] The negative mean of hedge funds' net flows in the summary statistics as presented in Table 2 confirms that, on average, hedge funds are net sellers of the CHF during the sample time, possibly due to FX carry trade strategies. FX carry trades involve borrowing the low-yielding currency to buy a high-yielding currency. Due to the comparably low-interest rates in Switzerland compared to many foreign countries over many years in the sample, the CHF served as a popular funding currency in carry trades. Contractionary monetary policy shocks by the SNB often lead to narrower interest rate differentials between Switzerland and foreign countries and to a stronger CHF, decreasing the attractiveness of the CHF as a funder in carry trades. This likely forces hedge funds to rapidly close out their positions, thereby amplifying the influence of their flows on CHF returns. Conversely, on days marked by expansionary monetary policy surprises, there is no urgency for hedge funds to adjust their carry trade positions, leading to a less pronounced impact of their net flow on CHF returns.

3.3 Robustness Tests

In this section, I conduct several robustness tests to guarantee that previously presented results are robust. First, I include different measures of CHF returns to ensure that previous results are not dependent on the chosen return measure. I calculate two additional CHF return measures, which I name the broad CHF index and the weighted narrow CHF index. The broad CHF index, ΔCHF_t^{Br}, is calculated using a method similar to the one suggested by Verdelhan (2018) and Fink et al. (2022). This method entails computing the simple average of the daily log returns of 28 bilateral CHF exchange rates, consistently using the CHF as the base currency. The aim is to isolate movements specific to the CHF, while filtering out the idiosyncratic variations of other currencies, such as the EUR or USD. This method offers a comprehensive perspective on the CHF's performance against various currencies. The equal weighting within this broad CHF index guarantees that no single pair dominates the overall average return. As this broad selection of currency pairs might introduce an emerging market bias in

[12] See Burnside et al. (2011) for a comprehensive literature review and investigation on momentum and carry trade strategies in currency markets.

[13] Past literature shows that the CHF appreciates following contractionary monetary policy surprises by the SNB (Ferrari et al., 2021; Fink et al., 2024; Grisse, 2020; Kugler, 2020; Ranaldo & Rossi, 2010).

the return calculation and acknowledging that the previous index does not adequately account for the varied trading volume among the different currency pairs, I additionally develop a weighted narrow CHF index, ΔCHF_t^{WNa}. The weighted narrow CHF index is calculated similarly to the CHF index in the previous section. However, the currencies considered in the index are the G10 currencies[14] rather than the currencies that are settled via CLS and rather than weighting the currency pairs according to their volume in the CLS dataset, the currency pairs are weighted according to their market volume as measured by BIS Triennial Surveys (BIS, 2007, 2010, 2013, 2016). During these years, the USDCHF and EURCHF pairs, on average, represented approximately 56% and 36% of the total CHF spot volume traded, respectively. The weighted narrow CHF index equally distributes the residual 8% among the remaining seven G10 currencies (excluding the CHF), given that the BIS Triennial Survey discloses volume data exclusively for CHF against USD and EUR and not against other currencies during these pertinent years.

Table 8: 2SLS regression estimates with alternative CHF return measures

	1st stage	2nd stage	
	NF_t^{HF}	ΔCHF_t^{Br}	ΔCHF_t^{WNa}
Intercept	-0.0026^{**}	0.0151^{*}	0.0075
	(0.0011)	(0.0081)	(0.0081)
$\widehat{NF}_t^{HF}$		0.3946^{**}	0.3952^{**}
		(0.1819)	(0.1797)
NF_{t-1}^{HF}	0.5126^{***}		
	(0.0470)		
Controls	Yes	Yes	Yes
R^2	0.2636	0.2171	0.1342
Adj. R^2	0.2622	0.2156	0.1326

Note: This table shows the results of the first and second stage of the 2SLS regression estimating the impact of hedge funds' net flow on different CHF return measures using one-day lagged hedge funds' net flow as instrument. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB. Net flow is in bn. CHF. *, **, and *** denote significance on 10, 5 and 1 percent level, respectively. Newey-West standard errors in parentheses.

Results are presented in Table 8 and confirm the robustness across different CHF return measures. Explained variation and coefficients in the second stages are in similar ranges than in Table 4 and coefficients for hedge funds' net flow show the same significance level. When re-estimating Table 6 and

[14]G10 currencies is a commonly known abbreviation in FX markets and includes the following currencies: AUD, CAD, EUR, JPY, NZD, NOK, GBP, SEK, CHF, USD.

Table 7 with the two alternative return measures, ΔCHF_t^{Br} and ΔCHF_t^{WNa}, as dependent variables, the results are again very similar to the results presented in the previous section (see Table B1 and Table B2).

To evaluate the dependence of the results on the instrument, I re-estimate the 2SLS regression using NF_{t-6}^{HF} as the instrument. Thus, I re-estimate Equation 3 and Equation 5 using past net flow lagged by six days as an instrument to allow an impact of past observations of hedge funds' net flow on CHF returns up to a lag of one week (i.e., five trading days). Results are presented in Table 9. The net flow of six-day lagged hedge funds is still highly significant in the first stage. However, the explained variation according to the R^2 is much lower compared to the first stage when using one-day lagged hedge funds' net flow as shown in Table 4, which is as expected due to the decreasing autocorrelation as presented in Figure 3. No matter which of the three different CHF return measures is used, the coefficient for hedge funds' net flow in the second stage is significantly different from 0 and the magnitude of the coefficient is even higher compared to when using one-day lagged net flow as an instrument confirming the robustness of the results.

Table 9: 2SLS regression estimates with six-day lagged hedge fund net flows as instrument

	1st stage	2nd stage		
	NF_t^{HF}	ΔCHF_t	ΔCHF_t^{Br}	ΔCHF_t^{WNa}
Intercept	−0.0038***	0.0174**	0.0092	0.0089
	(0.0012)	(0.0083)	(0.0082)	(0.0082)
$\widehat{NF}_t^{HF}$		0.8251**	0.6344*	0.6792**
		(0.3543)	(0.3413)	(0.3419)
NF_{t-6}^{HF}	0.2833***			
	(0.0391)			
Controls	Yes	Yes	Yes	Yes
R^2	0.0813	0.2177	0.1374	0.1345
Adj. R^2	0.0795	0.2162	0.1358	0.1329

Note: This table shows the results of the first and second stage of the 2SLS regression estimating the impact of hedge funds' net flow on different CHF return measures using six-day lagged hedge funds' net flow as instrument. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB. Net flow is in bn. CHF. *, **, and *** denote significance on 10, 5 and 1 percent level, respectively. Newey-West standard errors in parentheses.

Finally, to assess the robustness of the increased importance of hedge funds' net flow during contrac-

tionary monetary policy surprises by the SNB, I perform an alternative hypothesis test. Specifically, I conduct a t-test to evaluate whether the coefficients $\widehat{MPS_t^+ \cdot NF_t^{HF}}$ and $\widehat{MPS_t^- \cdot NF_t^{HF}}$ of Table 7 are significantly different. The null hypothesis that these two coefficients are equal is rejected at the 5% significance level. This supports the hypothesis that the impact of hedge funds' net flow on CHF returns is more pronounced during periods of contractionary monetary policy surprises by the SNB.

4 Trading price analysis

4.1 Methods

Hedge Funds are not only reputed to possess superior information but are also presumed to have unparalleled expertise in FX trading and forecasting and the ability to time their trades accordingly (Getmansky et al., 2015). Therefore, I hypothesize that on a given day hedge funds generally trade at more advantageous prices relative to other investors. This supposition is rooted in the expectation that hedge funds develop a well-informed perspective on the progression of exchange rates and strategize their trades accordingly. For instance, they may preemptively position themselves in anticipation of a specific risk event to maximize returns. Their expected proficiency in best execution and data analysis further strengthens the conjecture that hedge funds secure superior trading prices compared to other investors, who may be less price-sensitive as FX might not be their core business (see section 1). To validate this hypothesis, I contrast the VWAP of hedge funds with that of other market participants. The currency pairs considered for this analysis are CHFEUR and CHFUSD, owing to the lack of sufficient data in the CLS dataset to derive significant conclusions for the other available pairs. The CHF is always the base currency.

The VWAP for a buy order of currency pair c by market participant group m is calculated using the following formula:

$$VWAP_t^{m,c,B} = \frac{VariableCurrencySold_t^{m,c}}{CHFBought_t^m}, \tag{6}$$

where $VariableCurrencySold_t^{m,c}$ represents the total amount sold in the corresponding variable currency on day t. Conversely, the VWAP for sell orders is calculated as follows:

$$VWAP_t^{m,c,S} = \frac{VariableCurrencyBought_t^{m,c}}{CHFSold_t^m} \tag{7}$$

This method yields a daily VWAP for each market participant group m per currency pair c for both

buy and sell orders. When market participants purchase CHF, their objective is to secure the lowest price possible, whereas they aim to obtain the highest price during CHF sales. Therefore, the market participant group with the lowest price on a trading day for buy orders is deemed to have received the best price, and vice versa for sell orders. The outperformance when buying CHFEUR and CHFUSD is computed by subtracting the VWAP of hedge funds from the VWAP of other market participants and dividing by the VWAP of other market participants to obtain the outperformance:

$$OP_t^{HF,c,B} = \frac{VWAP_t^{O,c,B} - VWAP_t^{HF,c,B}}{VWAP_t^{O,c,B}} \tag{8}$$

For sales, a higher price is more desirable, thus the outperformance is calculated as:

$$OP_t^{HF,c,S} = \frac{VWAP_t^{HF,c,S} - VWAP_t^{O,c,S}}{VWAP_t^{O,c,S}} \tag{9}$$

Subsequently, I derive the mean, median, standard deviation, and the 10^{th} and 90^{th} percentiles of these daily outperformances. Finally, the annualized outperformance of hedge funds is calculated as:

$$R_t^{HF,c} = ((1+OP_1^{HF,c,B}) \times \cdots \times (1+OP_n^{HF,c,B}) \times (1+OP_1^{HF,c,S}) \times \cdots \times (1+OP_l^{HF,c,S}))^{\frac{1}{q}} - 1, \tag{10}$$

where n is the count of buy order observations, l represents the number of sell order observations, and q is the duration in years, which is 13 in the sample. The computation for the outperformance of asset managers mirrors the above procedure.

4.2 Results

Results of the trading price analysis are shown in Table 10 and indicate that hedge funds in aggregate tend to outperform other market participants across both examined currency pairs. The annualized outperformance is substantially higher in CHFUSD with 139 basis points compared to 40 basis points in CHFEUR. Although hedge funds' daily mean outperformance is positive for both currency pairs, a negative median outperformance in CHFEUR suggests that the group of hedge funds, despite outperforming other market participants, on average, may frequently transact at less favorable prices in CHFEUR. However, when they do outperform, the margin is significantly high. Conversely, asset managers appear to underperform in aggregate relative to other market participants, as evidenced by their negative annualized outperformance and negative daily mean and median outperformance. Moreover, hedge funds' standard deviation is considerably higher, suggesting greater variability in

their aggregate performance. The 10^{th} and 90^{th} percentiles of the outperformance are relatively similar for both hedge funds and asset managers in both currency pairs.

Table 10: Outperformance in basis points

	Currency pair	Annualized Outperformance	Daily Mean	Daily Median	Std. Dev.	10^{th} Percentile	90^{th} Percentile
HF	CHFEUR	40.46	0.23	−0.30	28.82	−11.34	10.98
	CHFUSD	138.92	0.61	0.32	49.31	−23.81	25.15
AM	CHFEUR	−218.35	−1.00	−0.63	19.01	−12.23	10.30
	CHFUSD	−288.23	−1.01	−1.17	19.24	−20.84	18.30

Note: This table presents the annaualized outperformance as well as the mean, median, standard deviation, 10^{th} and 90^{th} percentile of hedge funds' and asset managers' daily aggregate outperformance versus other market participants. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB.

To probe the potential influence of the SNB's minimum exchange rate regime on the performance of the group of hedge funds and asset managers, I reconfigure the examination by splitting the sample into two distinct phases: the period during the minimum exchange rate regime and the time frame outside of it. Results are presented in Table 11. The group of hedge funds exhibits an intriguing phenomenon: their aggregate performance is amplified during the period of the minimum exchange rate regime when trading in CHFEUR. This is evident from the positive annualized outperformance and daily mean, although the daily median is negative. A possible explanation for this phenomenon could be the additional market stability and predictability brought about by the minimum exchange rate regime, which was potentially utilized to maximum effect by hedge funds with their sophisticated trading techniques. On the contrary, their CHFUSD performance escalates in the absence of the minimum exchange rate regime. The group of asset managers persistently underperforms in both timeframes within and without the minimum exchange rate regime. The downturn in their performance is more pronounced during the absence of the regime, reflected in a deeper negative annualized outperformance, daily mean and median, suggesting less favorable transactions were more prevalent during this period. Due to the lower volatility of the CHFEUR exchange rate during the regime's enforcement, their underperformance might be less pronounced during this phase. Moreover, both hedge funds and asset managers demonstrate lesser variability in their aggregate performance during the minimum exchange rate regime, as indicated by the reduced standard deviations. The percentile figures also denote a more constrained range of outcomes during this period for both groups of investors. This pattern aligns with the fact that exchange rate fluctuations, particularly in CHFEUR,

were less pronounced during the regime.

Table 11: Outperformance within and outside of the minimum exchange rate regime in basis points

	Currency pair	Annualized Outperformance	Daily Mean	Daily Median	Std. Dev.	10^{th} Percentile	90^{th} Percentile
Outside the minimum exchange rate regime of the SNB							
HF	CHFEUR	−18.01	−0.08	−0.31	30.75	−13.53	13.46
	CHFUSD	85.10	0.56	0.45	56.25	−26.01	26.27
AM	CHFEUR	−182.89	−1.26	−0.80	22.03	−14.98	12.56
	CHFUSD	−210.42	−0.98	−1.27	21.02	−21.69	19.62
Within the minimum exchange rate regime of the SNB							
HF	CHFEUR	58.57	0.83	−0.29	24.55	−6.97	7.22
	CHFUSD	53.36	0.74	0.22	17.30	−19.14	22.16
AM	CHFEUR	−36.11	−0.49	−0.54	10.76	−6.79	5.38
	CHFUSD	−79.49	−1.08	−0.88	13.63	−18.15	14.71

Note: This table presents the annaualized outperformance as well as the mean, median, standard deviation, 10^{th} and 90^{th} percentile of hedge funds' and asset managers' daily aggregate outperformance versus other market participants. The sample is split into the time outside and within the minimum exchange rate regime by the SNB. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB.

The results provide compelling evidence that hedge funds in aggregate often surpass other market players in terms of performance, although this superiority is not observed constantly, as indicated by the negative daily median in CHFEUR. In contrast, asset managers typically trade at less favorable prices than their market counterparts. Thus, the findings validate the presumption that hedge funds in aggregate indeed possess advanced transaction timing abilities and proficiency in achieving the best execution in their transactions, which is expected given their broad investment focus, including currencies as outlined in subsection 2.1. It should be noted, however, that by treating hedge funds and asset managers as aggregate groups in the analysis, it is assumed that each group demonstrates homogeneous trading behavior and performance. However, in reality, there may be significant heterogeneity among different hedge funds and asset managers. The analysis is limited in its ability to distinguish the performance of skilled hedge funds from the average as the data does not provide any insights on individual investors within each group as outlined in section 2.

5 Conclusion

This study intends to shed new light on the behavior of hedge funds and their impact on CHF exchange rates using a novel dataset provided by CLS. In particular, I examine the following questions: What is the impact of hedge funds' net flow on CHF returns and how does the impact vary across different monetary policy regimes? Do hedge funds possess expertise in FX forecasting and best execution, as well as superior transaction timing abilities, allowing them to trade at better prices compared to other market participants?

Using a 2SLS approach, I investigate the complex dynamics between CHF net flows and CHF returns, shedding light on the causal impact of hedge funds' net flows on CHF returns. The analysis uncovers a distinct positive impact of hedge funds' net flows on CHF returns. This relationship is of substantial economic magnitude and remains robust across different CHF return measures and instrumental variables. A comparative analysis of the effects of other market participants, such as asset managers, further underscores the unique, pivotal role hedge funds play in driving CHF returns. These findings are in line with past literature (Cerrato et al., 2011; Osler & Vandrovych, 2009) and remain robust even when eliminating the potential impact of reverse causality for asset managers and other market participants. When further dissecting the impact of hedge funds' net flow within different SNB policy regimes, the analysis unveils that the impact of hedge funds' net flows is more prominent outside the minimum exchange rate regime of the SNB. Furthermore, hedge funds exhibit a significantly higher impact on days with contractionary SNB monetary policy surprises. Lastly, the examination of the execution proficiency among different market participants affirms that hedge funds in aggregate, indeed secure more favorable trade prices, demonstrating their superior expertise in capitalizing on advantageous market conditions.

This investigation offers a multidimensional perspective on the critical role of hedge funds in the CHF FX market. The study reaffirms the substantial impact of hedge funds' net flows on CHF returns, while concurrently bringing to light how these impacts diverge across diverse SNB policy regimes. Additionally, it underscores the superior execution capabilities of hedge funds, which in aggregate trade at more favorable prices. As such, these findings offer a profound enrichment to the comprehension of market dynamics and bear significant ramifications for both policy formulation and investment strategies.

The unique position of the CHF as a safe haven currency necessitates a nuanced analysis of its exchange rate market separate from other currency markets. Nevertheless, examining the impact of market participants' net flows on exchange rate returns is a multifaceted task that likely intersects with exchange rate movements in other currency markets. Therefore, while this study contributes to an advanced understanding of CHF exchange rate determination and its relation to market participants' net flows, it also underscores the need for future research. Further research could expand this analysis, providing additional insight into the complex landscape of exchange rate determination, and ultimately, enhancing the grasp of these complex market dynamics.

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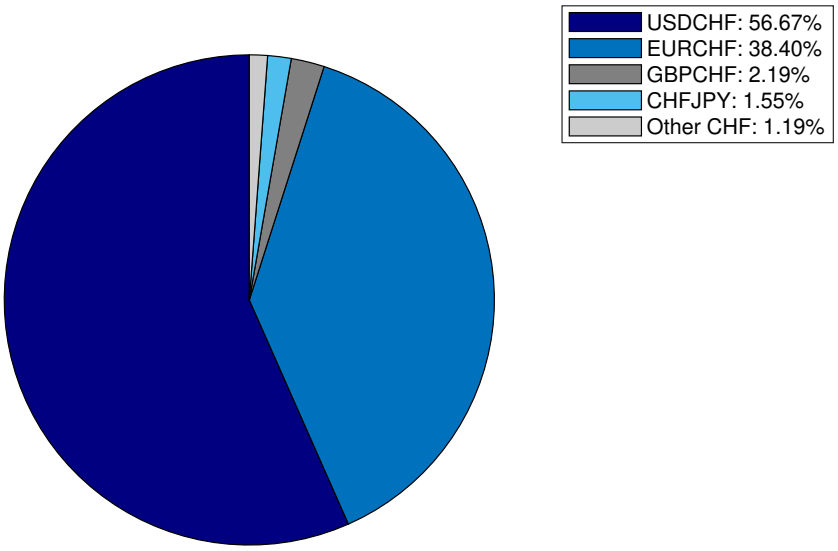
Appendices

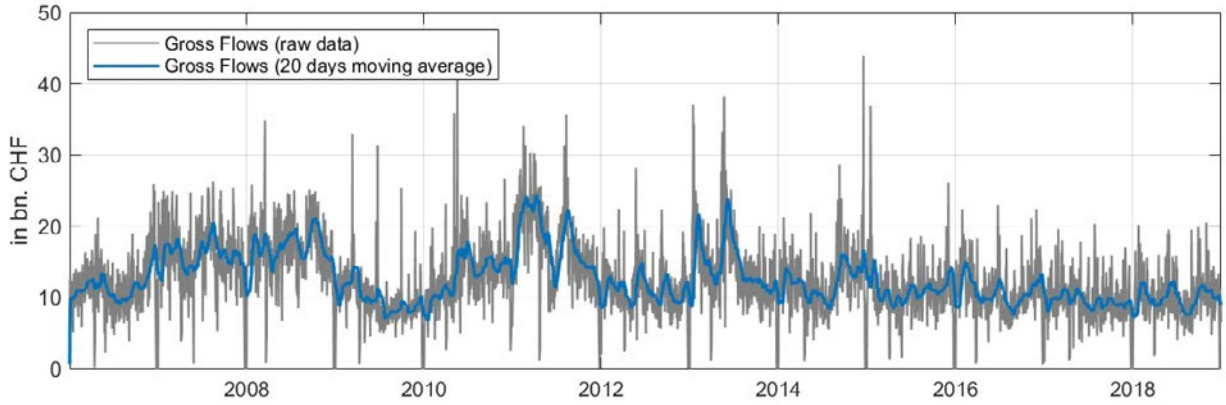
A Figures

Figure A1: CLS gross volume per currency pair



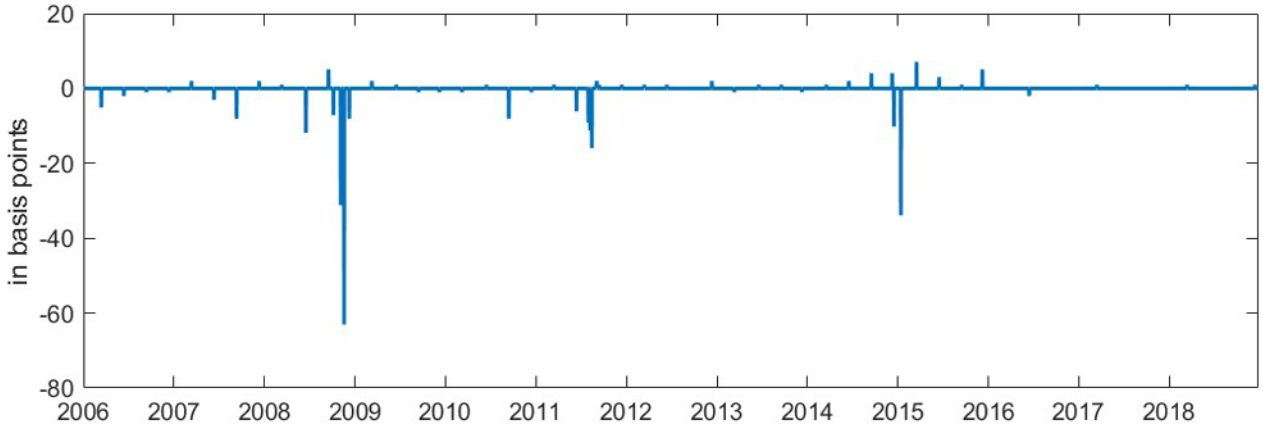
Note: This charts shows the CLS gross volume per currency pair. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB. Note that the CLS data in this chart includes all CLS flows, including interbank flows where no directional data is available.

Figure A2: CLS gross volume over time



Note: This charts shows the CLS gross volume over time excluding interbank flows. The grey line depicts the raw gross volume and the blue line the 20 days moving average. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB.

Figure A3: SNB Monetary Policy Surprises



Note: This chart shows the daily monetary policy surprises as computed in Koeniger et al. (2022) in basis points. The sample spans from 2006-01-01 to 2018-12-31.

B Tables

Table B1: 2SLS regression estimates with minimum exchange rate regime dummy and alternative CHF return measures

	1st stage		2nd stage	
	NF_t^{HF}	$d_t^{MER} \cdot NF_t^{HF}$	ΔCHF_t^{Br}	ΔCHF_t^{WNa}
Intercept	−0.0040***	0.0000	0.0158	0.0123
	(0.0012)	(0.0000)	(0.0101)	(0.0100)
d_t^{MER}	0.0050**	0.0009	0.0010	−0.0135
	(0.0025)	(0.0022)	(0.0167)	(0.0168)
$\widehat{NF_t^{HF}}$			0.5451**	0.5952***
			(0.2281)	(0.2208)
$\widehat{d^{MER_t} \cdot NF_t^{HF}}$			−0.4647	−0.5841
			(0.3874)	(0.3977)
NF_{t-1}^{HF}	0.4987***	−0.0001		
	(0.0591)	(0.0003)		
$d_{t-1}^{MER} \cdot NF_{t-1}^{HF}$	0.0389	0.5379***		
	(0.0936)	(0.0723)		
Controls	Yes	Yes	Yes	Yes
R^2	0.2649	0.2907	0.2173	0.1347
Adj. R^2	0.2630	0.2890	0.2154	0.1325

Note: This table shows the results of the first and second stage of the 2SLS regression estimating the impact of hedge funds' net flow on CHF returns using one-day lagged net flow as instruments and including a dummy which is 1 during the minimum exchange rate regime of the SNB and 0 otherwise. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB. Net flow is in bn. CHF. *, **, and *** denote significance on 10, 5 and 1 percent level, respectively. Newey-West standard errors in parentheses.

Table B2: 2SLS regression estimates with monetary policy surprises and alternative CHF return measures

	1st stage			2nd stage	
	NF_t^{HF}	$MPS_t^+ \cdot NF_t^{HF}$	$MPS_t^- \cdot NF_t^{HF}$	ΔCHF_t^{Br}	ΔCHF_t^{WNa}
Intercept	−0.0026**	0.0002*	−0.0005	0.0156*	0.0087
	(0.0011)	(0.0001)	(0.0004)	(0.0081)	(0.0080)
MPS_t^+	−0.0033	−0.0252***	−0.0001	0.0806	0.0447
	(0.0042)	(0.0086)	(0.0004)	(0.0588)	(0.0547)
MPS_t^-	0.0012	−0.0001	0.0355***	−0.0242***	−0.0264***
	(0.0008)	(0.0000)	(0.0051)	(0.0038)	(0.0039)
$\widehat{NF_t^{HF}}$				0.3810**	0.3873**
				(0.1814)	(0.1792)
$\widehat{MPS_t^+ \cdot NF_t^{HF}}$				2.6907**	2.0262**
				(1.1587)	(1.0274)
$\widehat{MPS_t^- \cdot NF_t^{HF}}$				0.1417*	0.1400
				(0.0816)	(0.0882)
NF_{t-1}^{HF}	0.5149***	−0.0005	0.0055		
	(0.0474)	(0.0012)	(0.0058)		
$MPS_{t-1}^+ \cdot NF_{t-1}^{HF}$	−0.0972**	0.1965*	−0.0032		
	(0.0424)	(0.1037)	(0.0039)		
$MPS_{t-1}^- \cdot NF_{t-1}^{HF}$	−0.1759***	0.0029	−4.1712***		
	(0.0649)	(0.0030)	(0.5013)		
R^2	0.2653	0.2576	0.7068	0.2206	0.1387
Adj. R^2	0.2630	0.2553	0.7059	0.2181	0.1360
Controls	Yes	Yes	Yes	Yes	Yes

Note: This table shows the results of the first and second stage of the 2SLS regression estimating the impact of hedge funds' net flow on different CHF return measures using one-day lagged net flow as instruments including variables measuring the impact when contractionary or accommodative monetary policy surprises occur. The sample spans from 2006-01-01 to 2018-12-31 and excludes the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB. Net flow is in bn. CHF. *, **, and *** denote significance on 10, 5 and 1 percent level, respectively. Newey-West standard errors in parentheses.

Table B3: 2SLS regression estimates with monetary policy surprises excluding accommodative shocks smaller than 10 basis points

	1st stage			2nd stage
	NF_t^{HF}	$MPS_t^+ \cdot NF_t^{HF}$	$MPS_t^- \cdot NF_t^{HF}$	ΔCHF_t
Intercept	−0.0025**	0.0002*	−0.0002	0.0085
	(0.0011)	(0.0001)	(0.0002)	(0.0080)
MPS_t^+	−0.0034	−0.0252***	0.0002	0.0562
	(0.0042)	(0.0086)	(0.0002)	(0.0544)
MPS_t^-	0.0006***	0.0000	0.0348***	−0.0257***
	(0.0002)	(0.0000)	(0.0035)	(0.0032)
NF_{t-1}^{HF}	0.5146***	−0.0005	−0.0003	
	(0.0473)	(0.0012)	(0.0004)	
$\widehat{NF_t^{HF}}$				0.3747**
				(0.1783)
$\widehat{MPS_t^+ \cdot NF_t^{HF}}$				2.1671**
				(0.9997)
$\widehat{MPS_t^- \cdot NF_t^{HF}}$				0.1704***
				(0.0544)
$MPS_{t-1}^+ \cdot NF_{t-1}^{HF}$	−0.0969**	0.1965*	0.0009	
	(0.0424)	(0.1037)	(0.0015)	
$MPS_{t-1}^- \cdot NF_{t-1}^{HF}$	−0.1280***	0.0026	−4.1375***	
	(0.0103)	(0.0026)	(0.1712)	
R^2	0.2648	0.2576	0.9256	0.1412
Adj. R^2	0.2625	0.2552	0.9254	0.1385

Note: This table shows the results of the first and second stage of the 2SLS regression estimating the impact of hedge funds' net flow on CHF returns using one-day lagged net flow as instruments including variables measuring the impact when contractionary or accommodative monetary policy surprises occur. MPS_t^- only includes surprises that are in absolute terms larger than 10 basis points, otherwise the variable takes on the value 0. The sample spans from 2006-01-01 to 2018-12-31 and exclude the days of the introduction and discontinuation of the minimum exchange rate regime by the SNB. Net flow is in bn. CHF. *, **, and *** denote significance on 10, 5 and 1 percent level, respectively. Newey-West standard errors in parentheses.

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