IMF Working Paper

The Curious Case of the Yen as a Safe Haven Currency: A Forensic Analysis

Dennis Botman,
Irineu de Carvalho Filho, and
W. Raphael Lam

INTERNATIONAL MONETARY FUND

WP/13/228

IMF Working Paper

Asia and Pacific Department

The Curious Case of the Yen as a Safe Haven Currency: A Forensic Analysis

Prepared by Dennis Botman, Irineu de Carvalho Filho, and W. Raphael Lam[1]

Authorized for distribution by Stephan Danninger

November 2013

Abstract

This Working Paper should not be reported as representing the views of the IMF.
The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

During risk-off episodes, the yen is a safe haven currency and on average appreciates against the U.S. dollar. We investigate the proximate causes of yen risk-off appreciations. We find that neither capital inflows nor expectations of the future monetary policy stance can explain the yen's safe haven behavior. In contrast, we find evidence that changes in market participants' risk perceptions trigger derivatives trading, which in turn lead to changes in the spot exchange rate without capital flows. Specifically, we find that risk-off episodes coincide with forward hedging and reduced net short positions or a buildup of net long positions in yen. These empirical findings suggest that offshore and complex financial transactions should be part of spillover analyses and that the effectiveness of capital flow management measures or monetary policy coordination to address excessive exchange rate volatility might be limited in certain cases.

---

[1] Irineu de Carvalho Filho thanks the hospitality of the Georgetown University School of Foreign Service in Qatar. We thank Stephan Danninger, Olivier Blanchard, Jerald Schiff, and Steven Philips and participants at a Bank of Japan seminar in Tokyo in May 2013 for useful comments on an earlier draft. Messrs. Botman and Lam are affiliated with the IMF's Asia and Pacific Department; Mr. de Carvalho Filho is with the IMF Research Department.

Contents   Page

I. INTRODUCTION

The yen is widely considered a safe haven currency, i.e. a currency that appreciates when global investors' behavior becomes more risk-averse or economic fundamentals are more uncertain. That is rightly so. Since 2008, the yen appreciated steadily against the U.S. dollar in effective terms in the aftermath of various shocks. First, the global financial crisis was associated with a large real exchange rate appreciation by over 20 percent. Second, in May 2010, higher market distress about peripheral European sovereigns led to a large jump in the VIX, followed by a 10 percent yen appreciation against the euro within a matter of weeks.[2] Third, following the Great East Japan Earthquake, the yen appreciated further on account of expectations about sizeable repatriation of foreign assets by insurance companies, which in fact subsequently did not occur. Fourth, on February 25, 2013, uncertainty surrounding the outcome of the Italian elections led to a whopping intra-day appreciation of the yen against the euro of 5¼ percent and about 4 percent against the dollar. These examples illustrate that appreciation of the yen during episodes of increased global risk aversion is recurrent. Indeed, since the mid-1990s, there have been 12 episodes where the yen has appreciated in nominal effective terms by 6 percent or more within one quarter and these coincided often with events outside Japan.[3]

Although the yen's safe haven status has been well documented (e.g. Ranaldo and Söderlind 2010, De Bock and de Carvalho Filho 2013), the mechanisms through which risk-off appreciations occur has received considerably less attention. In this regard, a casual glance at the data reveals a curious feature: large movements in the yen during risk-off episodes occur without any detectable movements in net capital in- or outflows (Figure 1).[4] A similar observation holds for the large depreciation that has occurred since late 2012, which coincided with the emergence of "Abenomics" as well as waning safe-haven effects and widening trade deficits. As such, our forensic investigation of what drives large movements in the yen fills a void in the literature, with potential important implications for spillover analysis and the role of macroeconomic policies to address excessive exchange rate volatility.

---

[2] The VIX is a proxy for the market's expectation of stock market volatility over the next 30-day period. Bekaert, Hoerova and Lo Duca (2010) show that the VIX can be decomposed into risk aversion and uncertainty components. However that decomposition is not very informative because risk aversion and uncertainty are highly correlated.

[3] These include: the Asian crisis in 1998, the 2008 Lehman shock, and the 2010–11 escalation of the euro area crisis and uncertainty surrounding the debt ceiling debate in the U.S.

[4] Common indicators of capital flows include the Balance of Payments (BoP) statistics and International Transactions of Securities published by the Ministry of Finance in Japan. The latter consists of portfolio investment statistics based on reports from designated major investors. In general, the BoP statistics have a wider coverage as it includes major and other investors, while the International Transactions of Securities provide a more frequent release (weekly and monthly).

**Figure 1. Japan: Financial Flows in the Balance of Payments and
the Real Effective Exchange Rate**

Japan: Net Capital Flows
(In Billion of US dollars; REER 2010=100)
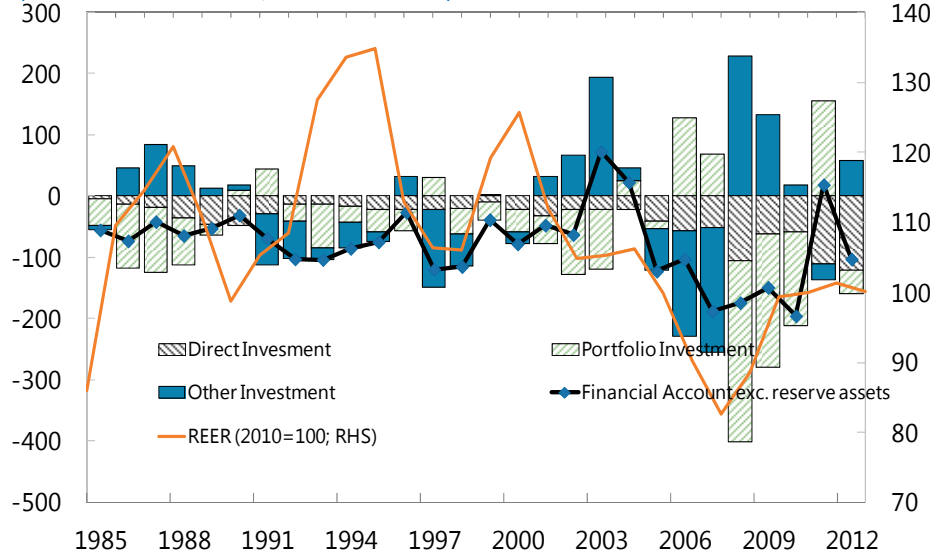
Source: Nomura Securities, IMF staff estimates

The rest of the paper is organized as follows. Section II discusses the yen's safe haven status as well as potential mechanisms that might explain these risk-off appreciations. Section III describes recent economic developments, including the rapid depreciation of the Japanese yen since the onset of "Abenomics". In Section IV we estimate the effect of risk-off episodes on the Japanese exchange rate and consider three proximate causes of yen risk-off appreciation: differentials in relative monetary stance between Japan and the United States; Balance of Payment's (BoP) financial flows; and portfolio rebalancing via derivatives markets. We conclude by discussing potential policy implications for mitigating the adverse effects of of large exchange rate movements.

II. THE YEN'S SAFE HAVEN STATUS

The safe haven status of the yen has been confirmed by several studies. Ranaldo and Söderlind (2010) document that the Japanese yen appreciates against the US dollar when US stock prices decrease and US bond prices and FX volatility increase. De Bock and de Carvalho Filho (2013) find that the Japanese yen and the Swiss franc are the only two currencies that on average appreciate against the U.S. dollar during risk-off episodes.

Safe haven currencies tend to have low interest rates, a strong net foreign asset position, and deep and liquid financial markets. Japan meets all these criteria. After controlling for the carry trade, Habib and Stracca (2012) find that safe haven status is robustly associated with stronger net foreign asset positions (an indicator of external vulnerability), and to a lesser extent with the absolute size of stock market (an indicator of market size and financial development). For

advanced countries, in addition to the net financial asset position, the public debt to GDP ratio and some measures of financial development and the liquidity of foreign exchange markets (measured by the bid-ask spread) are associated with safe haven status.

Although being a safe-haven country may appear enviable, when risk-off episodes recur, policymakers in safe haven countries face the challenge of dealing with sharp real appreciations or surges in capital flows. Transitory real appreciation may create hefty adjustment costs to the economy, and subsequently, economic dislocation when exchange rates eventually revert back (e.g. Bussiere, Lopez and Tille, 2013). The longer-lasting the real appreciation and surge in capital flows, the greater the potential for vulnerabilities to build-up of in either private or public sector balance sheets.[5] Moreover, in economies with already low inflation and interest rates close to the zero bound, real appreciations driven by risk-off episodes could feed deflation risks and place downward pressures on aggregate demand (see International Monetary Fund, 2012; de Carvalho Filho, 2013).

But the mechanisms that bring about risk-off appreciations are yet little explored in the literature. Thus this paper provides a forensic analysis of yen risk-off appreciations. We use the risk-off indicator proposed by De Bock and de Carvalho Filho (2013), which identifies the onset of risk-off episodes with large increases in the VIX relative to its 60-day historical moving average. We show first that the yen tends to appreciate after the onset of risk-off episodes (and more so than other safe-haven currencies).

We then explore four distinct and non-exclusive proximate causes, of which three can be mapped to the available economic and financial data.

The first possibility is that risk-off appreciations of the yen are driven by massive increases in financial inflows recorded in the BoP following spikes in the VIX, as Japanese residents reduce their rate of accumulation of foreign assets (retrenchment) and foreign investors increase their rate of accumulation of Japanese assets (capital flight).[6] However, we do not find empirical evidence that risk-off episodes trigger massive private financial inflows into Japan, unlike what happens in Switzerland (de Carvalho Filho 2013).

The second possibility is that risk-off appreciations of the yen occur because spikes in the VIX are informative about the stance of future monetary policy—therefore we test the hypothesis that

---

[5] Sorsa et al. (2007) identified expectations of appreciation driven in part by capital inflows as a driver of liability dollarization in Southeastern European countries. A similar phenomenon appears to have occurred in Turkey during the build-up to the crisis of 2000-01 (IMF 2004); and in Iceland before the Global Financial Crisis (IMF 2012b).

[6] The balance of payments records the trade in assets between resident and non-resident entities. There is a growing literature on the effects of cross-border trade in assets. The most recent works have increasingly turned their attention from the behavior of net capital flows (i.e. the difference between the net accumulation of foreign assets by residents and the net accumulation of claims on the domestic economy by non-residents) towards the joint behavior of gross outflows (i.e. the net accumulation of foreign assets by residents) and inflows (i.e. the net accumulation of claims on the domestic economy by non-residents). E.g., International Monetary Fund (2011), Forbes and Warnock (2012), Broner, Didier, Erce and Schmukler (2013), Bluehorn, Duttagupta, Guajardo and Topalova (2013).

risk-off episodes help predict interest rate differentials between Japan and the United States.[7] We also compare the behavior of yen spreads over the U.S. dollar with those of other advanced economies' currencies. We find that spreads of long and short rates between the yen and the U.S. dollar tend to widen after risk-off episodes, but the same is true for other advanced economies' currencies, including some like the Australian dollar that tends to depreciate with respect to the U.S. dollar during risk-off episodes (De Bock and de Carvalho Filho, 2013).

The third possibility is that risk-off appreciations of the yen come about because of portfolio rebalancing transactions that are not fully captured by BoP statistics, such as derivative transactions. For example, when risk perceptions change, exporters or overseas affiliates of Japanese companies may decide to lock in the exchange rate through hedging, or given Japan's sizeable net foreign asset position, holders of foreign securities may take a long yen position. As such, these derivative transactions may not just reflect short-term speculative behavior, but may just reflect prudent risk management. We find support for this conjecture as risk-off episodes are associated with increases in net non-commercial exposures to the yen in the derivatives market. A similar effect is found for the Swiss franc but not for the euro, which increases the plausibility that those transactions play an important role in safe haven currency dynamics.

Finally, as is true for any asset price, neither are transactions necessary for portfolio rebalancing, nor is cross-border trade in assets necessary for exchange rate movements. For instance, if risk-off episodes cause a reassessment by market participants of the expected return in yen denominated assets, exchange rate movements may occur with little or no underlying transactions. It is also possible that yen appreciation is driven by transactions among residents onshore or offshore transactions among non residents, both of which would not be captured in BoP statistics.

III. RECENT YEN DEPRECIATION AS AN ILLUSTRATION

The Japanese government has adopted a three-pronged approach ("Three Arrows of Abenomics") to revive the economy through flexible fiscal policy, aggressive monetary easing, and bold structural reforms to raise long-term growth. Immediate action has included the setting of a 2 percent inflation target in combination with open-ended asset purchases and fiscal stimulus amounting to about 1½ percent of GDP in effective terms in FY 2013-14. The combination of a decline in global risk aversion, the larger trade deficit, the widening of the expected interest rate differential with the U.S. and "Abenomics" have all contributed to a depreciation by close to 30 percent in effective terms between July 2012 and September 2013.

In terms of the proximate causes mentioned above, firstly net capital inflows in the balance of payments of Japan have not been substantial (Figure 2). In the past few years, Japan has consistently experienced outward FDIs as firms and financial institutions increased their presence abroad. Regarding the flows in the financial account, net portfolio investment (PI)
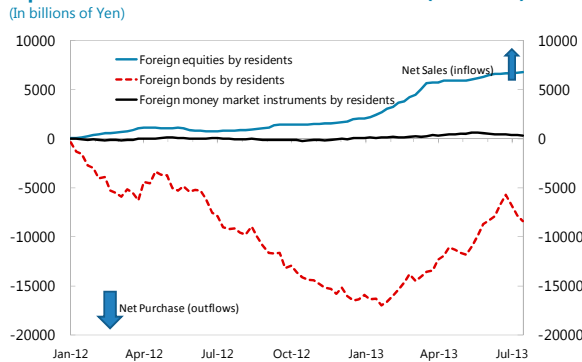
---

[7] Bekaert, Hoerova and Lo Duca (2010) find that monetary policy in the U.S. appears to relax in response to both risk aversion and uncertainty shocks, but these effects are statistically weaker than the effect of monetary policy on risk aversion and uncertainty.

flows has often been offset by net other investment (OI) flows, in part because of hedging activity and portfolio allocations in various instruments (e.g., bank deposits, derivatives, bonds and notes) between Japanese financial institutions and foreign counterparts. Moreover, while Japanese investors have gradually built up their portfolio asset positions since 2006 regardless of the direction of exchange rate movements, Japanese investors sold off foreign assets during the 2012-13 yen depreciation. On the other hand, foreign inflows into Japanese equities have increased noticeably, but since the currency risk on equity inflows is often hedged through selling of yen forwards, equity inflows may have had little impact on the exchange rate.
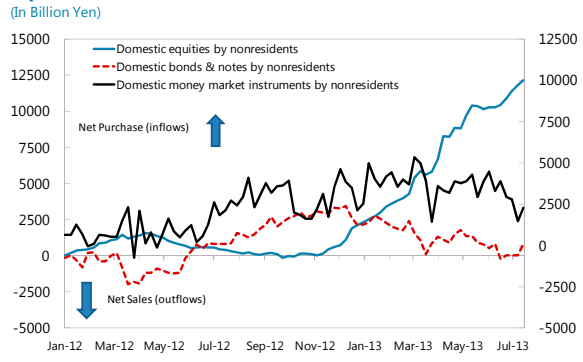
Figure 2. Recent Yen Depreciation and Capital Flows
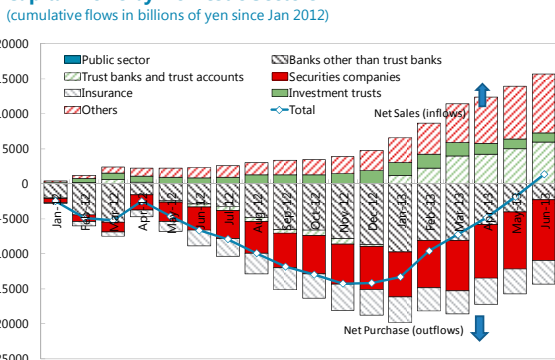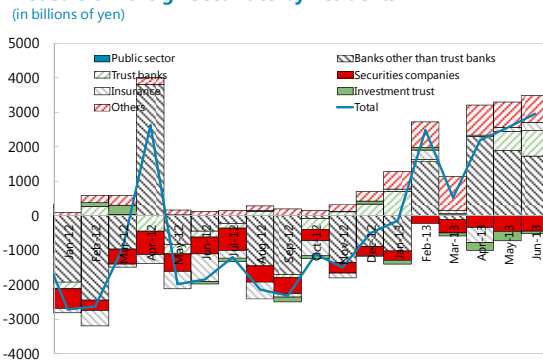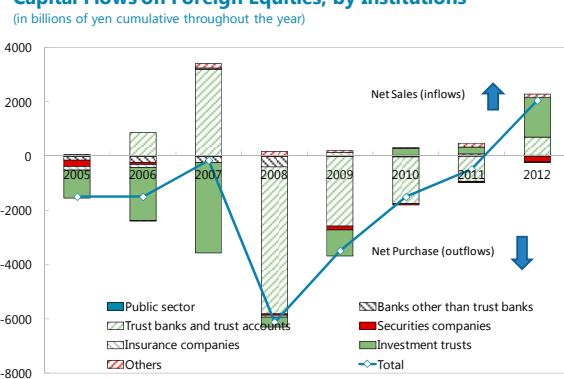
In terms of the second proximate cause, the yield differential with the U.S. dollar compressed since the global financial crisis, while, at the same time, the yen continued to strengthen. This may be supportive of the interpretation that risk-off appreciations are triggered by changes in the relative monetary stance (and its implications on the profitability of the carry trade). However, more recently, the yen has depreciated substantially while the interest differential has been broadly stable, at least until the onset of the "tapering" discussions in the United States in May 2013 (Figure 3). The latter led to a modest steepening of the yield curve in the U.S. while the Japanese government bond yields remain low and stable against the background of the Bank of Japan's asset purchases.

Figure 3. Recent Yen Movements and Interest Differentials

What about financial pressures on the exchange rate through financial transactions outside of those captured by Balance of Payments (BoP) statistics? Chan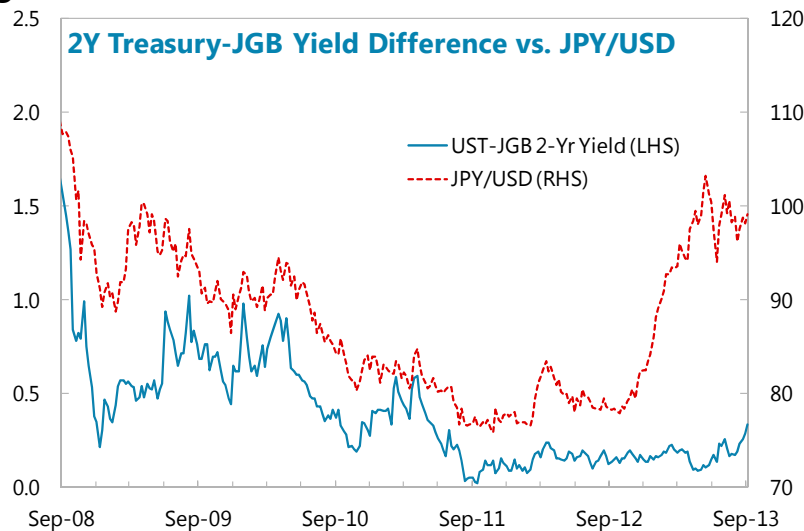ges in derivatives positions are closely correlated with the yen/dollar exchange rate. Specifically, since the global financial crisis, traders took substantial net long positions in the yen, which were repositioned into net short positions from October 2012 onwards (Figure 4). Foreign exchange swaps account for about 35-40 percent of daily yen trading, similar to other key global currencies (Table 1).[8] While the turnover in options is slightly higher than in other key currencies, the difference does not appear to explain the relatively limited cross-border capital flows and wide fluctuations in the exchange rates. In terms of the global foreign exchange market, many yen-transactions are offshore, as yen-denominated foreign exchange transactions account for near 10 percent of global foreign exchange markets but about two-thirds are conducted in onshore Japan (Figure 5).

All in all, the recent depreciation of the yen suggests an interesting puzzle as it occurred without detectable net capital inflows or a widening of the interest differential. At the same time, there was a significant change in derivatives' activities, from net long to net short positions. This

---

[8] That is based on the "Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity" published by the Bank of International Settlements.

raises the question of whether similar patterns are observed empirically during risk-off episodes, to which we turn in the next section.

Figure 4. The Yen and Non-Commercial Derivatives Positions

Chicago Mercantile Exchange Yen Trading Position
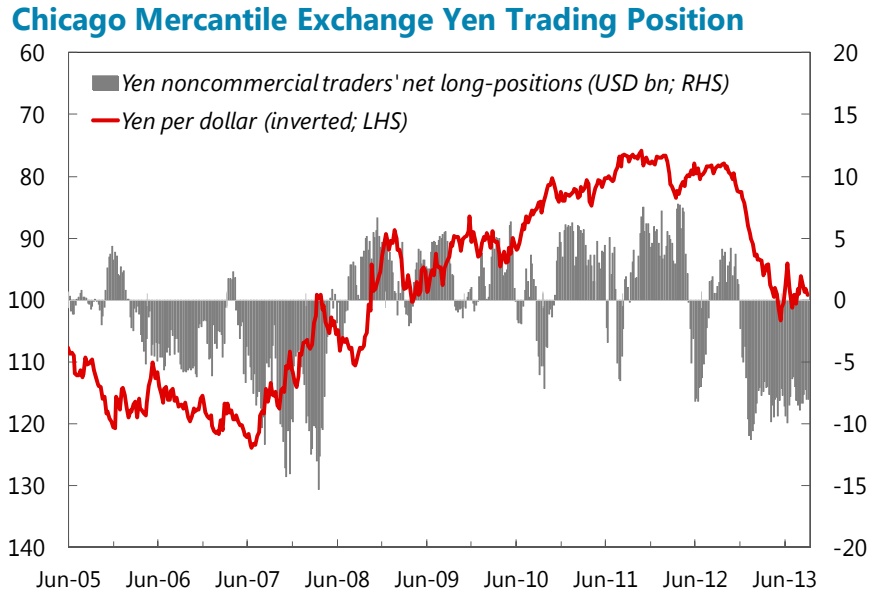
Source: Chicago Mercantile Exchange, via Bloomberg.

Figure 5. The Global Foreign Exchange Market

Global Foreign Exchange Market
(in percent)
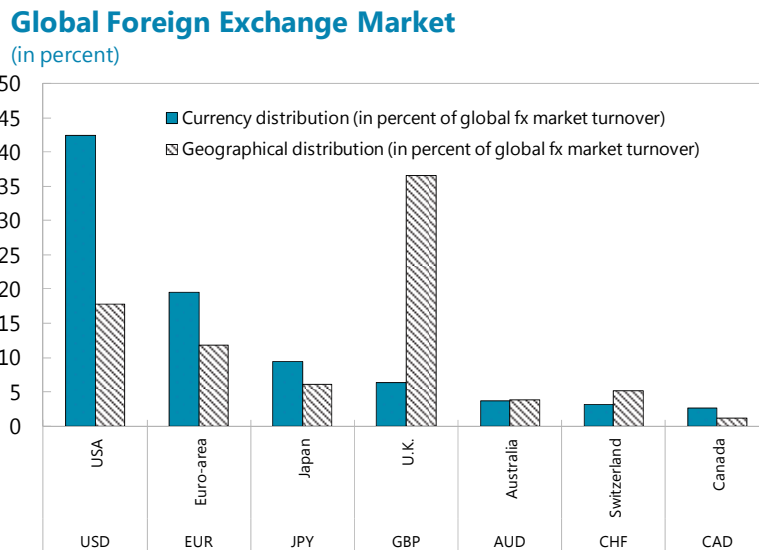
Source: BIS.

Table 1. Daily Turnover of Foreign Exchange (in millions of USD)

	USD	Euro	Yen	Pound sterling	Swiss franc	Canadian dollar	Australian dollar
Spot - Total	1,187,699	691,210	300,214	212,976	92,090	77,831	111,107
Local	455,443	246,461	111,782	77,077	35,042	28,126	41,975
Cross-border	732,255	444,749	188,432	135,900	57,048	49,705	69,132
Outright forwards	391,501	149,687	115,111	54,844	19,076	26,332	28,836
Local	138,381	64,449	38,035	26,448	7,610	11,464	13,271
Cross-border	253,121	85,238	77,076	28,395	11,466	14,868	15,564
Foreign exchange swaps	1,600,101	609,801	278,897	222,214	127,078	97,049	140,794
Local	478,526	166,564	84,303	83,657	30,076	29,531	39,004
Cross-border	1,121,575	443,236	194,594	138,556	97,002	67,518	101,789
Currency Swaps	38,313	17,673	6,597	2,575	1,681	2,839	5,649
Local	13,385	6,392	1,940	1,148	385	709	1,210
Cross-border	24,929	11,282	4,657	1,426	1,296	2,130	4,439
Options sold	105,529	57,445	34,497	12,866	9,197	4,189	10,444
Local	48,763	23,869	20,787	5,415	3,935	1,506	3,745
Cross-border	56,766	33,576	13,710	7,452	5,263	2,683	6,699
Options bought	101,003	54,981	31,397	13,423	8,373	4,055	10,663
Local	44,492	20,827	17,796	4,948	2,946	1,449	3,695
Cross-border	56,510	34,154	13,601	8,475	5,427	2,606	6,967
In percent of total daily average turnover in that currency							
by instruments							
Spot	34.7	43.7	39.2	41.0	35.8	36.7	36.1
Outright forwards	11.4	9.5	15.0	10.6	7.4	12.4	9.4
Foreign exchange swa	46.7	38.6	36.4	42.8	49.4	45.7	45.8
Currency Swaps	1.1	1.1	0.9	0.5	0.7	1.3	1.8
Options sold	3.1	3.6	4.5	2.5	3.6	2.0	3.4
Options bought	2.9	3.5	4.1	2.6	3.3	1.9	3.5
by counterparty							
local	34.4	33.4	35.8	38.3	31.1	34.3	33.5
cross-border	65.6	66.6	64.2	61.7	68.9	65.7	66.5

Source: BIS; as of April 2010.

IV. EMPIRICAL METHODOLOGY AND FINDINGS

Next, we examine empirically the mechanisms that may be behind risk-off appreciations. We follow the methodology introduced in De Bock and de Carvalho Filho (2012) to identify risk-off episodes, which are defined as beginning on days when the VIX index is 10 percentage points higher than its 60 days backward-looking moving average. Under this definition, there were 11 risk-off episodes since 1992 (Table 2), out of which one risk-off episode is related to an incident in Japan – the Great East Japan Earthquake in March 2011. The empirical analysis considers only the observations up to 2010Q4 (when quarterly data is used) or 2011M2 (when monthly data is used).

Table 2. Initial dates of risk-off episodes

#	Date	Event
1	3 August 1990	U.S. savings and loans
2	14 January 1991	Iraq War
3	29 October 1997	Escalation of Asian crisis
4	4 August 1998	Concerns on Russian economy
5	12 October 2000	Fear of slowing US economy
6	11 September 2001	9/11 Attacks
7	10 July 2002	Fear of slowing US economy
8	10 August 2007	BNP Paribas halts withdrawals from three money market mutual funds
9	12 November 2007	Disruptions in USD money markets
10	17 September 2008	Lehman failure
11	6 May 2010	Greek crisis
12	16 March 2011	Uncertainty over impact of Japan's March 11 Earthquake
13	4 August 2011	Confrontation over US debt ceiling and deterioration of crisis in euro area

Source: de Carvalho Filho and De Bock (2013).

We estimate empirical models to describe the relationship between risk-off episodes, capital inflows and the real exchange rate for Japan. The approach we adopt is minimalistic. We typically estimate a vector autoregression (VAR) that includes a dummy for risk-off episodes and the variable of interest (either an exchange rate or capital flow measure), using monthly or quarterly data starting in the early nineties or the earliest date for which we found the data for each country. The dummy for risk-off episodes is exogenous to the Japanese economy and therefore it is not affected by any lagged or current Japanese variable.

In algebraic terms, the specification is:

$$risk_t \in \{0,1\}$$
$$\mathbf{Y}_t = \sum_{\tau=1..4} \mathbf{Y}_{t-\tau}\mathbf{A}_\tau + \sum_{\tau=0..4} risk_{t-\tau}\mathbf{B}_\tau + \mathbf{v}_t$$

where $\mathbf{Y}$ stands for the endogenous variable of interest (or vector of endogenous variables) of interest; $risk_t$ denotes a dummy equal to one in the quarters when risk-off episodes started; the $\mathbf{A}_\tau$ and $\mathbf{B}_\tau$ are matrices of coefficients; the errors $\mathbf{v}_t$ and ε_t are serially uncorrelated, have mean zero and are independent; and the variance-covariance matrix for $\mathbf{v}_t$ is lower triangular.[9]

---

[9] Notice that the risk-off variable is treated as exogenous. If there is some temporal dependence in the distribution of risk-off episodes, that would affect the shape of the impulse response functions estimated in this article and therefore an explicit modeling of the arrival process for risk-off episodes would be desirable.

A.   The effect of risk-off episodes on the yen

The yen tends to appreciate in the aftermath – first two quarters – of risk-off episodes, whether the appreciation is measured as nominal, real effective, or bilateral against the U.S. dollar (Figure 6). These findings are obtained by estimating a vector auto-regression (VAR) model for Japan, including private flows/GDP, the exchange rate variable and GDP growth as endogenous variables, and the risk-off dummy (current and up to 4 lags) as the exogenous variable, along with seasonal dummies and a time trend. In Figure 6, the ordering of the endogenous variables is private flows (first), then the exchange rate variable, and GDP growth (last), but the finding of risk-off appreciations is robust to different orderings of the endogenous variables.

Figure 6. Impulse Response Functions of Alternative Exchange Rate Measures to Risk-off Shocks
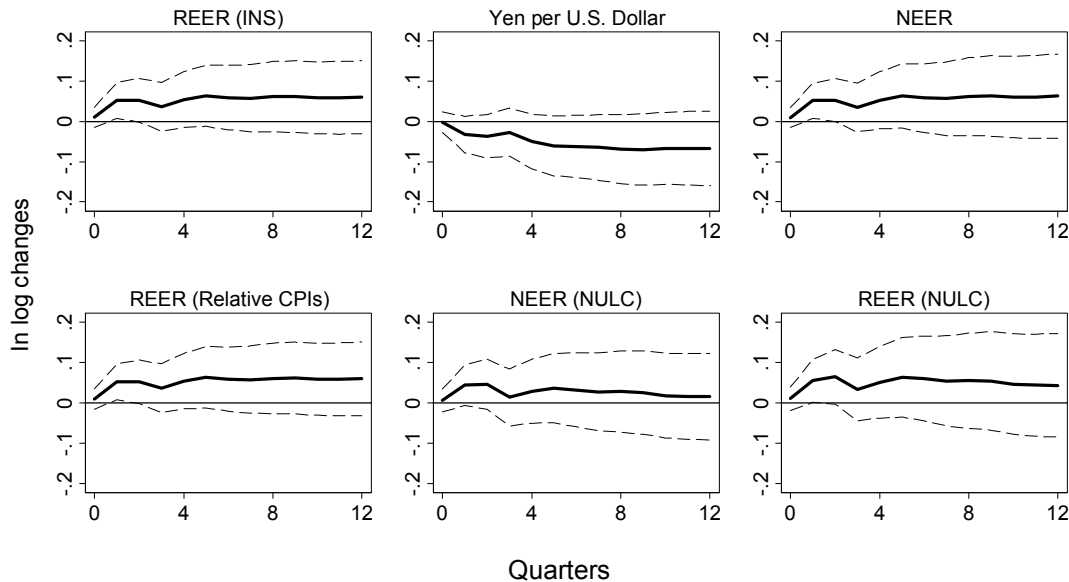
Note: The IRFs are based on quarterly VARs with 4 lags, including private flows/GDP, the exchange rate variable and GDP growth as endogenous variables, and the risk-off dummy (current and up to 4 lags) and a set of seasonal dummies as exogenous. The sample coverage goes from 1990Q1 to 2010Q4. The ordering of the endogenous variables is private flows (first), the exchange rate variable, and GDP growth (last). The dashed lines represent 90% confidence intervals.

B.   The effect of risk-off episodes on net financial flows into Japan

Is the risk-off appreciation caused by net capital inflows? We estimate the effect of risk-off episodes on gross and net balance of payment financial flows in Japan. Each flow (measured in US dollars) is scaled by *previous year* GDP in US dollars in order to avoid endogeneity due to changes in the exchange rate. We estimate for each flow a VAR with 4 lags; the estimation sample starts in 1991Q1 or the earliest available date and ends on 2010Q4. We do not include the risk-off event related to the Tohoku earthquake because we want to focus on those episodes that are arguably exogenous to the Japanese economy. We include in the VAR the change in the real effective exchange rate and the GDP growth rate. We assume that the financial flows have an immediate – same quarter – effect on the real exchange rate and GDP growth, but those variables

affect financial flows with a lag of one quarter. The real exchange rate is assumed to affect GDP growth in the same quarter, but the converse is not true.

We find no evidence that risk-off episodes trigger any sizeable balance of payments flows into Japan (Figure 7). The impulse response functions are typically statistically and economically insignificant. In the short-term, there is a small and statistically insignificant net outflow related to both foreign direct investment and aggregate portfolio investment flows, other investment and financial derivatives. As if offsetting those outflows, net reserve sales are positive (that is a balance of payments inflow). This finding stands in contrast with the Swiss experience of massive effects of risk-off episodes on net financial inflows (de Carvalho Filho, 2013).

Figure 7. Cumulative Impulse Response Functions to a Risk-Off Shock, Financial Flows Aggregates for Japan
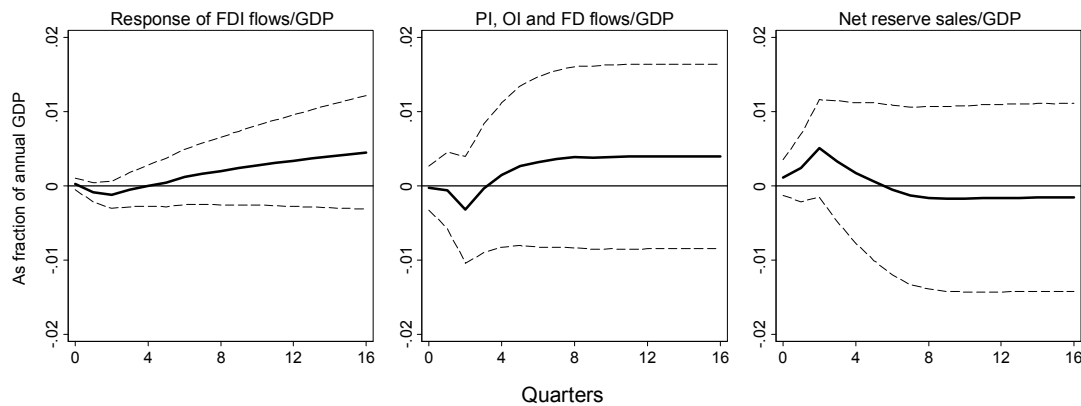
Note: The IRFs are based on a vector autoregression model $A(L)\mathbf{Y}_t = B(L)r_t + \lambda_m + \varepsilon_t$ where A(L) and B(L) are matrix polynomials of the 4th order on the lag operator. The vector $\mathbf{Y}$ includes a balance payments financial flow, the change in the real exchange rate and the GDP growth rate. The identification of the structural shocks is based on the Choleski decomposition with the ordering financial flow, real exchange rate and growth rate. The sample frequency is quarterly and coverage goes from 1991Q1 to 2010Q4. The dashed lines represent 95% confidence intervals.

Next, we decompose the portfolio and investment flows into their components. There is a small (less than 1 percent of GDP) portfolio debt inflow during the quarters when risk-off episodes start, but these are partly offset by a portfolio equity outflow (Figure 8). The latter is more persistent and cumulative net portfolio flows are negative over the horizon of 4 quarters after a risk-off. Results not reported here show that retrenchment of portfolio equity holdings of non-residents is the main driver of the net portfolio outflows. Other investment flows, which include net disposal of currencies and deposits and loans, show a small net inflow that cumulates to below 2 percent of GDP after 3 quarters and is statistically insignificant afterwards. The main driver of this net inflow is the reduction by Japanese residents in their holdings of foreign currencies and deposits. The flows related to loans show an immediate outflow that is quickly reversed. This too is mostly driven by the behavior of Japanese lenders. As such, and somewhat puzzling, appreciations do not coincide with any detectable net capital inflows from the Balance of Payments Statistics, although it remains a possibility that sizeable adjustments in prices (the exchange rate) can occur without large changes in quantities (capital flows) of cross-border trade in assets if market participants' expectations suddenly are realigned around a new equilibrium.

Figure 8. Cumulative Impulse Response Functions to a Risk-Off Shock, Selected Net Financial Flows
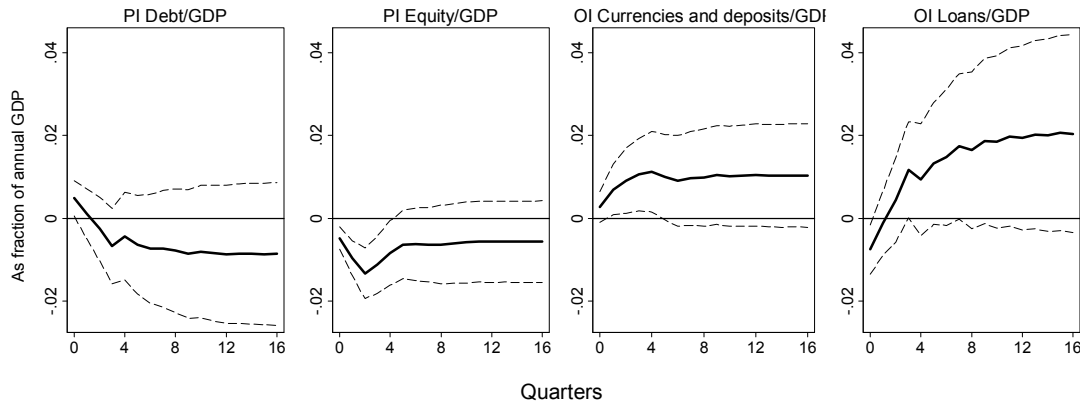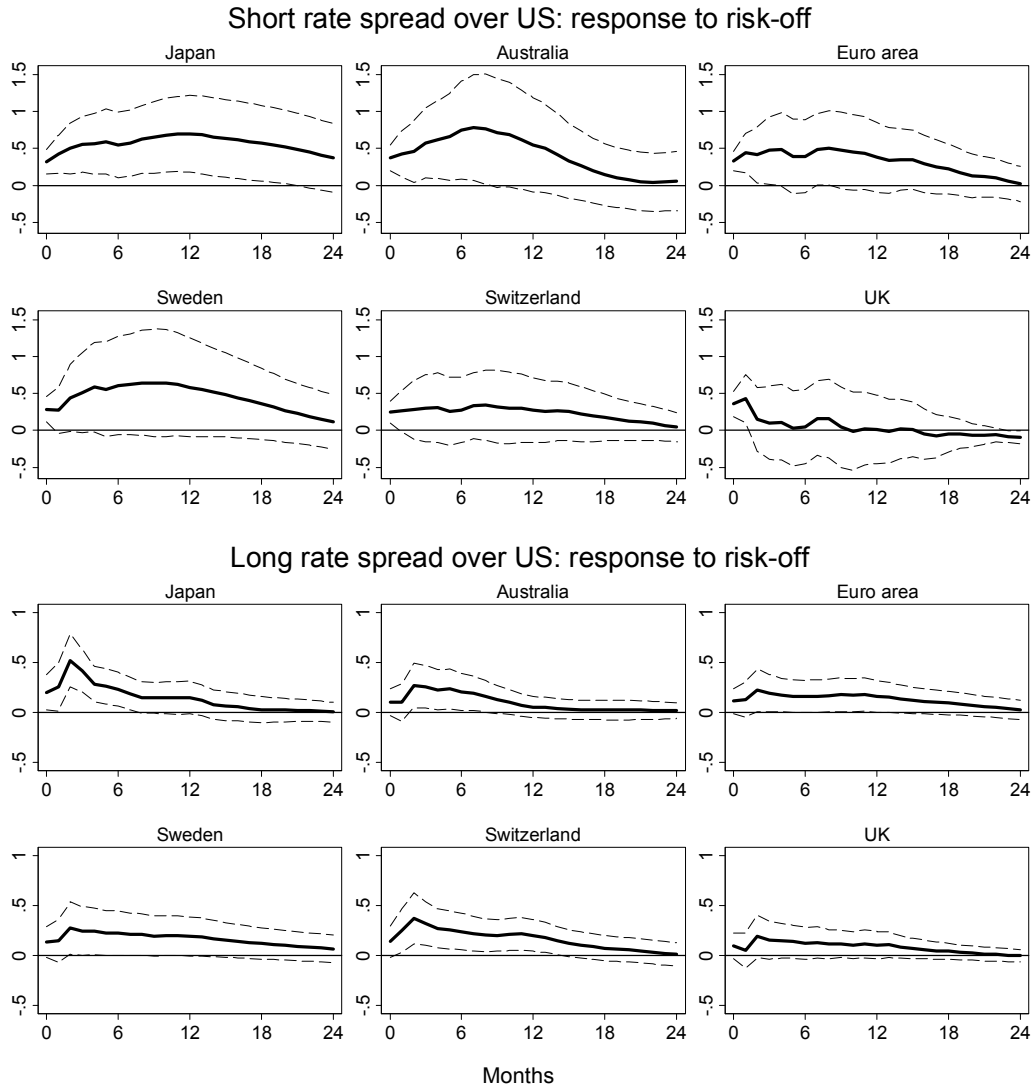

Note: The IRFs are based on a vector autoregression model $A(L)\mathbf{Y}_t = B(L)r_t + \lambda_m + \varepsilon_t$ where A(L) and B(L) are matrix polynomials of the 4th order on the lag operator. The vector **Y** includes a balance payments financial flow, the change in the real exchange rate and the GDP growth rate. The identification of the structural shocks is based on the Choleski decomposition with the ordering financial flow, real exchange rate and growth rate. The sample frequency is quarterly and coverage goes from 1991Q1 to 2010Q4. The dashed lines represent 95% confidence intervals.

C. The effect of risk-off episodes on yield differentials

Yield differentials between yen and U.S. dollar denominated assets tend to rise in the aftermath of risk-off episodes, for both short and long rate spreads (Figure 9). Long rate spreads between the yen and the US dollar on average widen in the aftermath of risk-off episodes by more than the spreads of other advanced economies currencies such as the Swedish kroner, UK pound, Swiss franc, Australian dollar and euro. However, the differences are not striking when one looks at short-term rates, in particular with regards to the Australian dollar, a currency known to depreciate against the U.S. dollar after the onset of risk-off episodes (e.g. De Bock and de Carvalho Filho, 2013). Since the Australian short rate spread over the U.S. dollar tends to increase by about as much as the yen spread, this calls into question the hypothesis that risk-off appreciations are driven by (expected) monetary policy changes.

D. The effect of risk-off episodes on non-commercial derivative positions

Transactions in the FX derivatives markets largely reflect hedging and funding activities as well as speculation. Portfolio rebalancing may also occur through repricing and net changes in exposures in the derivatives market. Since the BoP statistics only record the net payments between residents and non-residents upon settlement of derivative positions, they are not appropriate for tracking the evolution of gross or net exposures. Specifically, derivatives markets transactions (forwards, currency swaps, and options) are recorded in the balance of payments statistics only to the extent that they give rise to an actual payment between onshore and offshore parties, and cash payments usually represent only a very small fraction of the notional value of

Figure 9. Impulse Response Functions of Yield Spreads During Risk-Off Episodes

Short rate spread over US: response to risk-off

Long rate spread over US: response to risk-off

Months

Note: The IRFs are based on an autoregressive distributed lags (ADL) model $A(L)y_t = (B_0 + B_1L + B_2L^2) r_t + \gamma t + \lambda_m + \varepsilon_t$ where $A(L)$ is a polynomial of the 12th order on the lag operator. The sample frequency is monthly and coverage goes from 2000M1 to 2011M2. The dashed lines represent 95% confidence intervals.

derivatives contracts. Hence, the BoP statistics do not record the changes in FX exposure that may be achieved through offshore trading in currencies derivatives.

From the point of view of portfolio balance theory of exchange rate determination, foreign currency derivatives affect the spot exchange rate to the extent that they redistribute the exposure to each currency risk across agents, but derivative trading could also affect spot FX prices through market frictions. For instance, because banks break forward transactions between a spot and forward desk, forward transactions may generate pressures in the spot market. Currency swaps affect the spot over time as they are equivalent to a series of forward transactions. Options affect the spot rate through hedging that usually takes place through the forward market (see Dominique Dwor-Frécaut, 2008).

To assess the behavior of FX derivatives markets during risk-off episodes, we focus on non-commercial positions recorded in the Commitment of Traders in FX Futures Report (CFTC), based on trading at the Chicago Mercantile Exchange (CME). We find that risk-off episodes trigger increases in the non-commercial net long position in the yen, mostly through a reduction in short positions, more so than for the Swiss Franc and in contrast to the euro. Twelve weeks after the start of a VIX spike, non-commercial positions on the yen are 20 billion U.S. dollars net longer than otherwise. That is economically significant, as the average size of gross long non-commercial positions in the yen since 2000 is a little over 32 billion U.S. dollars, and the standard deviation of net non-commercial positions over the same period is about 43 billion U.S. dollars. As such, possibly self-fulfilling expectations of currency appreciation in combination with fundamental factors could play an important role for the Yen's safe haven status. Japan's exporters, overseas affiliates, as well as overseas investors who hold dollar assets all have an incentive to step up their FX hedging activities once a risk-off event occurs, given the well-established phenomenon of Yen appreciation during these periods. In contrast, importers or institutions with dollar-denominated debt have no incentive to increase their hedges. Such derivatives positions could be taken in anticipation of future real money inflows, which would suggest that some reversal in the yen should occur in the event such inflows do not materialize, which could be an interesting subject for further research.

V. CONCLUSIONS

The evidence presented in this paper supports the interpretation of the yen as a currency with safe haven status. But safe haven effects work differently for the yen than for other safe haven currencies. Surprisingly and in contrast to the experience of the Swiss Franc, yen risk-off appreciations appears unrelated to capital inflows (cross-border transactions) and do not seem supported by expectations about the relative stance of monetary policies. Instead, we presented evidence that portfolio rebalancing through offshore derivative transactions occur contemporaneously to yen risk-off appreciations. This could reflect either a causal effect of portfolio rebalancing through derivative transactions or the workings of self-fulfilling expectations causing both currency appreciation and portfolio rebalancing. It would be interesting to analyze in future research whether such expectations need to be validated by actual real money flows down the road for the appreciation to be sustained.

Due to data constraints, the analysis is not exhaustive and risk-off appreciation may be associated to other types of transactions. For instance, risk-off appreciations could be driven by transactions between residents or among non-residents, which would also not be captured in official Balance of Payments statistics. Or alternatively, portfolio rebalancing could be achieved with little or no transaction as prices adjust to changes in beliefs that are common to market participants.

Figure 10. IRFs to a Risk-Off Shock, Non-Commercial Derivative Positions

CFTC CME Japanese Yen Non-Commercial

CFTC CME Swiss Franc Non-Commercial

CFTC CME Euro Non-Commercial
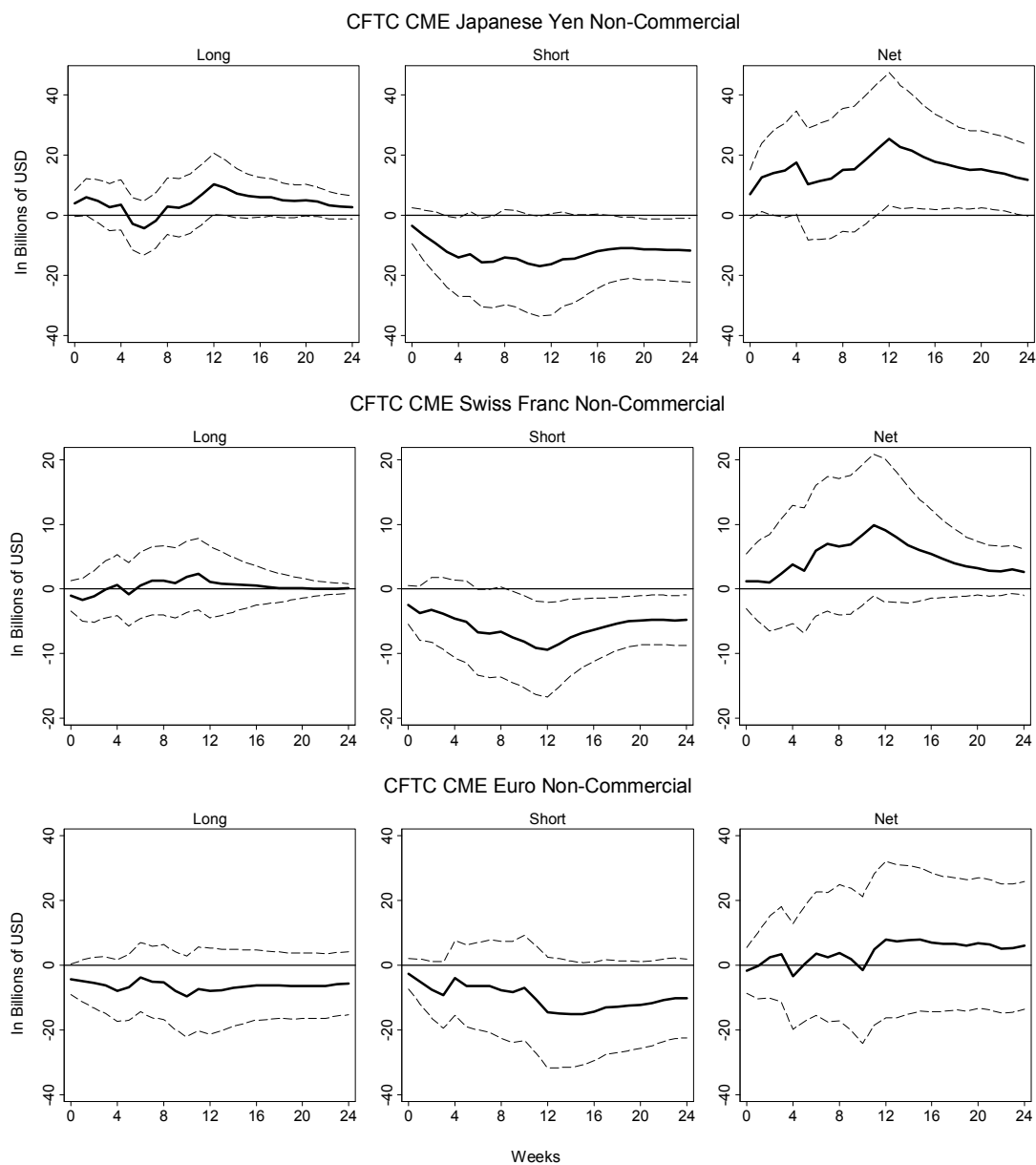
Note: The IRFs are based on an autoregressive distributed lags (ADL) model $A(L)y_t = B(L)r_t + \gamma t + \varepsilon_t$ where A(L) and B(L) are polynomials of the 12$^{\text{th}}$ order on the lag operator. The sample frequency is weekly and coverage goes from 05jan1993 to 15mar2011 for the yen; 21mar1995 to 04dec2012 for the Swiss franc; 30mar1999 to 04dec2012 for the euro.

From a policy-making perspective, risk-off appreciations may be undesirable. If temporary, real appreciations impose adjustment costs to the economy and lead to economic dislocation when exchange rates eventually come down. If persistent, but by no means permanent, real appreciation and capital flows surges have the potential to build-up vulnerabilities in either private or public sector balance sheets.

From a macroeconomic or welfare point of view it may not matter which mechanism triggers the risk-off appreciation (e.g. portfolio inflows, widening yield differential, portfolio rebalancing through derivative positions). But that is likely material for the design of capital flow management or macroprudential measures to counter excessive exchange rate volatility.

From a positive perspective, this paper contributes to the literature in documenting the curious case of the yen. It shows that exchange rates may be volatile even if balance of payments capital flows and interest rate differentials are not. This implies that measures that reduce the volatility of capital flows and more coordinated monetary policies may fail to make a dent on exchange rate volatility.

The possibility that offshore and complex financial transactions could be a key transmission mechanism of spillovers also points to broadening the analysis and data coverage for analyzing interconnectedness between countries.

REFERENCES

Bekaert, Geert and Marie Hoerova and Marco Lo Duca, 2010, "Risk, Uncertainty and Monetary Policy," NBER Working Paper 16397.

Bluedorn, John, Rupa Duttagupta, Jaime Guajardo and Petia Topalova, 2013, "Capital Flows Are Fickle: Anytime, Anywhere," mimeo.

Broner, Fernando, Tatiana Didier, Aitor Erce and Sergio L. Schmukler, 2013, "Gross Capital Flows: Dynamics and Crises," *Journal of Monetary Economics* 60: 113-133.

Bussière, Matthieu, Claude Lopez and Cédric Tille, 2013, "Currency Crises in Reverse: Do Large Real Exchange Rate Appreciations Matter for Growth?" MPRA Paper No. 44096.

Carrière-Swallow, Yan and Pablo García-Silva, 2013, "Capital Account Policies in Chile: Macro-financial Considerations Along the Path to Liberalization," IMF Working Paper 13/107.

De Bock, Reinout and Irineu de Carvalho Filho, 2013, "The Behavior of Currencies during Risk-off Episodes," IMF Working Paper 13/08.

de Carvalho Filho, Irineu, 2013, "Risk-off Episodes and Swiss Franc Appreciation: the Role of Capital Flows," *mimeo.*

Dwor-Frécaut, Dominique 2008, "Korea's Money Market", in: Korea's Economy 2008, Korea Economic Institute and Korea Institute for International Economic Policy, page 27-29.

Forbes, Kristin and Frank Warnock, 2012, "Capital Flow Waves: Surges, Stops, Flight and Retrenchment," *Journal of International Economics* 88(2), 235–251.

Habib, Maurizio M., Livio Stracca, 2012, "Getting Beyond Carry Trade: What Makes a Safe Haven Currency?" *Journal of International Economics,* 87(1): 50-64.

International Monetary Fund, 2004, "Debt-Related Vulnerabilities and Financial Crises—An Application of the Balance Sheet Approach to Emerging Market Countries," mimeo, http://www.imf.org/external/np/pdr/bal/2004/eng/070104.htm

International Monetary Fund, 2011, "International Capital Flows: Reliable or Fickle?" *World Economic Outlook*, April, Chapter 4, pp. 125-63.

International Monetary Fund, 2012, "Switzerland: Selected Issues Paper," IMF Country Report 12/107.

International Monetary Fund, 2012b, "Iceland: Ex Post Evaluation of Exceptional Access Under the 2008 Stand-by Arrangement," IMF Country Report 12/91.

Ito, Takatoshi, 2007, "Myths and Reality of Foreign Exchange Interventions: An Application to Japan," *International Journal of Finance and Economics,* 12: 133-154.

Milesi-Ferretti, Gian-Maria and Cédric Tille, 2011, "The Great Retrenchment: International Capital Flows during the Financial Crisis," *Economic Policy* vol. 26, issue 66: 289-346.

Ranaldo, Angelo and Paul Söderlind, 2010, "Safe Haven Currencies," *Review of Finance* 14(3): 385-407.

Sorsa, Piritta, Bas B. Bakker, Christoph Duenwald, Andrea M. Maechler, and Andrew Tiffin, 2007, "Vulnerabilities in Emerging Southeastern Europe—How Much Cause for Concern?" IMF Working Paper 07/236.