Risk-off Episodes and Swiss Franc Appreciation: the Role of Capital Flows

Irineu de Carvalho Filho

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Abstract

During episodes of increased global risk aversion, or risk-off episodes, safe haven currencies such as the Swiss franc tend to appreciate. The immediate impact of a risk-off shock is an increase in net private inflows to Switzerland, mostly driven by a reduction in Swiss residents' net purchases of foreign debt securities and reduced foreign exposure by Swiss banks: Over several quarters, risk-off episodes also appear to be related to reductions in net FDI outflows by Swiss residents. Given that the bulk of capital movements related to risk-off episodes is driven by decisions of Swiss residents, capital flow management policies that discriminate based on the residency of the investor (capital controls) are not likely to be effective at reducing the impact of risk-off episodes. However, prudential policies that limit leveraging or foreign exposure by Swiss banks may diminish the volatility of capital flows during risk-off episodes.

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INTRODUCTION

The economic literature on the effects of cross-border trade in assets (or if you will, international capital flows) has recently turned its 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) to 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).[2] That is a welcome addition to the economic literature as gross flows are larger and more volatile than net flows (Broner et al. 2013).

Understanding gross capital flows is of particular interest for policymakers, as sizeable gross flows bring difficult challenges for macroeconomic and financial policies. For instance, during episodes of increased global risk aversion, or risk-off episodes, as investors attempt to rebalance their portfolio towards currency exposures perceived to provide a safe haven, some currencies, in particular the Swiss franc, the Japanese yen and the U.S. dollar, tend to appreciate relative to other advanced and emerging market currencies (De Bock and de Carvalho Filho, 2013).[3] As risk-off episodes have clustered since 2007, both the Swiss franc and the Japanese yen have gone through sharp appreciation in nominal and real terms.

Episodes of sharp real appreciations or capital flows surges pose several challenges to policymakers. Transitory real appreciation may create adjustment costs to the economy and economic dislocation. But the longer the real appreciation and capital flows surge last, the greater the potential for build-up of currency risk in either private or public sector balance

[2] E.g. International Monetary Fund (2011), Forbes and Warnock (2012), Broner, Didier, Erce and Schmukler (2013), Bluedhorn, Duttagupta, Guajardo and Topalova (2013). For an emerging market case study that highlights the importance of understanding gross capital flows, see Carrière-Swallow and García-Silva (2013).

[3] Ranaldo and Söderlind (2010) also document the safe haven characteristics of the Swiss franc and Japanese yen. Habib and Stracca (2012) explore the determinants of safe haven behavior, finding a large role for positive net foreign asset positions. Among advanced economies, both Japan and Switzerland have large positive net foreign asset positions in absolute and relative terms.

sheets.[4] Real appreciation also may feed deflation risks for those economies with already low inflation, interest rates close to the zero bound, and exposed to downside risks to demand (e.g. International Monetary Fund 2012).

Understanding what drives safe haven currencies to appreciate may inform the design of policies to mitigate the consequences of real appreciation if they are undesirable, or even to avoid the phenomenon of risk-off appreciation altogether.

One possibility is that risk-off episodes trigger massive capital inflows to safe haven countries, bidding up asset prices including the safe haven currency itself. If that is the case, risk-off episodes may intensify risks to financial stability, as the ensuing capital inflows may fuel credit expansion beyond sustainable levels and inflate asset price bubbles. If safe haven appreciation is a direct consequence of capital inflows, the policy response ought to be informed about the nature of those flows and their persistence, the extent to which they reflect decisions by residents or non-residents, and whether flows are intermediated through the regulated banking system.[5] For instance, during risk-off episodes, net capital inflows may occur because of any combination of increased demand for safe haven securities by non-residents, reduction in demand for foreign securities by residents, or repatriation of FDI by residents. If flows are temporary and in short-term instruments, sand in the wheels, such as Brazil's IOF tax or the unremunerated reserve requirements adopted in many emerging economies, may be enough to stem capital inflows and their related appreciation pressures and financial stability risks during risk-off episodes.[6] Thus ranking the importance of different modalities of capital flows during a risk-off episode is a valuable input to determine

[4] 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 of the crisis of 2000-01 (IMF 2004); and in Iceland before the Global Financial Crisis (IMF 2012b).

[5] Ostry et al. 2010, 2011 provide guidelines for the adequacy of capital controls, in the context of the management of large inflows into emerging countries. I do not know of any recent work focusing on policies towards cross-border capital movements affecting small open advanced economies.

[6] Chamon and Garcia (2013) find that Brazilian restrictions on capital inflows have had some success in segmenting Brazilian from global financial markets, but had limited impact at mitigating real appreciation.

the desirability and scope of capital flow measures.

Another possibility is that risk-off episodes are informative about features of the global economic environment such as demand trends and future monetary policy. For instance, if global shocks cause an asymmetric monetary policy response (say, smaller interest rate reductions in safe-haven currencies), risk-off appreciation of safe haven currencies may occur despite an absence of massive capital inflows.[7]

This article studies the connection between capital flows and real exchange rate appreciation behind the recurrent phenomenon of Swiss franc appreciation during risk-off episodes. It adds to an extensive literature on the effects of global shocks transmitted through capital flows to small open economies (e.g. Calvo et al. 1993; Bruno et al. 2013). To this goal, it explores the data from balance of payment and banking transactions to identify the agents and portfolio rebalancing transactions that are the likely drivers of Swiss franc appreciation.

I use Vector Auto Regressions (VARs) to identify the effect of risk-off episodes on the real exchange rate and on disaggregated capital inflows to Switzerland. Confirming the results in De Bock et al. (2013), I find that risk-off episodes are associated in Switzerland with real appreciation and massive capital inflows.

Breaking new ground in the literature, I find that at the onset of risk-off episodes, the increase in net financial inflows to Switzerland comes mostly from increases in portfolio debt assets net inflows (i.e. downward adjustments in the rate at which Swiss residents accumulate foreign debt securities) and the deleveraging of Swiss banks – both phenomena likely linked to the greater price of risk during risk-off episodes. Taking a longer perspective, I also find that risk-off episodes are also associated with reductions in the rate at which Swiss residents accumulate foreign direct investment abroad over several quarters. Finally, the evidence from the cross-border asset and liability positions of Swiss banks is consistent with reductions in

[7] Safe-haven currencies have had lower interest rates as their peers. Therefore a global shock that calls for monetary easing across the board may imply smaller absolute reductions in nominal interest rate for safe-haven currencies and cause the unwinding of carry trades (for the evidence on Switzerland's persistently low interest rates, see Mauro 1995).

their gross international asset and liability positions beyond what one would expect from the mechanical valuation effect of Swiss franc appreciation, and a deliberate attempt to shed foreign currency risk.

The results in this paper also generalize from the discrete risk-off measure to continuous ones. The impulse response of financial flows to risk-off shocks when one uses the discrete risk-off dummy, the log of VIX, or the risk-aversion and uncertainty components of the VIX (Bekaert, Hoerova and Lo Duca, 2010). Financial flows also appear to respond similarly to shocks to the HML carry trade factor (Lustig, Roussanov and Verdelhan, 2010).

In the next section, I briefly describe the methodology to identify risk-off episodes, which follows the approach used in De Bock et al. (2013). In section III, I show the impact of risk-off episodes on financial inflows and real exchange rate appreciation in Switzerland. In section IV, I analyze the reaction of Swiss net capital flows to risk-off episodes. In section V, I analyze the evidence from the balance sheet of Swiss banks. In section VI, I discuss the results obtained from alternative risk-off measures. Finally, in section VII, I present my conclusions.

I. IDENTIFYING RISK-OFF EPISODES

I identify risk-off episodes using the methodology introduced by De Bock and de Carvalho Filho (2013). In that paper, risk-off episodes are defined as beginning on days when the VIX is 10 percentage points higher than its 60 days backward-looking moving average.[8] Under this definition, there were 11 risk-off episodes since 1992 (see chart and table below).

[8] The VIX is a real-time measure derived from option prices on the S&P 500 and informs us about risk pricing in the US equity market. The VIX is highly correlated with broader measures of financial stress (such as the Financial Stress Index developed by the Federal Reserve Bank of St. Louis).

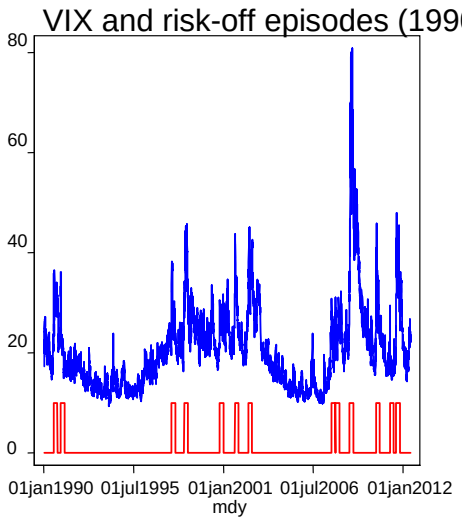

Figure 1. VIX and risk-off episodes: 1992-2012.

Using the rule described above, the events triggering most of the risk-off episodes can be easily identified from their start date (see Table 1 below). For instance, episode #1 is the U.S. Savings and Loans crisis; #2 is the First Iraq War; #3 is related to fears over the impact of the Asian crisis on the global economy; #4 can be traced back to concerns on Russia's economy ahead of the ruble's devaluation and default on domestic bonds on August 17 1998; #5 can be linked to wider macroeconomic concerns following the burst of the Dot Com bubble; #6 is the aftermath of the September 11 2001 attacks on the U.S.; #7 is connected to fears on a slowing U.S. economy. Episode #8 reflects increasing concerns on the valuation of subprime credit securities and asset-backed commercial paper. Episode #9 signals mounting disruptions in the USDUSD market in the fall of 2007. Episode #10 is the Lehman failure; #11 is the Greek crisis in May 2010; #12 is the aftermath of the Japan earthquake; and #13 is the bout of instability that started with the confrontation over the US debt ceiling and a deterioration of the European crisis.[9] [10]

[9] The algorithm chooses September 17 2001 as the beginning of the risk-off episode identified with the 9/11 attacks because US equity markets were closed for a few days and the VIX series was held constant at its 09/10 value until 9/16.

[10] In what follows, we treat the two risk-off episodes in the second semester of 2007 as a single risk-off episode, starting in August 10, 2007. Both episodes are related to the U.S. subprime crisis and disruptions in the market for asset-backed commercial paper.

Table 1 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 DUSD 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

II. Risk-off Episodes, the real exchange rate and Private financial flows to Switzerland

In this section, an empirical model describes the relationship between risk-off episodes, capital inflows and the real exchange rate for Switzerland. The approach adopted is minimalist. I estimate a VAR that includes a dummy for risk-off episodes, a measure of capital inflows (defined below), the real exchange rate and a measure of economic activity, using quarterly data starting in the early nineties or the earliest date for which I can find the data for each country.[11] The dummy for risk-off episodes is exogenous to the Swiss economy and therefore it is not affected by any lagged or current Swiss variable.[12]

[11] The U.S. dollar tends to appreciate relative to most other currencies during risk-off episodes, so that the Swiss franc and Japanese yen tend to appreciate in nominal effective terms during those episodes by a larger amount than their bilateral appreciation relative to the U.S. dollar.

[12] Romer and Romer (1989) use a dummy variable for monetary contractions in a similar specification to the one in this article.

To measure capital inflows I use net private capital flows as percent of GDP, as defined by Cardarelli, Elekdag and Kose (2010);[13] the real exchange rate is the real effective exchange rate series from IMF/INS; and the measure of economic activity is real GDP. I include also dummies for quarters to capture seasonal patterns in the data and a linear trend. I do not include "global" variables such as U.S. interest rates and corporate bond spreads or oil prices as exogenous controls because they are not exogenous to other global shocks such as risk-off episodes. For example, if risk-off episodes cause drops in global demand that affect oil prices, including oil prices as an exogenous variable would soak up some of the explanatory power of risk-off episodes.

My main concern is to describe what happens since the onset of a risk-off episode, without claiming that the apparent effect of the risk-off is truly structural (in other words, the risk-off dummy may capture the effect of other global shocks, say global demand). My working assumption is that risk-off episodes are exogenous to the Swiss economy, which is certainly plausible given the description of the risk-off episodes in the previous section. In that spirit, the reduced form is constrained so that neither the lags of the endogenous variables nor the exogenous variables help to predict risk-off episodes. To identify the shocks, I use a Cholesky-type decomposition. The variables are ordered with the private flows to GDP first, followed by the change in the log of REER and GDP growth, but the results are in general robust to permutations in the ordering of the variables, provided that the assumption of exogeneity of the risk-off dummy is maintained.

In algebraic terms, the specification is:

[13] From Cardarelli, Elekdag and Kose, 2010: "The net private capital inflows series used in the paper are constructed in five steps: First, we calculate (net) foreign direct investment (FDI) taking direct investments into the recipient country and subtracting direct investments abroad. Second, we strip out assets that are classified under the monetary authority and the general government for each of the remaining categories: portfolio investments, financial derivatives, and other investments. We then do the same for liabilities, in effect yielding assets and liabilities that are private in nature. Third, these series of private assets and liabilities are netted, yielding net inflows for the three categories. Fourth, we add FDI to the net private portfolio investment, financial derivative, and other investment categories, yielding our definition of net private capital inflows. Fifth, and finally, we scale the total net private capital inflows by GDP to get the net private capital inflows-to-GDP ratio."

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

where **Y** stands for a vector with capital flows, the real exchange rate and GDP growth; $risk_t$ 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 $\boldsymbol{\nu}_t$ and ε_t are serially uncorrelated, have mean zero and are independent; and the variance-covariance matrix for $\boldsymbol{\nu}_t$ is lower triangular.[14]

The data used in the VARs is presented in the Figure 2 below. The dates (quarters) with the onset of risk-off episodes are marked with vertical dashed lines. In Switzerland, (annualized) net private flows to GDP are negative in most of the quarters for which that variable is available (1999Q1 to 2011Q4), averaging about -9 percent of GDP. In 41 out of 51 quarters, annualized net private financial outflows are larger than 5 percent of GDP (here, financial flows are annualized before their shares of GDP are calculated; e.g. a quarterly flow of US4 billion when annual GDP is US100 billion translates into a flow of 16 percent of GDP). However, in the risk-off quarters or those immediately after risk-off quarters, net private financial *inflows* are sometimes quite large, surpassing 20 percent of GDP in four occasions.[15] The charts are also suggestive that risk-off episodes could also be driving Swiss

[14] 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. Furthermore, there are theoretical reasons why a MS-VAR would be appropriate for the econometric model of an individual exchange rate as the exposure of currencies to global shocks is time-varying (Lustig, Hanno, Nikolai Roussanov and Adrien Verdelhan, 2011; Hoffmann and Suter, 2010).

However the observation that impulse response functions in this baseline specification are similar qualitatively to impulse response functions from a VAR with the log of VIX as an endogenous variable suggests that refining the estimates to account for clustering of risk-off episodes would not generate significant differences. Moreover, since the focus of the paper is on the behavior of capital flows, it is not clear that the rationale for non-linearities applies.

[15] There are only two risk-off episodes prior to 2007 for which we have quarterly data on Switzerland balance of payments, and in each of them, we find no apparent spike in net private financial flows simultaneously or subsequently. Therefore, it is possible that the phenomenon of large private financial flows in the aftermath of risk-off episodes is a post-2007 feature. Further work exploring the

(continued…)

real (effective) exchange rate fluctuations at least during the decade of the 2000s and thereafter. The years of calm before the Global Financial Crisis, when no risk-off episodes were recorded for five years, coincided with a period of prolonged CHF depreciation in real effective terms.[16] On the other hand, the risk-off episodes of the 1990s were not associated with Swiss real appreciation. As regards economic activity, since 1990, there were four occasions when Swiss GDP contracted for two or more quarters in a row (1990Q3-1991Q2, 1992Q2-1992Q4, 2002Q4-2003Q1 and 2008Q3-2009Q1). In three out of those four occasions, a risk-off episode preceded the contraction by 1 or 2 quarters.

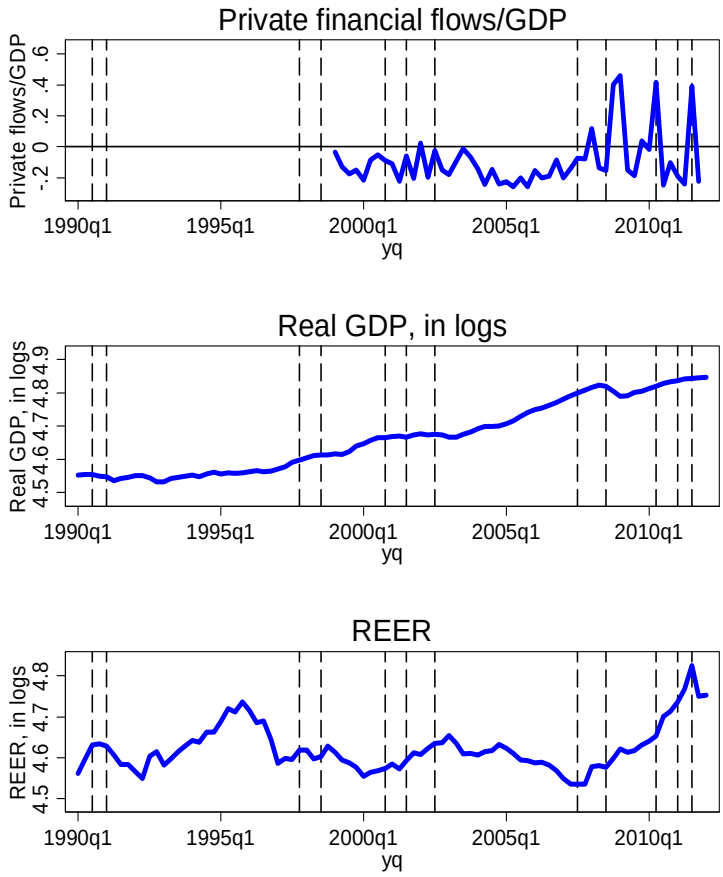

Figure 2. Quarterly net private flows (annualized) as percent of GDP, GDP growth and the log of real effective exchange rates, for Switzerland. Risk-off episodes are marked as vertical dashed lines.

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behavior of financial flows to Switzerland during the risk-off episodes of the 1990s would be welcome.

[16] Lenz and Savioz (2009) attribute to differentials in monetary policy a significant role driving the weakness of the Swiss franc relative to the euro during the mid 2000s.

For Switzerland, the onset of a risk-off episode is associated with an immediate (same quarter) REER appreciation of 1 percentage points and an increase in private flows to GDP of more than 25 percent of GDP. The real exchange rate appreciation is persistent and peaks at about 7 percent after 4 quarters. Cumulative net private flows to GDP peak 2 quarters after the start of the risk-off episode at 41 percent of GDP, after which net private flows reverse so at the end of one year after the risk-off episode cumulative net private flows amount to 21 percent of GDP.[17] Risk-off shocks are also a bad omen for economic activity in Switzerland. One year after the risk-off episode, GDP is 1.5 percent lower than its deterministic linear trend, and this gap remains two years after the risk-off episode. That is a substantial reduction in GDP growth – the average Swiss GDP growth in sample is about 1.8 percent per year. To summarize, risk-off episodes on average cause massive net private financial inflows to Switzerland, a significant real appreciation of the Swiss franc, and a sizeable reduction in growth rates over the year since their start.[18]

[17] The massive increase in private inflows connected to risk-off episodes in Switzerland is in its large part offset by public/official outflows (reserve accumulation), so risk-off episodes are not associated to movements of the current account balance of similar magnitude.

[18] I also estimated impulse response functions using an alternative specification adding the end-of-period euro/U.S. dollar exchange rate as an additional endogenous variable. In that specification, I ordered the euro/U.S. dollar exchange rate last, and I constrained the parameters in the reduced form so that no Swiss variables would affect the euro-U.S. dollar exchange rate. The resulting impulse response functions to risk-off episodes are very similar to the specification reported in the paper. Those results are available upon request.

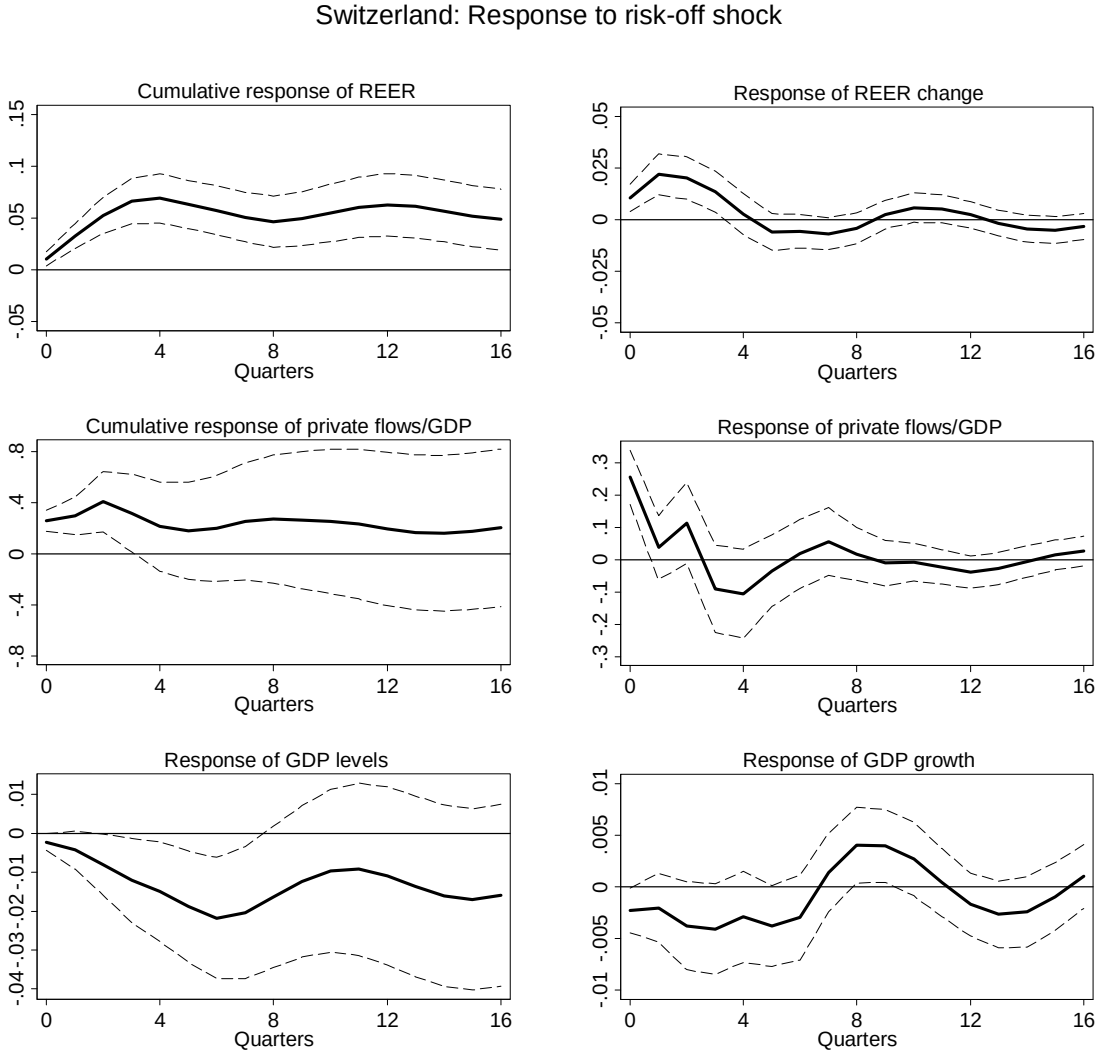

Figure 3. Panel A. Cumulative impulse response functions to a risk-off shock. Panel B. Impulse response functions to a risk-off shock.

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables net private flows to GDP, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

III. Risk-off Episodes and Disaggregated financial flows to Switzerland

In this section, I estimate the effect of risk-off shocks on disaggregated components of financial flows to Switzerland. The goal is to identify which component net flows of the financial account are responsible for the observed pattern of increased private financial flows to Switzerland during risk-off episodes; and evaluate the persistence of each of those flows. To this goal, I estimate a two variable VAR on the risk-off variable and each one of the financial flows, using quarterly data from 1999Q1 to 2011Q2.[19] The financial flows variables are scaled as percent of previous year GDP.[20] The VAR specification includes seasonal dummies and a linear time trend as exogenous controls, and it includes 4 lags.[21] Table 1 features the summary statistics of the quarterly Swiss balance of payments flows from 1999Q1 to 2011Q4. Again, I use a Cholesky decomposition to identify shocks, with the variables ordered with financial flows first, followed by the change in the log of REER and GDP growth.

In algebraic terms, the specification is:

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

[19] The sample does not include the period when SNB committed to intervene to avoid appreciation of the Swiss franc beyond the exchange rate of S.Fr. 1.20 equal to €1.

[20] I experimented with scaling financial flows by the lagged stock of gross international assets and liabilities (which is available for Switzerland on a quarterly basis since 1999Q4) and using the log of the VIX, a continuous variable, as an indicator of risk-off episodes, achieving in both exercises results that are qualitatively similar to those presented in this article. Those exercises are available upon request.

[21] When selecting the number of lags using statistical criteria (e.g. Akaike information criterion), there is substantial heterogeneity in the optimal number of lags. Using a different number of lags for each financial flow would create inconsistencies when comparing the impulse response function of aggregate series with their components (e.g portfolio investment, net ought to be the sum of 'portfolio investment equities, net' and 'portfolio investment debt, net'). I used 8 lags in a previous version of this paper, but because of the small sample sizes and the risk of overfitting, I chose to use only 4 lags in the current version.

where**Y** stands for a vector with capital flows, the real exchange rate and GDP growth; $risk_t$ 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 ν_t and ε_t are serially uncorrelated, have mean zero and are independent; and the variance-covariance matrix for ν_t is lower triangular.

The response of the components of the financial account to a risk-off impulse maps the modalities and timing of risk-off inflows. It is useful to start the analysis from an aggregated level and progressively dig into more disaggregated data, so I start by breaking down the financial account into FDI, not-FDI and net reserve sales (Figure 4, below). Here and henceforth, the impulse response functions are normalized so that the initial shock to the risk-off dummy is equal to one.

The immediate impact of a risk-off episode (i.e. the impact in the same quarter as the start of the risk-off episode) is an increase in net financial inflows mostly of the non-FDI type (or if you will, the composite of portfolio, 'other investment' and financial derivatives flows) of approximately 8 percent of annual GDP, which cumulates to 12 percent of GDP in the next two quarters and is then partially reversed in subsequent quarters. The response of FDI inflows is smoother and takes longer to emerge, but it is not statistically significant, as it cumulates to 3½ percent of GDP over four years. Finally, the impulse response of net reserve sales appears like the mirror image of the one for non-FDI flows.

One interesting question is if net reserve sales offset private financial inflows (for instance, reserve accumulation may be the mirror image of net financial inflows by the private sector). It turns out that for Switzerland in our sample, risk-off episodes are associated with reserve accumulation that is only about 2/3 of the increase in non-FDI inflows associated with risk-off episodes during the first 4 quarters, but nearly match the magnitude of net private inflows over longer horizons. This suggests that the supply of Swiss franc assets by the central bank appears to respond to temporary surges of demand during risk-off episodes, but does not fully offset that increased demand at least over shorter horizons.

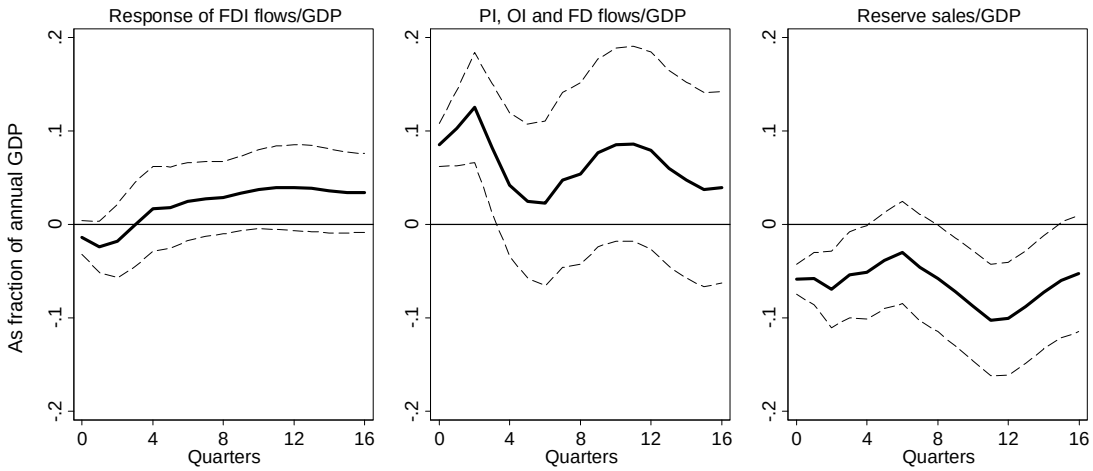

Figure 4. Cumulative impulse response functions to a risk-off shock, financial flows aggregates for Switzerland.

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables the financial flow, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

A. Response of FDI and its components

The cumulative response of FDI inflows is not statistically significant but it cumulates to about 3 percent of annual GDP over 2 years (Figure 5). When decomposing FDI into its components, it is clear that there are two competing forces. On one hand, there is an increase in inflows related to net FDI abroad, i.e. a reduction at the rate at which Swiss residents accumulate direct investment abroad, either because there was an increase in the rate of repatriation of previous investments and or a reduction in the rate at which they acquire new FDI assets. On the other hand, there is also a reduction in the rate at which foreign residents accumulate FDI assets in the Swiss economy. The magnitudes are plausible, as the average net FDI outflow over 1999Q1-2011Q4 was about 6 percent of GDP, of which 10.4 percent is the net outflow related to direct investment abroad and 4.4 percent is the net inflow of direct

investment into Switzerland (Table 1). The positive effect of a risk-off episode on net FDI flows is therefore consistent with a retrenchment in the face of greater uncertainty.[22]

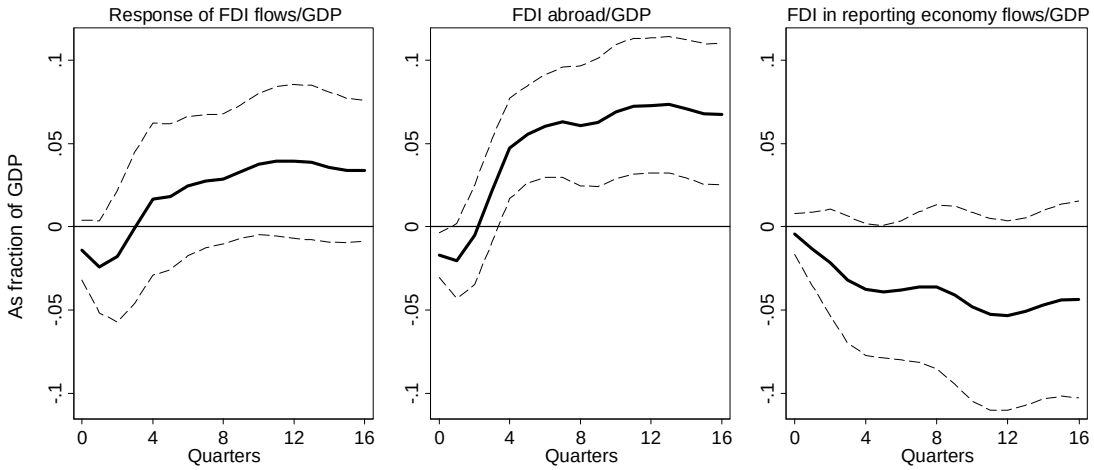

Figure 5. Cumulative impulse response functions to a risk-off shock, direct investment components for Switzerland

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables the financial flow, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

[22] FDI abroad can be further discriminated as equity capital, reinvested earnings and other capital flows. When I break it down to its components, the increase in inflows/decrease in FDI abroad outflows related to risk-off episodes is driven by the equity capital. In other words, the effect of risk-off episodes is to reduce the outflow of Swiss equity investment abroad, and not reductions in reinvested earnings.

B. Response of portfolio investments and its components

We have seen that the onset of a risk-off episode is associated with a sharp increase in non-FDI inflows to Switzerland. Those are mostly composed by portfolio and other investment flows (financial derivatives inflows are relatively minor).

In the same quarter as the onset of the risk-off episode, net portfolio inflows to Switzerland increase on average by about 5 percent of annual GDP, in its almost entirety because of increased net inflows related to portfolio debt securities as the immediate response of portfolio equity flows is close to nil (Figure 6). The response of portfolio debt flows is economically significant, as the standard deviation of quarterly net portfolio debt flows is 2.4 percent of GDP and for net portfolio inflows is 3 percent of GDP (Table 1). The effect of the risk-off shock is persistent, and cumulates to more than 5 percent of GDP over 4 years. To summarize, after the onset of a risk-off episode, there is a net portfolio debt inflow to Switzerland that is not reversed in the subsequent quarters.

In the next subsection, I decompose the portfolio debt inflow response into the component related to net sales of foreign portfolio debt assets by Swiss residents and the one related to net purchases of Swiss portfolio debt securities by non-residents.[23]

[23] The response of portfolio equity flows is not statistically or economically significant.

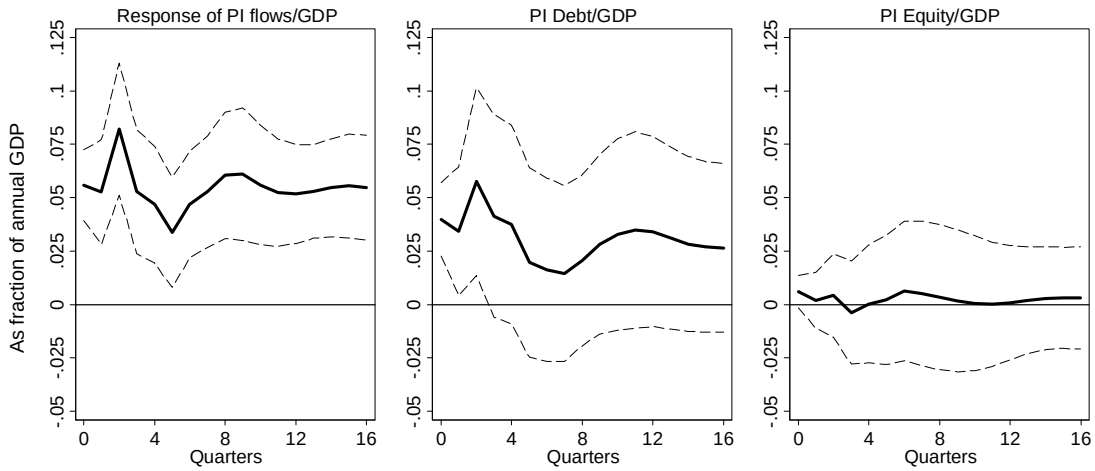

Figure 6. Cumulative impulse response functions to a risk-off shock, portfolio investment components for Switzerland

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables the financial flow, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

Portfolio investment debt securities

The one-off increase in portfolio debt inflows in the same quarter as the risk-off episode is – interestingly – entirely driven by the increase in net inflows related to the foreign debt securities held by Swiss residents (Figure 7).[24] That is not surprising, as 'portfolio debt assets' are three times more volatile than 'portfolio debt liabilities' in Switzerland. Risk-off episodes immediately reduce the rate of net purchase of portfolio debt securities by Swiss residents by 4 percent of annual GDP. This compares with the standard deviation of quarterly portfolio debt assets flows of 2.3 percent of annual GDP and the average net inflow of -1.6 percent of GDP (Table 1). There are protracted movements in portfolio debt liabilities flows, but they have a smaller magnitude and are less persistent than the changes in net portfolio debt assets inflows.

[24] The Swiss balance of payments statistics reported to the IMF International Financial Statistics do not include a breakdown of the holdings of portfolio securities by Swiss residents into monetary authorities, general government, banks and non-bank private sector.

The increase in net inflows related to portfolio debt securities suggests that Swiss investors want to de-risk after risk-off episodes. That is achieved by a reduction in net purchases of foreign debt securities. A more detailed breakdown of portfolio debt securities, including by currency denomination, would give us a better understanding of the drivers of Swiss portfolio investors de-risking.

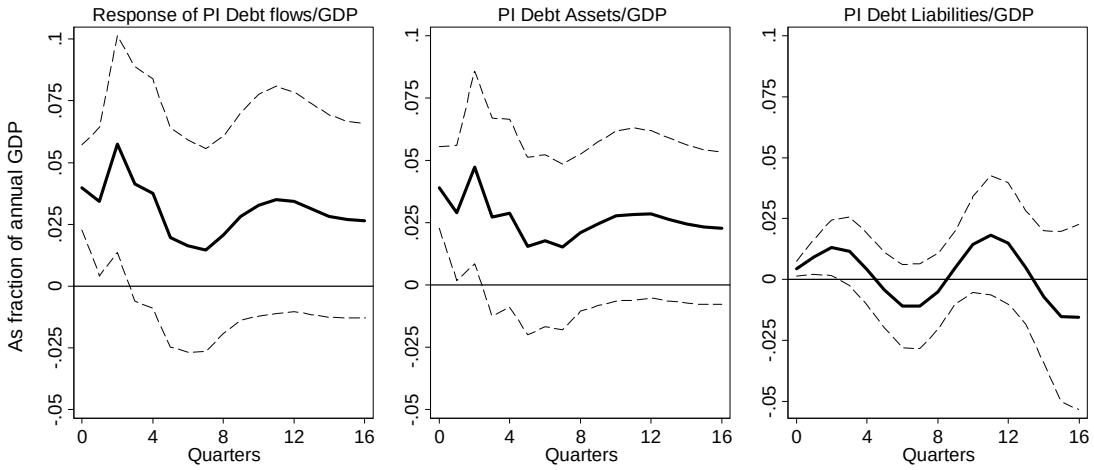

Figure 7. Cumulative impulse response functions to a risk-off shock, portfolio investment debt components for Switzerland

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables the financial flow, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

C. Response of other investments and its components

In the balance of payments, the item 'other investments' of the financial account is composed by (a) loans; (b) 'currency and deposits'; (c) trade credits; and (d) other 'other investments'. For Switzerland, there is an almost perfect negative correlation between flows classified as loans and currency and deposits (and those are also among the most volatile lines in the financial account),[25] so I find it useful to start the exposition by aggregating those two

[25] When a Swiss resident entity borrows from U.S. dollars or euros from a foreign resident entity, there is a positive entry in the financial account for loans (a financial inflow), and keeps the disbursed funds in a foreign bank or in specie, there is a negative entry for currency and deposits (a financial outflow).

accounts together when decomposing the response of 'other investments'. It turns out that most of the variation in that account comes from the aggregate combining the currency, deposits and loans flows, which from now on I refer to as *CD&L* (Figure 8), so that is where we will focus.

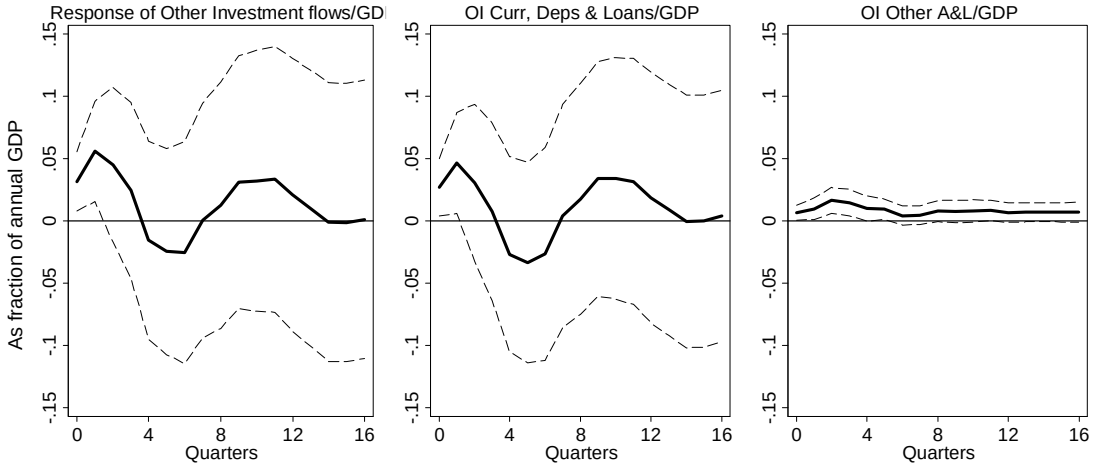

Figure 8. Cumulative impulse response functions to a risk-off shock, other investment components for Switzerland

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables the financial flow, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

In the aftermath of the onset of a risk-off episode, the related net inflows of *CD&L* are a combination of a positive inflow of 'currency and deposits' and a reduction in net borrowing (negative inflow) (Figure 9). While the net effect on *CD&L* is imprecisely estimated and not statistically different from zero, the impulse response functions imply a large drawdown on foreign currency and deposits accompanied by a large reduction in net borrowing over the 4 quarters since the onset of a risk-off episode.

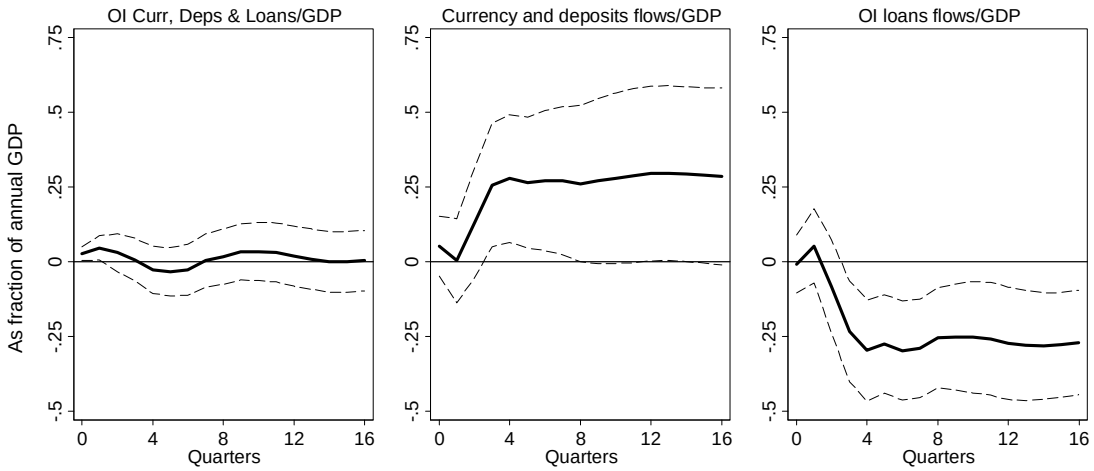

Figure 9. Cumulative impulse response functions to a risk-off shock, selected other investment components for Switzerland

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables the financial flow, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

To interpret these findings, it is helpful to break down the 'currency and deposits' account into its asset and liability components (Figure 10). It turns out that the bulk of the movements observed in the 'currency and deposits' account is driven by asset flows, i.e. Swiss residents draw down their foreign currency and deposits in non-resident depositary institutions, instead of 'currency and deposits' liability flows (those related to foreign residents holdings of Swiss currency and deposits in Swiss banks). In terms of magnitudes, the immediate impact on currency and deposits assets is 4 percent of annual GDP, which compares to a standard deviation of quarterly flows for that financial account item of 12.3 percent of annual GDP (Table 1), and an average holding of 'currency and deposits' assets by Swiss residents of 129 percent of GDP (Table 2).

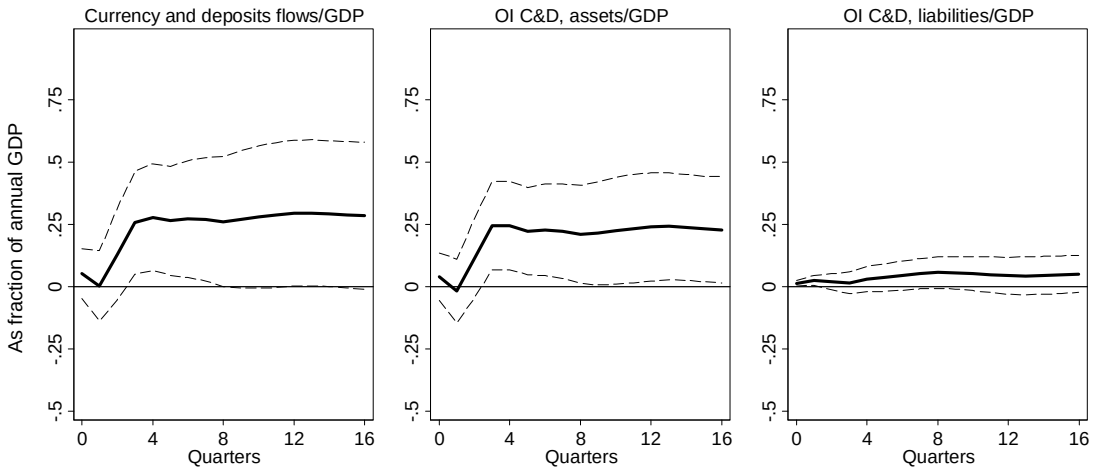

Figure 10. Cumulative impulse response functions to a risk-off shock, 'other investment, currency and deposits' and its components for Switzerland

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables the financial flow, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

I decompose the movements on 'other investment, loans' in Figure 11. The main finding is that the onset of a risk-off episode is associated with outflows in the 'other investment loans, liabilities' account – i.e. reductions in the flow of net borrowing from abroad by Swiss residents. In terms of magnitudes, the cumulative impact after 2 years is an outflow of almost 30 percent of GDP, which should be compared to an average of 159 percent of GDP for the 'other investment loans liabilities, position in the international investment position statistics for the period from 1999Q4 to 2011Q4.

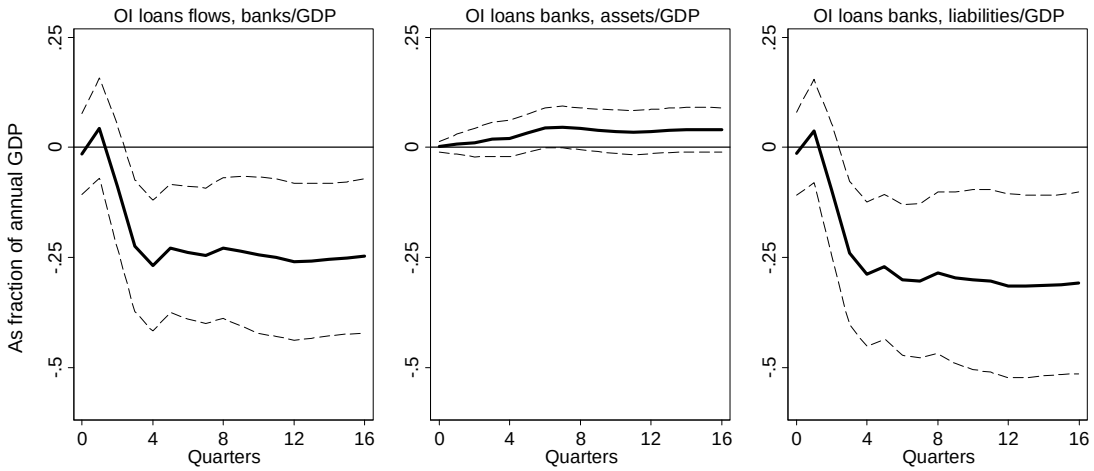

Figure 11. Cumulative impulse response functions to a risk-off shock, other investment loans and its components for Switzerland

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables the financial flow, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

Further breaking down the 'other investment accounts, I find that the movements in 'other investment currency and deposits' and 'other investment loans' is dominated by bank related flows (results available upon request). Therefore, to summarize the results, the onset of risk-off episodes is associated with a reduction in net borrowing by Swiss banks and a concomitant reduction in Swiss banks' foreign currency holdings and deposits in foreign institutions. This could reflect overall deleveraging by Swiss banks, but that is also consistent with a reduction of banks' foreign exposures offset by increased domestic exposures. Thus, the article focuses on the changes in bank balance sheets related to risk-off episodes in Switzerland in the next section.

IV. SWISS BANKS BALANCE SHEETS

The same VAR-based empirical strategy helps us also gain a better understanding of the dynamics of Swiss bank balance sheets after the onset of a risk-off episode. Data on the aggregate balance sheet of Swiss banks is available at the Monthly Bulletin of Banking Statistics published by the Swiss National Bank, with a breakdown on assets and liabilities by currency denomination and residency of the counterpart. Aggregate bank balance sheet

data is available for a longer span, but I restricted the sample to the period from 1999Q1 to 2011Q2 so the results are comparable to those for the quarterly balance of payment statistics (Table 3 features the summary statistics for end of period quarterly observations on aggregate bank balance sheets).

The aggregate bank balance sheet corroborates the evidence from the balance of payments that was suggestive of risk-off reduction in foreign exposure by Swiss banks (Figure 12). Risk-off episodes are associated with shrinking exposures to foreign counterparts, as banks foreign assets and liabilities contract relative to Swiss GDP for 2 years after a risk-off shock. Two non-exclusive factors may be behind the reduction in the ratios of Swiss banks gross foreign asset and liability positions to GDP: true deleveraging and valuation effects (as the market value of foreign currency denominated assets and liabilities shrinks in Swiss franc terms[26]). The evidence seems to support the hypothesis of some deleveraging, as Swiss banks' gross balance sheet positions against foreign resident entities shrink gradually over two years while Swiss franc real effective appreciation is relatively front-loaded.

[26] Exchange rate and valuation effects play a central role in the evolution of Swiss net foreign asset position, in the light of increasingly leveraged international assets and liabilities position. Since 1999, exchange rate and asset prices movements have led to substantial valuations losses, so large and persistent current account surpluses have failed to boost the value of Swiss foreign assets (Stoffels and Tille, 2007).

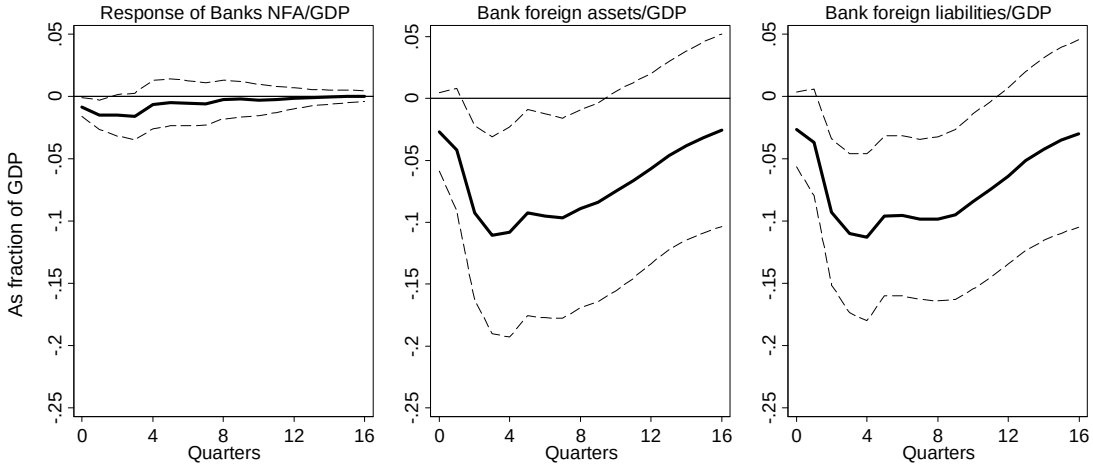

Figure 12. Impulse response functions to a risk-off shock, Swiss banks net foreign assets, gross foreign assets and liabilities, as percent of GDP.

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables the financial flow, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

The net foreign asset position of Swiss banks can be decomposed into its components: the positions against foreign banks, on money market instruments, against customers and a residual term, other net claims (Figure 13). The bulk of the reduction in net foreign asset position associated with the onset of a risk-off episode is concentrated in the residual component, which is an amalgam of several accounts, including liquid assets denominated in foreign currencies, and 'securities and precious metals trading portfolios'. To the extent that net exposure to foreign banks does not shrink during risk-off episodes, Swiss banks appear to reduce foreign exposure largely out of desire to shed foreign currency risk, instead of foreign counterpart risk,

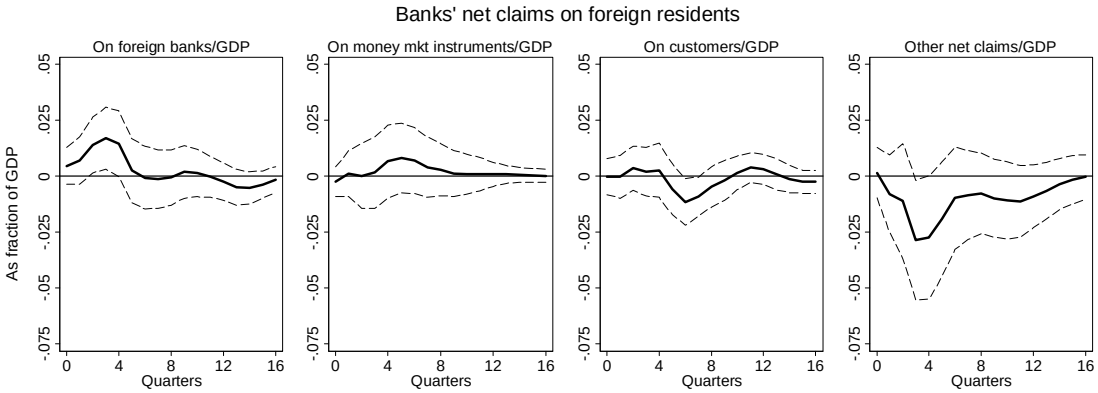

Figure 13. Impulse response functions to a risk-off shock, components of Swiss banks net claims on foreign residents

The impulse response functions were estimated in a Vector Auto-Regression (VAR) including as endogenous variables the financial flow, the log real exchange rate and GDP growth (in that order); and the risk-off dummies, a time trend and seasonal dummies as exogenous variables. The estimation was carried out on quarterly data, from 1999Q1 to 2011Q2. In dashed lines, there are 90% confidence intervals, based on asymptotic standard errors, calculated by Stata.

V. ALTERNATIVE RISK-OFF MEASURES

The findings of this paper generalize to alternative risk-off measures.[27]

The results in this paper generalize from discrete to continuous risk-off measures. The impulse response functions to 2 standard deviation shocks to the log of VIX are quantitatively and qualitatively similar to those from risk-off events as defined in this paper.

The VIX can be decomposed into a risk-aversion and an uncertainty component (Bekaert, Hoerova and Lo Duca, 2010) and it would be interesting to analyze whether there are meaningful differences in the response of international financial flows to each of those components. It turns out that the response of flows to both risk-aversion and uncertainty components are very similar to their response to the VIX itself (that is not very surprising because there is a high correlation between the VIX components).

The recent literature on exchange rate behavior has identified risk factors driving the cross-section distribution of exchange rates. In an influential contribution, Lustig, Roussanov and Verdelhan (2011) constructed a 'carry trade risk factor', named HML, that captures the return from a zero-cost strategy that goes long on a portfolio of high yield currencies and short on a portfolio of low risk currencies. The factor HML is related to non-FDI net flows to Switzerland, just as the risk-off dummy, but it has an effect on both portfolio debt and equity inflows, unlike the risk-off dummy that is related only to portfolio debt inflows. For the other BOP financial flows, HML generates similar impulse response functions as the risk-off dummy, but it fails to have an effect on banks' balance sheets.

[27] The results discussed in this section are all available upon request.

VI. Conclusion

Risk-off episodes cause large movements in the exchange rates of both 'safe haven' and 'risky' countries. The Swiss franc and the Japanese yen are the only two currencies that on average have appreciated relative to the U.S. dollar during risk-off episodes – which earns them the moniker of 'safe-haven currencies'. This articles shows that risk-off episodes are associated also with massive financial inflows to Switzerland. Upon examining the nature of these risk-off driven inflows, I conclude that the Swiss experience belies the usual narrative about safe haven countries, whereby foreigners look for a safe harbor to park their financial assets during periods of turmoil, as that the bulk of inflows represent portfolio rebalancing decisions of Swiss residents. At the onset of risk-off episodes, the increase in capital inflows comes mostly from increases in net portfolio debt asset flows (i.e. adjustments in the portfolio of foreign debt securities held by Swiss residents), and a combination of reduction in loan liabilities and increase in net currency holdings and deposits by Swiss banks (thus, a reduction of foreign exposure by Swiss banks, also consistent with overall deleveraging). Over several quarters, risk-off episodes may also be related to reductions in net FDI outflows by Swiss residents.

The evidence from Swiss bank balance sheets corroborate the evidence of reduced exposure to foreign counterparts (one may call it deleveraging of cross-border positions), as gross asset and liability positions vis-à-vis foreign resident entities shrink relative to GDP during risk-off episodes. The reduction in the net foreign asset position of Swiss banks happens despite no reduction in the net asset exposure to foreign banks or money market instruments, as the bulk of the risk-off reduction in net foreign asset position is concentrated in the residual component, which is an amalgam of several accounts, including liquid assets denominated in foreign currencies, and 'securities and precious metals trading portfolios'.

While smoothing exchange rates may be desirable because it would reduce adjustments costs to the economy and the possibility of economic dislocation if those fluctuations are transitory, capital flow management instruments may cause undesirable inefficiencies because they would hinder equilibrium responses to a greater price of risk. In the Swiss case, capital flow management policies that discriminate based on the residency of the investor

(capital controls) are not likely to be effective at reducing the impact of risk-off episodes because capital inflows during risk-off episodes are in large part driven by portfolio rebalancing by Swiss residents. However, prudential policies that limit leveraging or foreign exposure by Swiss banks may diminish the volatility of capital flows during risk-off episodes.

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Table 1. Table of Summary Statistics: 1999Q1-2011Q4

Variable	Mean	St. Dev.	Min	Max
Macroeconomic variables				
Risk-off	0.154	0.364	0.000	1.000
Private financial flows, net	-0.089	0.158	-0.252	0.470
REER, change in logs	0.002	0.021	-0.076	0.058
GDP growth	0.004	0.006	-0.015	0.016
BOP variables (in percent of annual GDP)				
Private financial flows, net	-2.2%	4.0%	-6.3%	11.7%
Public financial flows, net (ex-reserve net sales)	0.1%	1.6%	-4.8%	5.7%
Current account balance	2.8%	1.2%	-1.0%	4.3%
Capital account	-0.2%	0.1%	-0.4%	0.0%
Financial account	-2.9%	2.8%	-9.0%	5.8%
Direct investment, net	-1.5%	2.1%	-8.0%	4.3%
Direct investment abroad, net	-2.6%	1.9%	-10.6%	0.5%
Direct investment in reporting economy, net	1.1%	1.4%	-1.4%	8.2%
Financial derivatives, net	0.0%	0.5%	-1.1%	1.0%
Portfolio investment, net	-2.0%	3.0%	-10.3%	5.0%
Portfolio investment, assets	-2.4%	2.8%	-10.4%	3.3%
Portfolio investment, liabilities	0.4%	1.0%	-3.6%	3.2%
PI debt securities	-1.5%	2.4%	-6.6%	5.1%
PI debt securities, assets	-1.6%	2.3%	-6.6%	3.9%
PI debt securities, liabilities	0.1%	0.8%	-4.2%	2.2%
PI equity securities	-0.5%	1.3%	-3.8%	2.7%
PI equity securities, assets	-0.8%	1.0%	-3.8%	1.6%
PI equity securities, liabilities	0.3%	0.8%	-1.2%	3.1%
Other investments, net	1.3%	4.0%	-5.7%	11.5%
OI, Currency and deposits	0.0%	12.6%	-43.7%	36.0%
OI, Currency and deposits, assets	-0.9%	12.3%	-43.5%	35.0%
OI, Currency and deposits, liabilities	1.0%	1.7%	-2.3%	5.6%
OI, Currency and deposits, banks	-0.1%	12.4%	-43.3%	35.1%
OI, Currency and deposits, banks assets	-1.0%	12.2%	-43.1%	35.4%
OI, Currency and deposits, banks liabilities	0.9%	1.8%	-1.6%	7.7%
OI, Loans	0.8%	13.3%	-37.6%	46.9%
OI, Loans, assets	-0.9%	2.6%	-7.0%	5.4%
OI, Loans, liabilities	1.6%	13.7%	-33.1%	53.0%
OI, Loans, banks	0.8%	12.9%	-35.4%	46.3%
OI, Loans, banks assets	-0.5%	1.7%	-4.2%	6.8%
OI, Loans, banks liabilities	1.2%	13.2%	-34.2%	47.8%
OI, other assets and liabilities	0.5%	0.9%	-1.3%	3.3%
Net sale of reserve assets	-0.7%	3.6%	-19.0%	5.8%
Net errors and omissions	0.4%	2.5%	-5.9%	6.6%

The BOP variables are measured quarterly as percent of annual GDP. The sample coverage goes from 1999Q1 to 2011Q4, with the exception of the 'financial derivatives, net' line with coverage starting in 2005Q1.

Table 2. Table of Summary Statistics of International Investment Position (Sample 1999Q4-2011Q4)

Variable	Mean	St. Dev.	Min	Max
Net investment position	136%	11%	114%	159%
Direct investment, net	56%	10%	39%	89%
Direct investment abroad	123%	30%	73%	177%
Direct investment in the reporting economy	67%	25%	34%	113%
Other investment, net	-8%	14%	-41%	10%
OI, Currency and Deposits	98%	44%	8%	163%
OI, Currency and Deposits, assets	129%	33%	56%	192%
OI, Currency and Deposits, liabilities	31%	12%	19%	56%
OI, Currency and Deposits, banks	83%	39%	4%	142%
OI C&D banks, assets	112%	29%	48%	166%
OI C&D banks, liabilities	28%	11%	17%	52%
OI, currency and deposits, monetary authorities	3%	1%	1%	9%
OI, currency and deposits, other sectors	17%	5%	6%	25%
Other investment, loans	-91%	31%	-151%	-27%
OI Loans, assets	68%	13%	47%	94%
OI Loans, liabilities	159%	32%	95%	246%
OI Loans Banks	-97%	32%	-156%	-29%
OI Loans Banks, assets	29%	4%	22%	41%
OI Loans Banks, liabilities	125%	33%	55%	197%
Other investment, other assets and liabilities	-16%	4%	-25%	-12%
OI, other A&L, assets	4%	5%	0%	14%
OI, other A&L, liabilities	19%	8%	13%	36%
Portfolio investment, net	61%	11%	38%	83%
Portfolio investment, assets	200%	18%	167%	249%
Portfolio investment, liabilities	139%	22%	97%	189%
PI Debt, net	99%	12%	81%	126%
PI Debt, assets	112%	12%	92%	138%
PI Debt, liabilities	13%	2%	10%	18%
PI Equity, net	-38%	11%	-67%	-16%
PI Equity, assets	88%	15%	58%	118%
PI Equity, liabilities	126%	21%	86%	175%
Reserve assets	23%	12%	15%	59%

The IIP variables are measured as percent of GDP.

Table 3. Table of Summary Statistics of Swiss Banks Balance Sheet (Sample 1999Q1-2011Q4)

Variable	Mean	St. Dev.	Min	Max
Banks net foreign asset position	23%	12%	-9%	38%
of which:				
Money market instruments, net	1%	7%	-15%	14%
Claims on foreign banks, net	14%	9%	-7%	34%
Claims on customers, net	-36%	6%	-49%	-25%
Banks foreign asset position	328%	58%	237%	464%
Money market instruments held	19%	4%	12%	26%
Claims on foreign banks	129%	28%	83%	178%
Claims on customers	69%	16%	46%	113%
Banks foreign liabilities position	305%	49%	234%	427%
Money market instruments issued	18%	6%	10%	34%
Liabilities towards foreign banks	115%	30%	65%	173%
Liabilities towards customers	105%	16%	84%	146%

The bank balance sheet components are measured as percent of GDP. That is calculated by dividing the nominal variables by four times the quarterly nominal GDP.