Cross-Country Exposures to the Swiss Franc*

Agustín S. Bénétrix
Trinity College Dublin

Philip R. Lane
Trinity College Dublin and CEPR

June 2015

Abstract

This paper first documents the foreign currency exposures of Switzerland in the 2002-2012 period and quantifies the cross-border valuation effects generated by exchange rate fluctuations. Second, it examines the Swiss Franc holdings of the rest of the world. To this end, we study a sample of 116 countries and subsamples of advanced and emerging/developing countries.

*We thank Rudolfs Bems and the participants of the "*Foreign Currency Lending in Europe since the Financial Crisis*" workshop held at the Swiss National Bank for comments. Bénétrix thanks the Irish Research Council and Lane thanks the Institute for New Economic Thinking for financial support. Email: benetria@tcd.ie, plane@tcd.ie.

1 Introduction

This paper has two goals. From the one side, we seek to understand the foreign currency exposures of Switzerland. In turn, we calculate the associated currency-induced valuations effects in the Swiss net international investment position over 2002-2012. This first part is in the spirit of Bénétrix et al (2015). Second, from the other side, we wish to explore the Swiss Franc exposures of the rest of the world. For a 116 country sample, we quantify gross and net holdings of Swiss Francs and explore the country characteristics that might explain the cross-country variation in Swiss Franc positions.

To this end, we exploit the database on international currency exposures reported in Bénétrix et al (2015).[1] Estimates of international currency positions are constructed by combining a wide range of datasets in order to extract estimates for the currency of denomination of foreign assets, foreign liabilities and their main subcomponents.

We report that Switzerland has become increasingly long in foreign currencies. Moreover, we quantify the adverse valuation impact generated by the appreciation of the Swiss Franc in recent years and find that this is large relative to GDP, given the outsized scale of the Swiss international balance sheet.

The examination of the Swiss Franc positions held by other countries reveals that advanced economies exhibit a long position in Swiss Francs for the whole international balance sheet and a short position for debt. After the crisis, the overall long position became less positive and the debt short position became less negative. The average exposure across emerging and developing countries was a long position in the whole international balance sheet and also in the debt subcomponent. In contrast to the advanced group, these long positions became more positive after the crisis.

Our study of the determinants of cross-country exposures to the Swiss Franc produced several findings. First, bilateral trade, GDP volatility and capital controls are important determinants for the overall and the debt-only exposures in advanced countries. Second,

[1] This updates the dataset originally reported in Lane and Shambaugh (2010a) which ran from 1990-2004; the new dataset runs until 2012.

exchange rate risk, country size and the covariance between the exchange rate appreciation and GDP grow are relevant factors determining the exposure of the whole international balance sheet of these countries. However, this is not the case for the debt subcomponent. Third, our study shows that the exchange rate regime is important for the overall exposure while domestic inflation and EMU membership is relevant for debt-only exposures in emerging and developing countries.

The structure of the paper is the following. Section 2 describes the data and the approach to estimate international currency exposures. Section 3 describes Swiss currency exposures vis-à-vis all currencies for selected years and decomposes these into several interesting subcomponents. Then, valuation effects associated with these exposures are reported. Section 4 describes the cross-country exposure to the Swiss Franc and compares it with exposures to other foreign currencies. This section also studies the determinants of exposures to the Swiss Franc in advanced and emerging plus developing country groups. Finally, Section 5 concludes.

2 International Currency Exposures

This section describes the method to estimate international currency exposures. These estimates are based on data for the currency of denomination of foreign assets and liabilities from Lane and Shambaugh (2010a) and the recent update by Bénétrix et al (2015).

These papers make a relevant contribution since official balance of payments and international investment position data do not record the currency composition of foreign assets and foreign liabilities. More precisely, they show that it is possible to construct estimates for their currency of denomination by drawing on a range of datasets and inferential techniques.

This involves a two-step process in which the currency composition within individual investment categories are first calculated, before obtaining aggregate exposures by weighting across categories in line with their shares in the international balance sheet.

For equity-type assets, this approach asserts that currency exposures track geographic exposures.[2] Information on the geographical patterns in foreign assets can be obtained from the IMF's Coordinated Portfolio Investment Survey (CPIS) for portfolio equity assets, with the IMF's Coordinated Direct Investment Survey (CDIS) and the UNCTAD bilateral FDI database provide similar data for FDI holdings.

The CPIS dataset also provides the geographical pattern in portfolio debt assets, while the BIS locational banking statistics contain information on the geography of bank-type debt assets.[3] Since debt issuers in a given country can issue in foreign currencies as well as in domestic currency, the geographical data is combined with country-level and BIS data on the currency denomination of debt instruments to work out the currency exposures in cross-border debt positions.

Finally, estimates of the currency composition of official reserve assets are calculated through a combination of national data sources, COFER data and the implementation of the empirical model developed by Eichengreen and Mathieson (2000).

In the second step, the currency composition data for each category within foreign assets and foreign liabilities are combined to create aggregate weights, using the External Wealth of Nations dataset on the composition of international balance sheets (Lane and Milesi-Ferretti 2007).

The currency weights are given by the formulae

$$\omega^{A}_{ijt} = \sum_{k=1}^{k=N} \lambda^{Ak}_{it} * \omega^{Ak}_{ijt}; \qquad \omega^{L}_{ijt} = \sum_{k=1}^{k=N} \lambda^{Lk}_{it} * \omega^{Lk}_{ijt} \tag{1}$$

where $\omega^{A}_{ijt}, \omega^{L}_{ijt}$ are the weights for currency j in period t in country i's foreign assets and foreign liabilities, $\lambda^{Ak}_{it}, \lambda^{Lk}_{it}$ are the relative importance of category k (portfolio equity, FDI, debt, reserves) in country i's assets and liabilities in period t and $\omega^{Ak}_{ijt}, \omega^{Lk}_{ijt}$ are the weights for currency j in period t in category k for country i's assets and liabilities

[2] The process by which estimates of the currency composition of foreign liabilities are constructed is essentially symmetric.

[3] The BIS Statistics Department facilitated access to the underlying geographical and currency patterns in the locational banking data.

respectively. Accordingly, the aggregate weights are a function of the weights for currency j in period t for a particular k asset-class of country i's assets or liabilities, and the weights across the k asset classes (represented by λ_{it}^{k}).

It is possible to define aggregate net financial weights

$$\omega_{ijt}^{F} = \omega_{ijt}^{A} s_{it}^{A} - \omega_{ijt}^{L} s_{it}^{L} \tag{2}$$

where $s_{it}^{A} = A_{it}/(A_{it} + L_{it})$ and $s_{it}^{L} = L_{it}/(A_{it} + L_{it})$ are the shares of foreign assets and foreign liabilities in total cross-border holdings. These weights indicate the direction of the valuation impact of a movement in currency j. If the net foreign asset position is zero, this reduces to simply subtracting the liability weights from the asset weights.

In turn, the quantitative exposure of country i to a shift in the bilateral exchange rate between i and j can be simply written as

$$NETFX_{ijt}^{BILAT} = \omega_{ijt}^{F} * IFI_{it} \tag{3}$$

where IFI_{it} is equal to assets plus liabilities as a percentage of GDP, or the total size of the external balance sheet scaled by GDP, such that the valuation impact can be written as

$$VALXR_{ijt}^{BILAT} = NETFX_{ijt}^{BILAT} * \%\Delta E_{ijt}$$

where $\%\Delta E_{ijt}$ is the percentage change in the bilateral exchange rate in period t.

In terms of aggregation across all bilateral currency pairs, it is helpful to define asset- and liability-weighted currency indices

$$I_{t}^{A} = I_{t-1}^{A}(1 + \sum \omega_{ijt-1}^{A} * \%\Delta E_{ijt}) \tag{4}$$

$$I_{t}^{L} = I_{t-1}^{L}(1 + \sum \omega_{ijt-1}^{L} * \%\Delta E_{ijt}) \tag{5}$$

In turn, the aggregate net financial index can be written as

$$I_t^F = I_{t-1}^F(1 + \sum \omega_{ijt-1}^F * \%\Delta E_{ijt}) \tag{6}$$

and the aggregate impact of currency-based valuation effects can be equivalently written as

$$VALXR_{it} = \%\Delta I_{it}^F * IFI_{it-1} \tag{7}$$

or

$$VALXR_{it} = \sum VALXR_{ijt}^{BILAT} = \sum NETFX_{ijt}^{BILAT} * \%\Delta E_{ijt} \tag{8}$$

By way of illustration, if in a given year, 20 percent of Switzerland's assets are in U.S. dollars and 30 percent of its liabilities are in dollars, and Switzerland has a balanced NFA position (that is, assets equal liabilities), then the $\omega_{ijt}^F = -.05 = (.2*.5-.3*.5)$. If assets plus liabilities are equivalent to 200 percent of Switzerland's GDP, then $NETFX_{ijt}^{BILAT}$ is -10 percent. Thus a 10 percent depreciation of the Swiss Franc against the dollar (holding fixed all other bilateral exchange rates) would generate a one percent of GDP wealth loss.

3 Swiss Currency Exposures and Valuation Effects

Using the framework described above, we turn to he study of Switzerland's foreign currency exposure for selected years in the 2002-2012 period. The reasons for focusing on this period are: (i) it contains estimates for currency composition with the highest quality, as data from sources such as the CPIS are available from 2001; (ii) it accounts for the increase in international financial integration following the creation of the EMU; and (iii) it contains a sufficiently long tranquil period as well as the recent crisis.

We define the aggregate foreign currency exposure at the end of period t by

$$FXAGG_{it} = \omega_{it}^A s_{it}^A - \omega_{it}^L s_{it}^L \tag{9}$$

where ω_{it}^A is the share of foreign assets denominated in foreign currencies, s_{it}^A is the share of foreign assets in the sum of foreign assets and foreign liabilities and ω_{it}^L, s_{it}^L are defined analogously. By construction, the $FXAGG$ index lies in the range $(-1, 1)$, where a value of -1 corresponds to a country that has zero foreign-currency foreign assets and only foreign-currency foreign liabilities, whereas $+1$ corresponds to a country that has only foreign-currency foreign assets and only domestic-currency foreign liabilities. In turn, the scale of the aggregate foreign currency exposure is given by

$$NETFX_{it} = FXAGG_{it} * IFI_{it}. \tag{10}$$

Table 1 shows Swiss foreign currency exposure for 2002, 2007 and 2012. We select these years, since 2002 marks the beginning of a general surge in cross-border financial trade (Lane 2013), while 2007 represents the eve of the global financial crisis and 2012 is the final year in the sample. It shows the $FXAGG$ index defined by equation (9). In addition, it reports a decomposition of $FXAGG$ between the net currency exposures embedded in the foreign asset position and foreign liability positions (each scaled by total foreign assets plus liabilities), plus the net foreign liability position in Swiss Francs. These items are reported in rows (1), (2) and (3), respectively.

Furthermore, Table 1 also reports a decomposition of the net foreign asset position into the non-reserve net position and the reserve position in rows (4) and (5), respectively. Moreover, the net foreign liability position in Swiss Francs, reported in row (3), is decomposed into portfolio equity and FDI liabilities in row (6), debt liabilities in Swiss Francs in row (7), and non-reserve foreign assets denominated in Swiss Francs, in row (8).[4]

Finally, we also report the $NETFX$ index as defined in equation (10) and the debt-only foreign currency exposure. The former explicitly accounts for the quantitative exposure to a uniform change in the value of domestic currency against all foreign currencies.

[4]Lane and Shambaugh (2010a) and Bénétrix et al (2015) assume that the currency exposures of portfolio equity and FDI positions track the geographic exposure. Thus, Switzerland's portfolio equity and FDI liabilities are assumed to be denominated in Swiss Francs. That is, the foreign-currency value of these assets moves with the value of the Swiss Franc.

More precisely, it measures the scale of the aggregate net currency exposure. The latter is an index analogous to the $FXAGG$ but computed for foreign debt assets and liabilities only. This debt-only index helps to clarify the relative importance of debt and equity components in the aggregate index.

Table 1 shows that Switzerland was long in foreign currency in 2002, 2007 and 2012 and that this position has increased over time. Row (1) shows that $FXAGG$ values were similar in 2002 and 2007 (29 and 28 percent, respectively) but rose to 37 percent in 2012. The change in the $FXAGG$ between 2002 and 2012 was driven by an increase in the net foreign liability position $FXAGG^0$ that shifted from 0.14 to 0.23 as shown in row (3). The net asset position as a share of the sum of assets and liabilities did not change. The change in $FXAGG^0$ was driven by an increase in portfolio equity and FDI liabilities denominated in Swiss Francs from 0.17 to 0.23 in row (6). Foreign debt liabilities in domestic currency also contributed to the increase in $FXAGG$ shifting from 0.04 in 2002 to 0.07 in 2012. Foreign assets denominated in domestic currency (that is, Swiss Franc lending to foreign entities) did not contribute to this change in Swiss aggregate foreign exposure.

In terms of how exposures changed between 2007 and 2012, Table 1 shows that the shift in $FXAGG$ from 0.28 in 2007 to 0.37 in 2012 was explained by an increase in both the net foreign asset position and the net liability position in Swiss Francs. The former was driven by the increase in Swiss reserves from 0.01 to 0.07. The latter was mainly driven by an increase in foreign debt liabilities denominated in Swiss Francs, reflecting the high demand for Swiss Francs in the post-crisis environment in view of its safe haven properties. The increase of portfolio equity and FDI liabilities also contributed to this change but to a lesser extent.

The scale of the exposure to foreign currencies increased secularly across these years. This was not only driven by the change in $FXAGG$ but also by the increase in the scale of gross foreign assets and liability positions. More precisely, the $NETFX$ values in row (9) show that this long position in foreign currencies represented 2.6 times Swiss GDP in

2002, 3.4 times in 2007 and 3.7 times in 2012.

Finally, row (10) reports the debt-only foreign exposures to complement the previous assessment. In line with the aggregate measure, the debt-only exposure grew between 2002 and 2007 and between 2007 and 2012. However, this long position fell from 2002 to 2007.

Next, we employ the calculated international currency exposures to estimate the valuation impact of exchange rate movements on the net international investment position.

Figure 1 shows Swiss $VALXR$ for the period 2002-2012 as well as its cumulative value. As expected, the largest valuation loss was associated with the Swiss Franc appreciation (vis-à-vis all currencies) between 2007 and 2008. This exchange rate shift, combined with the long position in foreign currency in 2007, generated a valuation loss of nearly 41 percent of Swiss GDP. The second largest valuation loss in this period was associated with the appreciation of the Swiss Franc between 2009 and 2010. This created another valuation loss of 34 percent of GDP.

Overall, the Swiss long position in foreign currency combined with cumulative appreciation of the Swiss Franc generated sizable valuation losses.[5]. This adverse valuation impact of exchange rate appreciation has been accentuated in the years following the crisis as Switzerland exhibited an increase in the volume of foreign liabilities denominated in domestic currency and an increase in official reserve assets.

4 Cross-country exposures to the Swiss Franc

This section documents the exposure to the Swiss Franc using a sample of 116 countries, consisting of 21 advanced economies and 95 emerging and developing countries. As before, we focus on the period from 2002 to 2012.

Figure 2 reports the cross-country distributions exposures to Swiss Francs, using period

[5]Of course, valuation losses can be counterbalanced by valuation gains as a result of changes in the value of foreign assets or liabilities that are not associated with exchange rate movements. For instance, in 2007 Switzerland exhibited a valuation loss associated with exchange rate changes of 3.1 percent of GDP. However, the overall stock-flow adjustment for that year was a gain of 13 percent of GDP.

averages for 2002-2012 of the $FXAGG^{CHF}$ index. It shows that more than half of the countries are long Swiss Francs. From the advanced economies group, 33 percent were long, while 62 percent of emerging and developing countries were long. A comparison between these two country types shows that, within the set of countries being long Swiss Franc, emerging and developing countries hold larger positions. For the set of countries that are short Swiss Francs, the advanced countries tend to have a more negative position than the emerging and developing countries.

Tables 2 and 3 complement these stylised facts by reporting several statistics to characterise the $FXAGG^{CHF}$ and $NETFX^{CHF}$ distributions and their evolution in time. We look at these measures for the overall international investment position and the debt-only subcomponent.

Table 2 shows that the average $FXAGG^{CHF}$ increased substantially for all countries between 2002 and 2012. The $FXAGG^{CHF}$ mean value rose from 0.08 to 0.38, while its median grew from 0.08 to 0.13. Looking at these statistics by country type reveals that this increase was driven by few emerging and developing countries. Their mean $FXAGG^{CHF}$ increased substantially but their median value only increased marginally. This is confirmed by the changes in the tenth percentile for these countries between 2002 and 2012.

In terms of the values before and after the crisis, the average and the median $FXAGG^{CHF}$ also increased between 2007 and 2012. As for the full period, this is driven by the increase in the emerging market and developing countries exposure to the Swiss Franc in those years. The dynamics for the advanced group between 2007 and 2012 is different: the mean and median $FXAGG^{CHF}$ values decline but remain positive in 2012.

The second panel of Table 2 shows the same statistics for $NETFX^{CHF}$. Thus, these statistics explicitly account for the size of the international balance sheet, as measured by the IFI index in equation (10). An inspection of this panel shows that the relatively larger long positions in Swiss Francs for emerging and developing countries with respect to the advanced group did not mean a larger scale in their Swiss Franc position, in view

of their smaller international balance sheets.

Next we look at a subcomponent of the previous exposures and focus on the debt-only component. Table 3 reports these statistics and the same country groups as before. We label $FXDEBT^{CHF}$ the debt-only version of $FXAGG^{CHF}$ and $NETFXDEBT^{CHF}$ the version debt-only version of $NETFX^{CHF}$. In contrast to the overall case for all countries, the exposure for the full country sample does not exhibit a secular pattern. In particular, the mean $FXDEBT^{CHF}$ changes from 0.11 to 0.01 between 2002 ant 2007. The median $FXDEBT^{CHF}$ also falls. Breaking down these statistics by country groups reveals that advanced countries were short Swiss Franc in foreign debt while emerging and developing countries were long. For the former group, the position became less negative in time. In contrast, the emerging market and developing countries group exhibited a reduction of its long position in Swiss Franc from 2002 to 2007 before increasing between 2007 and 2012. In line with the aggregate position described above, the scale of the debt-only exposure was substantially larger for advanced economies, as shown in the second panel of Table 3. Still, it is interesting to report that the scale of the long position in Swiss Francs of emerging and developing countries has been increasing in magnitude and as a proportion of overall Swiss liabilities (Figure 3). The latter grew from being 3.9 percent of the overall assets denominated in Swiss Francs in 2002 to 11.4 percent in 2012.

Next, we put the focus on the exposures of these 116 countries to the Swiss Franc and compare it with the exposures to other foreign currencies.

To this end, Figure 4 reports the 2002-2012 period average of the $FXAGG$ index for the Swiss Franc and the aggregate of other currencies and shows that the range of exposures vis-à-vis the Swiss Franc is much smaller that the cross-country exposure vis-à-vis other currencies. The shape of this distribution is dominated by the cross-country exposures to the US dollar, the euro and, to a lesser extent, the exposures vis-à-vis the British pound and the Japanese Yen. This is the case for the 2002-2012 period average and also for each individual year. In terms of the proportion of countries being long 'other currencies' and long Swiss Franc, Figure 4 shows that these shares were 38 and 58 percent,

respectively.

Another way of looking at the relation between these exposures is by means of scatter plots and correlations for different years. To this end, Figure 5 reports these for 2002, 2007, 2010 and 2012. The immediate message of these figures is that, independently of the year being studied, the correlation between $FXAGG$ exposures for the Swiss Franc and for other currencies was quite low. This was positive and equal to 0.13 and 0.14 for 2002 and 2007, and negative and equivalent to -0.01 and -0.002 in 2010 and 2012, respectively.

However, the small magnitude of these correlations is not present in both country groups. For advanced economies, exposures to the Swiss Franc were positively correlated with exposures to other currencies. This positive correlation reached its peak in 2005 with a value of 0.53 and then fell secularly until 2012.[6] Correlations for the emerging and developing countries group were small in the whole period. [7] This suggests that the small change in the correlation coefficient in the overall sample from a small and positive correlation to a small and negative correlation was explained by the change in sign in the correlation for emerging and developing countries and the fall in the positive correlation coefficient in advanced economies.

Beyond the analysis of the unconditional correlation between these exposures, it is interesting to have a closer look at the countries that hold a long position in Swiss Francs and a short position in the rest of the currencies. These countries are reported in Figure 5 for the same years as before. Almost all countries with this exposure profile are emerging or developing economies and their quantity represents 24-41 percent of all countries, depending on the year. This is in line with the previous finding that this country group exhibits a mild negative correlation for these currency exposures.

Finally, we put the focus on the changes in exposures following the crisis by graphically illustrating the heterogenous changes in currency exposures between the years 2007 and 2012. To this end, we choose the interesting sub-sample of countries exhibiting a change

[6]For the years 2002, 2007, 2010 and 2012 reported in the figures, the correlation coefficients for advanced economies were 0.27, 0.44, 0.31 and 0.18, respectively.

[7]For emerging and developing countries, these correlation were positive and equal to 0.13 and 0.11 in 2002 and 2007, but then turned to negative and equal to -0.04 and -0.007 in 2007 and 2012, respectively.

towards a more positive (or less negative) net position in Swiss Francs in 2012. This represents 54 percent of our country sample (63 countries), with 53 of them being emerging and developing countries. To this end, Figure 6 reports the initial and end exposures of all these economies. Hollowed circles show exposures in Swiss Francs and other currencies in 2007 while filled circles show these in 2012. Dashed vectors indicate the direction of this change. As this figure shows, there has been a large heterogeneity in the changes of exposures vis-à-vis other foreign currencies. Thirty-one moved to a more positive (or less negative) position, twenty-seven stayed long in Swiss and also in other currencies while only five countries were long both and became short in other currencies after the crisis. This simple exercise illustrates the large variety of changes in exposures only for those countries moving to a more positive (or less negative) position in Swiss Francs. Next, we follow a more systematic approach and look at the determinants of Swiss currency exposures estimating several regression models.[8]

4.1 Determinants of country exposures to the Swiss Franc

This section studies the determinants of exposures to Swiss Franc. As shown in Table 1 it is possible to compute a number of key covariates for aggregate foreign exposure. As discussed before, the aggregate net international investment position and the net liability position in domestic currencies are key factors in determining whether a country is long or short foreign currency. For a given net international investment position, the distribution of the non-reserve position is especially influential (in particular, the share of portfolio equity and FDI in foreign liabilities). The level of reserves is also an important explanatory variable in the variance decomposition of the $FXAGG$ positions.

In terms of the fundamental factors that correlate with the external positions denominated in Swiss Francs, Lane and Shambaugh (2010b) and Bénétrix et al (2015) show that international trade, risk characteristics and institutional factors can influence the

[8]Extensions of this work include estimates of the relative importance of exposures to the Swiss Franc in the overall currency-induced valuations effects as well as decomposition exercises to account for the role of changes in the currency weights or in the scale of country's international balance sheet.

cross-country variation of the aggregate foreign exposure. Here, we adapt their empirical approach to study the cross-country variation of bilateral exposures to the Swiss Franc. To this end, we estimate equation (11),

$$\begin{aligned} FXAGG_{it}^{CHF} &= \alpha FXAGG_{it}^{OTH} + \beta_1 TRADE_{it} + \beta_2 VOL_{it} + \beta_3 COV_{it} + \\ &\quad \gamma Z_{it} + \lambda_1 GDP_{it}^{PC} + \lambda_2 SIZE_{it} + \theta Y_t + \varepsilon_{it}, \end{aligned} \tag{11}$$

where $FXAGG_{it}^{CHF}$, defined by equation (2), measures the degree of exposure to the Swiss Franc. $FXAGG_{it}^{CHF}$ is the aggregate foreign exposure to all currencies excluding the Swiss Franc. As shown in the previous section section, the unconditional correlation between the exposure to the Swiss Franc and to other currencies is small for the full sample of 116 countries and also for the 95 emerging and developing economies. However, these exposure indices are positively correlated in advanced countries. Thus, we include this indicator as explanatory variable to further study those previous findings now conditioning this relation on other fundamental factors.

$TRADE_{it}$ is bilateral trade with Switzerland scaled by GDP. We include this variable since the intensity of bilateral trade is highly correlated with bilateral financial positions.[9] Thus, it is likely that bilateral trade with Switzerland will be associated with the share of foreign assets and liabilities denominated in Swiss Francs.

In addition, we include different volatility measures in vector VOL_{it}. These are the volatility of real GDP and volatility of inflation to account for effect of domestic instability and uncertainty. We also include the standard deviation of the bilateral nominal exchange rate vis-à-vis the Swiss Franc. The higher is the volatility in domestic inflation and GDP growth, the larger is the uncertainty about the real returns on nominal positions. The higher the exogenous component in the volatility of the exchange rate, the more risky

[9]Several papers exploit this strong correlation to generate estimates of bilateral financial positions. Examples of these works are Lane and Shambaugh (2010b) or Bénétrix, Lane and Shambaugh (2015) among others.

will be assets denominated in Swiss Francs. A critical factor in determining the long or short position is the covariance between domestic wealth and the nominal exchange rate vis-à-vis the Swiss Franc (COV_{it}). This is proxied by the covariance between the change in real GDP per capita and the bilateral exchange rate.[10]

Z_{it} includes indicators for the quality of institutions and capital account openness and dummy variables for exchange rate peggers and EMU members. We include these as we want to consider institutional and policy factors that may alter the desired optimal currency exposure and/or restrict the ability to attain its desired level. GDP_{it}^{PC} is the level of GDP per capita and it is included since many of the characteristics listed above are plausibly correlated with the level of development. $SIZE_{it}$ is country size measured with the logarithm of population. This is included as a general control variable, following the empirical evidence in Lane and Milesi-Ferretti (2000) and Eichengreen et al (2003) suggesting that larger countries are better able to issue liabilities in domestic currency.

We estimate this equation by pooling data for the years 1996, 2000, 2004, 2007 and 2012. We follow this approach, instead of including all years, to avoid potential problems that could be created by variables with high serial correlation. In addition, we want to minimize the impact of using regressors, such as the volatilities and covariances that are based on period windows that overlap with each other. Finally, there is also a data availability limitation as the World Bank institutional quality estimates are only available in even years.

Table 4 reports the point estimates of the coefficients in equation (11), initially assuming that the vector γ is equal to zero and then relaxing this constrain to allow institutional and policy factors to play a role. We estimate these models for the full sample and for the both country subgroups.

Columns (1) and (2) report the estimates for the full country sample. These show that the joint explanatory power of our set of regressors is very small. They explain, at

[10]These variance and covariance measures are calculated for the log changes of each variable using a fifteen-year window. For instance, in year 1996 these statistics are computed using data for the period 1981-1995.

most, 5 percent of the total cross-country variation in the $FXAGG^{CHF}$. This is also the case for models estimated for emerging and developing economies reported in column (5) and (6). However, the regressions for advanced economies in columns (3) and (4) exhibit an overall explanatory power of up to 52 percent in its unrestricted version.

The main messages that columns (1)-(6) give in terms of the non-significance of some regressors are: (i) there is no systematic link between exposures to the Swiss Franc and to other currencies, in line with the unconditional correlations reported above (The exception is the unrestricted model for advanced countries showing a positive co-movement); (ii) inflation volatility, quality of institutions and the EMU appear to be unimportant and; (iii) the time dummies for the years 2000, 2004 and 2007 do not seem to be associated with a shift in the distribution of exposures.

In terms of the individual significance of the explanatory variables, there are considerable differences between the advanced and the other samples. The former shows several individual effects that are statistically relevant while the latter exhibits only a few. Taking this into account, we first focus on the advanced group and then on the other two samples.

As discussed above, there is some evidence of a positive association between positive positions in Swiss Francs and in other currencies for advanced countries. The magnitude of this link is larger once we include extra regressors. Trade between these countries and Switzerland appears to be negatively associated with more positive positions in Swiss Francs. In line with our expectations, there is strong evidence that domestic uncertainty proxied by GDP volatility will induce countries to hold positive position in Swiss Francs. The negative and significant point estimate for the exchange rate volatility confirms the conjecture that exchange rate risk will be associated with less positive positions in foreign currency. The coefficient of the covariance between the exchange rate and GDP growth is in line with the findings by Lane and Shambaugh (2010b) and Bénétrix et al (2015) for aggregate exposure and nominal effective exchange rates. Countries that depreciate in bad times tend to have a more positive positions in foreign currency. Here, we find

that advanced countries exhibiting a reduction in the value of their currency vis-à-vis the Swiss Franc in recessions will hold a more positive position. As expected, a stringent barrier for capital flows will negatively affect the Swiss Franc position. Finally, columns (3) and (4) show that bigger and richer countries have more positive positions.

For the cases of the full sample and the emerging/developing subsample, the coefficients that are statistically significant in both groups are the dummy variable for the exchange rate regime, GDP per capita and the year dummy for 1996 in the restricted model. For the overall sample only, the 2012 year dummy and country size are also statistically relevant. In both cases the point estimate is positive, indicating a general surge in Swiss Franc holdings in the post-crisis period and a pattern by which larger countries hold relatively more Swiss Francs. In addition, there is some evidence that higher exchange rate volatility may be associated with longer positions. However, this effect vanishes with institutional variables are included. For the emerging and developing sample only GDP per capita is relevant and exhibits a positive coefficient. However, this estimate become insignificant when the quality of institutions are included.

Table 5 reports the same set of regressions but focusing on exposures on the debt-only component. Several of the patterns emerging in the models using overall exposures are also present here. However, some variables that were insignificant determinants for the overall exposure are significant in the debt-only case. Inflation volatility is now positive and statistically significant. More volatility in terms of the real returns on nominal positions in the domestic economy are associated with more positive positions in Swiss Francs. GDP per capita has now a negative association with exposures for debt. For the restricted model, more developed economies tend to have a less positive position. This effect appears in the full and advanced samples. For the latter, some of the effects for the overall exposure become larger in the debt-only models and others become smaller or statistically zero. The effects of bilateral trade with Switzerland, GDP volatility and capital controls become stronger in the debt-only case. The effect of the GDP and exchange rate covariance becomes statistically zero.

This section has described the qualitative effect of several fundamental determinants that affect exposures to the Swiss Franc. In general, most of the action takes place in advanced countries. For them, bilateral trade, uncertainty in relation to GDP growth and capital controls matter for the overall and the debt-only exposures. Exchange rate risk, country size and the covariance between the exchange rate appreciation and GDP grow are relevant for the overall exposure only. For emerging and developing countries, the exchange rate regime is important for the overall exposure while domestic inflation and EMU membership is relevant for debt-only exposures.

5 Conclusions

This paper makes two contributions. First, we report the international currency exposures embedded in the Swiss international investment position. Switzerland has become increasingly long in foreign currencies, in part driven by the thirst by foreign investors for Swiss Franc assets. Moreover, the estimated international currency exposures are exploited to quantify the adverse valuation impact generated by the appreciation of the Swiss Franc in recent years: this is large relative to GDP, given the outsized scale of the Swiss international balance sheet.

Second, we examine the Swiss Franc positions held by a sample of 116 countries. We investigate the covariates of the cross-country and cross-time variation in these positions.

We find that the average exposure across advanced economies was a long position in Swiss Francs for the whole international balance sheet and a short position for debt. After the crisis, the overall long position became less positive and the debt short position became less negative. The average exposure across emerging and developing countries was a long position in the whole international balance sheet and in the debt subcomponent. In contrast to the advanced group, these long positions became more positive after the crisis.

In term of the relation between exposures to the Swiss Franc and exposures to other

foreign currencies, we find evidence of positive correlation among them in advanced economies. However, this correlation was low in emerging and developing countries.

Our study of the determinants of cross-country exposures to the Swiss Franc produced several findings. First, bilateral trade, GDP volatility and capital controls are important determinants for the overall and the debt-only exposures in advanced countries. Second, exchange rate risk, country size and the covariance between the exchange rate appreciation and GDP grow are relevant factors determining the exposure of the whole international balance sheet of these countries. However, this is not the case for the debt subcomponent. Third, our study shows that the exchange rate regime is important for the overall exposure while domestic inflation and EMU membership is relevant for debt-only exposures in emerging and developing countries.

Data Appendix

Country list

- Advanced countries (22): Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Iceland (ISL), Ireland (IRL), Italy (ITA), Japan (JPN), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Kingdom (GBR) and United States (USA)

- Emerging market economies and developing countries (95): Albania (ALB), Algeria (DZA), Argentina (ARG), Armenia (ARM), Azerbaijan (AZE), Bangladesh (BGD), Belarus (BLR), Benin (BEN), Bolivia (BOL), Bosnia and Herzegovina (BIH), Botswana (BWA), Brazil (BRA), Burkina Faso (BFA), Cambodia (KHM), Cameroon (CMR), Chad (TCD), Chile (CHL), China (CHN), Colombia (COL), Congo, Rep. (COG), Cote d'Ivoire (CIV), Croatia (HRV), Czech Republic (CZE), Dominican Republic (DOM), Egypt (EGY), El Salvador (SLV), Equatorial Guinea (GNQ), Estonia (EST), Ethiopia (ETH), Fiji (FJI), Gabon (GAB), Georgia (GEO), Ghana (GHA), Guatemala (GTM), Guinea (GIN), Haiti (HTI), Honduras (HND), Hong Kong (HKG), Hungary (HUN), India (IND), Indonesia (IDN), Iran (IRN), Israel (ISR), Jamaica (JAM), Jordan (JOR), Kazakhstan (KAZ), Kenya (KEN), Korea, Republic of (KOR), Kyrgyz Republic (KGZ), Latvia (LVA), Lithuania (LTU), Macedonia, FYR (MKD), Madagascar (MDG), Malawi (MWI), Malaysia (MYS), Mali (MLI), Mexico (MEX), Moldova (MDA), Morocco (MAR), Mozambique (MOZ), Nepal (NPL), Nicaragua (NIC), Niger (NER), Nigeria (NGA), Oman (OMN), Pakistan (PAK), Papua New Guinea (PNG), Paraguay (PRY), Peru (PER), Philippines (PHL), Poland (POL), Romania (ROM), Russian Federation (RUS), Rwanda (RWA), Senegal (SEN), Singapore (SGP), Slovak Republic (SVK), Slovenia (SVN), South Africa (ZAF), Sri Lanka (LKA), Syrian Arab Republic (SYR), Tanzania (TZA), Thailand (THA), Togo (TGO), Trinidad and Tobago (TTO), Tunisia (TUN), Turkey (TUR), Turkmenistan (TKM), Uganda (UGA), Ukraine (UKR), Uruguay (URY), Venezuela (VEN), Vietnam (VNM), Yemen, Republic of (YEM) and Zambia (ZMB)

Data and sources

The data to compute currency exposures comes from Bénétrix, Lane and Shambaugh (2015) which is and updated and extended version of the original data in Lane and Shambaugh (2010a). The data sources for the variables in Tables 4 and 5 are the following:

Real GDP growth is from the International Monetary Fund's (IMF) World Economic Outlook Database 2014. Stock-flow adjustment, net foreign assets and current account balance data are from the latest version of the External Wealth of Nations dataset (Lane and Milesi-Ferretti 2007). The source for stock market returns is MSCi Barra and national sources, while long term interest rates are taken from IMF's International Financial Statistics (IFS) data base and from national sources. Exchange rate regime data (peg and no peg) are from Klein and Shambaugh (2008). Trade openness, population, and per capita income are taken from World Bank's (WB) World Development Indicators. Nominal effective exchange rate (NEER) is sourced from IMF's IFS and Bank for International Settlements. The source for consumer price index (CPI) and nominal exchange rate is IMF's IFS; World Governance Indicators from World Bank; and Capital Account Openness from Chinn-Ito's website

References

Bénétrix, Agustín, Philip R. Lane and Jay C. Shambaugh (2015), "International Currency Exposures, Valuation Effects and the Global Financial Crisis," *Journal of International Economics* 96, 98-109.

Eichengreen, Barry and Donald J. Mathieson (2000), "The Currency Composition of Foreign Exchange Reserves: Retrospect and Prospect," International Monetary Fund Working Paper 00/131.

Eichengreen, Barry, Ricardo Hausmann and Ugo Panizza (2003), *Currency Mismatches, Debt Intolerence and Original Sin: Why They Are Not the Same and Why it Matters.* National Bureau of Economic Research Working Paper 10036.

Lane, Philip R. (2013), "Capital Flows in the Euro Area," *European Economy Economic Paper No. 497.*

Lane, Philip R. and Gian Maria Milesi-Ferretti (2007a), "The External Wealth of Nations Mark II," *Journal of International Economics* 73, 223-250.

Lane, Philip R. and Jay C. Shambaugh (2010a), "Financial Exchange Rates and International Currency Exposures," *American Economic Review* 100(1), 518-540.

Lane, Philip R. and Jay C. Shambaugh (2010b), "The Long or Short of It: Determinants of Foreign Currency Exposure in External Balance Sheets," *Journal of International Economics* 80(1), 33-44.

Klein, Michael W. and Jay C. Shambaugh (2008), "The Dynamics of Exchange Rate Regimes: Fixes, Floats, and Flips," *Journal of International Economics* 75(1), 70-92.

Table 1: Decomposition of Swiss Foreign exposure

	2002	2007	2012
(1) $FXAGG$	0.29	0.28	0.37
(2) $(A-L)/(A+L)$	0.14	0.11	0.14
(3) $FXAGG^0$	0.14	0.17	0.23
$(A-L)/(A+L)$=(4)+(5)			
(4) $(A_{NR}-L)/(A+L)$	0.13	0.10	0.07
(5) $FXR/(A+L)$	0.02	0.01	0.07
$FXAGG^0$=(6)+(7)-(8)			
(6) $(PEQL+FDIL)/(A+L)$	0.17	0.20	0.23
(7) $DEBTL^{DC}/(A+L)$	0.04	0.02	0.07
(8) $A_{NR}^{DC}/(A+L)$	0.07	0.06	0.07
(9) $NETFX$	2.63	3.38	3.74
(10) $FXDEBT$	0.15	0.11	0.22

Note: $FXAGG$ is the aggregate foreign exposure defined in equation (9), $(A-L)$ is the net foreign asset position. A are total foreign assets and L are foreing liabilities. Row (2)=(4)+(5). $FXAGG^0$ is the net foreign liability position in domestic currency and (3)=(6)+(7)-(8). $(A_{NR}-L)$ is the non-reserve net foreign asset position. FXR are foreign exchange reserves, $(PEQL+FDIL)$ are portfolio equity and FDI liabilities. These are denominated in Swiss Franc. $DEBTL^{DC}$ are debt liabilities in Swiss Francs. A_{NR}^{DC} are non-reserve foreign assets denominated in Swiss Francs. $NETFX$ is defined in equation (10) and measures the quantitative exposure to a uniform shift in the value of the domestic currency against all foreign currencies. $FXDEBT$ is a measure of foreign currency exposure analogous to $FXAGG$ but for debt only.

Table 2: Exposures to Swiss Franc.

$FXAGG^{CHF}$

Group	Year	10th Percentile	Mean	Median	90th Percentile
ALL	2002	-0.28	0.08	0.08	0.65
	2007	-0.15	0.12	0.10	0.68
	2012	-0.10	0.38	0.13	0.82
ADV	2002	-0.09	0.06	0.28	0.83
	2007	-0.34	0.26	0.43	0.84
	2012	-0.32	0.22	0.28	0.82
EMDEV	2002	-0.28	0.09	0.07	0.51
	2007	-0.10	0.09	0.08	0.50
	2012	-0.004	0.41	0.11	0.77

$NETFX^{CHF}$

Group	Year	10th Percentile	Mean	Median	90th Percentile
ALL	2002	-0.36	0.13	0.12	1.69
	2007	-0.21	0.36	0.12	1.86
	2012	-0.04	1.40	0.17	2.32
ADV	2002	-0.16	0.28	0.92	2.76
	2007	-3.98	1.44	1.86	5.36
	2012	-1.64	1.98	1.39	6.74
EMDEV	2002	-0.36	0.10	0.07	0.70
	2007	-0.18	0.12	0.08	0.80
	2012	-0.002	1.27	0.14	1.61

Note: Statistics computed using a sample of 21 advanced economies and 95 emerging and developing countries. $FXAGG^{CHF}$ is defined by equation (2) while $NETFX^{CHF}$ is defined by equation (3).

Table 3: Exposures to Swiss Franc. Foreign debt only.

$FXDEBT^{CHF}$

Group	Year	10th Percentile	Mean	Median	90th Percentile
ALL	2002	-1.16	0.11	0.24	1.19
	2007	-0.73	0.01	0.12	0.81
	2012	-0.84	0.15	0.13	1.23
ADV	2002	-1.63	-1.14	-0.62	-0.10
	2007	-1.17	-0.74	-0.39	0.06
	2012	-1.38	-0.64	-0.44	0.11
EMDEV	2002	-0.38	0.44	0.35	1.49
	2007	-0.07	0.21	0.17	0.87
	2012	-0.01	0.36	0.21	1.26

$NETFXDEBT^{CHF}$

Group	Year	10th Percentile	Mean	Median	90th Percentile
ALL	2002	-1.96	-0.27	0.15	1.08
	2007	-2.51	-0.49	0.06	0.69
	2012	-1.56	-0.01	0.09	1.17
ADV	2002	-3.73	-2.76	-1.52	-0.14
	2007	-4.89	-2.48	-1.26	0.19
	2012	-7.14	-1.31	-0.80	0.72
EMDEV	2002	-0.30	0.39	0.30	1.21
	2007	-0.05	0.04	0.09	0.78
	2012	-0.004	0.34	0.12	1.38

Note: Note: Statistics computed using a sample of 21 advanced economies and 95 emerging and developing countries. $FXDEBT^{CHF}$ is analogous to equation (2) while $NETFXDEBT^{CHF}$ is analogous to equation (3) with the difference that these are based on foreign debt only.

Table 4: Determinants of exposures to the Swiss Franc

$FXAGG^{CHF}$	ALL (1)	ALL (2)	ADV (3)	ADV (4)	EMDEV (5)	EMDEV (6)
$FXAGG^{OTH}$	0.003	0.003	0.004	0.018**	0.001	0.002
	(0.002)	(0.002)	(0.008)	(0.008)	(0.002)	(0.002)
Trade	-0.013	-0.017	-0.643***	-0.695***	0.056	0.036
	(0.038)	(0.035)	(0.188)	(0.202)	(0.034)	(0.030)
Vol(GDP)	0.009	0.013	0.513**	0.499***	-0.004	0.008
	(0.012)	(0.014)	(0.207)	(0.187)	(0.012)	(0.014)
Vol(π)	0.001	0.002	-0.496	-0.494	0.002	0.004
	(0.004)	(0.004)	(0.465)	(0.354)	(0.003)	(0.004)
Vol(E)	0.015*	0.009	-0.357**	-0.475***	0.010	0.007
	(0.008)	(0.009)	(0.154)	(0.162)	(0.008)	(0.008)
Cov(GDP,E)	-0.000	-0.000	0.037**	0.046***	-0.000	-0.000
	(0.000)	(0.000)	(0.014)	(0.014)	(0.000)	(0.000)
Institutions		-0.025		0.088		0.113
		(0.061)		(0.355)		(0.091)
Capital controls		0.034		-0.762***		0.032
		(0.037)		(0.175)		(0.038)
Peg		-0.210**		-0.138		-0.217**
		(0.090)		(0.290)		(0.089)
EMU		-0.076		0.481		0.037
		(0.204)		(0.417)		(0.316)
GDP^{PC}	0.084*	0.075	0.945*	1.003**	0.136*	0.073
	(0.050)	(0.055)	(0.477)	(0.504)	(0.074)	(0.057)
Size	0.053***	0.047**	0.297***	0.344***	0.023	0.026
	(0.020)	(0.022)	(0.075)	(0.092)	(0.022)	(0.024)
Year 1996	-1.102**	-0.891*	-10.309**	-9.230*	-1.302*	-0.675
	(0.504)	(0.510)	(4.661)	(4.829)	(0.686)	(0.531)
Year 2000	0.268	0.250	0.560	0.361	0.142	0.116
	(0.168)	(0.165)	(0.368)	(0.332)	(0.182)	(0.182)
Year 2004	0.232	0.217	0.244	0.027	0.094	0.091
	(0.170)	(0.166)	(0.423)	(0.406)	(0.185)	(0.181)
Year 2007	0.224	0.209	0.406	0.142	0.059	0.071
	(0.170)	(0.170)	(0.491)	(0.465)	(0.189)	(0.187)
Year 2012	0.473**	0.459**	-0.047	-0.335	0.375	0.401
	(0.215)	(0.221)	(0.418)	(0.401)	(0.245)	(0.260)
Observations	569	569	105	105	464	464
R^2	0.043	0.053	0.449	0.523	0.047	0.060

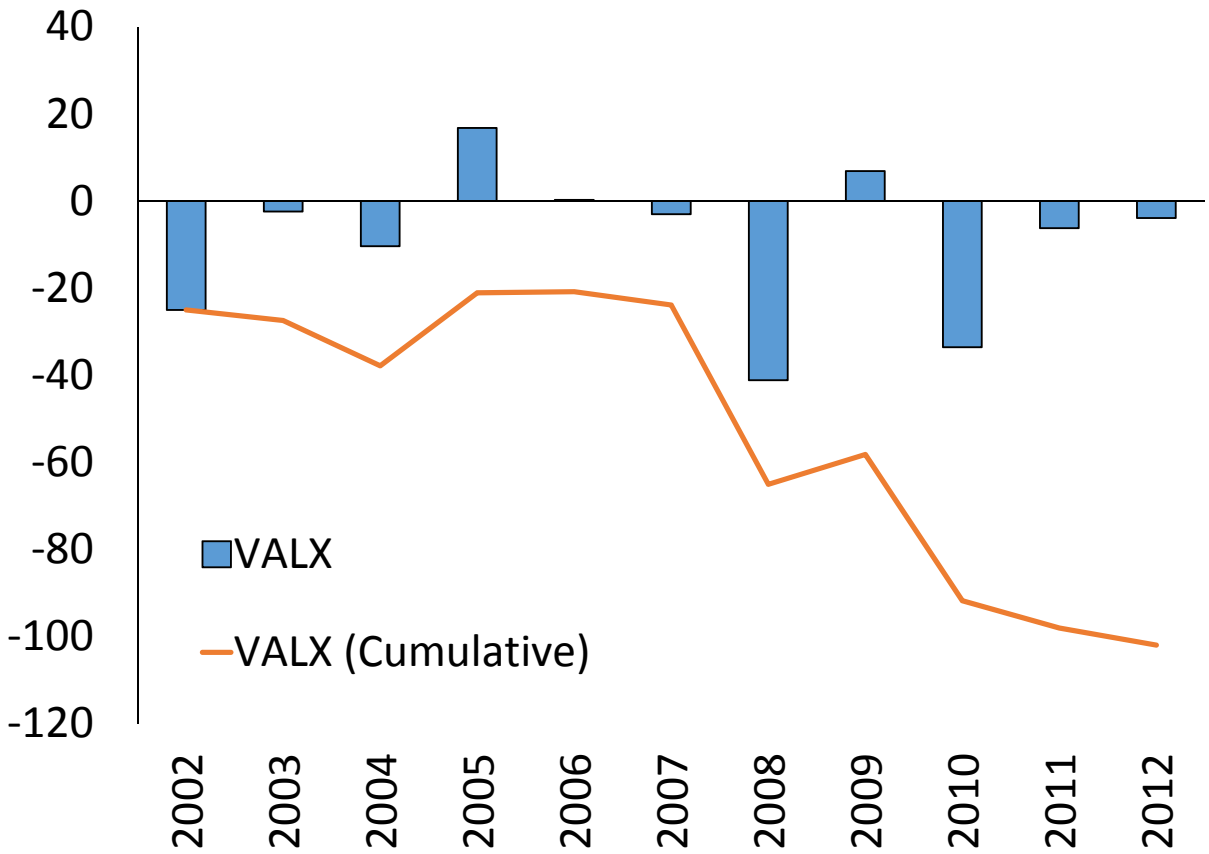
Note: Pooled regressions based on data for 1996, 2000, 2004, 2007 and 2012. Robust standard errors are in parentheses. Statistical significance is as follows *** p<0.01, ** p<0.05, * p<0.1. $FXAGG^{CHF}$ is aggregate exposure in Swiss Francs while $FXAGG^{OTH}$ is the aggregate exposure in other foreign currencies. Trade refers to the sum of bilateral imports and exports vis-à-vis Switzerland scaled by GDP. Vol(GDP) is the standard deviation of year-on-year GDP growth. Vol(π) is the standard deviation of month-on-month CPI inflation. Vol(E) is the standard deviation of month-on-month change in the bilateral nominal exchange. Cov(GDP,E) is the covariance between GDP growth and NEER change. All measures of volatilities and covariance are computed using a 15-year window. Institutions refers to World Bank Governance Indicators estimates; Capital controls are the Chinn-Ito's Capital Account Openness Index; Peg is a dummy variable that takes value 1 for countries with either peg or soft pegs as defined by Shambaugh (2004); EMU is a dummy variable for EMU member countries; GDP^{PC} is GDP per capita in log levels. Size is the logarithm of population. Finally, Year 1996, 2000, 2004, 2007 and 2012 are year dummy variables.

Table 5: Determinants of exposures to the Swiss Franc (debt only)

$FXDEBT^{CHF}$	ALL		ADV		EMDEV	
	(1)	(2)	(3)	(4)	(5)	(6)
$FXDEBT^{OTH}$	0.000	-0.001	0.001	0.023*	-0.002	-0.004
	(0.005)	(0.005)	(0.014)	(0.013)	(0.005)	(0.006)
Trade	-0.155	-0.078	-1.046***	-1.225***	0.030	0.067
	(0.114)	(0.093)	(0.335)	(0.363)	(0.041)	(0.060)
Vol(GDP)	0.048**	-0.003	1.038***	0.972***	0.008	-0.012
	(0.024)	(0.027)	(0.384)	(0.349)	(0.023)	(0.026)
Vol(π)	0.118***	0.140***	0.027	-0.493	0.123***	0.135***
	(0.038)	(0.044)	(0.792)	(0.580)	(0.040)	(0.043)
Vol(E)	-0.021	-0.044	-0.078	-0.430	-0.046	-0.053*
	(0.028)	(0.033)	(0.270)	(0.259)	(0.029)	(0.032)
Cov(GDP,E)	-0.001	-0.001	0.015	0.023	-0.001	-0.001
	(0.001)	(0.001)	(0.026)	(0.022)	(0.001)	(0.001)
Institutions		-0.618***		-0.510		-0.382*
		(0.183)		(0.579)		(0.209)
Capital controls		-0.038		-1.368***		-0.002
		(0.053)		(0.251)		(0.053)
Peg		-0.072		-0.539		0.064
		(0.156)		(0.455)		(0.150)
EMU		-0.468		0.477		0.564**
		(0.326)		(0.619)		(0.239)
GDP^{PC}	-0.187**	0.205	-1.323*	-0.304	0.037	0.186
	(0.076)	(0.147)	(0.710)	(0.873)	(0.099)	(0.150)
Size	-0.031	-0.067	0.312*	0.289*	-0.038	-0.054
	(0.040)	(0.043)	(0.166)	(0.167)	(0.045)	(0.052)
Year 1996	1.392*	-1.512	9.542	4.922	0.127	-1.116
	(0.810)	(1.262)	(6.932)	(8.440)	(0.975)	(1.285)
Year 2000	0.170	0.150	1.375**	1.114**	-0.101	-0.114
	(0.308)	(0.298)	(0.600)	(0.557)	(0.322)	(0.320)
Year 2004	0.318	0.198	1.479**	0.912	-0.017	-0.077
	(0.320)	(0.314)	(0.714)	(0.692)	(0.336)	(0.337)
Year 2007	0.303	0.073	2.440***	1.541**	-0.202	-0.301
	(0.290)	(0.296)	(0.828)	(0.770)	(0.298)	(0.310)
Year 2012	0.472	0.165	1.735**	0.846	-0.045	-0.194
	(0.293)	(0.308)	(0.733)	(0.685)	(0.301)	(0.322)
Observations	503	503	105	105	398	398
R^2	0.087	0.132	0.450	0.554	0.048	0.061

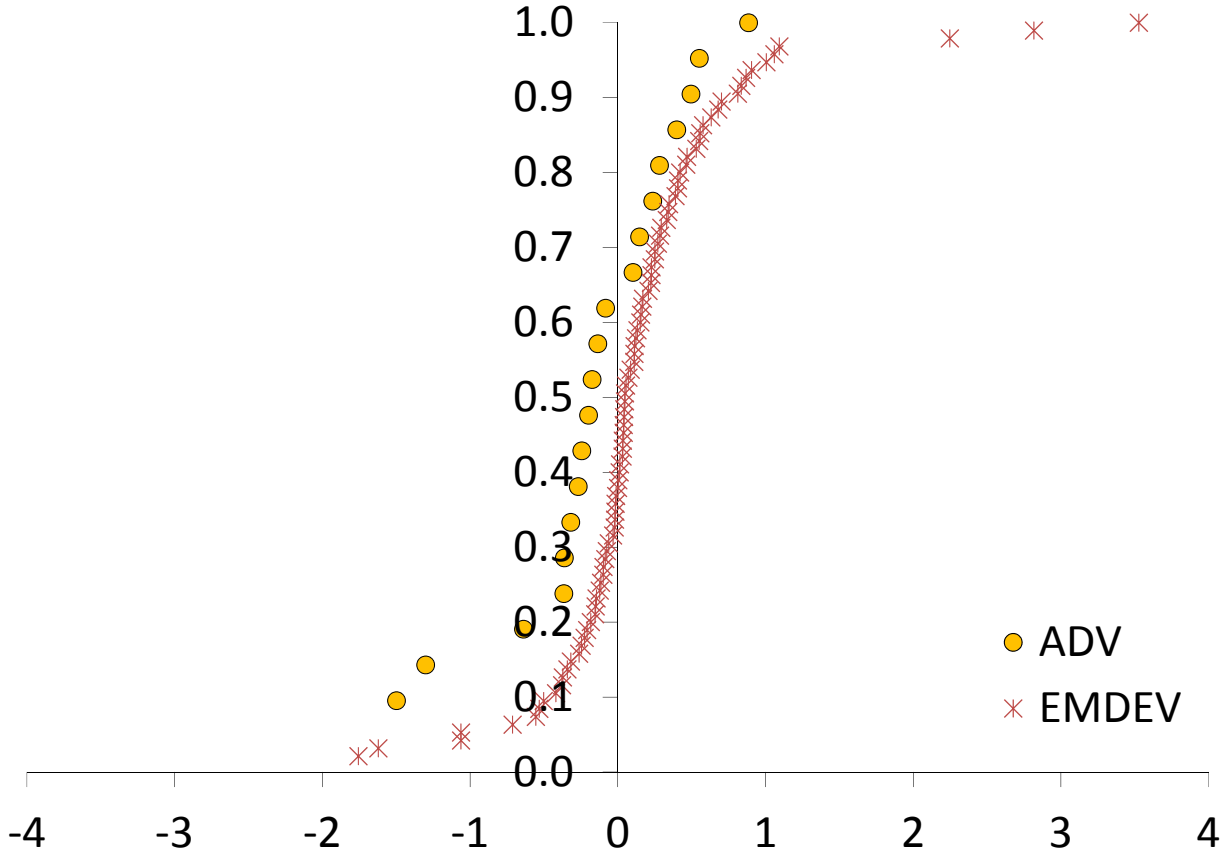
Note: Pooled regressions based on data for 1996, 2000, 2004, 2007 and 2012. Robust standard errors are in parentheses. Statistical significance is as follows *** p<0.01, ** p<0.05, * p<0.1. $FXDEBT^{CHF}$ is debt-only exposure in Swiss Francs while $FXDEBT^{OTH}$ is the debt-only exposure in other foreign currencies. Trade refers to the sum of bilateral imports and exports vis-à-vis Switzerland scaled by GDP. Vol(GDP) is the standard deviation of year-on-year GDP growth. Vol(π) is the standard deviation of month-on-month CPI inflation. Vol(E) is the standard deviation of month-on-month change in the bilateral nominal exchange. Cov(GDP,E) is the covariance between GDP growth and NEER change. All measures of volatilities and covariance are computed using a 15-year window. Institutions refers to World Bank Governance Indicators estimates; Capital controls are the Chinn-Ito's Capital Account Openness Index; Peg is a dummy variable that takes value 1 for countries with either peg or soft pegs as defined by Shambaugh (2004); EMU is a dummy variable for EMU member countries; GDP^{PC} is GDP per capita in log levels. Size is the logarithm of population. Finally, Year 1996, 2000, 2004, 2007 and 2012 are year dummy variables.

Figure 1: Swiss $VALX$



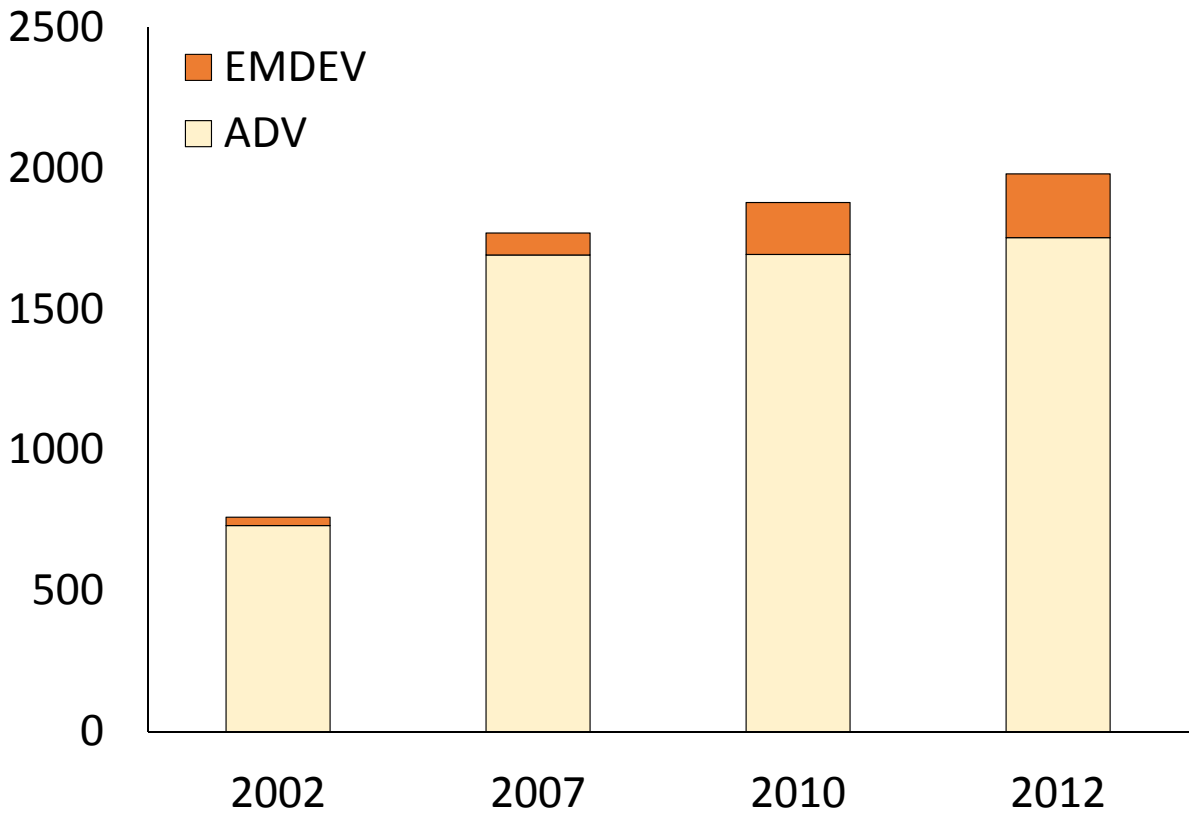
Note: $VALX$ is the exchange rate-induced valuation effect as defined in equation (8).

Figure 2: Exposures to Swiss Franc (Average 2002-2012)



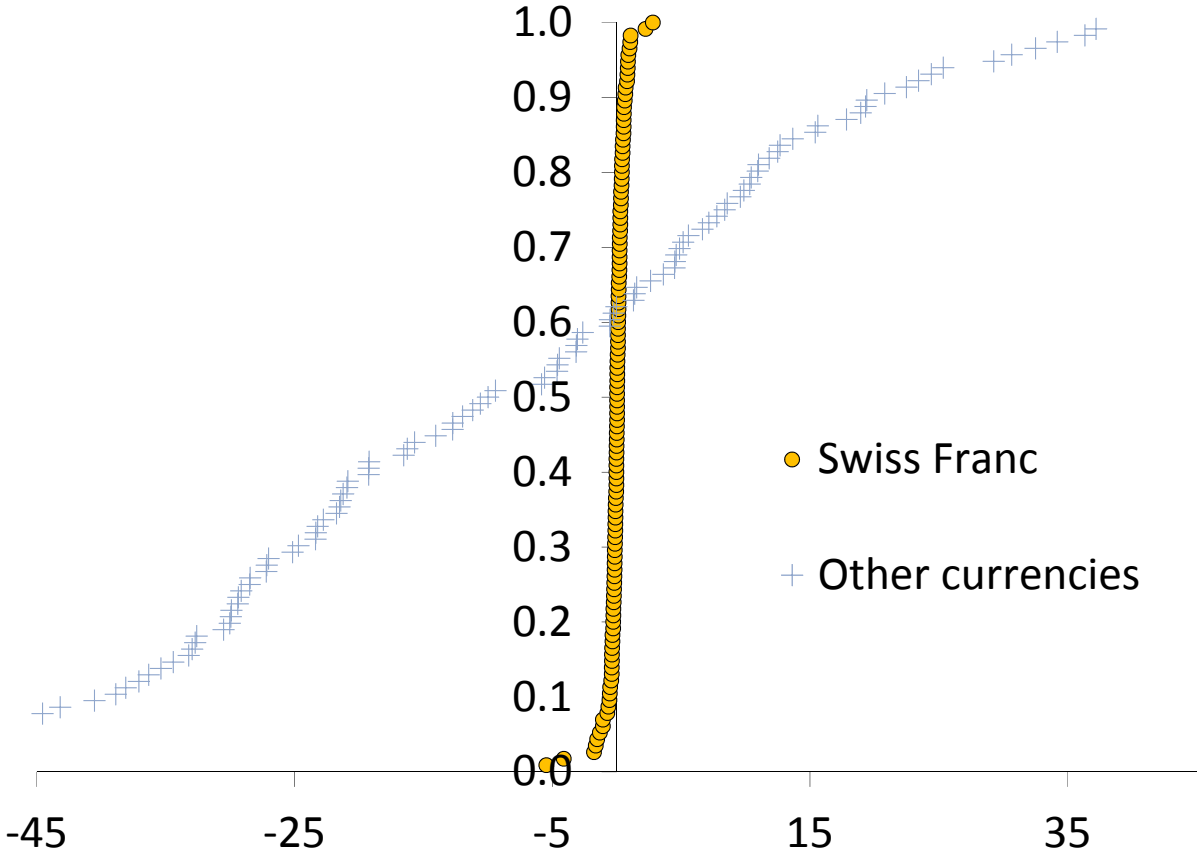
Note: Currency exposures are the average of $FXAGG^{CHF}$ for the 2002-2012 period.

Figure 3: Foreign Assets Denominated in Swiss Franc



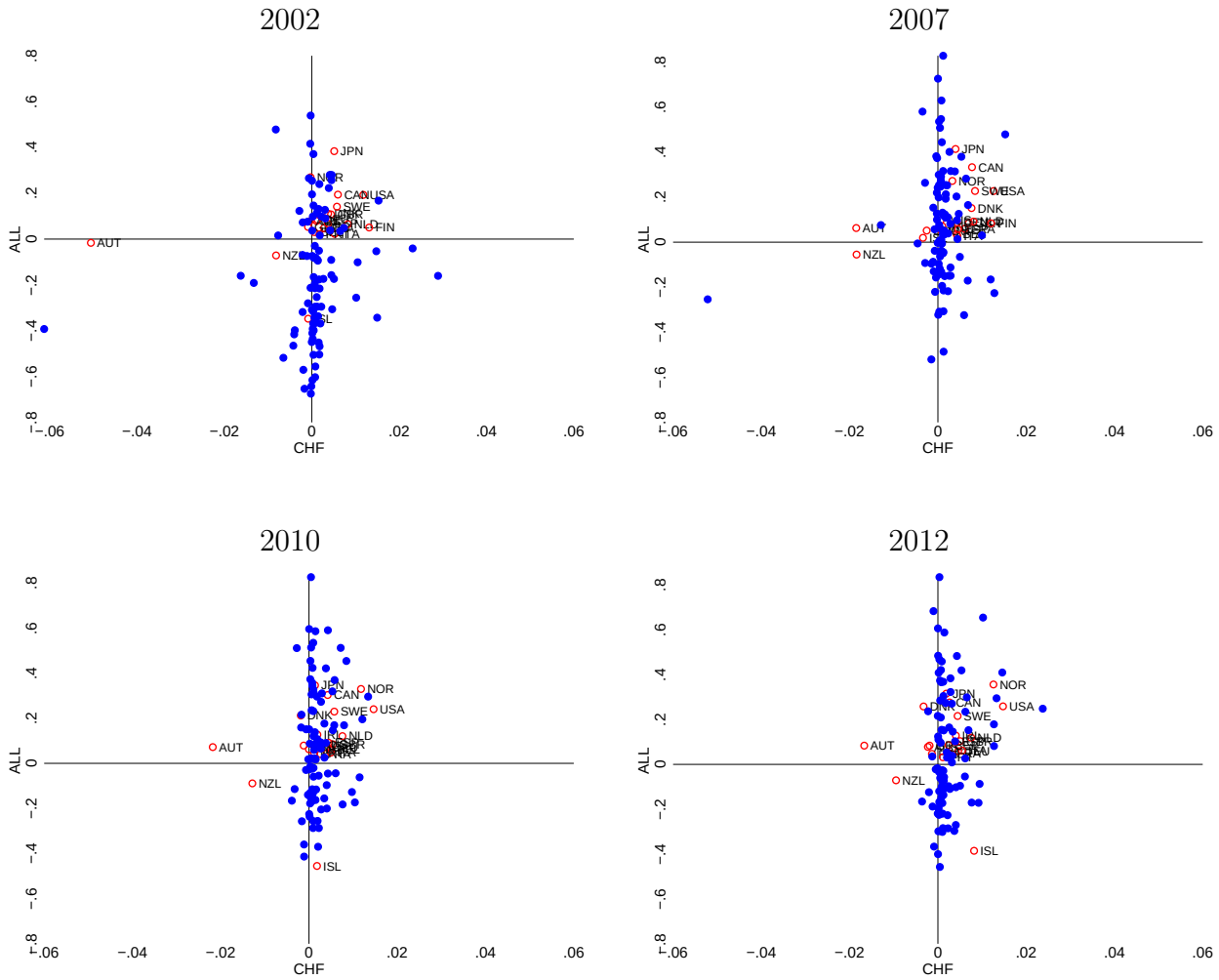
Note: Billion of US dollars. Estimates based on 116 countries.

Figure 4: Exposures to Swiss Franc and other currencies (Average 2002-2012)



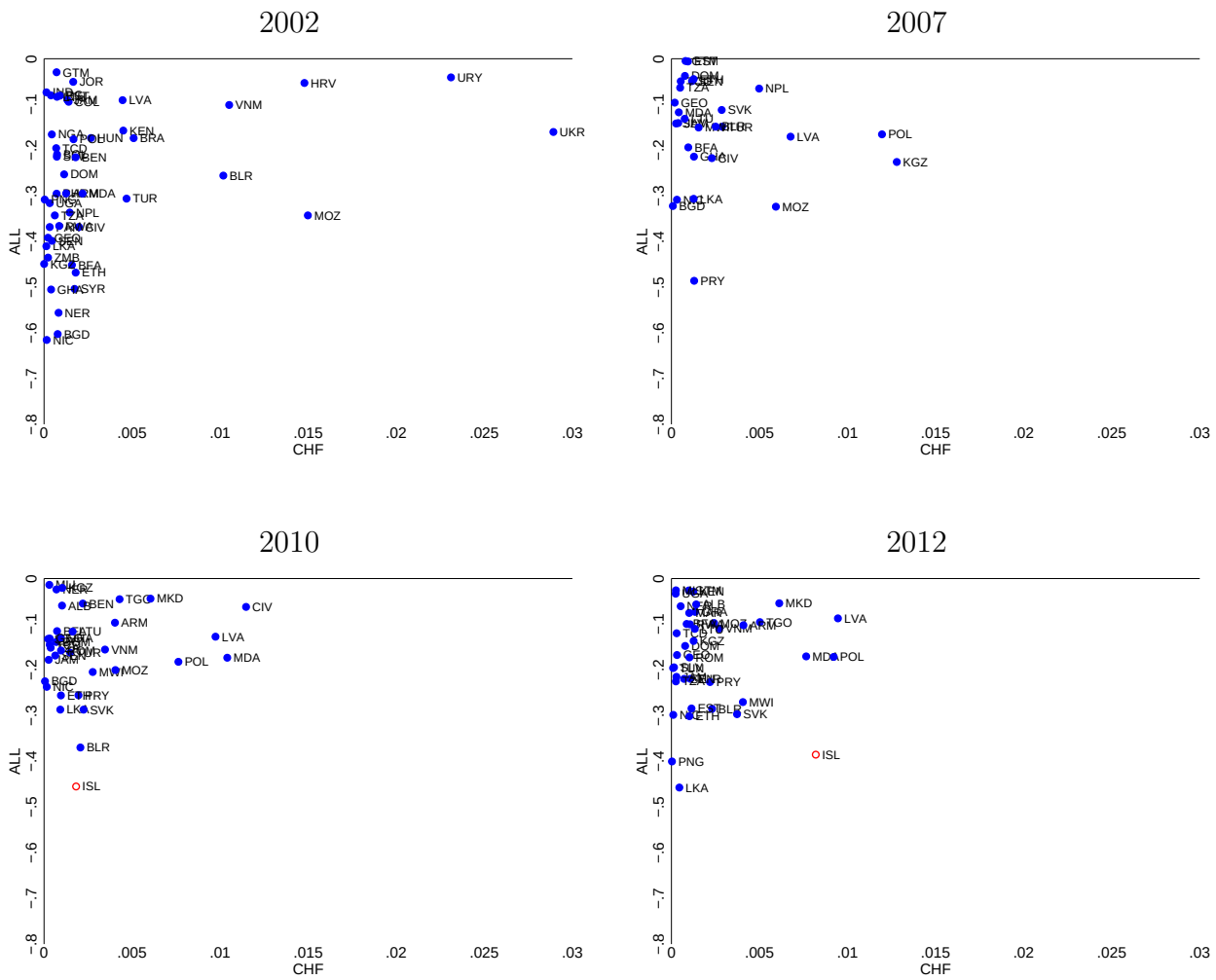
Note: Currency exposures are the average of $FXAGG$ for the 2002-2012 period. These distributions are based on 116 countries.

Figure 5: Swiss Franc Exposure vs. Overall Exposure



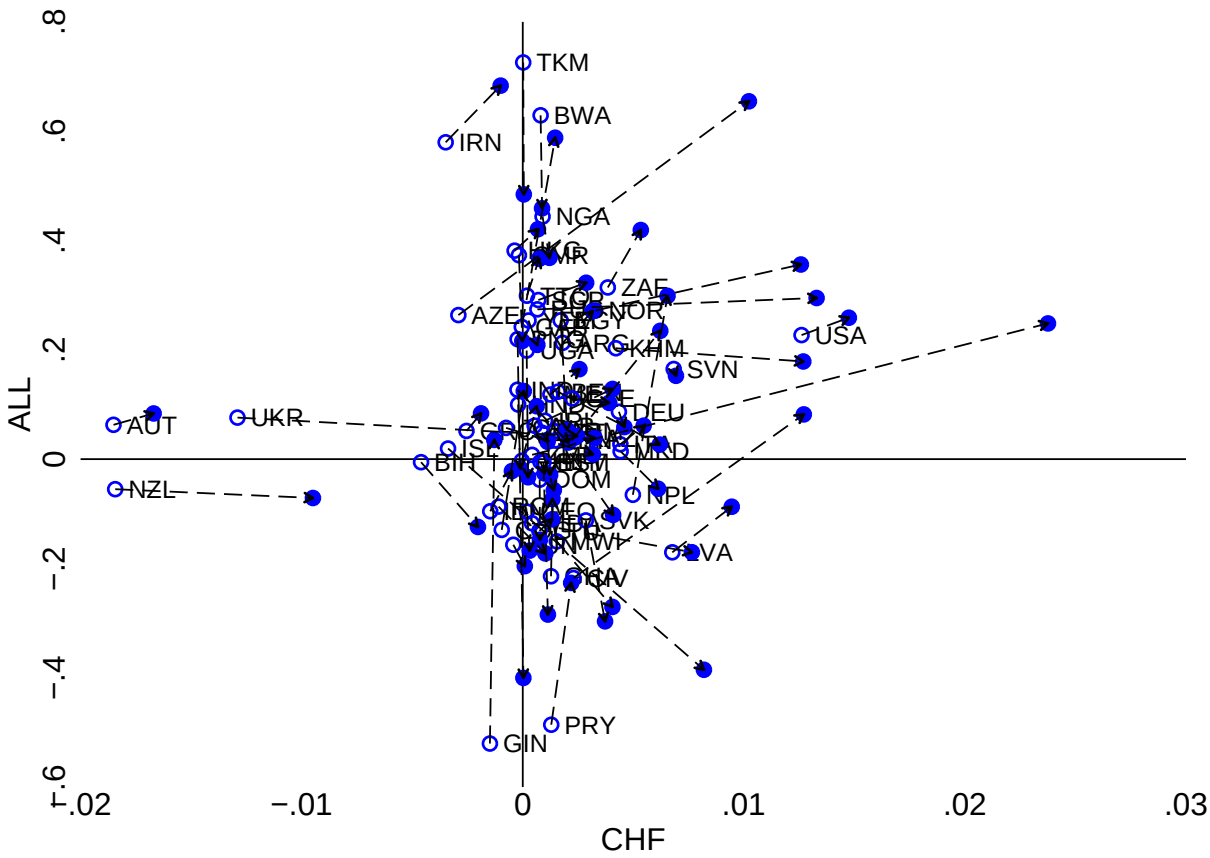
Note: CHF are cross-country exposures to Swiss Francs ($FXAGG^{CHF}$) while ALL are aggregate exposures to other foreign currencies ($FXAGG^{OTH}$). The correlation coefficient of these variables is positive for in 2002 and 2007 with values of 0.13 and 0.14, respectively. These correlations are negative in 2010 and 2012 with values of -0.01 and -0.002, respectively. Hollowed red circles are advanced countries while filled circles are emerging and developing countries.

captionSwiss Franc Exposure vs. Overall Exposure



Note: Countries long Swiss Franc but short in the rest of foreign currencies. CHF are cross-country exposures to Swiss Francs ($FXAGG^{CHF}$) while ALL are aggregate exposures to other foreign currencies ($FXAGG^{OTH}$). Hollowed red circles are advanced countries while filled circles are emerging and developing countries.

Figure 6: Dynamics of Currency Exposures (2007,2012)



Note: Countries with more positive (or less negative) Swiss Franc position after the crisis. CHF are cross-country exposures to Swiss Francs ($FXAGG^{CHF}$) while ALL are aggregate exposures to other foreign currencies ($FXAGG^{OTH}$). Hollowed circles are exposures in 2007 while filled circles represent exposures in 2012. Dashed vectors indicate the direction of the change in these exposures.