

# Do Swiss foreign assets hedge the business cycle?

Nicolas Stoffels and Cédric Tille<sup>1</sup>

Swiss National Bank; Graduate Institute for International and Development Studies and CEPR

While Switzerland's net creditor position is sizable, it has long remained steady despite large and persistent current account surpluses. This pattern reflects valuation losses on Swiss foreign assets driven by movements in exchange rates and assets prices. We compute estimates of these valuation effects and the associated rates of returns on Swiss external assets and liabilities. While Switzerland benefits from a modest advantage in terms of yields (interest and dividends in percent of holdings), we show that this has been dwarfed by valuation losses driven by the strengthening of the Swiss franc, even before the crisis. We then assess the extent to which the return on assets and liabilities (including capital gains) provides a hedge against movements in Swiss GDP and the purchasing power of income. While we find little evidence of such a hedge at a quarterly frequency, financial returns provide some offset for business cycle movements at the horizon of a year. This hedging property has strengthened since 2010 and is more pronounced for privately held assets and liabilities than for the fast-growing holdings of reserves by the Swiss National Bank.

*JEL codes:* G15, F21, F31, F36, F44, F65

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## 1 Introduction

Switzerland is a financial center that has long been deeply integrated in world financial markets. This has steadily increased since the early 2000s, as shown by the value of the country's external assets and liabilities. The value of Swiss residents' financial claims on the rest of the world has risen from 473% of annual GDP to 694% at the end of 2017 (Figure 1, solid line). Liabilities to foreign investors have increased in parallel, currently reaching 568% of GDP (dashed line). While financial integration stepped back during the global financial crisis, it has since resumed its upward trend.

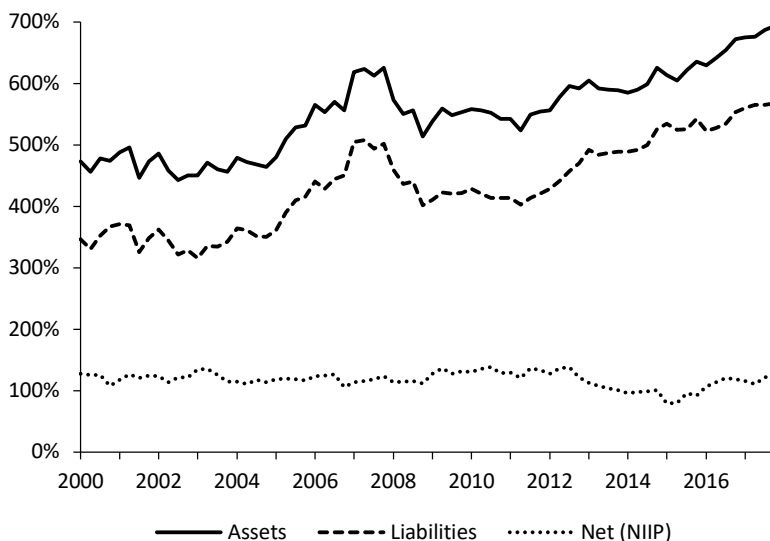
What does Switzerland gain from its sizable net claims on the rest of the world (i.e., its net international investment position, or NIIP; dotted line in Figure 1), currently standing at 126% of GDP? While this question may seem puzzling in light of the country's comfortable wealth, it is important to bear in mind that the net position has remained remarkably stable despite persistently large

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<sup>1</sup> Nicolas.Stoffels@snb.ch and Cedric.Tille@graduateinstitute.ch. We thank Pinar Yesin, Signe Krogstrup and Joe Gagnon for comments. We are grateful to Christoph Kappeler, Hildegard Muff, Simon Bösenberg, and Alexander Flühmann of the statistical department of the Swiss National Bank for their extensive and support with the data and availability to answer our questions, and to Francesca Pitsch for research assistance. Any remaining errors are ours alone. The views expressed in this paper are those of the authors and do not represent the views of the Swiss National Bank.

current account surpluses of one tenth of GDP each year (see TILLE, 2017 for a discussion).

**Figure 1:** International investment position (% GDP)



In this paper we assess the returns on financial assets and liabilities in three steps. We first compute estimates on the capital gains and losses on Swiss assets and liabilities, building on ongoing improvement in the statistics compiled by the Swiss National Bank (SNB, 2018). Second, we compute the average rates of returns on assets and liabilities, including gains from asset prices and exchange rates, following the approaches of CURCURI, DVORAK and WARNOCK (2013), GOURINCHAS and REY (2013, 2005) and LANE and MILESI-FERRETTI (2018). Finally, we assess the extent to which the Swiss net external position acts as a hedge against movements in GDP.

Our paper makes six points. First, our estimates of the valuation effects stemming from asset prices and exchange rates show that the losses from the strong Swiss franc have substantially offset the additional savings from current account surpluses. While this pattern has been particularly pronounced since the crisis, it was already observable beforehand. Second, we show that the moderately positive spread between the yield on Swiss assets (interest and dividends) and the yield on liabilities turns into a sizable negative gap once we include the impact of

asset prices and exchange rates. Third, we show that the returns on Swiss assets and liabilities offer a very limited hedge against business cycle movements at a quarterly frequency. Fourth, we find evidence of better hedging when considering co-movements between financial returns and the business cycle over four-quarter horizons. Fifth, this hedging has improved in recent years. Finally, the hedging benefits are concentrated among privately held assets, while the returns on reserves held by the central bank offer very little hedging.

While our results offer a contrasted view of the hedging benefits of the Swiss external assets and liabilities, it is important to bear in mind that we present stylized facts that should be interpreted with caution. Different investments have different motives, and some are undertaken with a long horizon in mind. These long-term investments may well offer limited hedging in the short run (even for one year) while still ultimately delivering substantial benefits. In addition, holdings of foreign reserves by the SNB have increased in order to contain the strengthening of the Swiss franc. Our finding of limited hedging properties does not put them into question, as without reserve accumulation the franc would likely have appreciated much more, and limited hedging may be a price worth paying for avoiding severe economic stress.

The rest of the paper is structured as follows. Section 2 puts our work in the context of the literature. Section 3 presents the evolution of the Swiss international investment position over the last 17 years and points the most salient developments. We present our adjustments for valuation effects from asset prices and exchange rates in Section 4. Section 5 discusses the gaps between the rates of returns on assets and liabilities and assesses the extent to which returns on foreign asset provide a hedge for business cycle movements. Section 6 concludes.

## 2 Relation to the literature

Our analysis fits into an active literature that analyses the drivers of countries' external financial assets, with an emphasis on taking account of capital gains and losses in addition to the streams of interest and dividend payments that enter the current account. LANE and MILESI-FERRETTI (2007) have pioneered the analysis of stocks of assets and liabilities – beyond the usual analysis of flows in the balance of payments – by compiling a multi-country database and documenting the pattern of rising financial integration. The increase in holdings of financial assets has boosted countries' exposure to capital gains and losses driven by movements in asset prices, including exchange rates. These so-called *valuation effects* make a sizable component of the overall return on financial positions in addition to the payments of interest and dividends that enter the current account

(TILLE, 2003), a feature that is of growing importance (GOURINCHAS and REY, 2013; LANE and MILESI-FERRETTI, 2018).

A salient characteristic of globalization is the rising extent of leveraged positions with increases in both assets and liabilities. As the composition of assets differs from that of liabilities, both in terms of currencies and type of assets, the valuation effects are asymmetric and can lead to sizeable differences in rates of returns. BÉNÉTRIX, LANE and SHAMBAUGH (2015) and LANE and SHAMBAUGH (2010) focus on the currency composition of countries' balance sheet and document large effects of exchange rate movements. GOURINCHAS and REY (2005) focus on the case of the United States and argue that it earns an "exorbitant privilege" in the form of a persistent return differential between assets and liabilities. Assessing whether the rate of return on assets is significantly different from that on liabilities is quite challenging, however, given the high volatility of returns, and subsequent research has questioned the presence of a US privilege (at least of a large one), with CURCURI, DVORAK and WARNOCK (2013) offering an overview.

Several contributions have focused on the Swiss case. BÉNÉTRIX and LANE (2016) assess the currency exposure of the country and show that Switzerland's long position in foreign currencies has substantially increased. They also consider the exposure of foreign countries to Swiss franc denominated assets, showing that it is concentrated among advanced economies. KUGLER and WEDER (2005, 2004) document the low level of interest rates on Swiss franc investments in international comparison and link it to the ability of these investments to provide a hedge during rare events. NITSCHKA (2014) assesses the safe haven feature of Swiss assets. Several studies have documented the behavior of capital flows to and from Switzerland, with an emphasis on their behavior during the recent crisis (AUER and TILLE, 2016; TILLE, 2017; YESIN, 2015). The analysis is made more complex by the specific nature of Switzerland as an international financial center. In particular, the presence of holding companies has a substantial impact on the capital flows data, as shown by FISCHER, GROEGER, SAURÉ, and YESIN (2018).

### **3 The evolution of the Swiss NIIP: Salient facts**

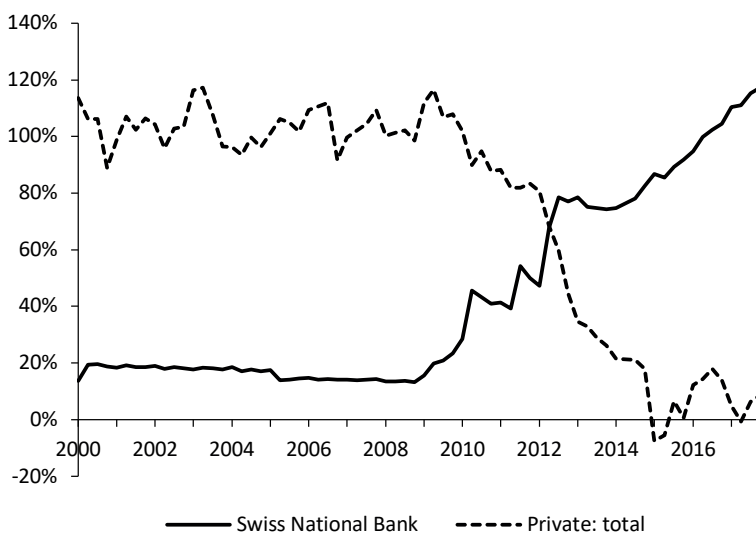
The value of Swiss external assets and liabilities is compiled by the SNB, along with the balance-of-payments statistics. The SNB data provide quarterly figures since 2000, with the editions of the annual report providing further analysis on specific topics. The figures are split into the usual categories: foreign direct investment (FDI), portfolio equity investment (split further between directly-held shares and holdings of collective investment schemes), portfolio debt investment (split between short- and long-term securities), other holdings consisting

predominantly of banks, and the foreign reserves assets of the SNB. The data also provide a breakdown by denomination: Swiss franc, euro, US dollar, other currencies, and precious metals.<sup>2</sup>

Switzerland has long been a sizable net creditor to the rest of the world, with its NIIP standing at 126% of GDP at the end of 2017. As pointed out above, the steady level of the net position hides the fact that assets (Swiss residents' claims on foreign assets) and liabilities (foreign investors' claims on Swiss residents) have substantially increased.

The last decade has seen a profound development in the form of the SNB taking a prominent position. Figure 2 splits the NIIP between the reserves of the SNB (solid line) and the NIIP of private investors (dashed line). Until the global financial crisis, the role of the SNB was negligible and the international financial integration of Switzerland was undertaken by the private sector. The pattern has since fully reversed – private investors have retrenched, and the net private position is now essentially balanced. The SNB has conducted large exchange rate interventions since 2010 to counter the strengthening of the Swiss franc and now accounts for the entire NIIP.

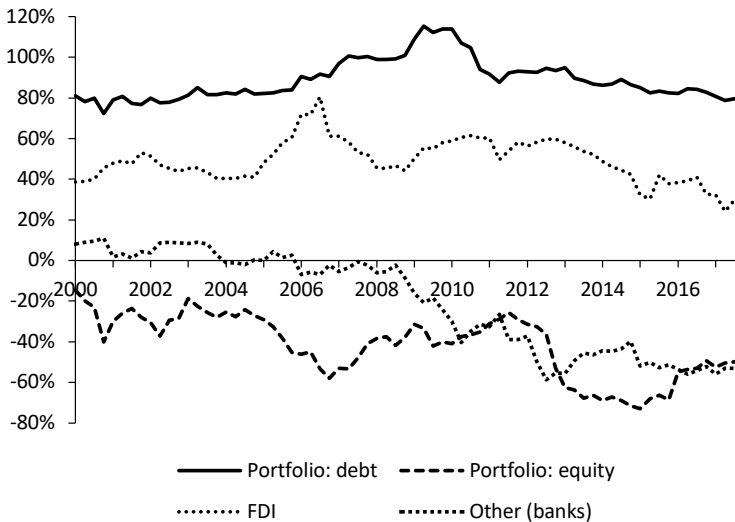
**Figure 2:** SNB and private NIIP (% GDP)



<sup>2</sup> The SNB statistical department provided us with a finer breakdown with positions denominated in yen and pound.

The private pullback since 2009 has been broad-based. Figure 3 shows the net position across the various components of private assets and liabilities – while the net position of banks was balanced before the crisis (square dotted line), it has since become negative. The pattern of bank retrenchment since 2008 (EMTER, SCHMITZ, and TIRPÁK, 2018; MILESI-FERRETTI and TILLE, 2011) has been especially pronounced for European banks. As Swiss banks have retrenched even more than institutes from other countries, the net position for banking has become negative. The decrease is not limited to banks, however, and is instead broadly observed. The net creditor positions of Switzerland in FDI (dotted line) and portfolio debt instruments (solid line) have narrowed, while its net debtor position in portfolio equity (dashed line) has increased.

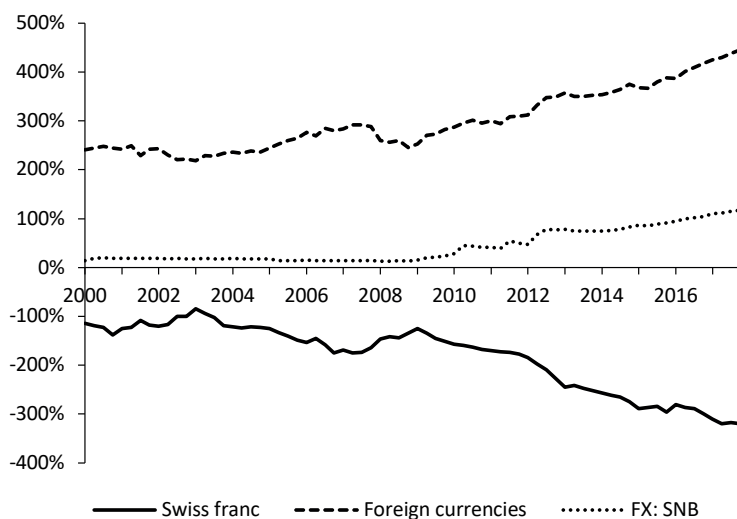
**Figure 3:** Private NIIP by components (% GDP)



The stability of the overall NIIP also hides a growing leverage in terms of currencies (Figure 4). Like most advanced economies (LANE and SHAMBAUGH, 2010) Switzerland is a net issuer of claims in its currency and a net creditor in other countries' currencies. The magnitude of this pattern has grown steadily, with the position in foreign currencies growing from 244% of GDP in 2000 to 439% today. This increase is evenly split between private positions (+99 percentage

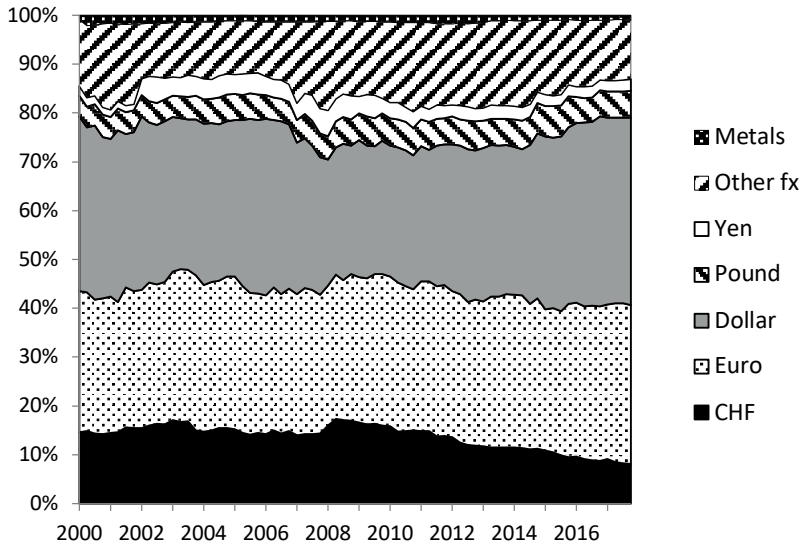
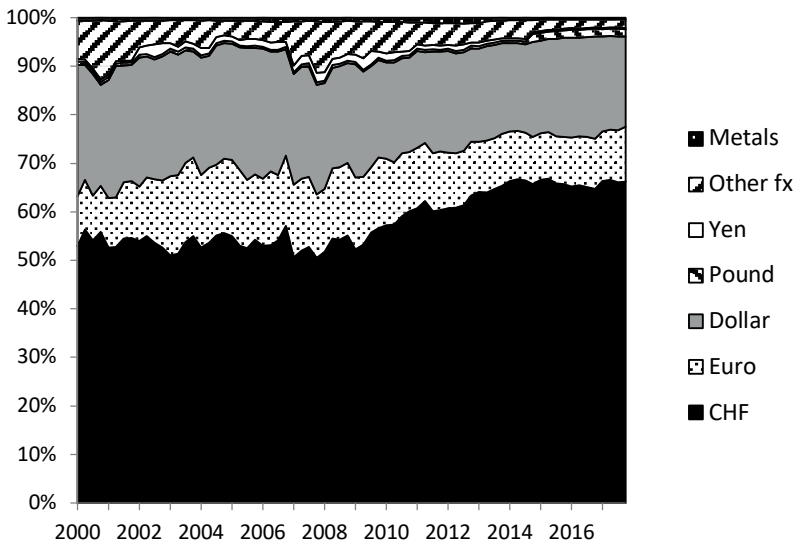
points) and the accumulation of foreign exchange reserves by the SNB (+94 percentage points), and the pace has picked up since the beginning of the crisis.<sup>3</sup>

**Figure 4:** NIIP by currency (% GDP)



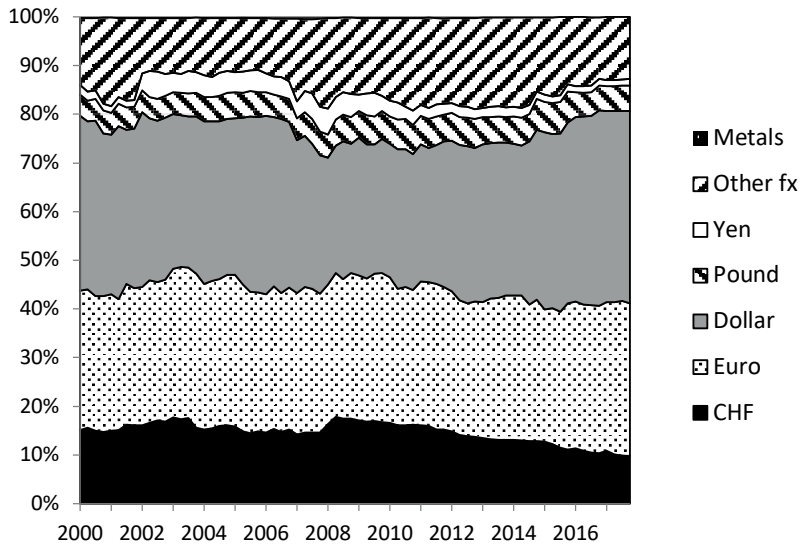
The rising currency leverage – despite a steady overall NIIP – reflects the changing currency composition of assets and liabilities. Figure 5 shows that the share of the US dollar has increased in Swiss residents' claims abroad, at the expense of the Swiss franc. By contrast, the Swiss currency represents a larger share of liabilities than it used to (Figure 6). A closer look in the composition of assets shows contrasting patterns of private and SNB holdings. While the share of the dollar has increased in private investors' portfolios (Figure 7), it has only moderately done so in reserves where the euro has gained a much larger share, primarily at the expense of gold (Figure 8).

<sup>3</sup> The growing role of the SNB reserves reflects its interventions aimed at preventing a disorderly appreciation of the Swiss franc. This has led the SNB to take on the foreign currency exposure that Swiss and foreign private investors were not willing to hold.

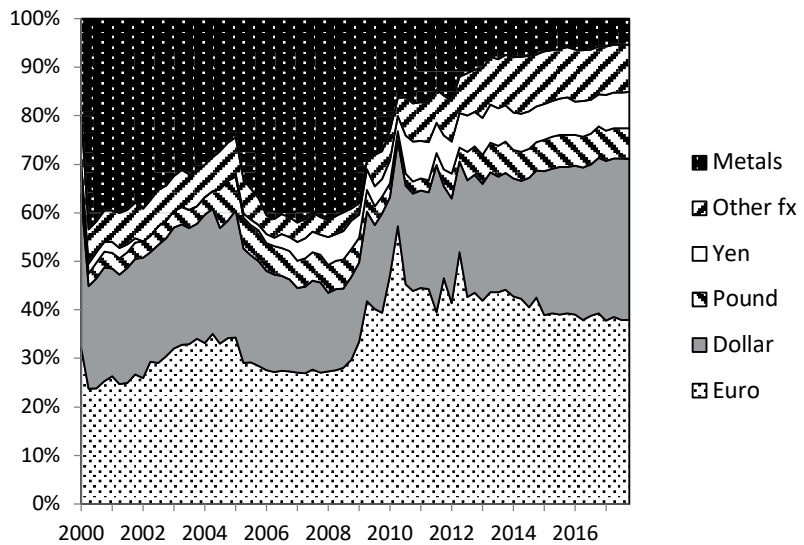
**Figure 5:** Currency composition of assets**Figure 6:** Currency composition of liabilities



**Figure 7:** Currency composition of private assets



**Figure 8:** Currency composition of SNB reserves



## 4 Valuation effects from exchange rates and asset prices

The rising leverage of the Swiss international investment position, both in terms of total assets and liabilities and in terms of currencies, has increased its exposure to valuation effects from exchange rates and asset price movements. In this section, we take a closer look at these by computing estimates of the various valuation effects.

### 4.1 Estimating valuation effects

The SNB does not provide a regular decomposition of the changes in the NIIP between financial transactions recorded in the financial account of the balance of payments, valuation effects from exchange rates, valuation effects from asset prices, and “other” valuation effects stemming, for instance, from statistical revisions. However, the last issue of its *International Investment Position* report (SNB, 2018) includes a special topic with estimates of such a decomposition focused on portfolio investment.

While splitting the overall valuation effect from financial transactions is straightforward, distinguishing the various types of valuation changes is more challenging. We compute our own estimates of these effects by combining information on the currency composition of assets and liabilities, exchange rates measured at quarter end, and asset prices measured at quarter end (details are given in the appendix).

The SNB statistics provide the currency composition of the various components of the international investment position at a quarterly frequency.<sup>4</sup> We compute the exchange rate valuation using the exchange rates for the various currencies identified in the SNB data, as well as our own estimates of the exchange rate index for the “other” currencies (using the weights used in the SNB’s trade weighted exchange rate index). The valuation effects stemming from exchange rate movements in a quarter  $t$  are computed as follows:

$$Val\_FX_{i,t} = \left( Pos_{i,t-1} + \frac{Flows_{i,t}}{2} \right) FX\_Change_{i,t}, \quad (1)$$

where  $i$  is a category-currency index (for instance, portfolio investment in euros),  $Pos_{i,t-1}$  is the corresponding position at the end of quarter  $t-1$ ,  $Flows_{i,t}$  the financial transactions during quarter  $t$ , and  $FX\_Change_{i,t}$  the percentage change in the

<sup>4</sup> Specifically, holdings are split between Swiss francs, euro, US dollars, yen, British pounds, and other currencies.

exchange rate between the end of quarter  $t-1$  and the end of quarter  $t$ . Equation (1) shows that the valuation effect is computed not only for the initial holdings, but also on the flows during the quarter (assuming that flows and exchange rate movements proceed evenly through the quarter).<sup>5</sup>

We follow a similar approach to estimate the valuation effect from price changes, with the percentage change in asset prices replacing the changes in the exchange rate in equation (1). Computing estimates of these valuation effects is more challenging, however, as one needs to determine which price to apply to the various components of the portfolio.

We use stock and bond prices for Switzerland, the euro area, Japan, the United Kingdom and the United States. Bond prices include sovereign and corporate bonds (since 2000Q3), and we construct a composite bond price using weights provided by the SNB statistical department. We use the gold price for positions in precious metals.<sup>6</sup>

To compute the valuation effects, the asset prices are applied to the position in the corresponding currencies. The specific use of the various prices is as follows. We first do not compute the price valuation effect for several categories. These include foreign direct investment (which is measured at book value in Swiss data),<sup>7</sup> short-term debt instruments in the portfolio category, and “other” holdings (as these predominantly consist of bank loans).<sup>8</sup> Bond prices are used on portfolio debt positions in long-term instruments, and equity prices on portfolio equity investment in the form of directly held shares. For equity investment in collective schemes, we rely on data from the SNB statistical department that give the share of schemes invested in equity (for which we use the equity price), in bonds (for which we use bond prices), and liquid assets (for which we make no adjustment).

Having computed our estimates of the valuation effects stemming from exchange rates and asset prices, we obtain the “other valuation” component as a residual.<sup>9</sup> The only exception to this approach is the reserves of the SNB. The data do not provide us with the split between bonds and equity instruments, the latter having now taken a non-negligible role, and thus we cannot compute an estimate of

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5 The SNB statistical department provided us with financial transactions by currencies for portfolio investment since 2002Q1. For other categories and other quarters we use the currency composition of holdings at the end of quarter  $t-1$  to estimate the financial transactions by currencies during quarter  $t$ .

6 Stock and bond prices are measured at the end of the quarter.

7 We do however compute an exchange rate valuation for FDI.

8 While we can split the “other” category between banks and non-banks for the value of the position, we cannot do so in the specific currencies and thus cannot compute an exchange rate valuation for the subcomponents of the “other category”.

9 Specifically: Other valuation = Change in position – financial flows – exchange rate valuation – asset price valuation.

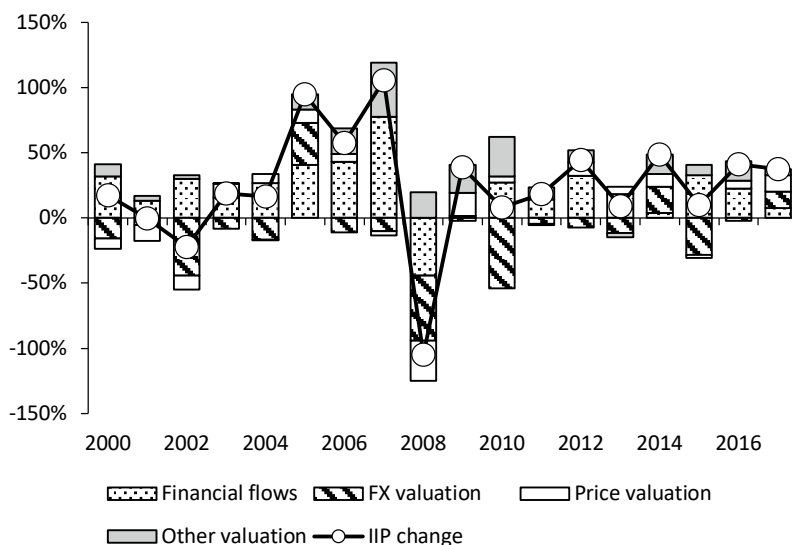
the valuation effect from asset prices. Holdings of the SNB are well measured, however, and we assume that there is no “other valuation” effect. We can then obtain the valuation effect from asset prices as a residual.

Our approach provides us with quarterly estimates of the various types of valuation effects. We can compare our results for the portfolio investment category against the annual estimates compiled by the SNB for the special topic in SNB (2018). As shown in the appendix, we get very close to their estimates.

Two particular points apply to the valuation of foreign direct investment. First, as mentioned above, the holdings are measured at book value in the currency of denomination, and not at market value. The returns on FDI then reflect only exchange rate movements and not asset price movements, and are thus a partial picture. Second, the position of Switzerland as a financial center implies that a large fraction of FDI assets and liabilities are related to entities that have only a limited economic presence in Switzerland. These include special purpose entities from multinationals (for instance, focused on financing of the corporate group) and headquarters for the reporting of profits. The special issue in SNB (2017) shows that this “pass-through capital” accounts for a sizable share of FDI, but also affects other components of the international investment position. Given the limited role of these entities in Swiss economic activities, it would be interesting to exclude them from our assessment of the movements of the NIIP. Such an exercise would be complex, however, and is left for future work.

## **4.2 What drives the Swiss net international investment position?**

We use our estimates to split the quarterly changes in the positions between financial flows and the various valuation effects. The results for Swiss assets are presented in Figure 9 (where we present annual sums for clarity). Financial transactions (dotted bars) always make a positive contribution, except in 2008 when banks pulled back. The adverse impact of the strengthening Swiss franc is visible in the negative valuation effects stemming from exchange rate movements (hatched bars). This is especially pronounced at times when safe haven flows pushed the franc higher (the global financial crisis in 2008 and the Greek crisis in 2010) and when the SNB abandoned the floor against the euro in 2015. The collapse in asset prices led to large losses in 2008, and the recent boom in financial markets led to gains (white bars). The relatively limited impact of asset prices is explained first by the fact that FDI is not measured at market value, and second by the relatively high share of bonds in Swiss assets (bond prices move by less than equity prices).

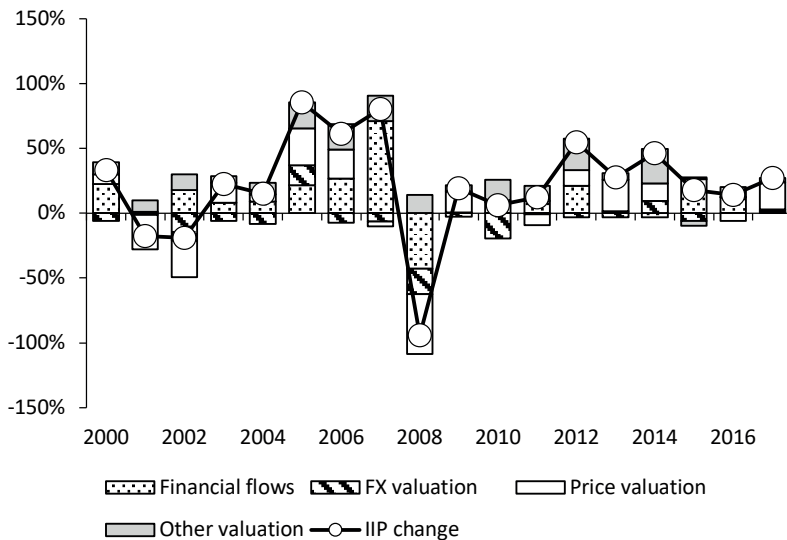
**Figure 9:** Asset changes (% GDP)

Turning to liabilities (Figure 10), we also observe a collapse in financial transactions in 2008. These have subsequently remained at a moderate level. As most Swiss liabilities are in Swiss francs, there is little exchange rate valuation effect. The impact of asset price movements is more substantial, reflecting foreign investors' holdings of Swiss equity, with large losses in the 2008 crisis followed by uneven gains thereafter.

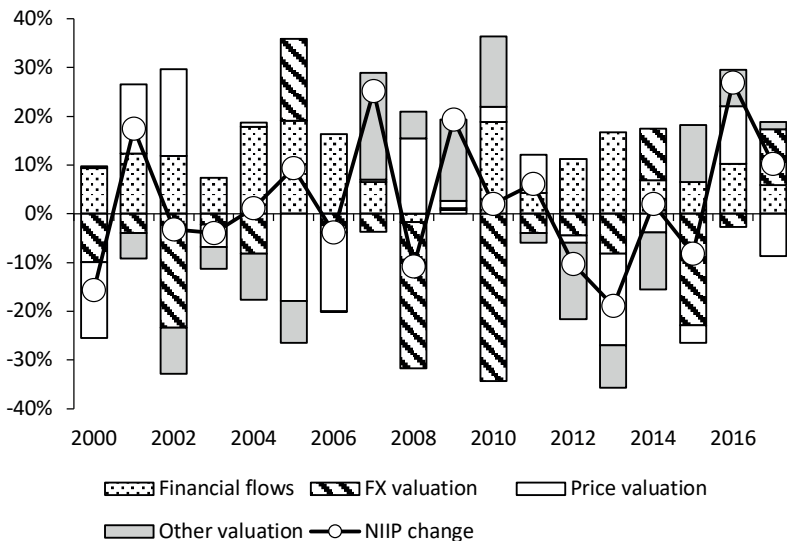
Figure 11 presents the impact of the various drivers on the NIIP. Financial transactions are always positive,<sup>10</sup> reflecting the persistent current account surplus. The strength of the Swiss franc translated into large losses in 2008, 2010 and 2015. The role of asset prices is more moderate. Interestingly, they led to a gain during the 2008 crisis. This simply reflects the fact that Switzerland is a net debtor in portfolio equity, and thus the global collapse primarily reduced its liabilities. We also observe that other valuation effects are sizable but show no systematic pattern.

<sup>10</sup> One exception is observed in 2008. In that year the current account remained positive, and the absence of net financial flows reflects the statistical error.

**Figure 10:** Liabilities changes (% GDP)

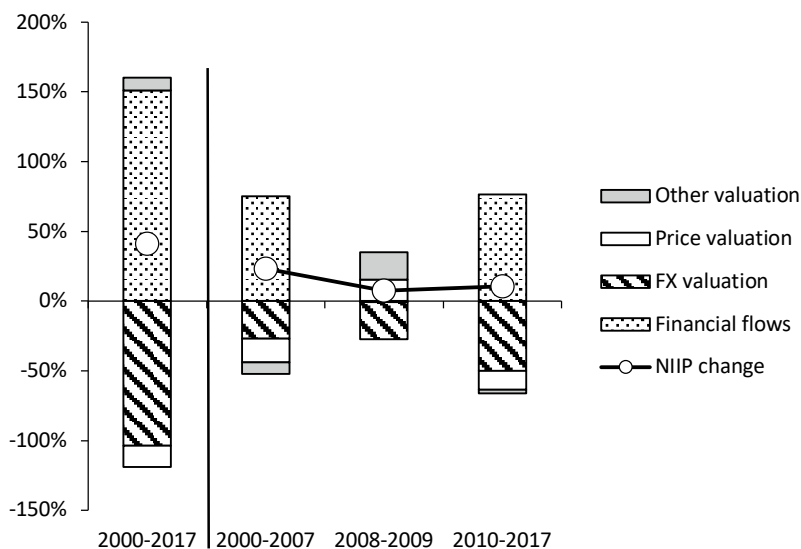


**Figure 11:** NIIP changes: total (% GDP)



A synthetic view of the drivers of the NIIP is presented in Figure 12, which sums the values of Figure 11 across years (all values are expressed as a percentage of 2017 GDP). Over the last seventeen years (first column) the increase of the NIIP only represents a third of the accumulated financial transactions. This large gap, equivalent to 110% of annual GDP, is a direct result of the strengthening of the franc and the resulting valuation losses. The right-hand part of the chart distinguishes between the years before the global financial crisis, the acute phase of the crisis (2008-2009) and the subsequent years when the SNB took on a growing role. Exchange rate losses were already sizable before the crisis, but have become more pronounced in recent years. Other valuation effects are negligible when we consider several years, as they average out from one year to the next. Over the whole period, the NIIP has been almost exclusively driven by financial transactions and the offsetting valuation impact of exchange rate movements.

**Figure 12:** NIIP change (sums, % 2017 GDP)



## 5 Returns and hedging characteristics of Swiss foreign assets

### 5.1 An exorbitant burden?

Our estimates of the valuation affect allow us to compute the rates of returns on assets and liabilities. Computing the yields (interest and dividends in percentage of the initial position) is straightforward as the streams of dividend and interest payments are recorded in the balance of payments. However, yields represent only a partial picture as assets generate a payoff via capital gains as well. We therefore need to compute the overall rate of return, which also includes the capital gains and losses. FISCHER, GROEGER, SAURÉ and YESIN (2018) show, for instance, that the treatment of reinvesting earnings can substantially distort the yield on portfolio equity, especially for financial centers such as Switzerland.

The computation of meaningful rates of return requires good estimates of the capital gains and losses stemming from exchange rate and asset prices. While one may be tempted to simply take the overall valuation (i.e., the change in position net of financial flows), this is not adequate, as pointed out by CURCURU, DVORAK and WARNOCK (2013). Doing so would treat the “other valuation” as a true capital gain or loss. However, this category mainly reflects changes in the coverage of the underlying surveys, or revisions across data vintages that cannot be precisely attributed to capital flows in specific years. These adjustments do not represent actual gains or losses on financial holdings. We therefore focus on our estimates of valuation effects stemming from asset prices and exchange rates, and compute the rates of returns on assets in category  $i$  (FDI, portfolio, SNB reserves, other) as follows:

$$\begin{aligned} r_{A,i,t} &= \frac{Earnings_{A,i,t} + FX_{Valuation_{A,i,t}} + Price_{Valuation_{A,i,t}}}{A_{i,t-1}} \\ &= S_{A,i,t} + \frac{FX\_Valuation_{A,i,t} + Price\_Valuation_{A,i,t}}{A_{i,t-1}}, \end{aligned} \quad (2)$$

where  $r_{A,i,t}$  is the rate of return,  $S_{A,i,t}$  the yield,  $Earnings_{A,i,t}$  the value of dividend and interest payments in quarter  $t$ ,  $FX\_Valuation_{A,i,t}$  the capital gains or losses resulting from exchange rate movements between the end of quarter  $t-1$  and the end of quarter  $t$ ,  $Price\_Valuation_{A,i,t}$  the capital gains or losses resulting from asset price movements, and  $A_{i,t-1}^k$  the position at the end of quarter  $t-1$ . The rate of return on liabilities is computed in a similar way.

Table 1 presents the average value of the rates of returns (quarter-on-quarter, annualized rate) over the whole sample. The top panel presents yields, while overall rates of return are shown in the bottom panel. Each panel shows the



figures for assets and liabilities, and the difference between the two. In addition to the numbers for the overall investment position, we present the figures for the total excluding FDI (as this category is not measured at market value), the private position (excluding SNB reserves), FDI, overall portfolio investment (and equity and debt separately) and other investments.

In terms of yields, Switzerland benefits from a moderate advantage, earning a higher yield on its assets than foreign investors do on their investments in Switzerland. This reflects the asymmetric composition of the Swiss international investment position, with high-yield investments representing a larger share of assets than liabilities.<sup>11</sup>

The situation is quite different once we take account of the valuation effects of exchange rates and asset prices. Taking this broader view shows that Switzerland faces an adverse pattern of paying a higher return to foreign investors than it gets from its investment abroad. The gap amounts to 1 percentage point overall, and is particularly pronounced in FDI and portfolio equity. The large negative gap for portfolio reflects the composition of this category, with a net creditor position in low-return bonds and a net debtor position in high-return equity.

Switzerland thus does not appear to benefit much from the high leverage of its international investment position – quite the contrary. A caveat with the computations presented in Table 1 is that valuation effects are highly volatile, and therefore so are total returns. Obtaining more solid estimates requires either constructing long time series, as GOURINCHAS and REY (2005) do, or focusing on categories where highly disaggregated and reliable data are available, as CURCURU, DVORAK and WARNOCK (2013) do.

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<sup>11</sup> This explains why the overall differential for private holdings (0.4%) is higher than the gap of any of the subcategories.

**Table 1:** Yields and total rates of returns

Average yield (2000-2017)

	<b>Total</b>	<b>Total non-FDI</b>	<b>Private</b>	<b>FDI</b>	<b>Portfolio</b>	<b>Portf: debt</b>	<b>Portf: equity</b>	<b>Other</b>	<b>SNB reserves</b>
<b>Assets</b>	3.7%	2.4%	3.8%	7.4%	2.8%	3.0%	2.6%	2.0%	2.5%
<b>Liabilities</b>	3.3%	2.2%	3.3%	7.2%	2.5%	3.0%	2.5%	2.0%	
<b>Gap</b>	0.4%	0.2%	0.5%	0.2	0.3%	0.0%	0.1%	0.0%	

Average rate of return (2000-2017)

Earnings + valuation from asset prices and exchange rates

	<b>Total</b>	<b>Total non-FDI</b>	<b>Private</b>	<b>FDI</b>	<b>Portfolio</b>	<b>Portf: debt</b>	<b>Portf: equity</b>	<b>Other</b>	<b>SNB reserves</b>
<b>Assets</b>	1.9%	1.0%	1.9%	4.7%	1.9%	1.9%	2.5%	-0.3%	2.8%
<b>Liabilities</b>	2.9%	2.1%	2.9%	6.6%	5.2%	2.5%	5.6%	-0.1%	
<b>Gap</b>	-1.0%	-1.1%	-1.0%	-1.9%	-3.3%	-0.5%	-3.1%	-0.2%	

*Notes:*

Averages computed from quarter-to-quarter rates of return (annualized).

## 5.2 The hedging properties of the NIIP: Empirical framework

### 5.2.1 Income: GDP and financial returns.

Should the evidence above of a negative gap in the Swiss rates of return be a concern? Not necessarily, if the negative excess return on Swiss investors' net assets is the price to pay for holding a portfolio that offers a good hedge against macroeconomic shocks. We therefore turn to assessing whether the Swiss international position offers such a hedge.

We start with a word of caution on the interpretation of our results. Our analysis provides stylized facts, showing whether the net return on Swiss assets increases when Swiss GDP is low at a specific horizon. The motives of various types of investment can differ, however, and are not observable. For instance, portfolio investment may be aimed at providing hedging against short-run movements in GDP, while FDI could have a much longer horizon. The most relevant horizon at which to assess the hedging properties could thus differ substantially across categories of assets. In addition, some investments can be driven by considerations other than hedging. The foreign exchange reserves of the SNB have been accumulated to fight the massive appreciation of the currency during the recent crisis. Even if these reserves offer limited hedging benefit, this may well be a price worth paying to avoid disruptive exchange rate movements.

Our framework starts with the definition of the overall income of Swiss residents, which includes GDP and the net return on foreign assets and liabilities:<sup>12</sup>

$$Inc_t = GDP_t + NetFin_t, \quad (3)$$

where the net financial income (earnings and capital gains) is  $NetFin_t = r_{A,t}A_{t-1} - r_{L,t}L_{t-1}$ ,  $A_{t-1}$  and  $L_{t-1}$  are the values of assets and liabilities at the end of period  $t-1$ , and  $r_{A,t}$  and  $r_{L,t}$  are the rates of return (including valuation gains from exchange rates and asset prices) in period  $t$ .

We take the difference from one quarter to the next and scale by initial GDP:

$$\frac{\Delta(Inc_t)}{GDP_{t-1}} = \frac{\Delta(GDP_t)}{GDP_{t-1}} + \frac{\Delta(NetFin_t)}{GDP_{t-1}}, \quad (4)$$

where  $\Delta(X_t) = X_t - X_{t-1}$ . Equation (4) shows that the two components of the dynamics of income are the growth rate of nominal GDP and the change in the net

<sup>12</sup> More precisely, our measure of income from sources other than financial assets is the sum of GDP and the net income on labor services, which shows a small deficit for Switzerland.

return scaled by GDP. Some *nominal income hedging* is achieved when the two components of equation (4) are negatively correlated, with for instance higher gains on foreign assets  $\Delta(\text{NetFin}_t)/\text{GDP}_{t-1}$  in quarters where growth  $\Delta(\text{GDP}_t)/\text{GDP}_{t-1}$  is low.

Computing equation (4) using the overall  $\Delta(\text{NetFin}_t)$  sheds light on the hedging properties of the overall portfolio on assets and liabilities. We can also assess whether some categories of financial holdings (SNB reserves, for instance) provide a good hedge by relying on  $\Delta(\text{NetFin}_t)$  for that category.

A limitation of equation (4) is that we compare the net financial return with the growth of Swiss GDP. However, GDP growth can reflect two drivers, with different implications for hedging. A period of high growth in Switzerland and abroad reflects a global shock that we should not expect to be offset by cross-border financial returns. By contrast, international risk-sharing implies that asymmetric growth shocks should be offset by net financial transfers in the forms of earnings on assets or capital gains and losses. Specifically, we would expect a negative correlation between the net return and the gap between Swiss and foreign growth. A more proper specification is therefore to consider the difference between Swiss GDP growth and its counterpart in the rest of the world in equation (4).

$\text{NetFin}_t$  is computed from our estimates. Swiss GDP growth is taken from the standard SECO data. We construct foreign growth as a weighted average of growth in the euro area, the United Kingdom, Japan and the United States, with the weights being those used in the SNB trade-weighted index.

### 5.2.2 Splitting quantities and prices

The specification in equation (4) is written for the growth of nominal GDP. Growth in nominal GDP can be split into growth in real GDP and changes in the price deflator:

$$\frac{\Delta(\text{GDP}_t)}{\text{GDP}_{t-1}} = \frac{\Delta(\text{GDP}_t^{\text{real}})}{\text{GDP}_{t-1}^{\text{real}}} + \frac{\Delta(P_t^{\text{GDP}})}{P_{t-1}^{\text{GDP}}} \quad (5)$$

Equation (5) allows us to assess the extent to which financial income provides a good *real income hedging* – through the comovements between  $\Delta(\text{NetFin}_t)/\text{GDP}_{t-1}$  and  $\Delta(\text{GDP}_t^{\text{real}})/\text{GDP}_{t-1}^{\text{real}}$  and a good *income price hedging* – through the comovements between  $\Delta(\text{NetFin}_t)/\text{GDP}_{t-1}$  and  $\Delta(P_t^{\text{GDP}})/P_{t-1}^{\text{GDP}}$ . This latter measure can be interpreted as hedging of the terms of trade.

### 5.2.3 Purchasing power of income

We also consider the purchasing power of income, which is income from equation (3) deflated by the consumer price index:

$$\frac{Inc_t}{CPI_t} = \frac{GDP_t}{CPI_t} + \frac{NetFin_t}{CPI_t}. \quad (6)$$

Taking the first difference of (6) we write:

$$\Delta\left(\frac{Inc_t}{CPI_t}\right) = \frac{GDP_{t-1}}{CPI_{t-1}} \left[ \frac{\Delta(GDP_t)}{GDP_{t-1}} - \frac{GDP_{t-1} + NetFin_{t-1}}{GDP_{t-1}} \frac{\Delta(CPI_t)}{CPI_{t-1}} + \frac{\Delta(NetFin_t)}{GDP_{t-1}} \right] \quad (7)$$

The extent of *purchasing power of income hedging* reflects the extent to which movements in net financial income  $\Delta(NetFin_t)/GDP_{t-1}$  offset changes in the nominal income adjusted by the cost of purchasing a consumption basket,  $\Delta(GDP_t)/GDP_{t-1} - (1 + NetFin_{t-1}/GDP_{t-1})(\Delta(CPI_t)/\Delta(CPI_{t-1}))$ .

In addition to considering the movements in the Swiss purchasing power of income, we undertake our analysis in terms of its difference relative to the foreign counterpart as motivated above. Denoting the exchange rate by  $S$  (expressed in Swiss francs per unit of foreign currency), and recalling that the Swiss net financial income mirrors the foreign one, the corresponding foreign measure is:  $\Delta(GDP_t^*)/GDP_{t-1}^* - (1 - NetFin_{t-1}/S_{t-1}GDP_{t-1}^*)(\Delta(CPI_t^*)/\Delta(CPI_{t-1}^*))$ .

### 5.2.4 Time horizon

We consider two types of periods for the analysis of equations (4) and (7). We first take quarter-to-quarter changes, with, for instance,  $t-1$  and  $t$  being 2007 Q1 and 2007 Q2. This measures the hedging properties of the portfolio at a high frequency. Agents may care more about the hedging at longer horizons, however, and a portfolio that provides a good hedge of annual movements of income is valuable even though it may not hedge well fluctuations from one quarter to the next.

We therefore also consider four-quarter blocks, with, for instance,  $t-1$  covering the 2007Q1 to 2007Q4 and  $t$  going from 2008Q1 to 2008Q4. The various variables are then taken as averages over the four quarters.<sup>13</sup>

<sup>13</sup> Another possibility is to rely on annual data, which however substantially limits the sample.

### 5.3 The hedging properties of the NIIP: Some a priori economic considerations

What can we expect a priori regarding the ability of the Swiss foreign assets and liabilities to hedge business cycle movements? Three important characteristics stand out:

- the long positions in foreign currencies – with a strong Swiss franc leading to low (or negative) values of  $\Delta(NetFin_t)$ ;
- the safe haven motive of capital flowing into Switzerland, and appreciating the franc, in times of adverse global conditions; and
- the large short position in equity (with foreign investors holding a big share of Swiss multinational firms), which means that rising global stock prices affect valuation negatively.

The hedging properties are likely to depend substantially on the specific shocks. A surge of capital inflows fuels an appreciation of the Swiss franc, causing both a deterioration of trade competitiveness and growth and adverse valuation effects. The Swiss external portfolio is then a poor hedge and magnifies income risk instead of reducing it.

By contrast, hedging properties are likely to be more favorable in the case of a domestic demand shock. Higher Swiss demand leads to higher growth, as well as a strengthening of the currency leading to valuation losses on the portfolio. In this case, the portfolio is a good hedge as the valuation losses offset the gain in terms of growth.

In addition to movements in exchange rates, the specific composition of Swiss foreign assets adds a layer of complexity. Consider a favorable growth shock in foreign countries. In this case, Swiss growth is low relative to foreign countries (even though it may be high in absolute terms). If the shock increases global asset prices (including those of Swiss multinational firms) and depresses bond prices as foreign interest rates print higher for some time, the portfolio acts as a poor hedge as Swiss foreign assets are short on equity and long on bonds. By contrast, if the positive foreign shock strengthens the currencies of these countries, the portfolio then represents a valuable hedge.

The examples listed above are far from an exhaustive list of economic shocks, and is it hard to build a clear a priori expectation of the hedging properties of the Swiss international portfolio. That said, given the currency position and the safe

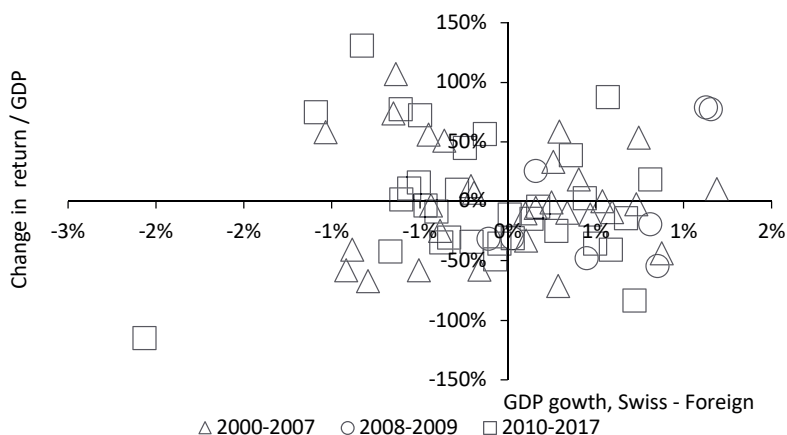
asset motive for capital flows into Switzerland, one can expect the portfolio to provide only a limited hedge.

## 5.4 The hedging properties of the NIIP: Empirical results

### 5.4.1 Broad pattern

We start by illustrating the comovements of  $\Delta(GDP_t)/GDP_{t-1}$  (in terms of the Swiss – foreign difference) and  $\Delta(NetFin_t)/GDP_{t-1}$  in equation (4). Figure 13 shows a scatter plot of nominal GDP growth (Swiss minus foreign, quarterly rate) on the horizontal axis and the net return on the vertical axis (scaled by quarterly GDP). We contrast the pre-crisis period (triangles) with the acute crisis phase (2008-2009, circles) and the subsequent period of rising SNB role (2010 and later, squares). The pre-crisis period shows some visual evidence of a negative correlation. This correlation is less apparent in the post-crisis years, with a clear outlier corresponding to the first quarter of 2015 when the exchange rate floor was abandoned.<sup>14</sup> The figure also shows that the net financial income fluctuates much more than GDP, which is not surprising as it entails volatile capital gains and losses.

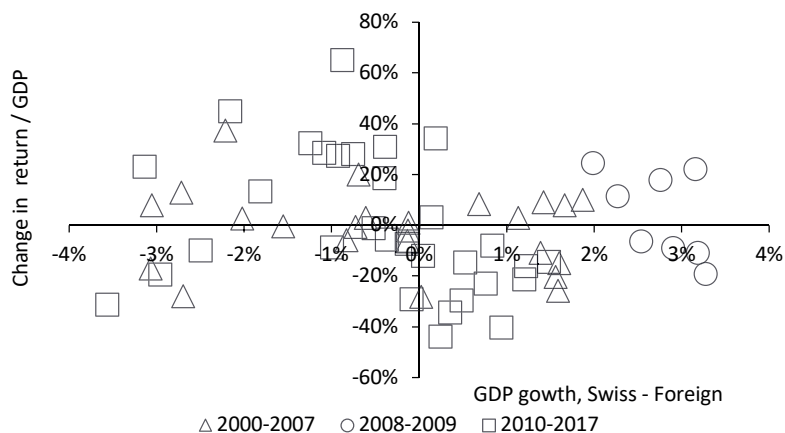
**Figure 13:** Nominal GDP - NetFin return (quarterly)



<sup>14</sup> Specifically,  $NetFin_t$  moved from CHF+23 billion in the last quarter of 2015 to CHF-164 billion in the first quarter of 2015, with GDP in the last quarter of 2014 amounting to CHF164 billion (quarterly rate).

Figure 14 is constructed along the same lines as Figure 13, but considers the changes from one four-quarter period to the next (non-overlapping) period, following equation (7). The scatter plot shows little negative correlation, except for the post-crisis period. Interestingly there are no stark outliers, and the magnitude of net financial income movements is reduced by half compared to Figure 13. This indicates that extreme quarter-to-quarter movements tend to be reverted in subsequent quarters.

**Figure 14:** Nominal GDP - NetFin return (4 q)



#### 5.4.2 Hedging from quarter to quarter

We turn to a more rigorous assessment of the hedging pattern by computing the correlation between the Swiss minus foreign growth gap and net return. In this section we consider the quarter-to-quarter movements.

Figure 15 presents the correlation for the four types of hedging we consider: nominal income hedging (top-left panel), real income hedging (top-right panel), income price hedging (bottom-left panel) and purchasing power of income hedging (bottom-right panel).<sup>15</sup> Each panel presents the correlation for several asset categories for the net financial return. From left to right, we show the correlation based on the total holdings of assets and liabilities, the private holdings excluding SNB reserves, the SNB reserves, the total holdings excluding

<sup>15</sup> We set the same vertical scale for all four panels for ease of comparison.



FDI, and the holdings of portfolio positions (debt and equity) for which we are confident that our estimates closely match those provided by the SNB. For each we show the correlation over the entire sample, the years before the crisis (until 2007Q4, hatched bars), the years including the acute phase of the crisis in the United States (until 2009Q4, black bars) and the years since 2010Q1, when the SNB took a prominent role (dotted bars).

Four points emerge from the evidence on nominal income hedging (top-left panel). First, the ability of net financial income to hedge GDP is minimal, with the coefficients being at best moderately negative. Second, hedging properties have improved over time, with correlations becoming negative since 2010. Third, the hedging ability is strongest for private non-FDI holdings, in particular portfolio investment. Finally, private holdings offer a better hedge than SNB reserves, which exhibit a positive correlation with the cycle.<sup>16</sup>

We next split the nominal income hedging between hedging of real income (top-right panel) and income price (bottom-left panel). We see that hedging is primarily driven by real income, although it remains limited. We again observe that hedging is stronger for non-FDI assets, in particular portfolio, with SNB reserves offering little offset of income fluctuations.

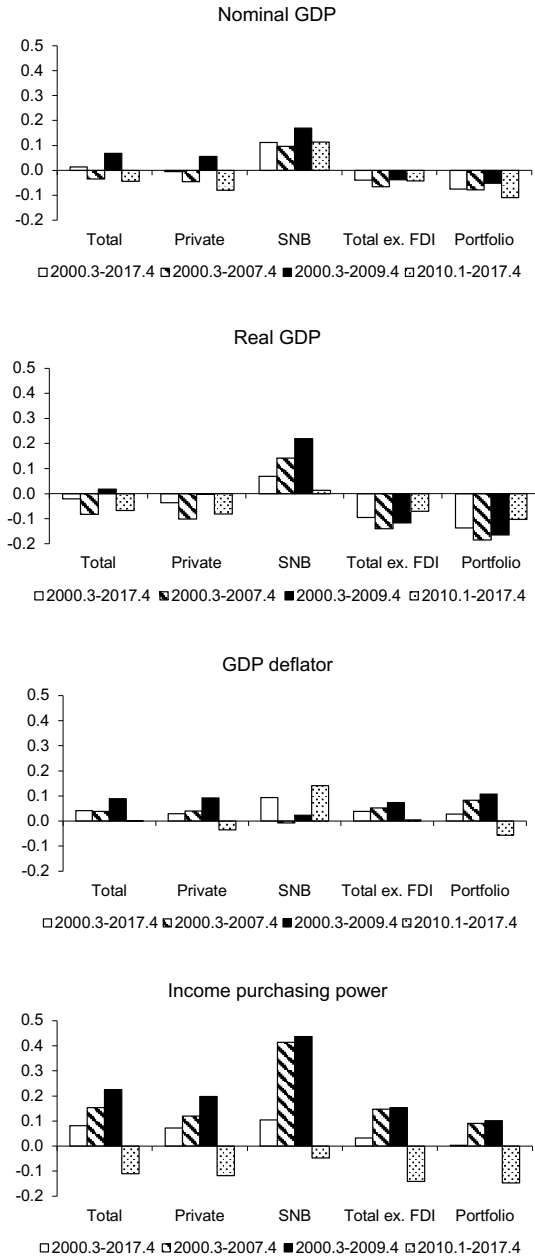
The last step assesses the hedging of purchasing power of income, that is, income deflated by the CPI (bottom-right panel). Three points emerge. First, hedging is only present in the years since the crisis, with net financial income instead amplifying deflated GDP movements before that. Second, even in recent years hedging remains limited. Third, we again see stronger hedging for non-FDI and portfolio investment, especially in contrast to SNB reserves.

Overall, our analysis of movements from one quarter to the next shows that the foreign portfolio offers a very limited hedge against movements in GDP. This is mostly the case in recent years and is driven by non-FDI private investment, especially in portfolio holdings. Figure A.10 in the appendix presents the analysis considering only movements in Swiss GDP (i.e., without contrasting them with their foreign counterparts). The pattern is broadly similar, with only moderate hedging, concentrated in recent years. The only difference is a stronger GDP price hedging since 2010.

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<sup>16</sup> The hatched and black bars for SNB reserves are of little interest given the marginal role of reserves before 2010.

**Figure 15:** Correlation of net financial income with GDP  
Swiss – Foreign GDP growth, quarter-to-quarter changes



### 5.4.3 Hedging over a four-quarter horizon

The analysis in Section 5.4.2 focused on hedging at a short one-quarter horizon. However, the economic well-being of Swiss residents is likely to be more affected by the hedging over longer horizons. We therefore extend our analysis to movements in financial returns and growth over periods of four quarters.

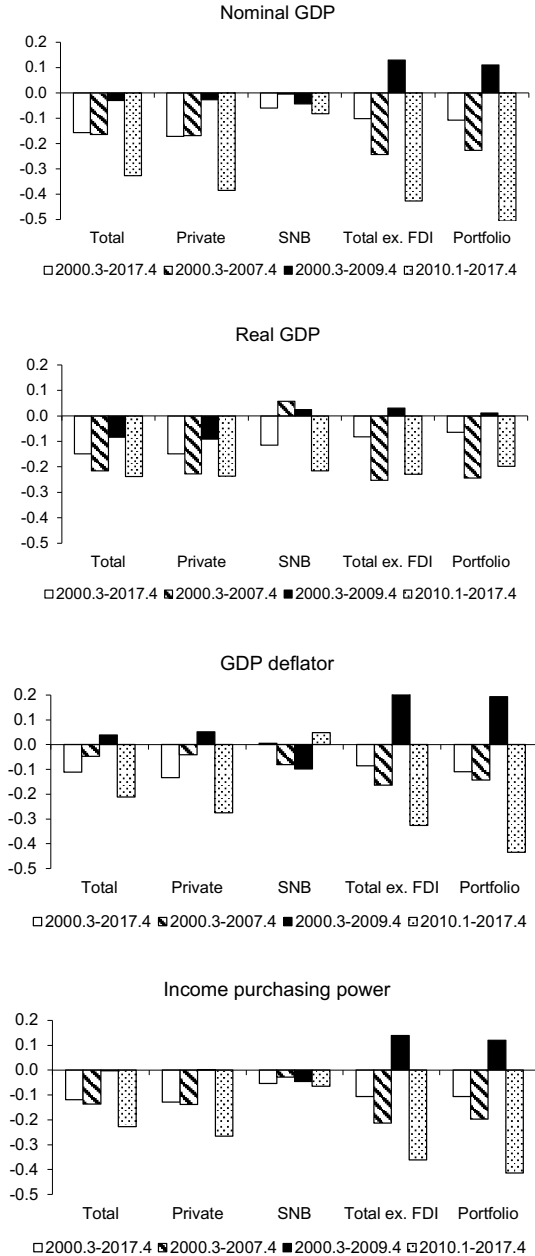
Figure 16 shows the hedging of the various components of income and is constructed in the same way as Figure 15. Looking at the nominal income hedging (top-left panel) reveals five points. First, hedging is stronger than at the horizon of one quarter (the scale being doubled from the previous figure). Second, hedging was weak during the most acute phase of the crisis, with the coefficients including 2008-9 (black bars) being much smaller than before the crisis (hatched bars). Third, hedging has strengthened in the years following the most acute phase of the crisis. Fourth, the holding excluding FDI and portfolio investment provide the stronger hedging, with a correlation of nearly -50% in recent years. Finally, the SNB reserves offer limited hedging.

Turning to the hedging of real income and prices (top-right and bottom-left panels), we see that hedging of real income has remained steady through time, except for the acute years of the crisis. In recent years, SNB reserves offer similar hedging as the privately held portfolio. The improvement in nominal income hedging thus comes entirely from the relative price of GDP between Switzerland and the rest of the world, and has been driven by non-FDI holdings, especially portfolio investment.

The final step is to assess the hedging of income purchasing power (bottom-right panel). We observe that hedging is sizable and has strengthened over time. As seen above, it is driven by the non-FDI portfolio, and especially privately held investments.

Overall, we find evidence that foreign assets and liabilities offer a better hedge for growth at longer horizon than they do on a quarter-to-quarter basis. The hedge has improved in recent years for nominal income and for the purchasing power of income. If we consider GDP movements solely for Switzerland instead of contrasting them with the rest of the world (see Figure A.11 in the appendix), we see a deterioration of hedging, except for the income price, and weak hedging for the purchasing power of income. This shows the importance of taking a cross-country view. Swiss growth may have weakened during the euro crisis, but it behaved quite differently from growth in the rest of the world.

**Figure 16:** Correlation of net financial income with GDP  
Swiss – Foreign GDP growth, 4 quarter-to-4 quarter changes



## 6 Conclusion

This paper presents estimates on the valuation gains from exchange rates and assets prices for the Swiss international investment position, building on improvements in the Swiss statistics, which now include a partial breakdown between various sources of capital gains. We show that Switzerland has faced sizable losses from the strength of the franc, even before the crisis. These losses translate into a negative return differential between Swiss assets and liabilities.

Our main contribution is to assess the hedging properties of the Swiss international investment position. Specifically, we consider whether the gains on the position (earnings and capital gains) occur at times of weaker growth. Assessing the presence of hedging benefits is important, given that Switzerland tends to suffer from persistent capital losses on its foreign assets. The presence of hedging properties would offer a partial compensation for such losses.

We find little evidence of hedging benefits when looking at movements from one quarter to the next. While the foreign portfolio offers some hedge against movements in nominal GDP, as well as the purchasing power of income in terms of the consumption basket, the magnitude of this effect is small. The situation is more favorable when considering movements over four quarters, a horizon that is more economically meaningful. We find evidence of hedging benefits of the portfolio of foreign assets and liabilities, with these benefits increasing in recent years. The finding of hedging benefits in recent years may appear surprising in light of the sizable appreciation of the franc. It is important to bear in mind that hedging is assessed in terms of Swiss growth relative to foreign growth, and not in terms of Swiss growth alone. While the Swiss economy has experienced a slowdown due to the strong franc, the situations of other countries have been even more challenging, especially in Europe. The cost of the strong Swiss franc can then be seen as offsetting the relatively favorable Swiss growth performance.

Our analysis allows us to contrast the hedging properties of the reserves held by the SNB against those of the private portfolio. We find that private holdings tend to offer a better hedge than reserves. Of course, this does not question the adequacy of reserve accumulation. First, the policy was driven by other reasons. Second, absent reserves accumulation, the Swiss franc would have appreciated much more, which would have substantially affected the hedging properties of the private portfolio. Finally, the policy of reigning in the appreciation may offer hedging benefits over the medium run, beyond the horizon that we considered.

Our work is a first step towards assessing the sizable Swiss foreign asset position against the business cycle, and there are several avenues for future research. First,

the hedging properties of the overall returns could be split between the impact of earnings, exchange rate movements, and changes in asset prices. Second, the pattern could be assessed at a finer level, for instance contrasting the role of gross assets and gross liabilities. Third, our assessment considers unconditional correlations. It is likely that the hedging properties would be quite different depending on the exact nature of the underlying shocks.

Finally, we show that the hedging properties are sensitive to whether or not FDI positions are included. This suggests that a finer analysis of the FDI positions would be a promising avenue for future work. A first line of research would be to compute market valuation of FDI holdings; a second topic would be to split the holding of FDI (and other categories of assets) that are linked to pass-through capital of foreign multinationals, following SNB (2017).

## References

- AUER, RAPHAEL and CÉDRIC TILLE (2016), The banking sector and the Swiss financial account during the financial and European debt crises, *Aussenwirtschaft*, 67 (2), pp. 69-97.
- BÉNÉTRIX, AGUSTÍN and Philip Lane (2016), Cross-Country Exposures to the Swiss Franc, Trinity Economics Papers tep0116, Trinity College Dublin.
- BÉNÉTRIX, AGUSTIN, PHILIP LANE and JAY SHAMBAUGH (2015), International currency exposures, valuation effects and the global financial crisis, *Journal of International Economics* 96 (S1), pp. 98-109.
- CURCURU, STEPHANIE, TOMAS DVORAK and FRANCIS WARNOCK (2013), On Returns Differentials, *Journal of International Money and Finance* 36 (C), pp. 1-25.
- EMTER, LORENZ, MARTIN SCHMITZ and MARCEL TIRPÁK (2018), Cross-border banking in the EU since the crisis: what is driving the great retrenchment?, ECB Working Paper 2130.
- FISCHER, ANDREAS, HENRIKE GROEGER, PHILIP SAURÉ and PINAR YESIN (2018), Financial centers and the retained earnings bias, mimeo, Swiss National Bank.
- GOURINCHAS, PIERRE-OLIVIER and HÉLÈNE REY (2013), External Adjustment, Global Imbalances and Valuation Effects, NBER Working Paper 19240.
- GOURINCHAS, PIERRE-OLIVIER and HÉLÈNE REY (2005), From World Banker to World Venture Capitalist: US External Adjustment and the Exorbitant Privilege, NBER Working Paper 11563.
- KUGLER, PETER and BEATRICE WEDER (2005), Why Are Returns on Swiss Franc Assets So Low? Rare Events May Solve the Puzzle, CEPR Discussion Paper 5181.

- KUGLER, PETER and BEATRICE WEDER (2004), International Portfolio Holdings and Swiss Franc Asset Returns, *Swiss Journal of Economics and Statistics* 140(III), pp. 301-325
- LANE, PHILIP and GIAN-MARIA MILESI-FERRETTI (2018), International Financial Integration in the Aftermath of the Global Financial Crisis, *IMF Economic Review* 66 (1), pp. 189-222
- LANE, PHILIP and GIAN-MARIA MILESI-FERRETTI (2007), The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970-2004, *Journal of International Economics* 73 (2), pp. 223-250.
- LANE, PHILIP and JAY SHAMBAUGH (2010), The long or short of it: Determinants of foreign currency exposure in external balance sheets, *Journal of International Economics* 80 (1), pp. 33-44.
- MILESI-FERRETTI, GIAN-MARIA and CÉDRIC TILLE (2011), The great retrenchment: international capital flows during the global financial crisis, *Economic Policy* 66, pp. 287-342.
- NITSCHKA, THOMAS (2014), Have investors been looking for exposure to specific countries since the global financial crisis? Insights from the Swiss franc bond market, SNB Working Papers 13/2014.
- SWISS NATIONAL BANK (2018), *Swiss Balance of Payments and International Investment Position in 2017*, Zürich.
- SWISS NATIONAL BANK (2017), *Direct Investments in 2017*, Zürich.
- TILLE, CÉDRIC (2017), Les liens économiques entre la Suisse et le monde: une situation en pleine évolution, in: *Essays in Monetary Economic Issues Today – Festschrift in Honour of Ernst Baltensperger*, Orell Füssli, Zürich, pp. 75-92 (English version published as The Changing International Linkages of Switzerland: An Overview, CEPR Discussion Paper 12176).
- TILLE, CÉDRIC (2003), The impact of exchange rate movements on U.S. foreign debt, *Current Issues in Economics and Finance* 9 (1).
- YESIN, PINAR (2015), Capital flows waves to and from Switzerland before and after the financial crisis, *Swiss Journal of Economics and Statistics* 151 (1), pp. 27-75.

## Appendix A: Data and adjustments

### A.1 Data sources

The data on the Swiss international investment position are obtained from the SNB website (a more detailed currency decomposition was provided directly by the SNB statistics department). Data on capital flows are from the balance of payments statistics published by the SNB.

Bilateral exchange rates and effective exchange rate weights are taken from the SNB website. Equity and bond prices are from Datastream and Bloomberg, via the SNB internal database.

GDP numbers are from the websites of SECO (Switzerland), the Bureau of Economic Statistics (United States), Eurostat (euro area and United Kingdom) and ESRI (Japan).

### A.2 Exchange rate valuation

The international investment position data on the SNB website split holdings into positions denominated in Swiss francs, US dollars, euros, precious metals, and all other currencies. The SNB statistics department provided us with the value of positions denominated in yen and British pounds.

The SNB website does not split the flows of financial transactions in the balance of payments by currencies. The SNB statistical department provided us with estimates of financial transactions by currency for portfolio investment since 2002Q1. For other categories of holdings, and for earlier quarters, we estimate the currency composition of financial transactions in a quarter  $t$  by applying the shares of the various currencies in the corresponding holdings at the end of quarter  $t-1$ .

We use bilateral exchange rates against the countries included in the SNB exchange rate statistics<sup>17</sup> and take end of month/quarter values. We compute an exchange rate for the “other currencies” by taking an index of the currencies

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17 The countries covered are the euro area, United Kingdom, Denmark, Norway, Czech Republic, Hungary, Poland, Russia, Sweden, Turkey, United States, Canada, Argentina, Brazil, Mexico, South Africa, Japan, Australia, China, Hong Kong, South Korea, Malaysia, New Zealand, Singapore, and Thailand. As the Turkish lira went through currency redenomination in January 2015, we adjust the December 2014 number by taking the January 2015 number times the depreciation rate between January and February 2015. Numbers before December 2014 are adjusted by taking a rule of three using the adjusted and unadjusted December 2014 numbers. The exchange rate for Turkey is adjusted to take account of the redenomination of the lira in January 2005.



(other than the US dollar, euro, yen and British pound) using the annual trade weights used by the SNB in its effective exchange rate index, available on its website. We attribute the annual value to the month of June and use a linear interpolation for the other months. The index is computed as:

$$\begin{aligned} & \ln(FX\_Index_t) - \ln(FX\_Index_{t-1}) \\ &= \sum_i Weight_{i,t-1} \times [\ln(FX\_Index_{i,t}) - \ln(FX\_Index_{i,t-1})] \end{aligned} \quad (A.1)$$

where  $FX\_Index_{i,t}$  is the index of the exchange rate of country  $I$  (excluding the four for which we have the specific positions), with a higher value of the index denoting a stronger Swiss franc relative to the foreign currency.

The valuation effect from exchange rate movements for a position in currency  $i$  between quarters  $t-1$  and  $t$  is (recall that a higher value of the exchange rate index represents a stronger Swiss franc):

$$Val\_FX_{i,t} = \left( Pos_{i,t-1} + \frac{Flows_{i,t}}{2} \right) \frac{(1/FX\_Index_{i,t}) - (1/FX\_Index_{i,t-1})}{(1/FX\_Index_{i,t-1})}$$

where  $Pos_{i,t-1}$  is the position in the currency at the end of quarter  $t-1$  and  $Flows_{i,t}$  is the financial transactions in quarter  $t$  for  $i =$  US dollar, euro, yen and British pound, and index of other currencies (A.1).

### A.3 Asset price valuation

We rely on stock prices, bond prices, and the price of gold. The price of gold is used to compute the valuation change for position denominated in precious metals. All prices are measured at end of month/quarter.

Stock and bond price indices are obtained for the euro area, the United States, Japan, the United Kingdom, and Switzerland. Stock prices for the euro area are only available since 2002. For the quarters before that, we extend the index backward by applying the average of the percent changes in indices for Germany and France.

Sovereign bond prices start in 1999Q1. The sovereign bond index for the euro area only starts in 2001Q4. For prior quarters we extend the index backwards by applying the average of the percentage changes in indices for German and French quarters. We combine sovereign and corporate bonds indices in a composite

index using the share of sovereign bonds in holdings of long-term debt securities since 2001Q4 (the share for earlier quarters is set at the share of 2001Q4). The share of sovereign bonds is computed by the SNB statistics department for assets and for liabilities. The share is computed only for overall bond holdings and not at the level of individual currencies. For assets, we assume that the share is the same across currencies. For liabilities, we assume that sovereign bonds are only in Swiss francs. As corporate bond prices do not go back earlier than 2000Q3, we backtrack the index using the sovereign price index.

Asset prices for the various countries are applied to the positions denominated in these countries' currencies. We do not compute any price valuation change for positions in "other currencies". The valuation effect from asset prices movements for a position in currency  $i$  between quarters  $t-1$  and  $t$  is:

$$Val\_Price_{i,t} = \left( Pos_{i,t-1} + \frac{Flows_{i,t}}{2} \right) \frac{Price\_Index_{i,t} - Price\_Index_{i,t-1}}{Price\_Index_{i,t-1}}$$

The specific computations are as follows for the various categories:

- No valuation effect of price changes is computed for FDI, as these are measured at book value.
- Holdings in shares in portfolio equity are valued using stock prices.
- Holdings of collective investment schemes in portfolio equity are split into schemes invested in equity, bonds, or liquid assets (such as bank accounts) using data from the SNB. Investment schemes in equity are valued using stock prices, while schemes invested into bonds are valued using the composite sovereign and corporate bond price index. No price valuation change is computed for collective investment schemes in liquid assets.
- Portfolio debt is valued using the composite sovereign and corporate bond prices for holdings of long-term debt. No adjustment is made for holdings of short-term debt as we assume these to be held to maturity shorter than one year.
- No effect is computed for the holdings of "other" as these consist mostly of bank loans.
- The valuation effect of prices changes for SNB reserves is taken as the residual from the change in the position minus capital flows and the valuation

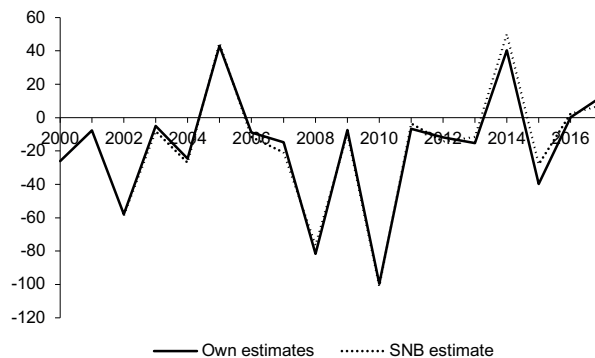
impact of exchange rate. As the SNB reserves are well measured, we assume that there is no “other valuation” change.<sup>18</sup>

#### A.4 Comparison with SNB estimates of valuation changes for portfolio holdings

In a special topic section of SNB (2018), the Swiss National Bank published estimates of the composition of annual changes in the value of portfolio holdings from 2002 to 2017. Our estimates are computed at a quarterly frequency for portfolio equity, portfolio short-term debt, and portfolio long-term debt. We aggregate our estimates at an annual frequency and check our numbers against the estimates computed by the SNB.

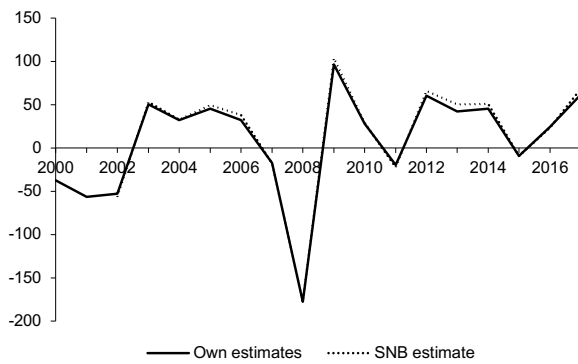
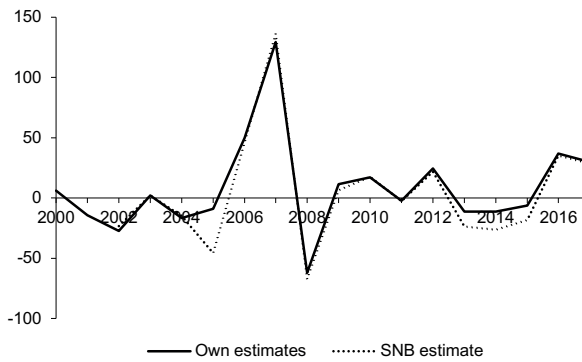
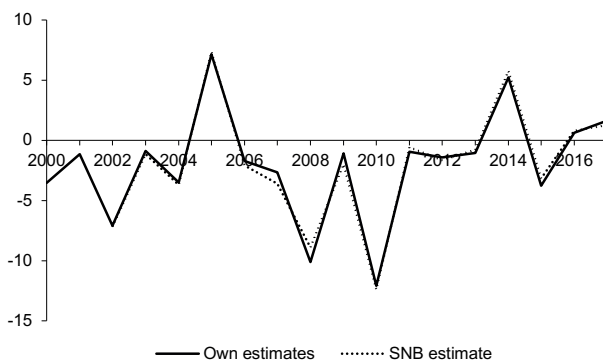
The valuation changes for assets are shown in Figures A.1-A.3 (foreign exchange valuation, price valuation, and other valuation, respectively), which contrast our estimates and the SNB numbers. The numbers are very close.<sup>19</sup> This is also the case for the estimates for liabilities (Figures A.4-A.6) and the net position (Figures A.7-A.9).

**Figure A1:** FX valuation, assets (Chf billion)

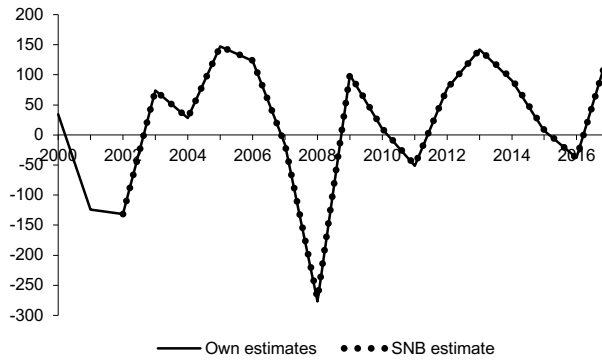


<sup>18</sup> The only exception is in the second quarter of 2000, when the value of reserves jumps. We attribute this to the introduction of market valuation of some reserves and put the whole change (net of financial flows and exchange rate valuations) as an “other valuation” effect.

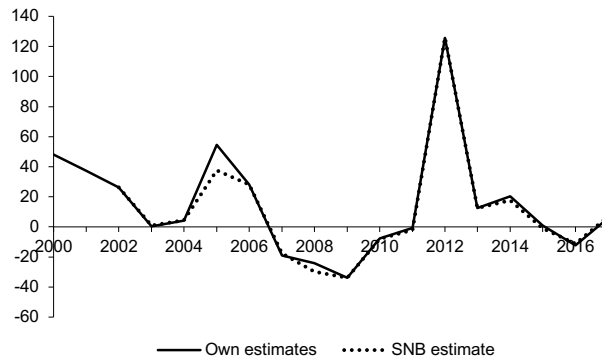
<sup>19</sup> Small gaps in the foreign exchange valuation effect are due to the SNB using the US dollar exchange rate for positions in other currencies, whereas we use our composite exchange rate index.

**Figure A2:** Price valuation, assets (Chf billion)**Figure A3:** Other valuation, assets (Chf billion)**Figure A4:** FX valuation, liabilities (Chf billion)

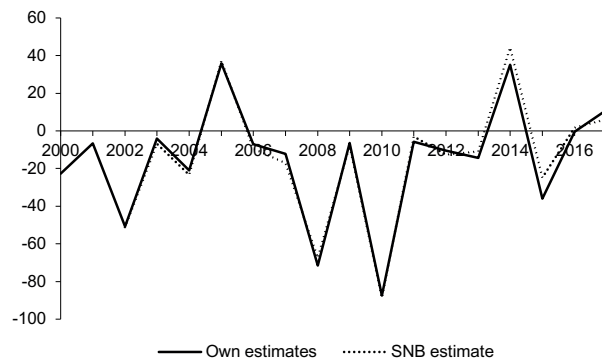
**Figure A5:** Price valuation, liabilities (Chf billion)

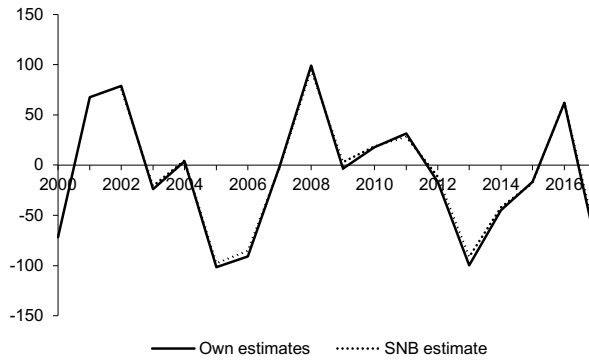
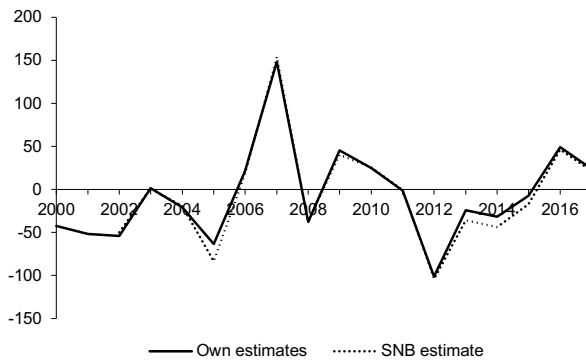


**Figure A6:** Other valuation, liabilities (Chf billion)

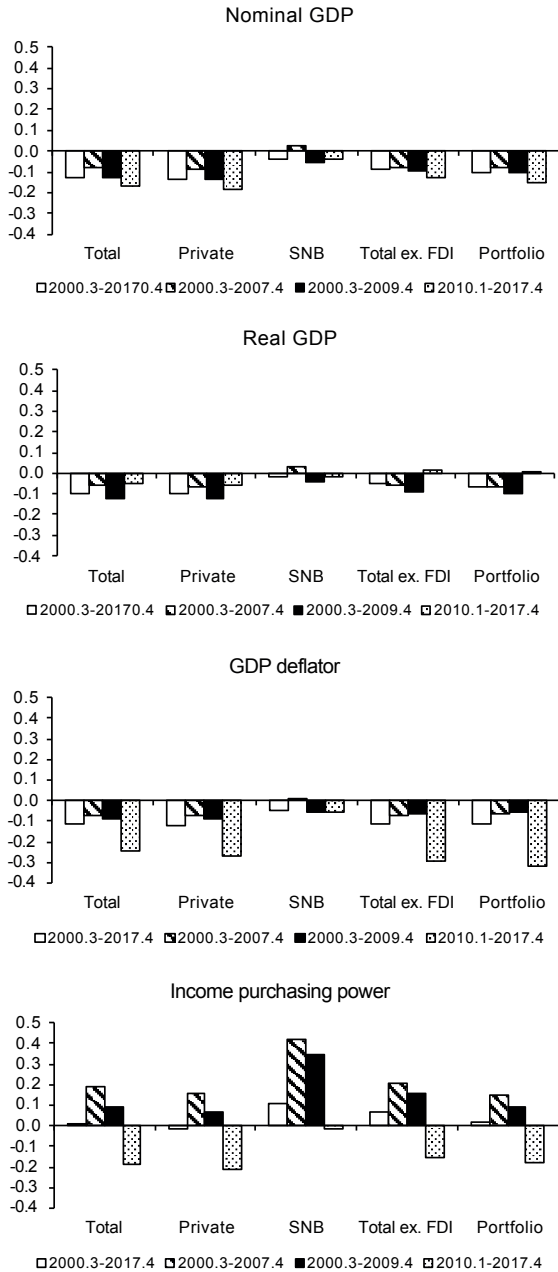


**Figure A7:** FX valuation, net (Chf billion)



**Figure A8:** Other valuation, liabilities (Chf billion)**Figure A9:** FX valuation, net (Chf billion)

**Figure A10:** Correlation of net financial income with GDP  
Swiss GDP growth, quarter-to-quarter changes



**Figure A11:** Correlation of net financial income with GDP  
Swiss GDP growth, 4 quarter-to-4 quarter changes

