



SWITZERLAND

SELECTED ISSUES

June 2019

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June 4, 2019

Approved By
**The European
Department**

Prepared by Apostolos Apostolou, Sylwia Nowak (both EUR),
Tryggvi Gudmundsson (MCM), and Shafik Hebous (FAD).

CONTENTS

THE SWISS FRANC—LIVING IN A MULTIPOLAR WORLD	3
A. Introduction	3
B. Related Literature	4
C. Estimating the De Facto Swiss Franc Currency Regime	4
D. Interpretation and Implications	8
TABLE	
1. Swiss Franc Exchange Regime Estimation Results	6
References	11
SWITZERLAND'S INTERNATIONAL RESERVES	13
A. Reserve Accumulation	13
B. Some Additional Motives for Holding Reserves	14
C. Reserve Management and Asset Allocation	15
D. Reserve Coverage, Gross International Liabilities, and SNB Capital, Income and Distribution	17
References	20
SWITZERLAND: CROSS-BORDER WAGE GAPS—POSSIBLE DRIVERS	21
A. Drivers of Swiss Wages—Stylized Facts	22
B. Are Swiss Wages in Line with Swiss Fundamentals?	25
C. What Explains the Dynamics of Cross Border Wage Gaps?	28
D. Conclusions	31

FIGURE

1. Swiss Wages in the International and Regional Context, 1991–2017	22
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TABLES

1. Estimates of Wage Phillips Curves	27
2. Short-term Drivers of Nominal Wage Gap	30

ANNEXES

I. Cross Border and Posted Workers	32
II. Cointegration Tests	34

References	35
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FISCAL FEDERALISM IN SWITZERLAND 36

A. The Fiscal Role of Cantons	36
B. Inter-Governmental Fiscal Transfers	39

FIGURES

1. Expenditure and Tax Decentralization in OECD Countries, 2016	36
2. Public Debt by Government Level	37
3. Cantonal Debt (Maastricht Definition), 2016	38
4. Resource Equalization, 2018	39

TABLE

1. Task Allocation Across Levels of Government	37
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THE SWISS FRANC—LIVING IN A MULTIPOLAR WORLD¹

A. Introduction

1. With Switzerland being a globally-integrated small open economy, major international currencies and their associated monetary policies likely provide important reference points for the Swiss franc and the operation of Swiss monetary policy. Nonetheless, the behavior of the Swiss franc relative to the US dollar and to the euro has shifted significantly during the past decade:

- Before 2010, the franc was relatively stable against the euro (blue line), while its movements against the US dollar (red line) paralleled those of the euro vis-a-vis the dollar (green line);
- During 2010 to end-2011, the franc strengthened against both the euro and the US dollar;
- Between end-2011 and early-2015, the SNB maintained an exchange rate floor for the Swiss franc against the euro, and hence both currencies moved together relative to the dollar; and
- Since early-2015, following removal of the exchange rate floor and subsequent appreciation against both currencies (but more so relative to the euro, which weakened against the dollar), the franc has tended to depreciate somewhat against both currencies.

2. This paper models the evolving behavior of the Swiss franc relative to the world's major reserve currencies and considers possible reasons for the shifts. Economic fundamentals, including country-partners and currency of denomination of Swiss trade and finance, are likely to affect which currencies the franc co-moves with, although these factors tend to change only slowly. The behavior of the Swiss franc may have also been affected by the global financial crisis and its aftermath, as well as the shift in recent years from synchronized to divergent monetary policies by the major central banks. The extent of flexibility along the currency stability—monetary policy-independence continuum under the monetary trilemma will determine how closely the franc moves with its anchor currencies.² To gain insights into these issues, this paper estimates the extent to which the Swiss franc comoved with the major currencies during the past two decades, as well as the

Bilateral Exchange Rate

(Index - 1999 January = 100, increase = CHF appreciation & EUR appreciation against US dollar)



Sources: Bloomberg Finance L.P.; and IMF staff calculations.

¹ Prepared by Apostolos Apostolou (EUR) and Tryggvi Gudmundsson (MCM). The paper benefited from comments and suggestions from Christian Grisse and colleagues from the Swiss National Bank.

² The term “anchor currency” should be interpreted in an observational sense as the franc was never pegged on a de jure basis.

extent of fixity of the franc relative to the estimated reserve currency “anchor baskets.” The estimated currency weights are then considered in the context of fundamental factors that might influence which currencies the Swiss franc comoves with, and the weights are used to calculate an effective foreign interest rate relevant for Switzerland.

B. Related Literature

3. Identifying reserve currency blocks and the de facto behavior of currencies is an ongoing pursuit. The gap between de jure and de facto exchange rate regimes has been extensively documented. Many countries, especially emerging markets, tend to maintain less-flexible arrangements than suggested by their official regimes, which has been attributed to fear of floating (Calvo and Reinhart, 2012). Tovar and Nor (2018) find that the international monetary system has transitioned from a bi-polar to a tri-polar one, with an increasing role for the renminbi. Ilzetzi and others (2019) find that despite the prediction of a more multipolar system, the US dollar remains the dominant global anchor currency (or reference currency in the case of more flexible arrangements). They also find the euro to be the only other major anchor currency, although its sphere of influence is limited to Europe, and only a few examples of dollar-euro baskets have existed. McCauley (2014) finds that the euro’s importance was growing prior to the GFC—with its sphere of influence extending to Australia, New Zealand, Canada and Latin America—but has since retreated alongside an increasing role for the dollar.

4. A related issue is how closely countries peg to the anchor currency (basket). The purported widespread adoption of inflation forecast targeting in recent decades was generally believed to have led to more flexible exchange rates. Bracke and Bunda (2011) find evidence of greater exchange rate flexibility among Central and Eastern European and CIS countries. On the other hand, while Ilzetzi and others (2019) find an increase in the number of intermediate managed-float and target-zone regimes, they conclude that the world remains heavily skewed toward less-flexible arrangements.

5. Available characterizations of Switzerland’s de facto exchange rate regime convey a mixed picture and may not apply to the most recent period. Prior to the floor with the euro, Bracke and Bunda (2011) conclude the franc was very flexible, with the euro playing only a limited anchor role. For the period since the floor, Ilzetzi and others (2019) characterize the franc as a de facto moving band linked to the euro within a relatively narrow range. This latter characterization therefore does not detect any recent influence of the dollar on the franc.

C. Estimating the De Facto Swiss Franc Currency Regime

6. The two dimensions of exchange regimes—the anchor currency (basket) and the degree of exchange rate flexibility—should be identified simultaneously. This makes it possible to determine whether changes in the value of a country’s currency are due to co-movement with its anchor(s) or result from less-fixity around a central parity. Frankel and Wei (2008) and Frankel and Xie (2010) present an approach that synthesizes these steps into a single equation estimation model.

Flexibility is determined by whether shocks to demand for a currency translate into the price of the currency (floating), the quantity of the currency (fixed) or some combination (intermediate regime).³ Identification of the anchor currency (basket) is obtained by regressing changes in the value of the currency on changes in the value of potential candidate anchors.

7. Following the models proposed by Frankel and Wei (2007, 2008) and Frankel and Xie (2010), the de facto Swiss franc regime is estimated by regressing changes in the Swiss franc on a weighted average of changes in leading reserve currencies. Each currency is valued in terms of the SDR,⁴ and enters as a percentage change to reduce the likelihood of nonstationarity while also allowing for the inclusion of a constant term to reflect a possible trend appreciation (or depreciation) in the level of the currency relative to its “basket”. Additionally, we include an exchange market pressure term, defined as the sum of the percentage change in the value of the currency and the percentage change in the stock of base money. The specification is as follows:

$$\begin{aligned} [\Delta \log CHF_t - \Delta \log GBP_t] &= c + \\ w_1[\Delta \log EUR_t - \Delta \log GBP_t] &+ w_2[\Delta \log USD_t - \Delta \log GBP_t] + \\ w_3[\Delta \log JPY_t - \Delta \log GBP_t] &+ \beta \text{ EMP} + u_t \\ \text{where EMP} &= [\Delta \log CHF_t + \Delta \log MB_t] \end{aligned}$$

CHF, USD, EUR, JPY and *GBP* denote the value of the currencies relative to the SDR. Monetary base is denominated in Swiss franc. The coefficients, w_i , capture the weight of each currency in the de facto exchange rate basket, where their sum is constrained to unity.⁵ β measures the extent of de facto exchange rate flexibility, and multiplies a measure of exchange market pressure (EMP) defined as the percentage change in CHF relative to the SDR plus the percentage change in the SNB’s monetary base. When β is equal to zero, changes in EMP do not affect the value of the franc, implying a pegged regime, whereas a value of unity implies a pure float because *MB* does not change.⁶ The estimation is performed using ordinary least squares on monthly data for the period July 1999 to January 2019.

³ Demand shocks are measured using exchange market pressure. See Country Report No. 18/174.

⁴ If the currency follows a peg, identification of the basket will be precise (an R^2 of 100 percent), irrespective of the choice of numeraire. Alternatives to the SDR, including the Australian and New Zealand dollars, were tested as numeraires, and resulted in similar estimation outcomes.

⁵ This condition is imposed by subtracting the percentage change in the pound-SDR exchange rate from the left side of the equation and the percentage change in the pound-SDR weighted by the remaining currency weights from the right-hand side of the equation. The weight on the pound can be recovered as the difference between unity and sum of the other currency weights.

⁶ If the regime is a peg (to the anchor currency or basket), then the value of the currency—the first term in the EMP variable—does not change in response to a demand shock for the currency, which instead will be absorbed by a change in monetary base—the second term in the EMP variable. To ensure that the change in the value of the EMP

(continued)

8. To capture possible changes in the exchange rate regime over time, the sample is split into four periods. Three breaks are assumed, resulting in four separate sub-periods:⁷

- i. July 1999–December 2007, corresponding to the period prior to the GFC;
- ii. January 2008–August 2011, corresponding to the GFC;
- iii. September 2011–December 2014, corresponding to the period with the minimum exchange floor against the euro; and,
- iv. January 2015–January 2019, corresponding to the period after the exchange floor.

9. The empirical model performs well overall, although fit (measured by R²) is relatively weak during the period of the GFC. The fit is especially strong for the most recent period (90 percent) and moderate for the first and third intervals (around 75 percent). Nonetheless, even when the overall fit is relatively weak, where the currency weights are of an economically-meaningful size, they are highly statistically significant.

Table 1. Switzerland: Swiss Franc Exchange Regime Estimation Results

Variable	July'99 - December'07		January'08 - August'11		September'11 - December'14		January'15 - January'19	
	coefficient	p-value	coefficient	p-value	coefficient	p-value	coefficient	p-value
Constant	0.000	0.612	0.006	0.212	0.001	0.735	-0.005	0.005
$\Delta\log\text{EUR} - \Delta\log\text{GBP}$	0.748	0.000	0.694	0.000	0.918	0.000	0.495	0.000
$\Delta\log\text{USD} - \Delta\log\text{GBP}$	0.063	0.233	-0.024	0.903	-0.212	0.036	0.375	0.000
$\Delta\log\text{JPY} - \Delta\log\text{GBP}$	0.123	0.003	0.320	0.027	0.030	0.655	0.160	0.041
EMP	0.154	0.000	-0.011	0.713	-0.066	0.002	0.570	0.000
R-squared	0.781		0.589		0.781		0.907	

Source: IMF staff calculations

10. Several notable empirical results are evident:

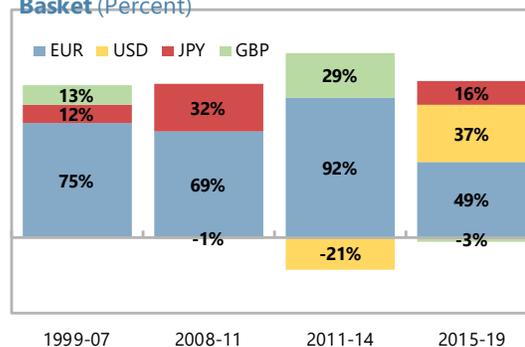
- The euro has had a major weight in the estimated franc “basket” since the beginning of the sample period, while the role for the dollar has increased considerably in recent years. The weight of the euro rose from 70–75 percent prior to and during the GFC, and peaked at more than 90 percent during the period of the floor. The yen’s weight in the “basket” increased

variable does not affect the dependent variable—as would be the case under a peg—then β must be close to zero. In the case of a pure float, a shock to demand for the currency would be absorbed in the exchange rate—the first term in the EMP variable—with no change in monetary base—the second term. To ensure the EMP variable moves with the dependent variable, β must be close to unity.

⁷ The Bai-Perron test for break points identified only two significant breakpoints: May 2010 and September 2014. However, residuals for the two years prior to the first of these breakpoints—coinciding with the onset of the GFC—had a systematically-positive mean, suggesting that the behavior of the franc had already changed during these two years. We therefore impose an earlier first break as well as an additional break corresponding to the period of the floor.

sharply to around one-third during the GFC. With sizable weights on the euro, dollar and the yen since the removal of the exchange rate floor, the franc can be characterized as a multipolar “basket.” The weight of the pound is relevant mainly during the time of the floor, which likely reflects identification issues owing to co-movement of the pound with the euro.⁸

Shares in the de Facto Swiss Franc Exchange Rate Basket (Percent)



Sources: IMF staff calculations

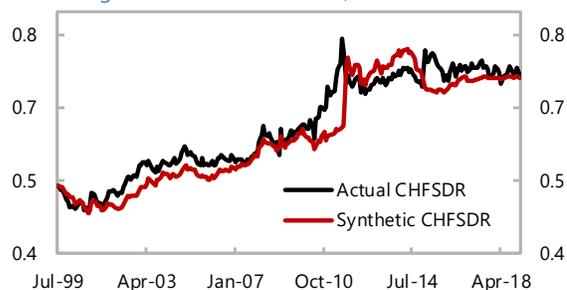
- The franc tracked the estimated currency “baskets” very closely prior to the GFC and during the floor (i.e., the coefficient on EMP is small), implying that idiosyncratic shocks to the franc were absorbed mostly through changes in monetary base.⁹ Since removing the floor, monetary policy has become considerably more flexible (the coefficient on EMP has risen from around zero to 57 percent).
- A coefficient of close to zero on the constant term in each of the four periods implies that the franc does not display a trend with respect to its implied “baskets.”¹⁰ Nonetheless, the franc has appreciated relative to the SDR because reserve currencies which tended to appreciate (notably the yen) have a larger weight in the franc’s “basket” than in the SDR basket.

11. A synthetic Swiss franc reveals the extent of idiosyncratic market pressure on the currency since the onset of the GFC.

A synthetic franc can be derived by cumulating up the time-varying “basket-weighted” changes in the reserve currencies, using the actual level of the CHF-SDR exchange rate at the beginning of each of the four intervals as the starting points. Comparing the synthetic with the actual value of the franc during 2010–11 indicates the large divergence of the franc from its reserve-currency linkages, which peaked at nearly 25 percent in August 2011. This provides a gauge of the extent of safe haven pressure exerted on the franc at that time. By contrast, appreciation pressures triggered by the realignment of monetary policies of major central banks (interest rate lift-off by the Federal Reserve and introduction of asset purchases and negative rates by the ECB) and exit of the franc from the euro

Actual and Synthetic CHF Against SDR

(Level, increase = CHF appreciation, synthetic CHFSDR rebased for actual values of 1999 June, 2007 December, 2011 August and 2014 December)



Sources: IMF staff calculations.

⁸ A negative weight on the dollar during the floor implies that the franc was moving in the opposite direction to the dollar because the euro and the dollar were diverging.

⁹ During the GFC, the coefficient on EMP—though small—is insignificant. During this time, the franc both appreciated and monetary base grew strongly.

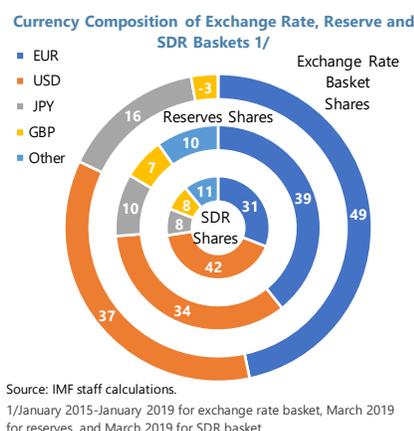
¹⁰ The coefficients are not significant during the first three periods, and only marginally so during the most recent period.

floor around late 2014-early 2015 induced a smaller, but still substantial appreciation of the franc even as the synthetic franc was weakening.

D. Interpretation and Implications

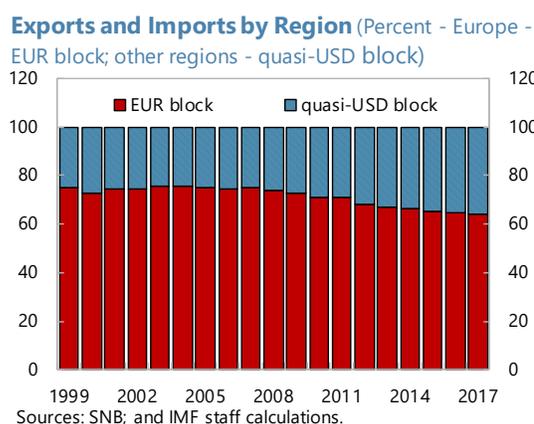
12. The implied regimes align well with Switzerland’s de facto exchange rate arrangements and monetary policy frameworks. As documented in the IMF’s AREAER, the official exchange rate arrangement prior to and subsequent to the exchange rate floor is free floating, coupled with an “other” monetary policy framework. On a de facto basis, the regime was classified as a crawl-like arrangement during the period of the exchange rate floor, and was reclassified as floating after the floor was removed in 2015. According to the AREAER (2016), numerous countries moved to more flexible or less clearly defined exchange rate arrangements around that time due to heightened uncertainty in global economic and financial conditions.

13. The weights in the estimated exchange rate “basket” during the most recent period are now more aligned with the currency composition of the SDR basket. The change in the structure of the currency “basket”—which was previously dominated by the euro—has brought it closer to the SDR basket, although the weight on the euro and the yen are higher than in the SDR. The exchange rate weights are also relatively similar to the currency composition of the SNB’s reserves (see accompanying Selected Issues Paper).



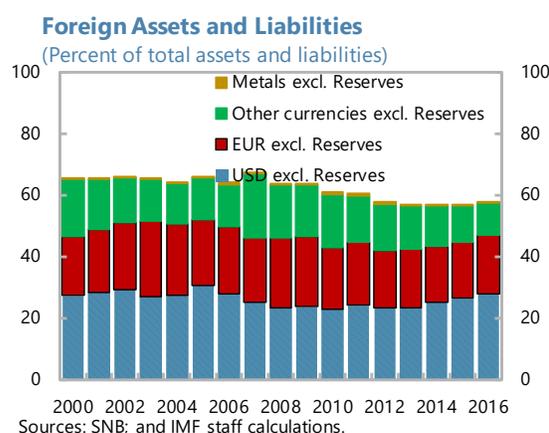
14. The implied currency weights and greater diversification of the “basket” accords well with Switzerland’s economic fundamentals:

- A large weight on the euro is consistent with its important role in Swiss trade, although the dollar’s share in trade has risen. About two-thirds of Switzerland’s external trade is conducted with European countries, where the euro is likely the currency of invoicing and medium of exchange. The trade share with the US and the rest of the world, where the US dollar is likely to be important, has risen somewhat during the past decade, reaching around 30 percent. Swiss exports tend to be oriented to the quasi dollar-block region while imports are sourced mostly from Europe. This accords with Gopinath and others (2018), who report that 53 percent of Swiss imports are invoiced in euros, while 13 percent are invoiced in dollars. Beyond trade, the euro



has added importance for Switzerland in view of its open labor market with the EU (see accompanying Selected Issues paper) and cross-border competition from EU firms.

- *A sizable weight on the dollar in the franc currency “basket” is consistent with Switzerland’s role as financial center.* The dollar remains the dominant currency in international finance.¹¹ About half of Switzerland’s FX-denominated private-sector foreign assets and liabilities are held in dollars, and a third are euros. A significant weight on the dollar and the euro therefore helps to limit currency risk in the context of financial dollarization and—to a lesser degree—financial euroization. The much-deeper spot and swap markets for the franc-dollar pair than for the franc-euro pair (as reported in the BIS Triennial Survey (2016)) also supports a sizable weight on the dollar in the currency “basket.”



- *Increased demand for safe assets during and since the GFC may have also affected the behavior of the franc vis-à-vis other currencies.* To varying degrees, the US dollar, yen and the franc have in common the characteristic of a safe-haven currency. Jäggi and others (2016) find that negative surprises to the world economy cause the franc and the yen to appreciate, and that during the GFC, these currencies reacted more strongly to negative surprises than to positive ones. In line with this finding, one would expect that during risk-off episodes, demand for safe-haven currencies would tend to increase, causing them to co-move while appreciating against other currencies. These factors may explain the increased weight on the yen during the GFC.¹² The shift in recent years to a more-diversified currency “basket” for the franc, with a greater role for the dollar and yen, may also reflect this common safe-asset characteristic.
- *Divergence of monetary policies by major central banks may have also contributed to a more diversified “basket.”* Prior to and during the crisis, the monetary policy loosening cycles of the Federal Reserve and the ECB were relatively closely aligned. As a result, tracking only one of these currencies was not too dissimilar from tracking both. However, the more asynchronous policies in recent years would tend to discourage excessive concentration on any individual reference currency in favor of a more diversified “basket.”

15. The approach used in this paper identifies how the franc co-moves with the major reserve currencies, but is agnostic about the driving forces behind these moves. Is the franc’s behavior driven by markets, the result of policy or divine coincidence? McCauley (2014) observes that policy and market trading tend to align currencies into zones of shared movement. Relatively-

¹¹ Gourinchas and Rey (2017).

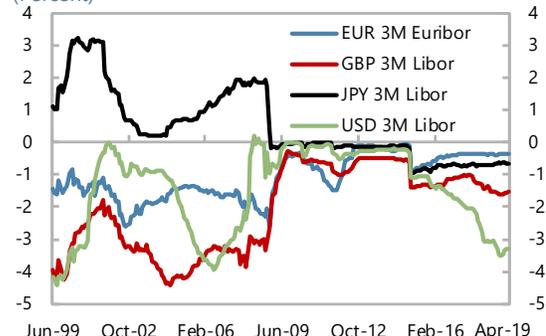
¹² McCauley (2014) finds instances of a negative currency weight on the yen, which tends to move inversely to the dollar, reflecting carry trade behavior.

deep markets for the Swiss franc and franc-denominated assets suggest that market trading plays an important role in moving the franc in the direction that market participants want it to go, implying that persistent divergence between policy and markets would be costly. Moreover, reverse causality, reflecting spillovers from policy actions by other central banks, is also likely to affect the behavior of the franc. Thus, in the absence of capital controls, and if policies are credible, whether markets or policies drive exchange rates is largely moot.

16. An effective foreign interest rate can shed light on the challenges facing a financially-globalized small economy in a multipolar world.

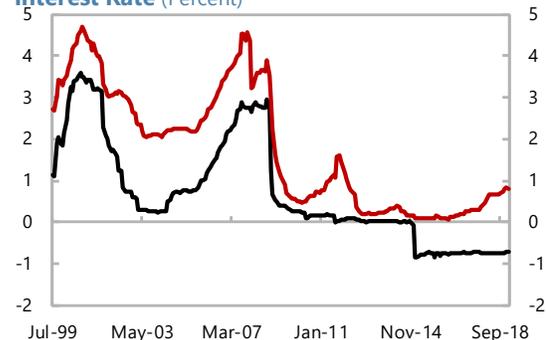
Except for the yen, Swiss 3-month LIBOR was below comparable rates for the other major reserve currencies prior to the GFC. The negative differential between the Swiss interest rate and the effective foreign interest rate—defined as the time-varying “currency basket”-weighted interest rates—averaged around one percentage point before the crisis.¹³ During the GFC, the effective interest differential was compressed as central banks converged simultaneously to the zero lower bound (ZLB). However, Switzerland not only faced the ZLB constraint earlier than other countries (because its initial rates were lower), it also faced a lower bound on the effective interest differential, and was thus squeezed from below and above. As a result, Switzerland experienced large inflows that appreciated the franc. To partly restore the historical differential, a negative policy rate was introduced at a rate below the ECB’s, helping to lessen the extent of appreciation pressure. The policy stances of the Federal Reserve and the ECB began to diverge around 2015. While the bilateral interest differential with the US widened, it remained compressed with the euro. This shift to asynchronous monetary policies by reference currencies—both of which are important for Switzerland’s real and financial sectors—likely contributed to the greater diversification of Switzerland’s “currency basket” in recent years.

Interest Rate Differential With the CHF 3M Libor (Percent)



Sources: Bloomberg Finance L.P.; and IMF staff calculations.

Actual CHF 3 month Libor and Effective Foreign Interest Rate (Percent)



Sources: Bloomberg Finance L.P.; and IMF staff calculations

¹³ Adjusted for expected exchange rate changes, this negative interest differential can be considered the return discount investors are willing to forego in order to hold franc-denominated fixed income assets.

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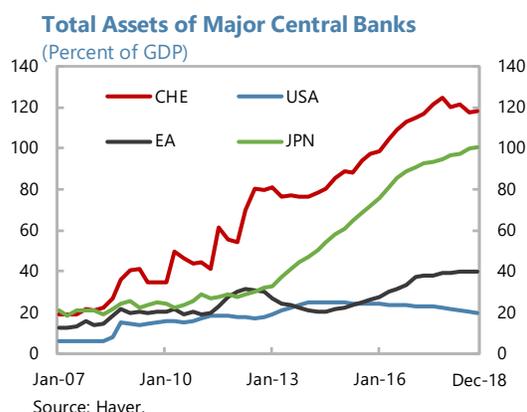
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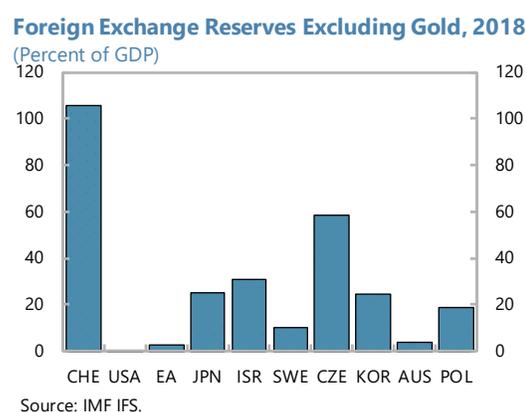
SWITZERLAND'S INTERNATIONAL RESERVES¹

A. Reserve Accumulation

1. Monetary policy actions since the onset of the GFC have significantly expanded the SNB's balance sheet and international reserves. Prior to the crisis, the SNB's balance sheet was small and similar in size to that of other major central banks. Since then, foreign exchange purchases by the SNB and returns on these assets have grown its balance sheet, which now stands at around 120 percent of GDP, one of the largest in the world relative to GDP. Unlike some other major central banks, the increase was due to purchases of foreign—rather than domestic—assets. Interest income and dividends received on these foreign assets will continue to passively raise international reserves, while changes in foreign prices of these assets and in the value of the franc will also affect the stock of reserves.



2. The SNB's focus on foreign assets reflects the relatively small stock of Swiss franc assets and the large role of the exchange rate in inflation developments. Early in the global financial crisis (GFC), the SNB expanded the money supply by raising its holdings of a range of assets, including Swiss franc securities (mainly bonds issued by the domestic private sector).² However, given the relatively small size of franc-denominated asset markets, that domestic credit growth remained robust and the risk of severe deflationary pressure given the franc's status as a safe haven, the SNB increasingly focused on unsterilized foreign exchange purchases to expand its balance sheet and effectively support inflation and growth once the policy interest rate had been reduced close to zero. To further counter deflationary pressure, in September



Year	Switzerland
1999-2010	Floating
2011	Other managed arrangement
2012	Other managed arrangement
2013	Crawl-like arrangement
2014	Crawl-like arrangement
2015	Floating
2016	Floating
2017	Floating

Source: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions

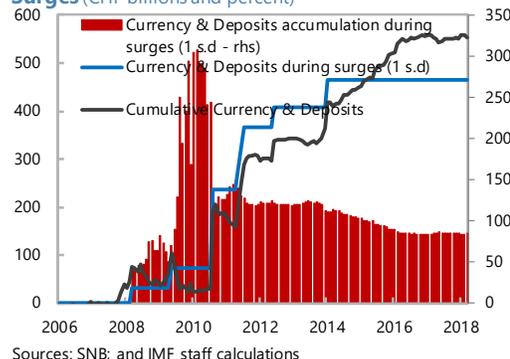
¹ Prepared by Apostolos Apostolou (EUR). The paper benefited from comments from colleagues at the Swiss National Bank.

² See https://www.snb.ch/en/mmr/reference/annrep_2009_rechenschaft/source/annrep_2009_rechenschaft.en.pdf.

2011, the SNB introduced an exchange rate floor against the euro, thereby committing to purchase foreign exchange to prevent the franc from strengthening. Removal of the floor in early 2015, even though it was accompanied by the introduction of a negative policy interest rate, saw additional large inflows and led to further accumulation of reserves.

3. The SNB's FX purchases were concentrated into relatively few episodes. Intervention, as proxied by the sum of changes in sight deposits at the SNB and currency in circulation, was especially large in August 2011, and purchases were also sizable around April 2010, June 2012 and January 2015.³ Around 85 percent of cumulative foreign exchange purchases occurred during inflow surge episodes (defined as monthly purchases that exceeded the mean by 1 standard deviation or more).⁴ Unlike some other central banks, intervention occurred mainly in the spot market.

SNB Currency and Deposits Accumulation During Surges (CHF billions and percent)



B. Some Additional Motives for Holding Reserves

4. While the SNB's stock of reserves is a by-product of its constrained monetary policy, there are a number of reasons why it—together with other central banks—may wish to hold reserves. The literature shows that during financial crises, including the GFC, central banks provide substantial emergency liquidity assistance in domestic and foreign currencies (Domanski and others (2014), CGFS (2010), Ghosh and others (2017)). In fact, some advanced and emerging countries pursuing inflation targeting have acquired significant reserves since the GFC, including Sweden, Israel, the Czech Republic and Poland. The two Swiss G-SIBs—which are very large relative to the size of the domestic economy—as well as several domestically-focused banks are active in international financial markets. These financial institutions' own liquid foreign-currency assets should provide the first line of defense during liquidity stress. However, during extreme episodes of market disruption, temporary provision of foreign exchange liquidity by the central bank may be warranted to protect financial stability.

5. Prior to the GFC, the prospect of losing exchange market access and of external-sector crises was perceived to be remote for a reserve-currency country such as Switzerland.

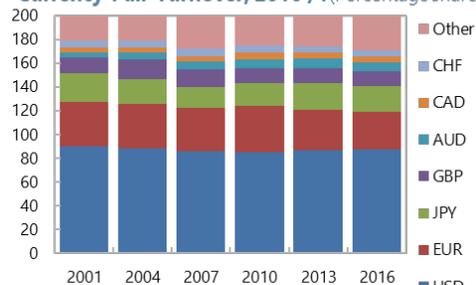
However, the onset of the crisis caused the market for US dollars to freeze as risk-averse investors hoarded what was perceived to be the global safe asset, while concerns about counterparty risk

³ The proxy for intervention (sum of changes in sight deposits at the SNB and currency in circulation) excludes passive inflows due to income on reserves and valuation changes, both of which affect the level of international reserves (measured in Swiss francs) on the asset side of the SNB's balance sheet. This measure also does not take into account other changes in the composition of SNB liabilities, which contributed to the surge in sight deposits in August 2011.

⁴ As the SNB conducted FX swaps during 2008–12, the cumulative share of purchases (including the first leg of FX swaps) occurring during surge episodes exceeded 100 percent for some time.

caused repo markets to seize. As with other major international banks, the two Swiss G-SIBs were affected by foreign exchange liquidity shortages. Moreover, the declining share of the Swiss franc in global foreign exchange market turnover—which has accelerated since the GFC—may indicate a less-liquid market for the Swiss franc, which could intensify during stress periods, creating the need for precautionary balances.⁵ On the other hand, as occurred during the GFC, the SNB may be able to participate in currency swap arrangements in the event of severe international financial market stress, thereby reducing the need to hold foreign exchange reserves.⁶

Distribution of OTC Foreign Exchange Bilateral Currency-Pair Turnover, 2016 /1 (Percentage shares)



Source: BIS Triennial Central Bank Survey of foreign exchange and OTC derivatives.

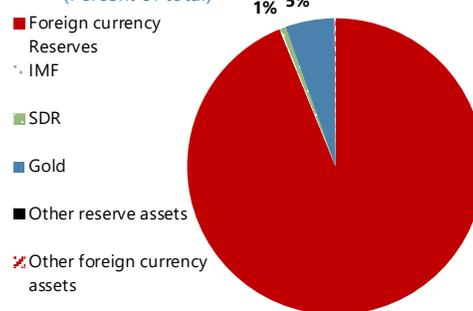
/1 As two currencies are involved in each transaction, the sum of shares in individual currencies will total 200 percent.

C. Reserve Management and Asset Allocation

6. The SNB’s management of its reserves is governed by investment policy guidelines.⁷

Monetary policy takes primacy over foreign exchange reserve management in order to avoid conflicting objectives. Reserve management is guided by security, liquidity and return on investment. As one of the world’s major investors, the SNB seeks to avoid disrupting the markets in which it participates,⁸ thereby creating a preference for deep markets and adjusting gradually to its desired portfolio. It also implies that the currencies purchased in the context of intervention need not be the same as the ultimate basket of currencies in its reserve’s portfolio. The SNB’s Governing Board sets the broad investment principles and strategy, while the SNB’s Asset Management unit implements the strategy, and its Risk Management unit monitors implementation.⁹

SNB’s Foreign Assets (Percent of total)



Sources: SNB; and IMF staff calculations.

7. The SNB’s reserve portfolio comprises of gold and highly-rated sovereign bonds, as well as other assets that are less-commonly held by central banks:

⁵ Advanced economies that do not issue a reserve currency or have no automatic access to reserve currencies through standing swap lines may need precautionary reserve buffers in the event of foreign exchange or external funding pressures (IMF, 2016).

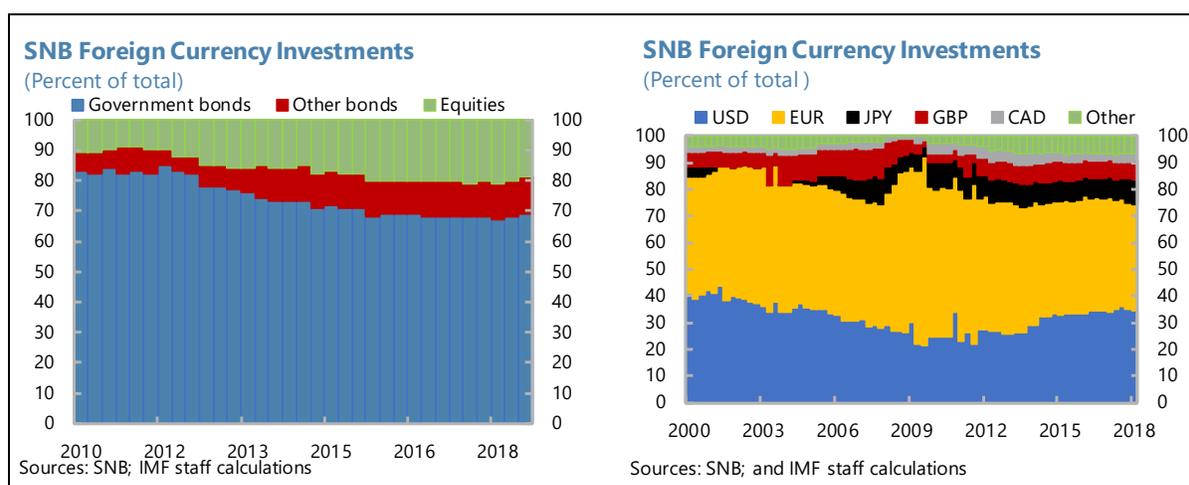
⁶ Standing currency swap lines exist between the Federal Reserve, European Central Bank, Bank of England, Bank of Canada, Bank of Japan and the Swiss National Bank.

⁷ See https://www.snb.ch/en/mmr/reference/snb_legal_richtlinien/source.

⁸ Speech by SNB Governing Board member Zurbrugg (2012) “Challenges Posed by the Growth in the SNB’s Foreign Exchange Reserves.” (https://www.snb.ch/en/mmr/speeches/id/ref_20121108_zur).

⁹ Reports are provided regularly to the SNB’s Governing Board and Council.

- Gold represents around five percent of the SNB's foreign assets.
- Of foreign currency assets, nearly 70 percent are held in government bonds (including deposits at central banks and the BIS), 12 percent are in corporate and other bonds, while equities account for one-fifth.¹⁰
- By currency, nearly 40 percent is in euros, 35 percent is in US dollars, with eight percent in Japanese yen and 15 percent in other currencies.
- Of fixed-income assets, just-below 60 percent are rated AAA, over 20 percent are rated AA, with most others A-rated.



8. Unlike for most other central banks, equities form a sizable share of the SNB's foreign exchange reserves, supporting diversification and higher returns. The equity portfolio consists of shares of mid- and large-capitalization companies in advanced economies and, to a lesser extent, shares of small-capitalization companies, as well as shares of companies in emerging economies. The SNB invests passively, based on a combination of standard equity indices spanning different markets and currencies. While this passive investment strategy ensures that holdings in individual companies remain as low as possible, it nonetheless implies that the SNB owns—in absolute terms—substantial equity positions in US companies with high market capitalization, including major US technology sector companies.¹¹ However, to avoid potential conflict of interest in the event the SNB has an informational advantage over other investors, the SNB does not invest in shares of mid- or large-capitalization banks. The SNB also does not own equities in companies that are “gross violators of ethical principles” (i.e., produce internationally-banned weapons, seriously violate fundamental human rights or systematically cause severe environmental damage). Consistent with

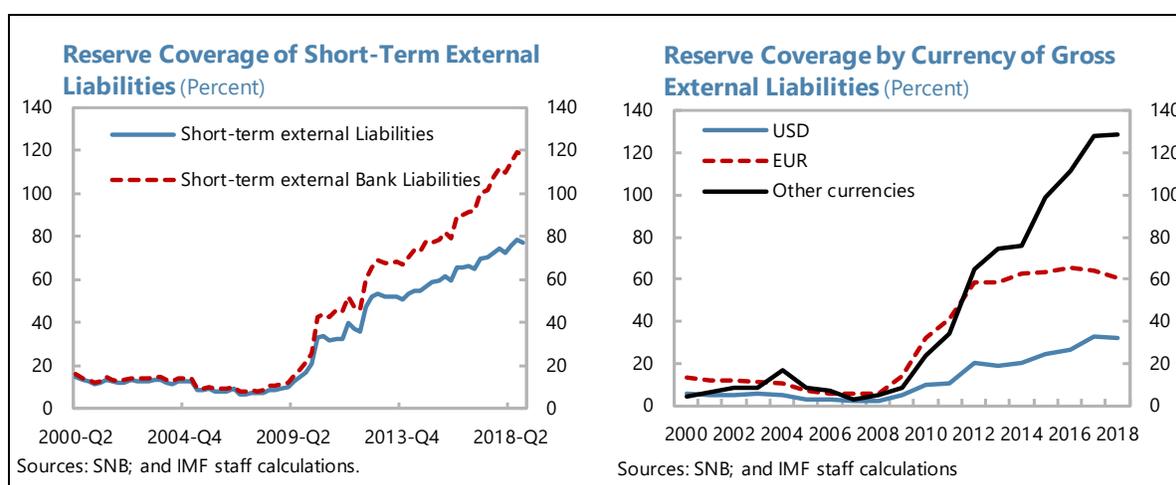
¹⁰ As of Q1:2019. Information is published quarterly. The SNB occasionally invests in derivatives such as futures or interest rate swaps (Zurbrugg, 2012).

¹¹ The SNB provides disclosures of its US equity holdings with the Securities and Exchange Commission. See <https://www.sec.gov/Archives/edgar/data/1582202/0001582202-16-000005-index.htm>.

being a passive investor, the SNB exercises its voting rights selectively, and instances are limited to ensuring good corporate governance.¹²

D. Reserve Coverage, Gross International Liabilities, and SNB Capital, Income and Distribution

9. Standard indicators suggest the SNB has adequate foreign reserves, notwithstanding a large financial sector. At around 120 percent of GDP, reserves cover around 22 months of imports. Reserves also cover around 120 percent of banks' short-term foreign liabilities and around three-quarters of economy-wide short-term foreign liabilities.¹³ Relative to gross foreign liabilities by individual currency, reserves cover a substantial portion, but with considerable variation across currencies.¹⁴



10. Reserves appear more-than-adequate from the perspective of foreign exchange mismatches.¹⁵ Banks are required to comply with liquidity coverage ratios on their foreign currency exposures. Moreover, for the private sector as a whole, foreign assets are denominated in foreign currencies, while foreign liabilities are mostly denominated in Swiss franc. This net long foreign currency position of the private sector is augmented by the long foreign currency position of the

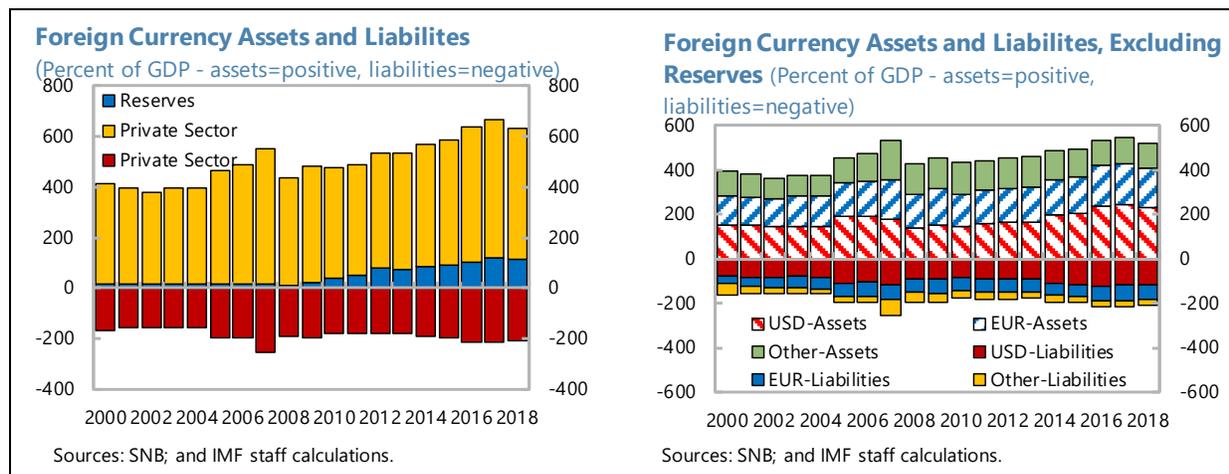
¹² Speech by SNB Governing Board member Maechler (2016), "Investment Policy in Times of High Foreign Exchange Reserves."

¹³ This excludes liabilities associated with Swiss banks' wealth management units (which are largely off-balance sheet).

¹⁴ While individual foreign-currency coverage may not matter when foreign exchange markets are operating smoothly, the market for some currencies could seize up during a rush for global safe assets or concerns about counterparty risk.

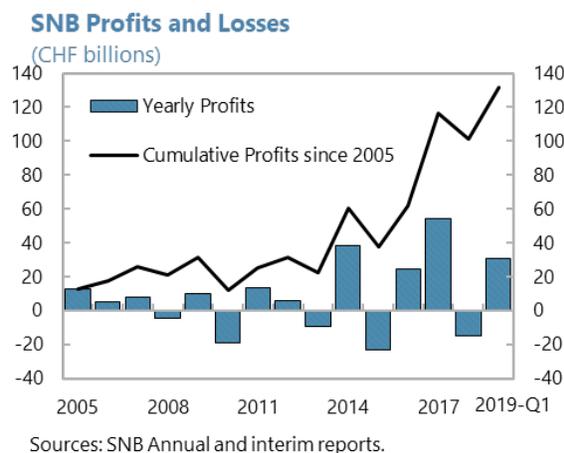
¹⁵ IMF (2016), "Guidance Note on the Assessment of Reserve Adequacy and Related Considerations" suggests reserve adequacy should be take into consideration reserve drains that can arise from on-and-off balance sheet activities.

SNB. Nonetheless, despite that in the aggregate the private sector is net long in foreign currency, the sector—or segments thereof—may still have foreign currency liquidity mismatches.¹⁶



11. The SNB has tended to earn a positive return on its reserves. Exchange rate fluctuations and changes in asset valuations¹⁷ generate mark-to-market gains and losses for the SNB.¹⁸

Moreover, because the NEER tends to increase over time, large FX reserves—whose fluctuations against the franc are unhedged (given that hedging is in effect a purchase of Swiss franc against other currencies, and could conflict with monetary policy goals)—tend to generate sizable valuation losses.¹⁹ Nonetheless, total returns (measured in Swiss franc terms) on reserves have averaged 2.6 percent since 2006, despite negative outcomes in five of those years. This reflects the generally-positive local-currency-denominated returns which have tended to offset losses from appreciation of the franc. Cumulative profits since 2006—mainly attributable to reserves—reached around one-sixth of 2018 GDP by early 2019.



¹⁶ For example, even though the private sector is long in foreign currency, its short-term foreign currency liabilities could exceed its liquid foreign currency assets.

¹⁷ Speech by President of the SNB Council Jean Studer (2018) "Spotlight on SNB profits and shares" discusses how the SNB's profits arise and how they are used.

¹⁸ See SNB 'Questions and answers on equity capital and profit appropriation'

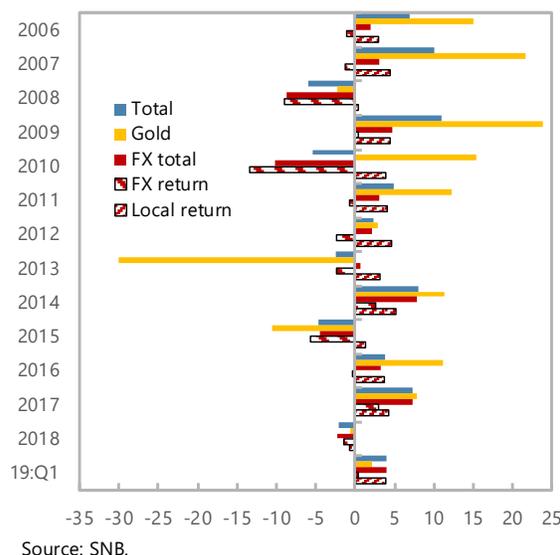
https://www.snb.ch/en/ifor/public/qas/id/qas_eigenkapital#t14.

¹⁹ For example, a 5 percent depreciation of the NEER would lower the value of reserves by around 6 percent GDP.

12. Profits are used to build capital and fund distributions to the general government.

Part of profits is used to raise provisions by a minimum of 8 percent per year, and a small amount is paid as dividends to shareholders. Current profit is also shared with the Confederation and cantonal governments in the amount of CHF 1 billion per year, with any remaining unallocated profit accumulated in a distribution reserve to support an additional annual CHF 1 billion disbursement to the Confederation and cantonal governments whenever the balance in that reserve exceeds CHF 20 billion. The SNB's provisions currently stand at CHF 73 billion (11 percent of GDP) and the balance in the distribution reserve is CHF 43 billion.

SNB Reserves—Return on Investments (In percent)



13. The SNB's large balance sheet and profits have at times attracted proposals on how these could be allocated or spent. Proposals to create a sovereign wealth fund, to more than double the share of gold in reserves, to invest in Switzerland, and to change the functioning of the SNB have been rejected so far.²⁰ Had they been approved, these proposals would have restricted the flexibility of the SNB to make monetary policy and reserve-accumulation decisions.

²⁰ More recently, an initiative has been proposed that would prohibit the SNB from investing in companies making weapons.

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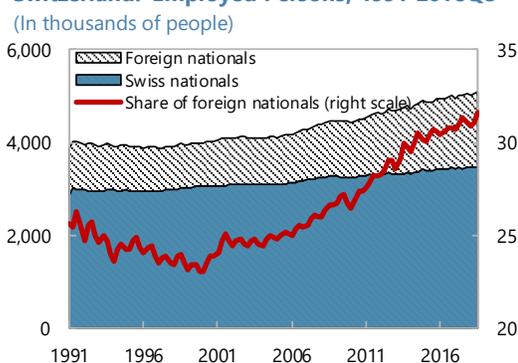
SWITZERLAND: CROSS-BORDER WAGE GAPS— POSSIBLE DRIVERS¹

Long-standing wage differences between Switzerland and its neighbors are found to reflect strong fundamentals, and have been sustained notwithstanding increased international labor mobility. Higher Swiss productivity accounts for much of the trend gap in wages, while appreciation surges temporarily widen the gap. Inflows of foreign workers, most of whom are highly skilled, have coincided with net job creation for Swiss workers, while also boosting average wages.

1. Wage differences between Switzerland and its neighboring countries are large and persistent. The average annual wage in Switzerland stood at US\$88 thousand in 2017, second only to Iceland among the OECD countries (Figure 1, panel 1). In particular, Swiss wages are considerably higher than those of its neighbors—Austria, France, Germany, Italy—at both the national and regional levels (Figure 1, panels 2 and 3). Specifically, country-average salaries in Austria, France, and Germany are about half of Swiss salaries, while average Italian salaries are a third.² Differences between neighboring cross-border regions are in some instances even larger.³ These wage gaps are a long-standing phenomenon and tend to widen as a result of Swiss franc appreciation surges.

2. The wage gaps have been sustained notwithstanding Switzerland’s open labor market with the European Union (EU). Following the coming into effect of a bilateral agreement on the free movement of workers and supply of services in 2002, the share of foreign nationals in Swiss employment has risen. Currently, about one-third of Swiss workers are foreign nationals, up from around 22 percent before the bilateral agreement.⁴ This increase in the foreign share of employment coincided with rising employment of Swiss nationals and with widening cross-border wage gaps. This paper explores the possible drivers of cross-border wage gaps. It first documents some stylized facts about the Swiss economy, and empirically tests their relevance for Swiss wage dynamics in the long- and short-run. The final section then studies the factors underpinning cross-border wage gaps.

Switzerland: Employed Persons, 1991-2018Q3



Sources: Federal Statistical Office.

¹ Prepared by Sylwia Nowak. This work has benefited from discussions with and comments from the Swiss authorities, including the Federal Finance Administration, State Secretariat for Economic Affairs and the Swiss National Bank.

² Gaps are somewhat narrower at skill levels used in elementary occupations.

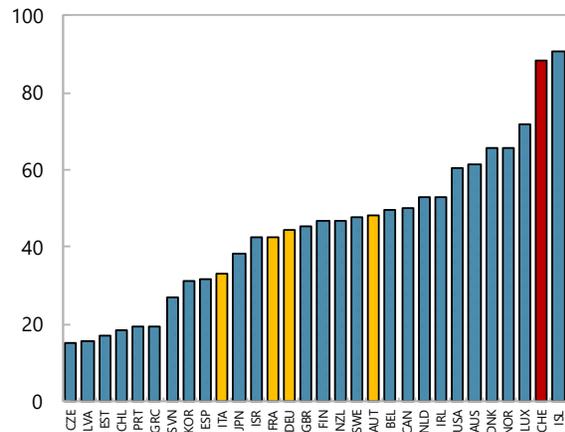
³ Notably between Switzerland’s Lake Geneva region and Bourgogne-Franche-Comté in France.

⁴ This includes a sizable number of cross-border workers, as well as posted workers (see Annex I).

Figure 1. Swiss Wages in the International and Regional Context, 1991–2017

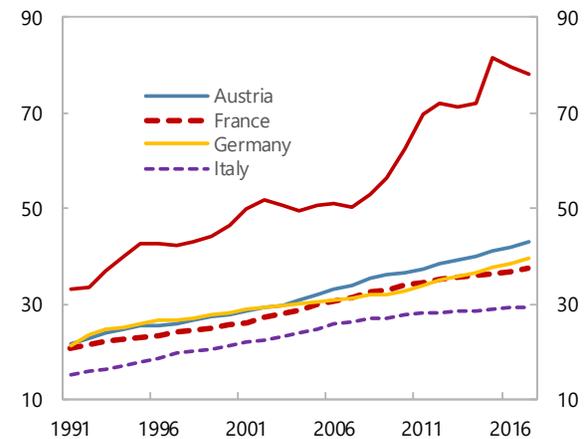
Average Annual Wages, 2017 ^{1/}

(In thousands of U.S. dollars)



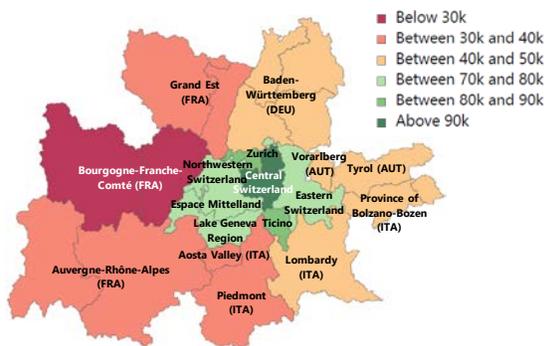
Average Nominal Wages, 1991–2017 ^{1/}

(In thousands of euros; at current exchange rates)



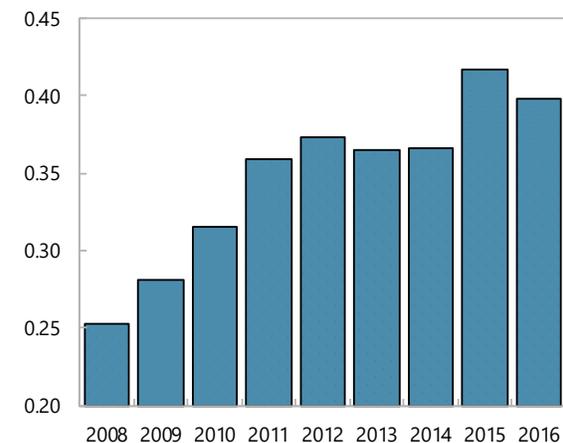
Regional GDP per Capita, 2016 ^{2/}

(In thousands of U.S. dollars)



Regional Wage Dispersion, 2008–16 ^{2/}

(Coefficient of variation)



Sources: Swiss Federal Statistical Office; OECD; and IMF's WEO and staff calculations.

¹ To ensure internationally comparable data, annual wages are obtained by dividing the national-accounts-based total wage bill by the average number of employees in the total economy, which is then multiplied by the ratio of average usual weekly hours per full-time employee to average usually weekly hours for all employees. ² Regional GDP for capita is used to proxy regional annual wages. In Switzerland, regional GDP per capita is broadly equal to the median gross annual wages reported in the Swiss Earnings Structure Survey. The two exceptions are the regions of Zurich (due to its large financial sector) and Ticino (due to a high number of cross-border workers, who contribute to regional GDP but are excluded from the population figures). Regional wages are calculated for Swiss regions and Austrian (AUT), German (DEU), French (FRA), and Italian (ITA) regions that share a border with Switzerland.

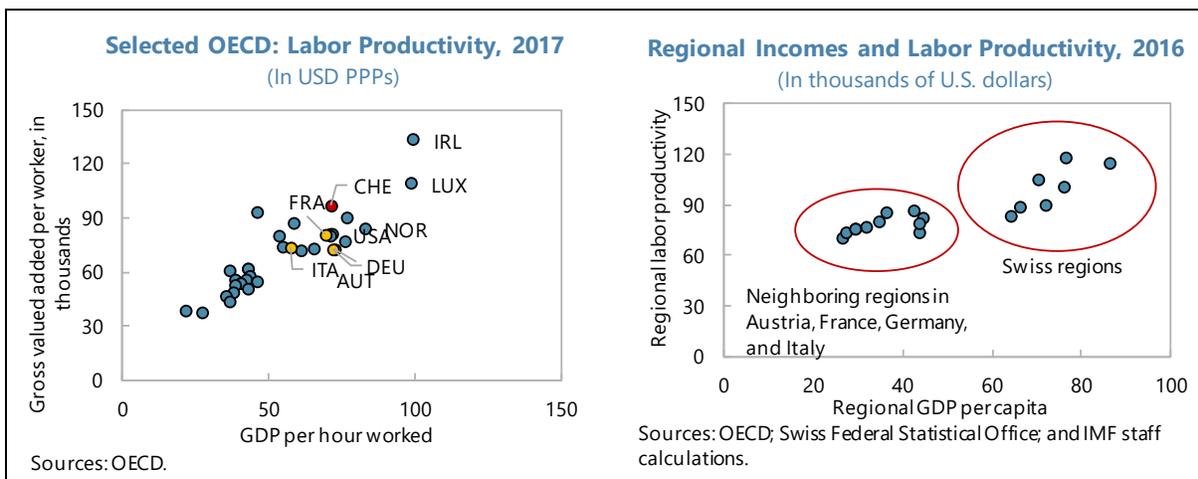
A. Drivers of Swiss Wages—Stylized Facts

3. Economic theory suggests that higher wages coincide with higher labor productivity.

Switzerland's labor productivity is among the highest in the OECD countries, especially when measured as annual gross value added per worker.⁵ According to this measure, Swiss workers are

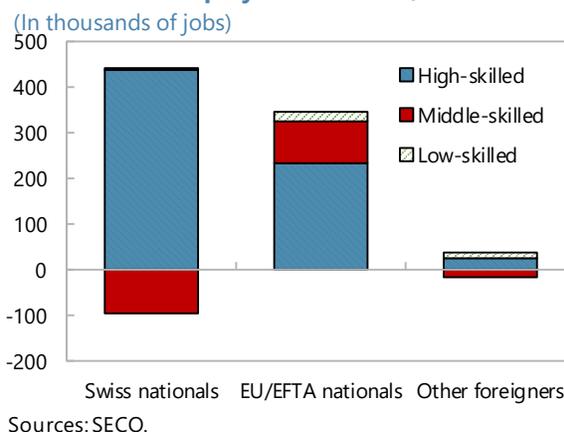
⁵ Labor productivity is the ratio of a volume-measure of output and a volume-measure of labor input. Real GDP is used to measure gross value added. Labor input can be measured by total number of hours worked or total employment (head count).

also more productive than their counterparts in neighboring cross-border regions, which provides a possible explanation for the positive wage differentials. However, an alternative metric based on hours worked suggests Switzerland is less productive than several other OECD countries, including several of its neighbors.⁶ Nonetheless, from the perspective of adjacent cross-border regions, Swiss productivity remains higher than in neighboring countries.



4. Switzerland has created mostly high-skill, high-wage jobs. The number of new high-skill jobs (i.e., requiring at least a college degree) during 2003–17 was broadly equal to total job creation, while the number of middle- and low-skill jobs remained broadly unchanged. Around half of new jobs were filled by foreign nationals, although Swiss nationals disproportionately filled the new high-skill jobs. Nonetheless, two-thirds of new EU/EFTA workers in Switzerland were college graduates. EU nationals also tended to fill mid-skill positions vacated by Swiss nationals.⁷

Switzerland: Employment Growth, 2003-2017



⁶ The divergence between alternative productivity measures may reflect difficulties quantifying labor productivity in knowledge-intensive business services sectors, such as information and communications technology, banking and insurance, research and development, and consulting (Kaiser and Siegenthaler 2015). Investment in intellectual property and a significant presence of multinationals with a high intellectual-property content in generating value added further complicates the assessment (OECD 2018).

⁷ EU workers also helped to meet demand for less-skilled jobs. For example, EU nationals made moderate employment gains in terms of service and sales occupations, filling vacancies created by Swiss workers avoiding or leaving these professions (SECO 2018).

5. Nominal wage differentials between Switzerland and its neighbors are likely influenced by the higher cost of living in Switzerland.

The two largest Swiss cities— Zürich and Geneva—are consistently found to be the top two most-expensive in the world.⁸ Switzerland has the second-highest price level in Europe, with prices of consumer goods and services some 60 percent higher than the EU average. Prices of services—a proxy for nontradables—are significantly higher in Switzerland than in neighboring countries, as are several products that are shielded from international competition.⁹

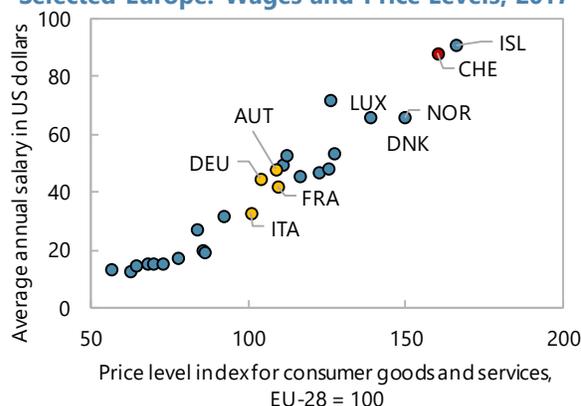
6. Swiss firms compensate their employees for the higher cost of living.

Cross-country wage differences narrow after adjusting for price differences. Measured at current purchasing power parity (PPP) exchange rates, the wage gap stood at about 30 percent in 2017 (in percent of Swiss salaries), compared to about 50 percent at market exchange rates. Moreover, the PPP-adjusted wage gap has been relatively constant over time.

7. Appreciation of the Swiss franc since the global financial crisis has widened the cross-border nominal wage gap.

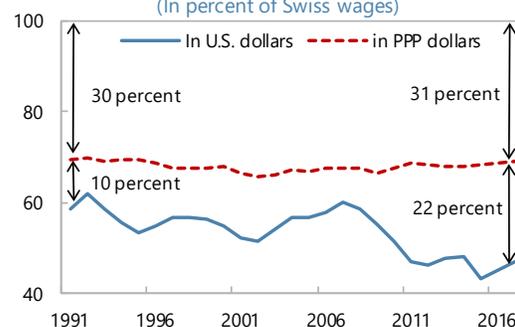
On several occasions, the safe-haven Swiss franc has appreciated sharply against the euro since 2008. These successive appreciation surges expanded wage differentials. Despite some reversal since 2015, cumulative franc-euro appreciation accounts for most of the widening of the wage gap since the early 1990s. Increases in foreign wages (measured in euros) and Swiss wages (measured in Swiss francs) nearly offset each other.

Selected Europe: Wages and Price Levels, 2017



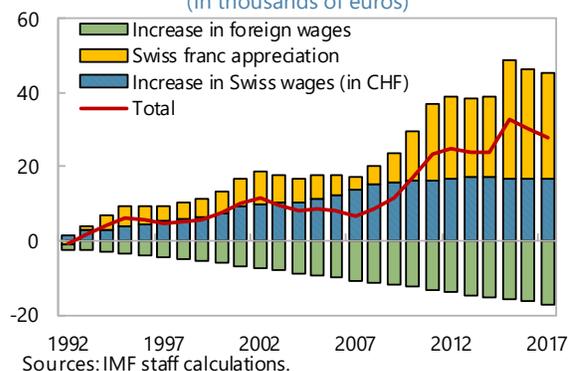
Sources: Eurostat; OECD; and IMF staff calculations.

Wage Gap between Switzerland and Neighboring Countries, 1991–2017
(In percent of Swiss wages)



Sources: OECD; IMF's WEO and staff calculations.
Note: PPP-GDP weighted average for Austria, France, Germany, and Italy.

Cumulative Increase in Nominal Wage Gap between Switzerland and Neighboring Countries since 1991
(In thousands of euros)



⁸ <https://www.ubs.com/microsites/prices-earnings/en/intro/>.

⁹ According to Credit Suisse, 2018. Transfers from consumers and taxpayers to producers of several agricultural goods arising from policy measures equal about CHF 3.5 billion per year, and create a gap between domestic market prices and border prices (OECD 2017a). In addition, pharmaceuticals are subject to separate authorization procedures and restrictions on sales.

8. Lower Swiss tax and mandatory contribution rates relative to neighboring countries partly offset the cost to employers of higher wages. Swiss companies pay lower rates of corporate tax. In addition, employers' mandatory tax and nontax contributions (first and second pillar pensions and health insurance) on wages are lower than those in neighboring countries.



Sources: OECD.

Note: Effective corporate tax rates are for multinational enterprises, as reported for 2011-2015 in the Orbis database.

9. Several supporting measures help underpin Swiss wages, notably in construction and catering.

Foreign firms who post their workers to Switzerland are required to meet Swiss minimum wage and labor conditions.¹⁰ An eight-day notice period of intention to work in Switzerland is required in order to allow the Swiss authorities sufficient time to verify that domestic wage protections are being observed. Compliance also relies on on-site inspections and sanctions. In addition, implementing the 2014 referendum that aims to slow EU migration requires employers to publish vacancies for five working days exclusively for job seekers in Switzerland in occupations with above-average unemployment rates.¹¹ Quotas on permanent residency applications from nationals from Bulgaria and Romania are also applied.

B. Are Swiss Wages in Line with Swiss Fundamentals?

10. This section identifies the long- and short-run drivers of Swiss wages using an error correction model (ECM). In the long-run, real wages are expected to be synchronized with labor productivity. In the short-run, a wage Phillips curve would imply a relationship between nominal wage growth, labor productivity growth, inflation and labor market slack. This short-term relationship is augmented with the error correction term from the long-run model, allowing nominal wages to react to deviations of real wages from their predicted long-run relationship. We also investigate the impact of foreign workers on wage growth.

11. The empirical model is specified as follows:

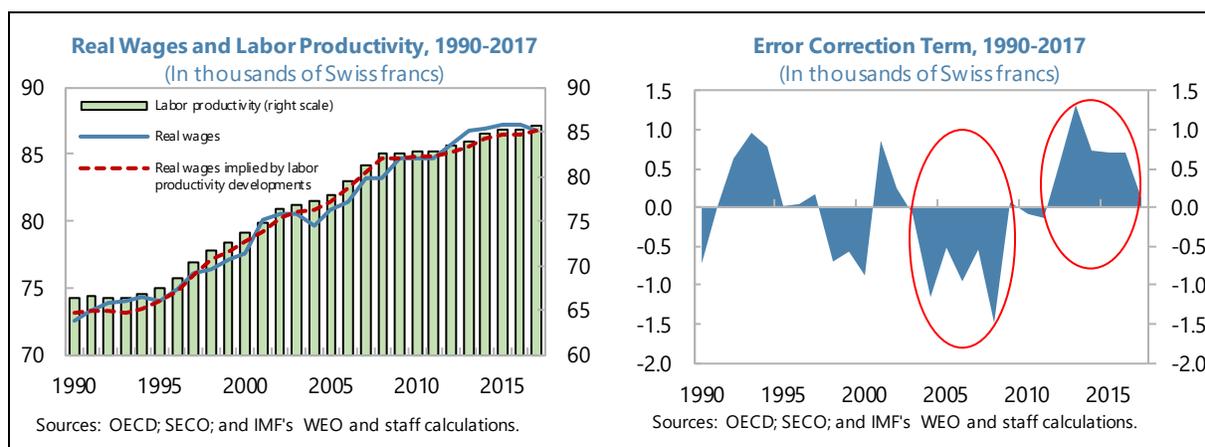
$$\Delta w_t = \beta_0 + \beta_1 \pi_{t-1} + \beta_2 u_t + \beta_3 \Delta y_t + \beta_4 (\log(RW_{t-1}) - \alpha_0 - \alpha_1 \log(y_{t-1})) + \beta_5 FW_t + e_t.$$

¹⁰ A minimum wage of CHF 20 per hour applies in Cantons Jura and Neuchâtel, while no minimum wage exists in the rest of the country. However, minimum compensation clauses are included in voluntary collective labor agreements (General Labor Contracts), which are negotiated on a sector-by-sector basis. These require compensation ranging from CHF 2,200 to 4,200 per month for unskilled workers and CHF 2,800 to 5,300 per month for skilled employees.

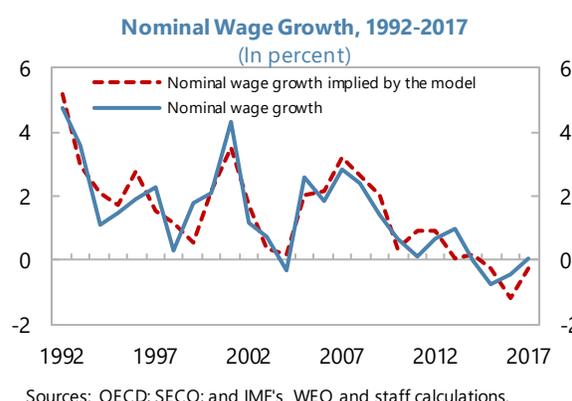
¹¹ Swiss nationals and foreigners registered in Switzerland benefit equally from this measure. A new referendum proposal to moderate immigration is pending with the Federal Council.

In this specification, Δw_t is the year-on-year change in nominal Swiss wages, measured as compensation per employee adjusted for hours worked.¹² The explanatory variables are Switzerland’s previous year’s inflation, π_{t-1} , unemployment gap, u_t , (a deviation from the time-varying equilibrium unemployment rate, estimated with a Hodrick-Prescott filter), labor productivity growth, Δy_t , (measured as real GDP per hour worked),¹³ the previous-year’s deviation of the real wage, RW_{t-1} , from its long-run relationship with labor productivity, y_{t-1} , (i.e., the error correction term), and a year-on-year change in the ratio of foreign workers to domestic workers, FW_t . The analysis is based on annual data during 1990–2017.

12. Over the long run, real wages and labor productivity are found to co-move. This cointegrating relationship between real wages and labor productivity (both in levels) implies they share a common trend (see Annex II). A 1 percent increase in labor productivity is found to raise real wages by 0.7 percent. The long-run analysis suggests that real wages were below levels predicted by productivity before the global financial crisis (2003–2008), and were above their long-run predicted levels since 2012, although the deviations are relatively modest.



13. The short-run behavior of nominal wages is found to conform with the wage Phillips curve. The baseline model (Table 1, column 1) explains about two-thirds of the variation in nominal wage growth during the past three decades, with the estimated coefficients on past inflation, unemployment rate gap, and labor productivity growth all significant and having the expected signs. Unemployment of Swiss workers has a somewhat-larger impact on wages than



¹² That is, the national accounts-based total wage bill is divided by the average number of employees in the economy, multiplied by the ratio of the average weekly hours per full-time employee to the average weekly hours for all employees.

¹³ The regression is based on GDP per hour worked, rather than annual GDP per worker, because data on the latter are not available for the entire sample period.

overall (Swiss plus foreign) unemployment (columns 1 and 2). Adding the error correction term to the baseline regression considerably improves the model fit, and gives the expected negative coefficient, implying that a past overshoot of wages from its dynamic long-run equilibrium dampens current year's wage growth (column 3).

Table 1. Switzerland: Estimates of Wage Phillips Curves

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged domestic inflation	0.77***	0.81***	0.82***	0.92***	0.91***	0.86***
Labor productivity growth	0.26*	0.25*	0.31***	0.36***	0.38***	0.31***
Unemployment rate gap	-2.15***		-1.31***	-0.83	-0.68	-1.26**
Unemployment rate gap, Swiss workers		-3.84***				
Lagged error correction term ¹			-0.74***	-0.77***	-0.78***	-0.74***
Foreign workers ²				0.40		
Foreign permanent workers ²					0.57*	
Cross-border workers ²						0.45
Constant	0.26	0.21	0.14	-0.23	-0.25	0.04
Number of observations	27	27	27	27	27	27
Adjusted R-squared	0.64	0.64	0.80	0.81	0.82	0.79

Source: IMF staff calculations.

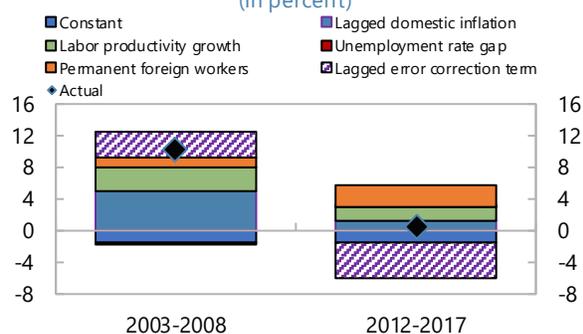
Note: Dependent variable: year-on-year growth rate of nominal average annual wages, in Swiss francs. Sample is of annual frequency from 1990 to 2017. *p<0.10; **p<0.05; ***p<0.01.

¹ Error correction term is estimated as the residual from the long-run regression of $\log(RW_t)$ on a constant and $\log(y_t)$.

² Year-on-year change in the ratio of foreign / foreign permanent / cross-border workers to domestic workers.

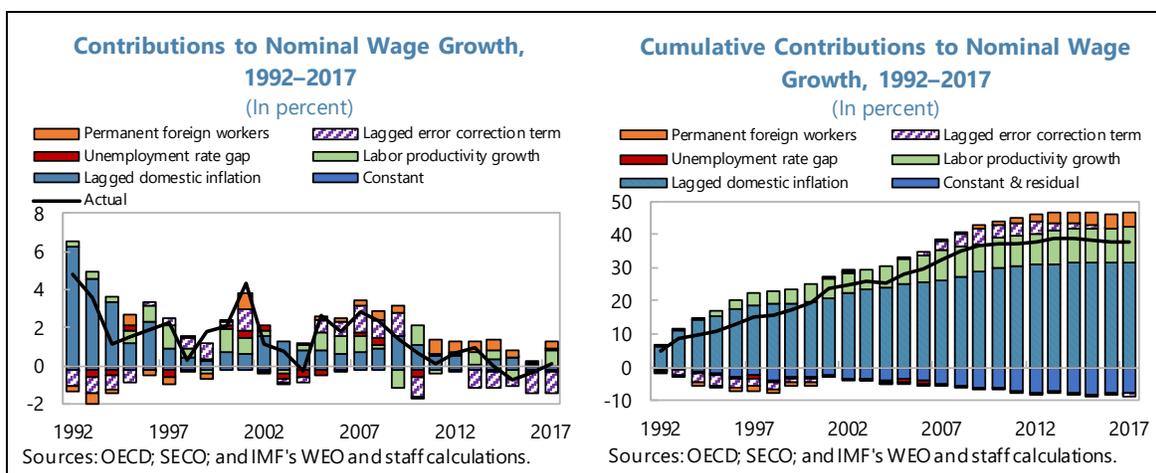
14. Foreign workers are associated with higher Swiss wages. The effect is the clearest for permanent foreign workers, where the coefficient has a positive sign, is statistically-significant, and is of an economically-meaningful size (column 5).¹⁴ Specifically, during 2012–17, permanent foreign workers contributed a cumulative 2½ percentage points to nominal wage growth, which is as large as all other wage-boosting factors combined. This result is consistent with inflows of generally well-educated, permanent foreign workers, which would also tend to push up aggregate labor productivity and support higher long-run real wages.

Cumulative Contributions to Nominal Wage Growth (In percent)



Sources: OECD; SECO; and IMF's WEO and staff calculations.

¹⁴ Cross-border workers or foreign workers in general also raised wages, but the impacts are not statistically significant (Table 1, columns 4 and 6).



C. What Explains the Dynamics of Cross Border Wage Gaps?

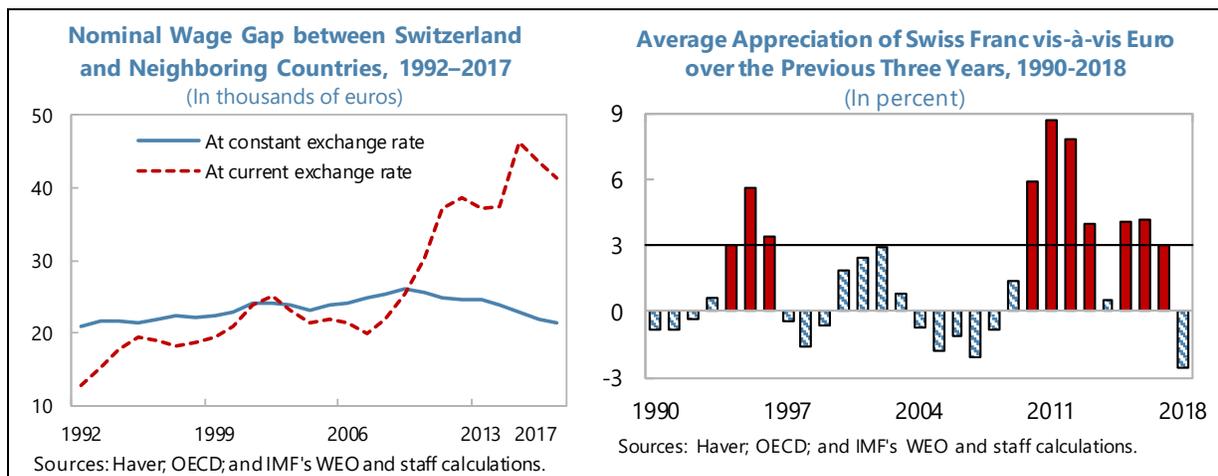
15. We also use an error correction model to analyze the long- and short-run dynamics of wage differentials with neighboring countries. Gaps are calculated as differences between Swiss variables and PPP-GDP-weighted averages of Austria, France, Germany, and Italy. As with the previous Switzerland-only model, we hypothesize that over the long run, the real wage gap moves in line with differences in labor productivity. In the short-run, cross-border differences in the pace of nominal wage growth (measured in euros) may reflect differences in labor productivity growth, Swiss franc appreciation, and changes in firms' cross-border profit gap, while allowing for corrections from the long-run equilibrium via the error correction term.

16. The empirical model is specified as follows:

$$\Delta w_{gap_t} = \beta_0 + \beta_1 \Delta f x_t + \beta_2 \Delta profit_gap_t + \beta_3 \Delta y_{gap_t} + \beta_4 (\log(RW_gap_{t-1}) - \alpha_0 - \alpha_1 \log(y_gap_{t-1})) + e_t$$

In this specification, Swiss wages and productivity are measured in euros at a constant exchange rate, equal to the 1991–2017 average exchange rate between the Swiss franc and euro. Thus Δw_{gap_t} is the year-on-year change in the nominal wage gap between Switzerland and neighboring countries, but holding constant the exchange rate. The impact of exchange rate movements around this average is included as a separate explanatory variable: $\Delta f x_t$ is the year-on-year appreciation of the Swiss franc vis-à-vis euro. This approach allows for separately identifying how the wage gap responds to an appreciation shock. As we are primarily interested in the impact of large, persistent foreign exchange rate shocks, $\Delta f x_t$ is an indicator variable that takes the value of the average cumulative appreciation of the Swiss franc vis-à-vis the euro during the previous three years in years when that appreciation exceeded 3 percent per annum (i.e. about a half standard deviation above the long-term average appreciation). In other years, the variable is set to zero (the text chart depicts exchange rate developments in all years, but only the episodes highlighted in red are included in the regressions). Other explanatory variables are the year-on-year change in firms' cross-border profit gaps as a share of GDP, $\Delta profit_gap_t$, labor productivity gap growth Δy_{gap_t} , and the previous

year's deviation of the real wage gap RW_gap_{t-1} from labor productivity gap y_gap_{t-1} (i.e. the error correction term). As before, the analysis is performed on annual data during 1990–2017.



17. In the long run, higher Swiss labor productivity accounts for much of the real, constant exchange rate wage differential between Switzerland and its neighboring countries. The real wage gap and labor productivity gap are cointegrated, with a 1 percent increase in the labor productivity gap raising the real wage gap by about 0.5 percent in the long run (see Annex II). Deviations from the long-run equilibrium tend to persist for several consecutive years. For example, the productivity gap widened by nearly 50 percent during 2004–2008, mostly due to subdued growth in output per hour worked in France and Italy. Yet the real wage gap increased by only 11 percent during this period, in part reflecting the subpar wage growth in Switzerland discussed in section B. This situation reversed in 2011, and the current real wage gap exceeds the level predicted by labor productivity in Switzerland and neighboring countries.

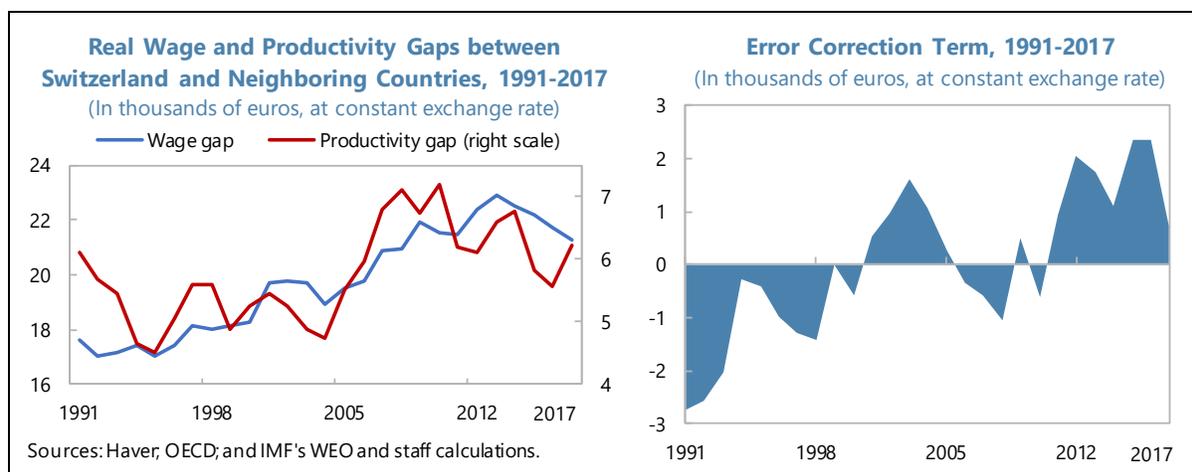


Table 2. Switzerland: Short-term Drivers of Nominal Wage Gap

	(1)	(2)	(3)
Labor productivity gap growth	0.15***	0.20***	0.18***
Large CHF/EUR appreciation ¹	- 0.22*		-0.18*
Change in firms' profit gap ²		-1.04***	-0.98***
Lagged error correction term ³	-1.27***	-1.47***	-1.34***
Constant	0.57	0.07	0.43
Number of observations	26	26	26
Adjusted R-squared	0.66	0.75	0.77

Source: IMF staff calculations.

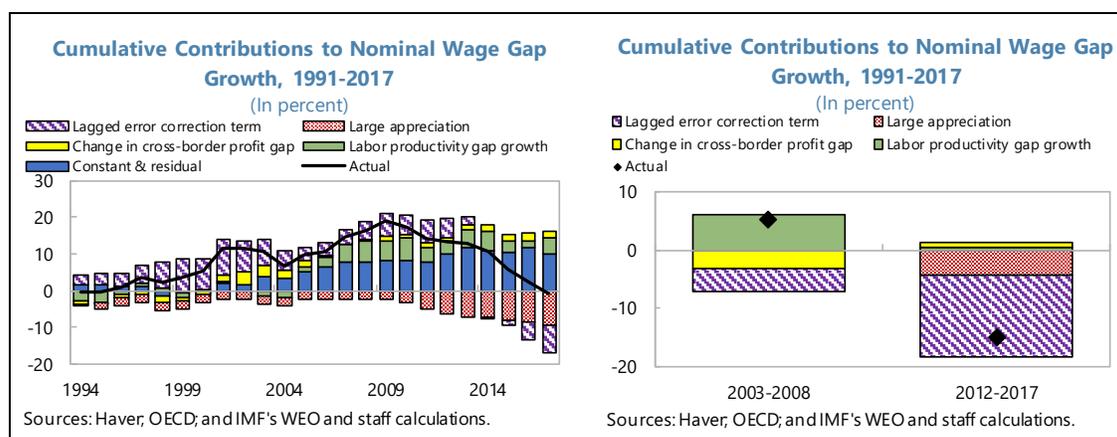
Note: Dependent variable: year-on-year change in nominal wage gap between Switzerland and neighboring countries (PPP-GDP weighted average wages for Austria, France, Germany, and Italy), measured at the constant exchange rate. Sample is of annual frequency from 1990 to 2017. *p<0.10; **p<0.05; ***p<0.01.

¹ Average year-on-year appreciation of Swiss franc vis-à-vis euro over the previous three years, in years when that appreciation exceeded 3 percent per year, or zero otherwise.

² In percent of GDP.

³ Error correction term is estimated as a residual from the long-run regression of $\log(RW_gap_t)$ on a constant and $\log(y_gap_t)$.

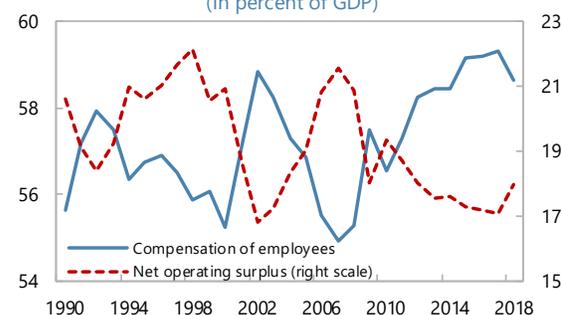
18. Swiss wages adjust to large appreciation shocks. Measured at *current* exchange rates, and due to short-term wage stickiness,¹⁵ a Swiss franc appreciation initially widens the euro-denominated wage gap vis-à-vis neighboring countries, reducing the competitiveness of Swiss firms. Following a large exchange rate shock, wages measured at a *constant* exchange rate (effectively, in Swiss francs) are found to decrease in subsequent years (Table 2, columns 1 and 3), thereby helping to narrow the wage gap measured at current (and constant) exchange rates. For example, following a series of large appreciation episodes since 2011, the cross-country wage gap (measured at a constant exchange rate) narrowed by almost 18 percent during 2012–17 reflecting downward adjustment in response to appreciation episodes, as well as the error correction term. Nonetheless, despite this large corrective response, the wage gap between Switzerland and neighboring countries (measured at current exchange rates) remains 12 percent higher than in 2011.



¹⁵ Wages for the subsequent year tend to be agreed in the fall of the previous year.

19. Swiss firms tend to absorb higher labor costs in part through lower profit margins. Real wages in Switzerland increased faster than productivity since 2012, reducing corporate profit margins.¹⁶ This profit squeeze vis-à-vis neighboring countries contributed positively to the growth in the nominal wage gap: 1 percentage point of GDP decline in profit gaps increased the wage gap by about 1 percent (Table 2, columns 1 and 3). During 2012–2017, compression of Swiss firms' profits relative to those of firms abroad was associated with a widening of the cross-border wage gap by 0.8 percentage points.

Switzerland: Labor Shares and Firms' Profits, 1990–2018
(In percent of GDP)



Sources: Haver, and IMF's staff calculations.

D. Conclusions

20. Wage differences between Switzerland and its neighbors are found to be consistent with Switzerland's strong fundamentals. The level of Swiss wages is aligned with workers' productivity over time, and wages respond to cyclical conditions in the Swiss economy, including unemployment rates as well as deviations from the long-run wage-productivity relationship. Moreover, an increasing share of foreign workers, most of whom are well educated, is associated with rising wages in Switzerland. Looking at the cross-border wage gap, results suggest that the higher productivity of Swiss workers accounts for much of the sustained positive wage gap. However, large appreciation shocks, which initially expand the wage gap beyond levels consistent with fundamentals, are gradually unwound through slower growth in Swiss wages (measured in Swiss francs), some compression of profits among Swiss firms, and by raising productivity.

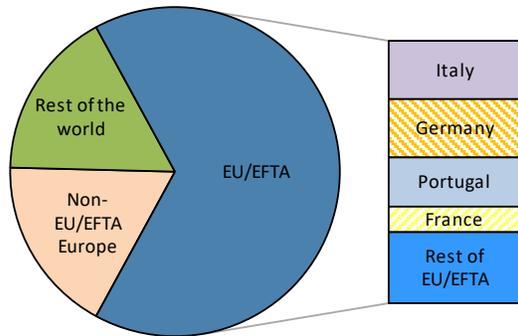
¹⁶ Many firms reduced their profit margins following the removal of the Swiss franc floor against the euro in early 2015 (Swiss National Bank 2015). As a result, the share of national income paid to workers increased to historically high levels, in contrast to downward trends observed in other advanced economies (IMF 2017). In fact, firms' profits have been declining steadily for much longer: between 2007 and 2017, firms' profits declined by a cumulative 4.5 percentage points of GDP.

Annex I. Cross Border and Posted Workers

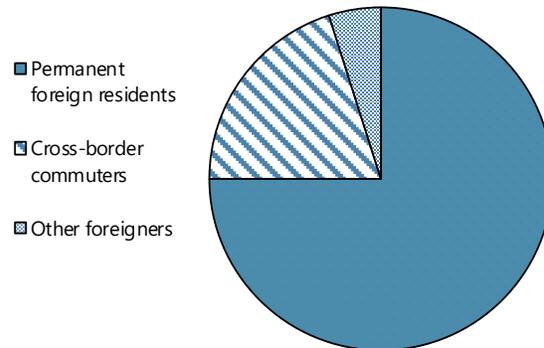
- 1. The number of cross-border workers more than doubled since 2002 to about 312 thousand people in 2018, or about 20 percent of foreign workers** (Annex I Figure 1, panel 2). Switzerland has the highest number of cross-border commuters within the European Economic Area, with 6 percent of workers commuting daily from other countries (European Commission 2018).
- 2. Cross-border workers are concentrated in northwestern Switzerland near Basel, around Lake Geneva, and in Ticino** (in both absolute terms and in percent of regional population). These regions also host the largest number of permanent foreign workers (Annex I Figure 1, panel 3). In the Italian-speaking Ticino, foreign nationals and cross-border workers account for nearly half of the region's employment. Most cross-border commuters are French resident (55 percent of all cross-border workers), followed by Italians (23 percent), and Germans (19 percent). The number of French and Italian cross-border commuters doubled since 2002 (Annex I Figure 1, panel 4). The large number of French cross-border workers reflects the significant wage differentials between the neighboring French and Swiss regions (panel 3). In 2016, average regional GDP per capita in Auvergne-Rhône-Alpes, Bourgogne-Franche-Comté, and Grand Est regions stood at only US\$32 thousand compared to the average regional GDP per capita of US\$78 thousand in Lake Geneva Region, Espace Mittelland, and Northwestern Switzerland.
- 3. In addition to permanent and cross-border foreign workers, Switzerland also receives a large number of posted workers.** Under the 1999 agreement, EU firms have the right to offer their services in Switzerland, and to temporarily post workers to supply those services. Posted workers can be sent by their EU employers to Switzerland for up to 90 working days per calendar year. These workers have regular employment relationships in their usual country of work and maintain their employment relationship during the period of posting, with minimum working and pay conditions subject to the Swiss Posted Workers Act. About 140 thousand workers from the EU were posted to Switzerland in 2018, mostly to work in the construction sector. In addition, short-stay workers (up to 90 days) were also present, of which 27 thousand were declared as self-employed and some 86 thousand were employed by Swiss employers.

Figure 1. Foreign Workers in Switzerland, 2002–2018

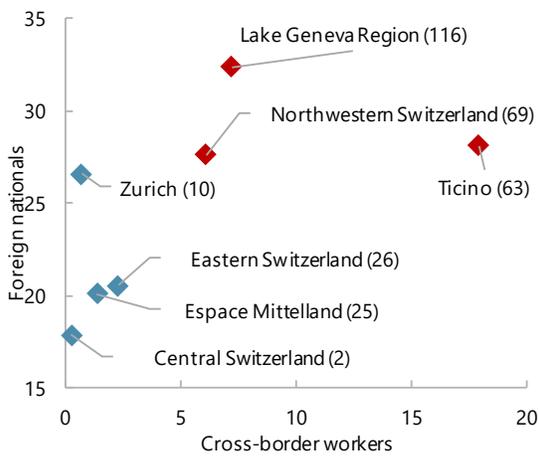
Foreign Residents by Nationality, 2017
(In percent of total)



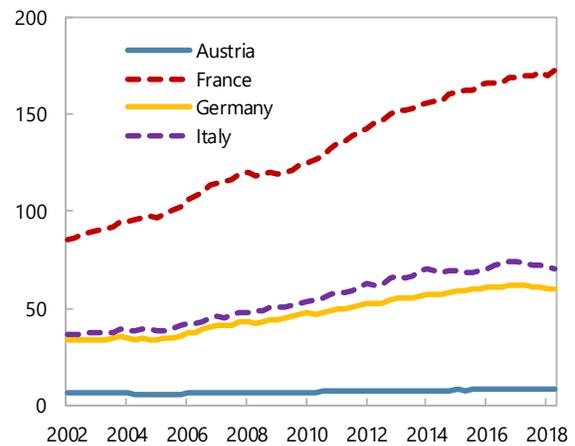
Foreign Workers by Permit Type, 2018
(In percent of all foreign workers)



Foreign and Cross-Border Workers, 2016¹
(In percent of population)



Cross-Border Workers by Country of Residence, 2002–2018
(In thousands of workers)



Sources: Federal Statistical Office; SECO; and IMF's WEO and staff calculations.

¹ Red markers highlight the regions with the highest number of cross-border workers. Number of cross-border workers in thousands in parenthesis.

Annex II. Cointegration Tests

1. We use Engle-Granger two-step test for cointegration to establish long-run equilibrium relationships between (i) real wages and labor productivity, and (ii) as real wage gap and labor productivity gap. We first apply the Augmented Dickey-Fuller test to establish that each time series contains a unit root. We then use the Engle and Granger (1987) two-step procedure to test if the paired variables have a stationary long-run equilibrium relationship, i.e. they are cointegrated. The results are presented in Annex Table II.1. Swiss real wages and labor productivity are found to be cointegrated, as are the cross-border wage and labor productivity gaps.

Table 1. Switzerland: Engle-Granger Cointegration Tests

	t-statistic
Cointegration between Swiss real wages and labor productivity ¹	-3.22*
Cointegration between real wage gap and labor productivity gap ²	-2.42*

Source: IMF staff calculations.

Note: *p<0.10; **p<0.05; ***p<0.01.

¹ The test examines the residual from the long-run regression of the natural logarithm of Swiss real wage on a constant and natural logarithm of labor productivity.

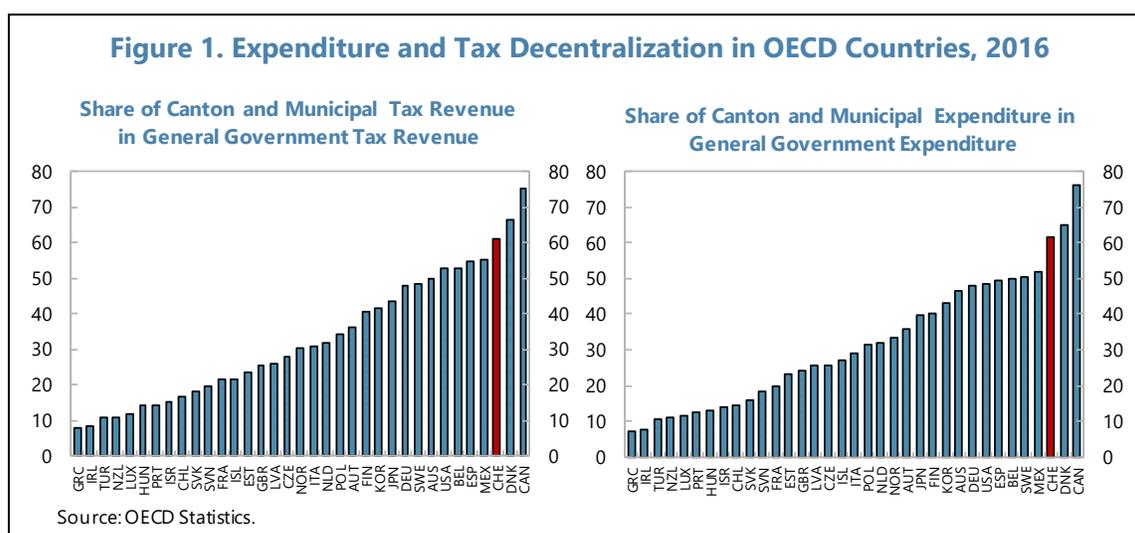
² The test examines the residual from the long-run regression of the natural logarithm of real wage gap on a constant and natural logarithm of labor productivity gap.

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FISCAL FEDERALISM IN SWITZERLAND¹

1. Switzerland is a highly decentralized country. Three political levels share power in Switzerland: the Confederation, 26 cantons and over 2,200 municipalities. Cantons have considerable autonomy in fiscal decisions. A revenue sharing arrangement from the confederation to the cantons and an elaborate transfer system between cantons as well as between the confederation and cantons mitigate financial differences between cantons. Cantons and municipalities raise close to 61 percent of general government tax revenue—the third highest among OECD countries—and account for a similar share of general government spending (Figure 1).



A. The Fiscal Role of Cantons

Cantons Have Comprehensive Responsibilities and Set Their Own Fiscal Targets:

Functions

2. The assignment of expenditure and tax functions is specified in the Federal Constitution. The cantons have authority on a wide range of matters, including schools, hospitals, and policing. Consistent with the principle of subsidiarity, the federal government only takes on tasks which are assigned to it by the Constitution. These are generally tasks that the cantons and municipalities cannot perform on their own (e.g., public goods such as defense). The allocation of taxing rights between the different levels of government is largely in line with economic theory, whereby taxation of more-mobile activities—including VAT and other consumption taxes—is centralized, while cantons hold constitutional tax raising competences and levy taxes on immobile factors, such as real property, consistent with the principle that payers are beneficiaries. An exception to this principle is corporate income and wealth taxation (i.e., highly

¹ Prepared by Shafik Hebous (FAD). This paper has benefited from comments from the Swiss authorities.

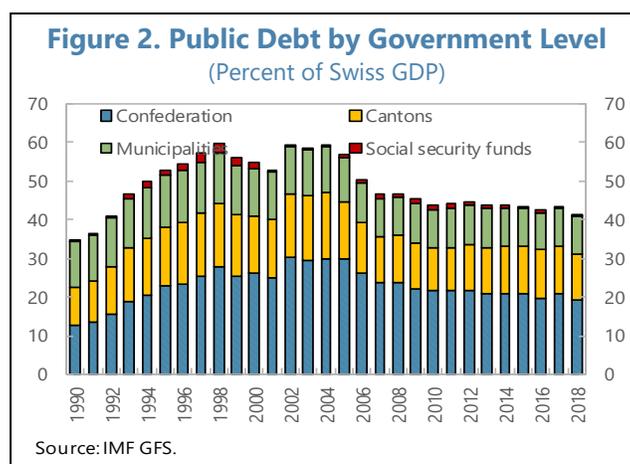
mobile tax bases), which is subject to tax competition among the cantons. Table 1 provides a compilation of task distribution among the confederation and cantons, as well as of the responsibilities shared between different levels of government.

Spending				Taxes	
<i>Solely to the Confederation</i>	<i>Common tasks between Confederation and cantons</i>	<i>Shared cantonal tasks</i>	<i>Tasks assigned solely to a canton</i>	<i>Confederation</i>	<i>Canton (& municipality)</i>
National defense	Health insurance	Cantonal universities	Homes for the disabled, and the elderly	VAT & excises	Personal income tax
Motorways	Scholarships	Specialist clinics	Special schools	Personal & corporate income tax	Corporate income tax
Old-age pensions	Urban transportation Regional transportation	Waste disposal	Scholarships for general schools	Cross-border withholding taxes	Property tax
Disability pensions	Landscape, water protection	Wastewater treatment		Tariffs	

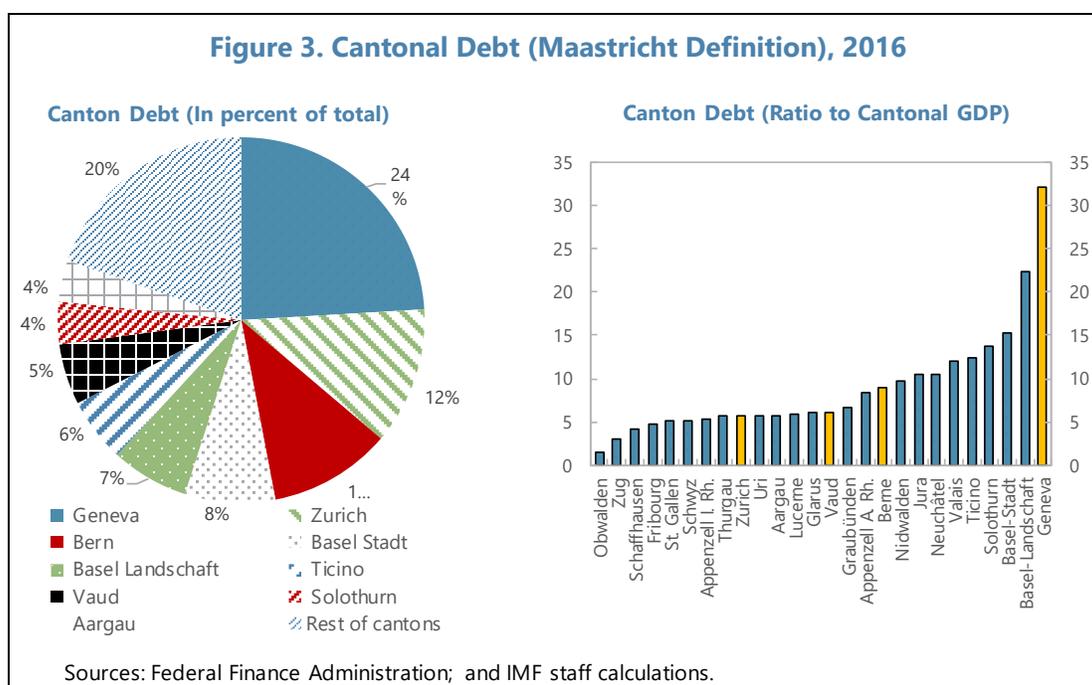
Source: IMF staff.

Borrowing

3. Subnational borrowing is not subject to limits from the central government, but is governed by cantonal fiscal rules and market discipline. Cantonal and municipal debt is about 52 percent of general government debt (21.3 percent of GDP) (Figure 2). The canton of Geneva accounts for about a quarter of total cantonal debt, and its debt is equivalent to approximately one-third of Geneva’s GDP (Figure 3).²



² These numbers are based on the Maastricht definition of debt as GFS-based public debt is not available for every canton.



Debt Brake Rules

4. There is considerable heterogeneity across cantonal debt brake rules. In addition to the federal debt brake rule, which applies only to the Confederation, all cantons have their own fiscal rules. Differences include: (i) whether or not the fiscal rule is in the canton’s constitution; (ii) fiscal balance requirements (e.g., each year or cumulative over a window of several years; headline or cyclically-adjusted); (iii) (a)symmetric treatment of over/under-performance; and (iv) the level of the fiscal balance target (e.g., Basel-Stadt targets 0.65 percent of Swiss GDP whereas Bern targets 12 percent of the canton’s GDP). Some of these rules can be viewed as more restrictive and procyclical than the federal debt break rule. For example, St. Gallen adopts a balanced budget rule, whereby a deficit must be automatically included in the following year’s budget and any budget deficit above 3 percent automatically triggers an increase in taxes as a penalty. While some cantons exceed their targets (e.g., Zurich and Basel Stadt), others (such as Bern) have less room for maneuver, but tend to preserve some space under the annual target to avoid hitting the limits of their fiscal rules.

Contingent Liabilities

5. Cantonal banks are a source of contingent liability for cantonal governments. These banks are largely owned by cantons. Explicit guarantees are provided for 21 of the 24 cantonal banks, while one cantonal bank (Geneva) has a limited guarantee, and two cantonal banks (Bern and Vaud) are without explicit guarantees. Some cantonal banks have significantly larger balance sheets than their cantons’ revenues (e.g., the balance sheet of Zurich Cantonal Bank is 11 times larger than Zurich’s revenues) and their cantonal GDPs. However, cantonal banks have very high credit ratings, although some have a lower rating on a standalone basis. Moreover, a relatively weak coverage ratio

in some cantonal pension funds potentially poses a fiscal risk. For example, Geneva's pension fund will be recapitalized with CHF 4.4 billion, increasing its coverage ratio from 58 to 75 percent, following a popular vote in May 2019.

B. Inter-Governmental Fiscal Transfers

6. The Swiss National Fiscal Equalization Scheme is an Intertwined System of Vertical and Horizontal Transfers:

- *Resource equalization* scheme aims to reduce differences in resource capacity between cantons. In the first step, a revenue (or 'resource') potential index is computed, based on cantonal taxable income and assets, to identify financially strong and financially weak cantons. In the second step, vertical contributions from the confederation and horizontal contributions from financially strong cantons to financially weak cantons are determined based on a formula that aims to lift cantons with weak resource potential to a minimum of 85 percent of the average Swiss resource capacity index, although in practice, a higher percentage has consistently been achieved (Figure 4).
- *Cost compensation* scheme provides a modest transfer from the federal budget to cantons with high expenditure needs due to geographical and socio-demographic factors (mountainous and urban regions).
- *Cohesion fund* was introduced in 2008 to facilitate transition from a previous system of transfers, and amounts have been declining over time.

7. The total amount of fiscal transfers under the three schemes was about CHF 5.1 billion (0.8 percent of national GDP) in 2018. However, for some cantons the transfers are significant (Figure 4). For example, the index of financial resources in the canton of Jura was increased from 65.9 percent of the Swiss average to 88.3 percent through resource equalization transfers. Since 2008, six cantons (Zurich, Schwyz, Nidwalden, Zug, Basel-Stadt and Geneva) have consistently been net contributors, while the others have been recipients.

8. The Federal Council is proposing a partial revision of the Fiscal Equalization and Cost Compensation Act system. The core element of the reform is to raise the minimum threshold to 86.5 percent of the Swiss average for the financially weakest cantons. This minimum will be guaranteed, which is not the case in the current system. The reform is expected to only marginally raise the contribution of the confederation, and to decrease contributions by the financially-strong cantons collectively by about CHF 230 million annually. Parliament is expected to approve the reform in June 2019, and it would go into effect in 2020.

