The « burden » of Swiss public debt: Lessons from research and options for the future

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Abstract

The Swiss Federal government finances are in an excellent shape: debt is small (and decreasing), and carries a low interest rate. This paper reviews the prospects for Swiss public finances, drawing on the recent literature. We argue that the current policy of running surpluses and paying down debt is inefficient, and propose three alternatives. First, as the interest rate on the debt is much lower than the GDP growth rate – a pattern that is not unusual – Switzerland could stabilize its debt-to-GDP ratio and run a primary deficit of about CHF 2.6 billion (0.37% of GDP). Second, the low cost of debt implies that investments in education and infrastructure are more attractive than in the past. Third, Switzerland could use its implicit asset (the trust of investors) and set up a sovereign wealth fund financed by government debt. We estimate that a fund amounting to 10% of GDP could generate an annual revenue between CHF 0.7 to 2 billion (0.1% to 0.3% of GDP), though these estimates could be refined further.

JEL codes : E62, F3, H6
Keywords : public debt, low interest rates, sovereign wealth fund, Switzerland

Executive summary

The Swiss Confederation's finances are in an excellent shape. We are far from the challenging times of the 1990's that had rightly led to the adoption of a debt brake mechanism. While public finances in most advanced economies have worsened over the last 10 years, Switzerland is an exception. The Federal government's debt is low (currently 14.5% of GDP) and has substantially decreased since the mid-2000's, as the Swiss government repaid nearly one-fifth of its outstanding debt. Forecasts show a continuing decrease of debt in coming years. In addition, the cost of the debt is at exceptionally low levels: investors are willing to pay to put their funds with the Swiss Confederation even at very long horizons. Against such an environment it makes sense to re-assess the options available in light of recent research works.

This paper presents a review of recent contributions in the context of Switzerland. The last ten years have seen active research work on public finances in advanced economies. This has substantially been driven by the exceptionally low level of interest rates on sovereign debt (with the exception of countries affected by the euro crisis). In his AEA presidential address in January 2019, Olivier Blanchard stressed that public debt is manageable and does not constitute a major problem for economic policy.

A first point stressed by research is that the level of interest rates has been on a downwards trends for several years, even when controlling for the impact of inflation and business cycles. This phenomenon is observed in the majority of advanced economies, including Switzerland, and is driven by structural factors that are likely to persist. In particular, the demand for safe assets keeping their value even in times of global crisis has substantially increased since the start of the Global Financial Crisis.

A second point is that interest rates on sovereign debt are lower than the growth rates of GDP. A government can then afford a primary deficit (deficit before the payment of interest on the debt) while keeping the ratio of debt-to-GDP steady, this ratio being the economically relevant indicator for debt sustainability. Even though this gap between interest rates and growth is not homogenously seen across advanced economies, it is clearly relevant for Switzerland.

A third point is that the decrease of the yields of sovereign bonds appears larger than the decrease observed for private bonds. While this point remains generally debated, we observe some widening of the private-sovereign gap in Switzerland.

This favorable background, which is likely to persist, opens new options for Swiss public finances. We stress three of them.

First, the sizable gap between the interest rate on public debt and the growth rate of GDP implies that Switzerland can afford a primary deficit and still keep the debt-to-GDP ratio at its current low level. A simple computation indicates that an annual deficit of CHF 2.6 billion is feasible.

Second, public investments in infrastructure, education or research can be funded on very favorable terms given the low level of interest rates. While it is difficult to quantify precisely the return on these investments, it has likely increased with the need to train the labor force for the challenges of the digital economy, as well as the need to improve energy efficiency. The gap between these returns and the decreasing cost of debt has thus widened compared to the past.

Third, the low level of interest rates asked by global investors from the Swiss Confederation raises the question of whether to set up a sovereign wealth fund. Such a fund would be funded by government bonds and invested in higher-return asset. While in the Swiss context the question of a sovereign wealth fund is often raised in relation to the large size of the Swiss National Bank's balance sheet, it is important to treat a fund as clearly distinct from the central bank, because the two institutions have profoundly different mandates. This paper considers a range of possible returns that a fund could generate and contrasts them with the interest cost on debt. This analysis shows that a fund amounting to 10% of annual GDP could generate an annual gain between CHF 0.7 billion and CHF 2 billion. These estimates give an order of magnitude and should be completed with finer analyses to get a more precise picture. It is important to carefully design the governance structure of a sovereign fund so that it can focus on its main task. These governance challenges are however manageable and can build on the mechanisms put in place in institutions facing similar challenges, such as central banks.

In addition to these points focusing on the long-term trends of public finances, the last decade have seen a rich number of academic contributions on whether fiscal policy is appropriate as a tool to manage the short-term business cycle. This research shows a substantial degree of heterogeneity in policy effectiveness, depending on the exact tools used and the economic situation. A broad message is that fiscal policy is more effective when aimed at households facing credit constraints, as they have a high propensity to consume. In addition, a fiscal expansion is more beneficial when monetary policy faces constraints such as the zero lower bound on interest rates. In such situations the central bank will tend to welcome the inflationary effect of an expansionary fiscal policy. The studies also show the need to rely on automatic stabilizers and preset rules given the relatively slow pace of decision processes for fiscal policy.

The strong situation of Swiss public finances is an opportunity. It can be put to good use without putting debt in a dangerous dynamics, and without putting the debt brake into question. While a cautious policy was fully adequate after the sharp worsening of public finances in the 1990's, the situation has since profoundly changed and we have moved from a debt brake to a shift in reverse gear since several years. Even the International Monetary Fund stresses the need to make good use of the available room for maneuver.

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1.   <u>Introduction</u>

In his AEA presidential address in January 2019 Olivier Blanchard stressed that the increase in sovereign debt levels seen in many countries should not necessarily be seen as a cause for alarm (Blanchard 2009a,b). Focusing on the United States he shows that economic growth is strong enough to stabilize the ratio of public debt-to-GDP, which is the appropriate indicator for analyzing debt sustainability. The GDP growth rate currently exceeds the interest rate that the government pays on its debt, a gap that is far from being the exception. He concludes that while debt is not free, the alarmist view that is often seen in the debate is not warranted.

Blanchard's point is particularly relevant for Switzerland that has experienced a very favorable financial situation for many years (Soguel 2009). Figure 1 shows that the Swiss Federal government's (Confederation) debt has substantially decreased since 2002, moving from 25.6% of GDP (CHF 120.4 billion) to 14.5% in 2017 (CHF 97.1 billion). [2] Forecasts by the Swiss Federal Finance Administration indicate an additional decrease until 2022, and debt should by then only amount to 11% of GDP (CHF 83.5 billion).

Figure 1: Swiss Federal Government's debt (forecasts since 2018)
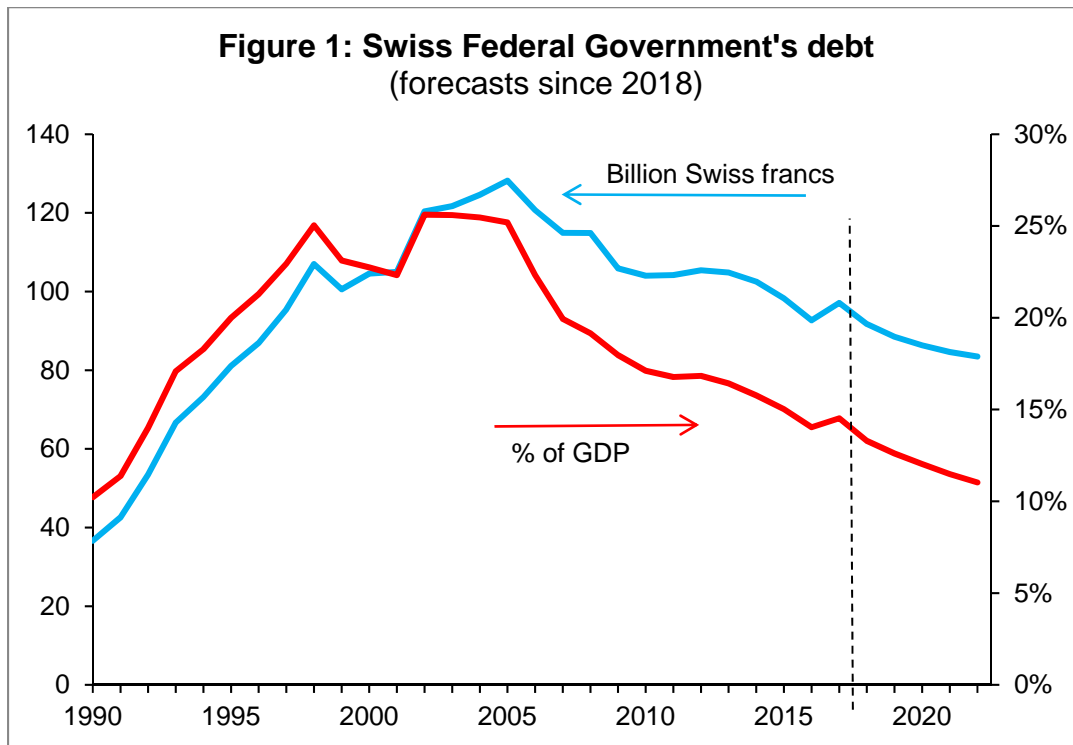
This decrease of the debt-to-GDP ratio is driven both by GDP growth and, to a large extent, by the government paying down its debt. The debt has decreased by CHF 23 billion over 15 years, which represents one-fifth of its initial amount, and forecasts shows additional reductions of more than CHF 13 billion over the next 5 years.

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[2] The sources for the data used in this paper are listed in the appendix at the end.

A second relevant aspect is that the Swiss Confederation funds its debt on very good terms. Figure 2 shows the nominal yields on Federal government bonds of different maturities. We clearly see that they have fallen and are currently at historical lows. Investors are currently willing to pay the Swiss government for being able to put their money with it even over long periods. The figures for August 2019 show that investing at an horizon of 10 years *costs* investors 0.98% per year, the cost being of 0.69% at a maturity of 20 years and 0.57% at a maturity of 30 years. In other words, investors treat Swiss government bonds as a safe and are willing to pay a rental fee to put their money there.

Figure 2: Yield on Swiss Federal government bonds by maturity
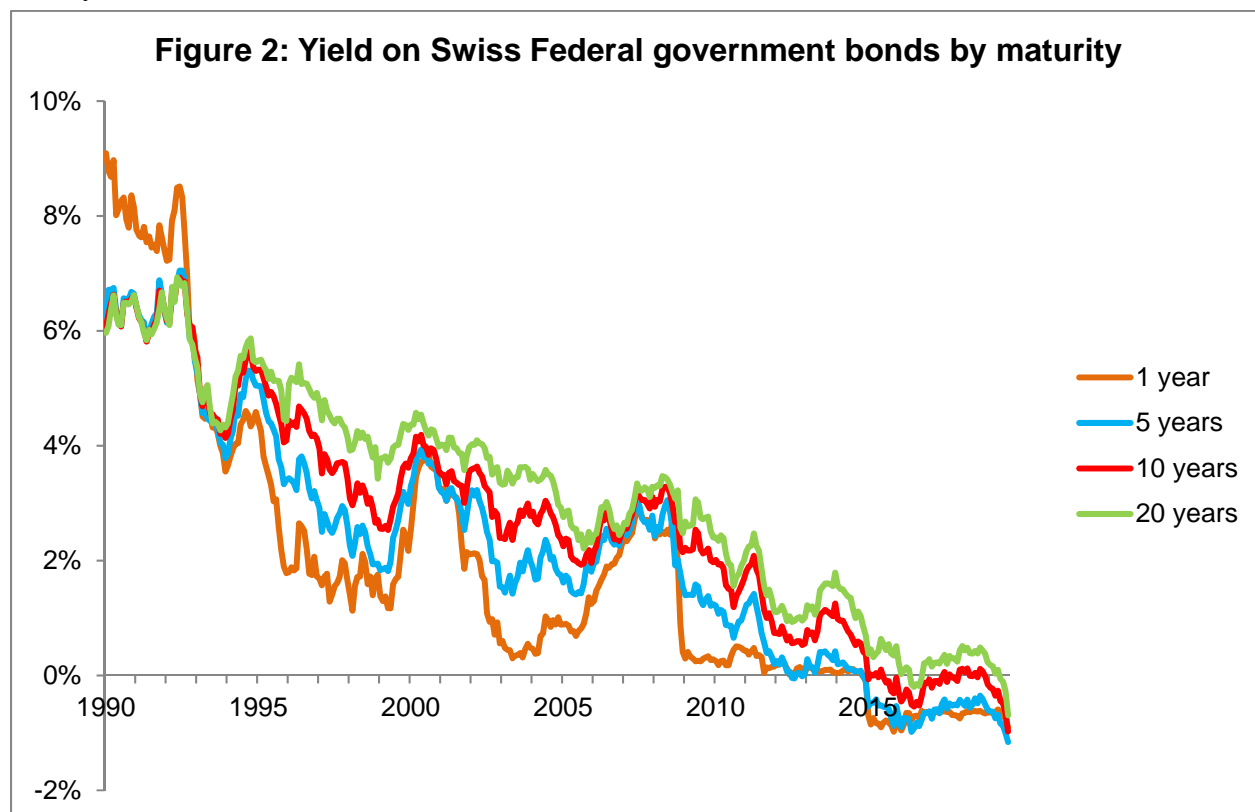
The very low level of public debt and favorable funding terms raise the question of whether the debt brake mechanism in place in Switzerland should be adjusted, as this mechanism has shown a bias toward budgets surplus in practice. A recent report recognizes the issues but recommends against major changes (Brülhart and al. 2017). Tille (2017) presents a critical assessment of the report. A recent analysis by the IMF in their article IV report on Switzerland (2019) also stresses that a more flexible approach to public finances should be taken, without fundamentally putting the debt brake into question.

This paper takes stock of the Swiss situation in light of recent research on public debt. We first document that the global downward trend in interest rates is also present in Switzerland, even after controlling for inflation and the business cycle. While interest rates on private borrowing have also decreased, they have done so by somewhat less than for government bonds. We then show that the interest rate on Swiss government bonds is substantially below the GDP growth rate, and

this pattern has been the norm historically with the 1990's being the exception. In light of this gap, we estimate that Switzerland can keep the debt-to-GDP ratio stable at its current low value and still run an annual primary deficit of CHF 2.6 billion.

The favorable funding terms faced by the Swiss Confederation also raise the option of establishing a sovereign wealth fund that would be financed by debt and invest in higher yielding assets. We consider a broad range of investment options and estimate that a fund amounting to 10% of annual GDP could generate an annual gain between CHF 0.7 billion and CHF 2 billion. While the idea of a sovereign wealth fund has been raised on several instances in recent years, the debate links it to the large balance sheet of the Swiss National Bank. By contrast this paper considers a fund that is entirely distinct from the central bank given that the two institutions have profoundly different mandates.

The paper is structured as follows. The next section clarifies the key concepts, with an emphasis on long run patterns. Section 3 reviews the main aspects identified in the literature and applies them to Switzerland. Section 4 assesses whether Switzerland should take advantage of favorable funding terms by setting up a sovereign wealth fund, and discusses the potential returns as well as governance issues. Section 5 reviews the recent literature on the role of fiscal policy as a business cycle stabilization tool. Section 6 concludes.

2.   <u>Clarification of concepts</u>

2.1.   **Debt dynamics**

The starting point of our analysis is the dynamics of public debt. For brevity we focus on the major aspects and leave a more detailed presentation to the appendix at the end of the paper.

We denote the ratio between public debt and GDP at the end of a year s by b_s. This ratio is the relevant measure for the analysis as it reflects both the amount of debt and the income generated by the economy. The nominal interest rate on the debt is denoted by i_s^G, and the nominal GDP growth rate by μ_s. The primary deficit is denoted by d_s^p (as a ratio to GDP). The dynamics of the debt-to-GDP ratio are then written as:

$$b_s - b_{s-1} = d_s^p + \frac{i_s^G - \mu_s}{1 + \mu_s} b_{s-1} \qquad (1)$$

The debt ratio can increase for two reasons. First, additional borrowing is needed if taxes do not cover non-interest spending. Second, the interest payments on the debt increase its level. Interest payments lead to an increase of the ratio if they exceed the pace of growth (that is if $i_s^G - \mu_s > 0$). Interest payments increase indebtedness but economic growth reduces it.

Equation (1) shows that a stabilization of the ratio between debt-to-GDP ($b_s - b_{s-1} = 0$) leads to a relation between the primary deficit and the gap between the interest rate and the growth rate:

$$d_s^p = -\frac{i_s^G - \mu_s}{1 + \mu_s} b_{s-1} \qquad (2)$$

If the interest rate exceeds the growth rate ($i_s^G > \mu_s$), stabilization requires a primary surplus ($d_s^p < 0$). However, the debt-to-GDP ratio can be stabilized even with a primary deficit if the interest rate is smaller than the GDP growth rate ($i_s^G < \mu_s$).

The central point of Blanchard (2009a,b) is to show that in the United States the most common pattern is an interest rate below the growth rate ($i_s^G < \mu_s$). Whereas this is clearly the case since the global crisis, the pattern is also quite common historically.

2.2.   **Financial assets held by the government**

The analysis can easily be extended to a case where the government purchases assets in addition to issuing debt. We denote the ratio between assets and GDP by f_s and the nominal interest rate earned on the assets by i_s^P. The dynamics of the government's net debt are then given by a modified version of equation (2):

$$(b_s - f_s) - (b_{s-1} - f_{s-1}) = g_s - t_s + \frac{i_s^G - \mu_s}{1 + \mu_s}(b_{s-1} - f_{s-1}) - \frac{i_s^P - i_s^G}{1 + \mu_s}f_{s-1} \qquad (3)$$

As before the dynamics of net debt reflect the primary deficit and the gap between the interest rate on government liabilities and the GDP growth rate. A new element is that difference between the interest rate that the government earns on its asset and the one that it pays on its liabilities. The debt-to-GDP ratio can be stabilized despite a primary deficit if the interest rate on liabilities is lower than GDP growth ($i_s^G - \mu_s < 0$) or if the government earns a higher return on its assets ($i_s^P - i_s^G > 0$).

2.3.   **Theoretical analysis**

Before turning to the Swiss case, we assess how the gap between different interest rates and the gap relative to the GDP growth rate can arise in a standard macroeconomic model. For brevity we focus on the key elements and leave a detailed presentation to the appendix.

The economy is inhabited by a representative household who consumes, supplies a set amount of labor to a firm, and accumulates capital that she rents to the firm. In addition to capital the household can invest in private bonds and government bonds. The government raises taxes, spends, issues bonds, and can purchase private bonds.

Two elements are central to the analysis. The first, and most important one, is that the household's utility is affected not only by consumption but also by her holdings of government bonds. This is a simple way to capture the convenience yield of public bonds, which provide more liquidity and safety than private bonds do. [3] This special benefit from government bonds implies that the interest rate on them is always smaller than the one on private bonds ($i_s^P > i_s^G$). The second element is that the government can invest in private bonds in addition to issuing its own.

The equilibrium of the model gives the interest rates on sovereign and private bonds. They reflect productivity growth, the household's discount rate, and the special nature of government bonds (i.e. their direct impact on utility). We can then assess the impact of changing various parameters based on a numerical illustration presented in the appendix. This exercise is meant to be illustrative and does not reflect a fine calibration of the Swiss economy – an exercise that would require a much more detailed model. The main findings from the analysis are as follows:

- A decrease in public debt increases the gap between the interest rates on private and government bonds, $i_s^P - i_s^G$, reduces the gap relative to GDP growth, $i_s^G - \mu_s$, as well as the primary balance $t_s - g_s$ required to stabilize the debt-to-GDP ratio.
- An increase in public debt that is reinvested in private bonds reduces the interest rate gap, $i_s^P - i_s^G$, as well as the primary surplus $t_s - g_s$ needed for stabilization. This last aspect is

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[3] This modelling approach is identical to the standard "money in the utility function" assumption to capture the transaction benefits from money holdings.

impacted by the sensitivity of the household's portfolio allocation between government and private bonds to the interest rate differential, an aspect that is hard to quantify with precision.

- An increase in the household's patience, for instance reflecting greater uncertainty, raises its propensity to save and lowers interest rates. While the impact on the interest rate gap $i_s^P - i_s^G$ is limited, the gap relative to the growth rate $i_s^G - \mu_s$ is substantially reduced, which lowers the primary surplus $t_s - g_s$ needed to stabilize the debt-to-GDP ratio.

- An increase in the utility that the household directly gets from holding government bonds, for instance reflecting a scarcity of safe assets, reduces the interest rate on these bonds. It increases the interest rate gap, $i_s^P - i_s^G$, reduces the gap vis-a-vis growth, $i_s^G - \mu_s$, as well as the primary balance $t_s - g_s$.

- A decrease in the productivity growth rate lowers all interest rates, but has only a limited impact on the difference between the various interest rates, as well as on the difference between interest rates and the growth rate.

3. __Results from the literature__

3.1. __Introduction__

This section presents a focused review of the main recent research contributions on interest rates on government bonds, and illustrates them in the Swiss context. We start with the downwards trend in equilibrium interest rates – adjusted for inflation and the business cycle – and then consider the gap between the interest rate and GDP growth, before turning to the gap between interest rates on government and private bonds.

3.2. __The downward trend in interest rates__

3.2.1. General points

A major development in advanced economies since more than a decade has been the substantial decrease of interest rates in government bonds. While the case of the United States has been the object of many contributions, it is far from isolated. Bean and al. (2015) show that the pattern is observed in most advanced economies (with of course the exception of the ones that suffered from a crisis, such as Greece). Del Negro and al. (2019) undertake a statistical analysis to identify the component of the interest rate that is common across countries and document a sizable decrease of that global factor. While the downward trend has picked up in the last ten years, it had already been present since the 1980's, which shows the presence of structural drivers.

It is important not to just look at nominal interest rate, as in figure 2, but to take account of inflation and the business cycle. Advanced countries have seen a sizable decrease in inflation since the 1980's. As nominal interest rates include a compensation for inflation, that decrease is of course mechanically reflected in lower interest rates. We thus need to consider real interest rates. An additional element is the need to correct for the business cycle, as the real interest rate is lower during recessions without this necessarily reflecting a long-term trend.

The literature has thus focused on the so-called equilibrium real interest rate, also referred to as the natural rate, which is the real interest rate that would prevail if the economy was growing at its potential growth rate, thus being neither overheating nor in recession. This natural rate cannot be directly observed but can be estimated based on models. Laubach and Williams (2015) developed an approach that is now standard. They apply it to the United States and conclude that the natural rate has markedly decreased, even before the global crisis, in part because of a decrease of the potential growth rate of GDP. Holston, Laubach and Williams (2018) reach a similar conclusion for other advanced economies, as do Del Negro and al. (2019, 2018) based on a broader sample of countries.

There are several underlying causes for this trend. The first is a decrease in the long term growth rate of GDP, primarily because of the slowdown in productivity growth seen over the last decade. Demographic factors also play a role. Gagnon, Johannsen and Lopez-Salido (2016) show that the retirement of the baby-boom generation reduces the labor supply, while the capital accumulated in the past remains in place. The economy is then left with abundant capital which reduces its rate of return and interest rates. Rachel and Summers (2019) review a broad range of drivers that impact the propensity to save of households. They conclude that without the increase in public deficits over the last ten years, the decrease in interest rates would have been even more pronounced. While lower potential growth plays a role, Rachel and Summers (2019) stress that this is a rather recent element while the decrease in interest rates started well before.

Another element is the demand from investors for safe assets that keep their value even during systemic crises. Caballero, Farhi, and Gourinchas (2017) show an imbalance since the beginning of the global crisis between a growing demand and a shrinking supply. Before the crisis safe assets consisted of sovereign debts and structured products developed by financial intermediaries using advances in financial engineering. The crisis sharply changed the environment. The number of countries where sovereign debt can be considered safe has substantially decreased. In addition, the reliability of structured products as safe assets turned out to be much weaker than expected. This led to a sharp decrease in the supply of safe assets at a time when demand kept increasing, leading to lower interest rates on these assets. In a detailed study of the euro area Brunnermeier and al. (2016) make a proposal to increase the supply of safe assets by setting up a European wide institution that would hold sovereign bonds from many countries and issue bonds structured into tranches of varying risk levels.

In addition to being a safe asset, the sovereign debts of some countries are also highly liquid. The transaction volume is high enough so that an investor wanting to buy or sell a sizable amount knows that she can do so easily. Given their safety and liquidity, sovereign bonds are a benchmark asset for the entire financial system. Their yield is often used as the basis to compute the price of other assets by simply adding a spread, and they are used as collateral for a broad range of investments. Sovereign bonds thus constitute a form of infrastructure for financial markets and are an important element in their development, in the same way as the physical infrastructure is important for the development of economic activity.

The special role of government bonds implies that investors are willing to accept a lower yield compared to other assets. This gap can be seen as a convenience yield provided by public debt. [4] Several recent papers focused on that yield. Del Negro and al. (2017) estimate that the yield gap between US government bonds (at a 10 year maturity) and AAA corporate bonds accounts for a substantial share on the decrease in the yield on government bonds. Jian and al. (2019) show that

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[4] In the theoretical model presented in the appendix, this convenience yield is driven by the assumption that government bonds directly contribute to utility.

the convenience yield for short maturities (12 months) play an important role in driving the dollar exchange rate. An increase in the foreign demand for the US dollar raises the convenience yield and appreciates the US currency. Jian and al. (2019) estimate that this factor accounts for 54% of the quarterly exchange rate volatility. Engel and Wu (2019) broaden the sample to the ten major advanced economies, including Switzerland. They show that the cross-country difference in convenience yields[5] is a major driver of the exchange rate, and taking this aspect into account strengthens the estimates of the role of other drivers. A country's currency appreciates when the interest rate or convenience yield on its bond increases relative to their counterparts on foreign bonds. The relevance of the convenience yield is not limited to the United States and is also similarly present for other countries, including Switzerland. [6] This factor has also gained in relevance since the 2008 crisis which showed that sovereign bonds offer more safety than private bonds.

The various drivers of lower interest rates identified in the literature reflect long term trends that we can expect to persist, a point stressed by Williams (2017). The environment of low interest rates should therefore not be dismissed as a temporary situation but should be included as a central feature in the scenarios for the dynamics of public finances in coming years.

3.2.2. *The Swiss case*

What about the Swiss case ? A first approach to compute the real interest rate is to take the difference between the nominal rates (shown in figure 2) and inflation over the last twelve months. While this computation is easy to do, it is important to keep in mind that conceptually the real interest rate should be taken as the difference between the nominal interest rate and the inflation expected over the duration of the investment. For instance, the real interest rate for a 10 year maturity should be built based on expectations of inflation over the next ten years.[7]

Figure 3 shows the evolution of the difference between the nominal interest rates on Swiss Federal government bonds shown in figure 2 and the inflation over the previous year. We observe a clear downward trend since the mid-1990's that has picked up pace since 2015.

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[5] For each country the convenience yield is estimated as the difference between the yield on a 1 year government bond and Libor swaps over the same maturity.

[6] The estimates of Engel and Wu (2019) show a weaker role for Switzerland. This is in part due to the fact that the unexpected exit from the exchange rate floor against the euro in January 2015 makes that month an outlier observation. The results are closer to those for other countries when January 2015 is excluded from the sample.

[7] The simple computation is more reliable at a one year horizon as the measures of inflation expectations at that horizon are quite close to the observed inflation over the previous twelve months.

Figure 3: Difference between interest rates and inflation
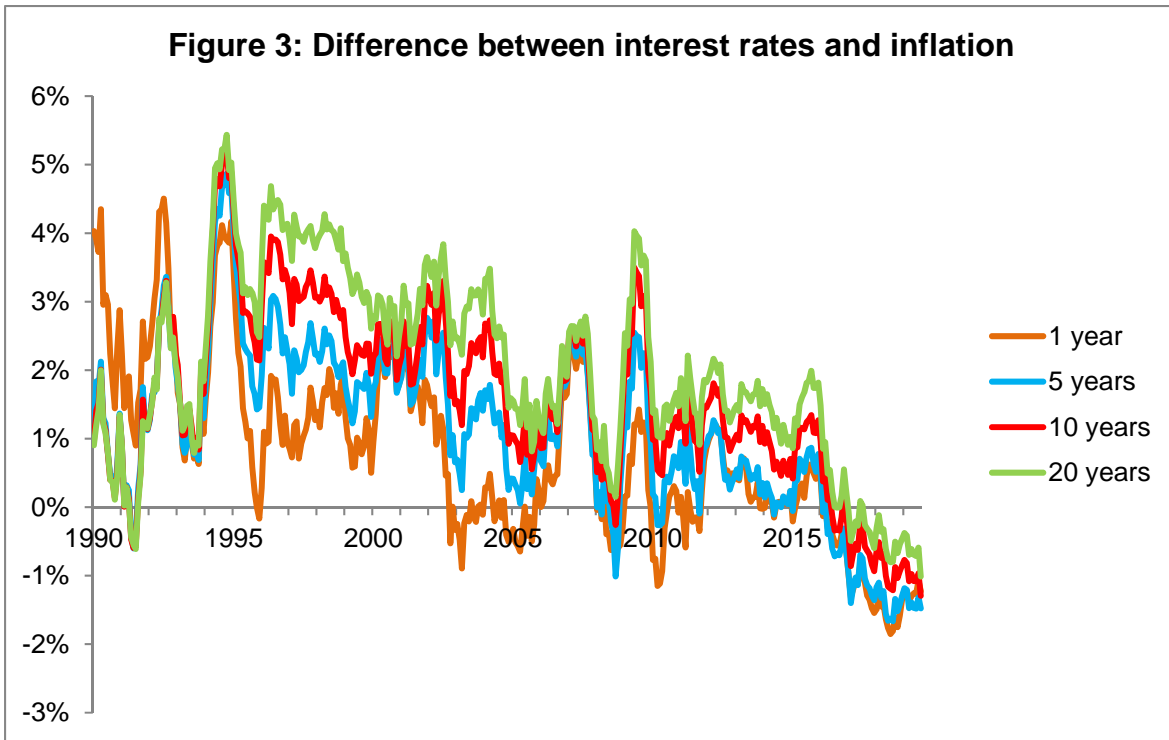
Figure 4 offers a longer perspective and shows the figures (annual averages) since the 1990's based on the yield for a 10 year maturity (red line in figure 3). The real interest rate was clearly positive during the 1950's. It then fluctuated around zero from the early 1960's to the early 1980's, with negative values during the period of high inflation in the 1970's. The real rate since then increased until the mid-1990's before starting a long downward trend. An interesting point from the figure is that the low values of recent years are not unusual in historical perspective.

Figure 4: Difference between interest rate (10 years) and inflation
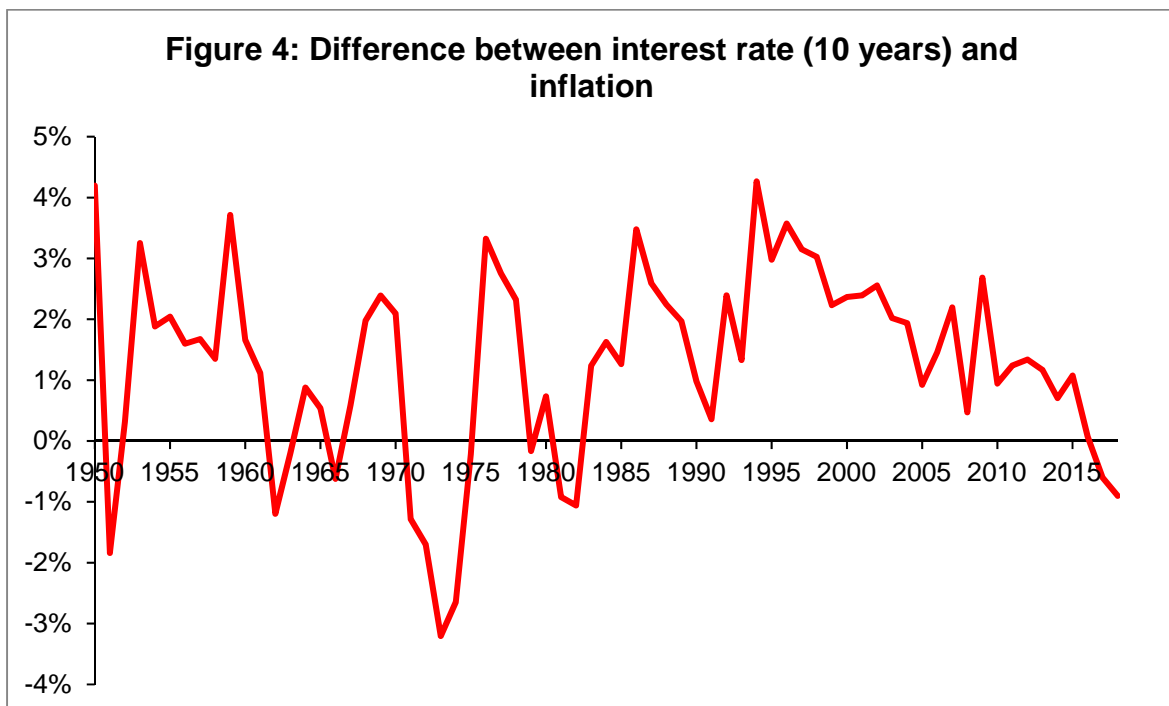
As indicated above, the conceptually correct approach for computing the real interest rate is to rely on inflation expectations. Data on expectations are unfortunately only available for a very short period, in particular for expectations beyond one year. Another approach is to estimate inflation expectations based on a statistical model. The Swiss National Bank published such an estimate for the real interest rate at a 10 year horizon (SNB 2018, figure 5.3) shown in figure 5. It is important to bear in mind that these estimate are not perfectly precise. One should thus look at the general trend instead of the value of any particular year. Figure 5 shows that the estimated value of the real interest rate shows a clear decrease at the beginning of the 2010's, and has since then fluctuated around a slightly positive value.

Figure 5: Estimated real interest rate (10 years)
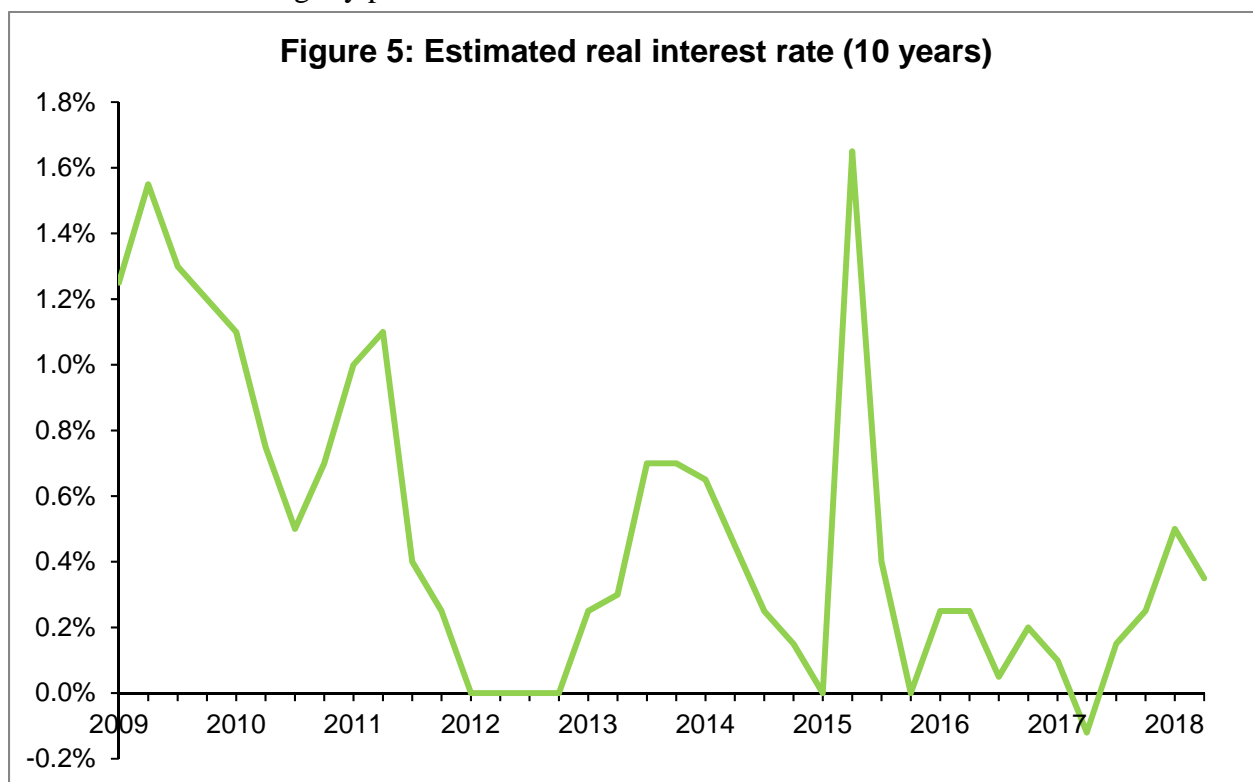
To sum up, the Swiss data show a clear decrease of the real yield of Swiss government bonds. This trend is similar to the one observed in other advanced economies.

3.3.   Interest rates and growth

3.3.1. *General points*

As indicated in the introduction the interest rate on government bonds is lower than the growth rate, a pattern that is not unusual. Blanchard (2009 a,b) points that this gap between the interest and growth rates does not mean that debt is free, as one needs to take into account any crowding out effect at the expense of private investment. He however argues that the magnitude of

this effect is limited, as the return on private capital has not increased. [8] Even though debt is not painless, there is no urgent need to lower it in the current context, a point shared by Furman and Summers (2019).

A recent analysis by Wyplosz (2019) broadens the horizon to a large sample of advanced economies since the 1960's and offers a caveat to the work of Blanchard. Wyplosz (2019) shows that the pattern of an interest rate on public bonds lower than the GDP growth rate is not the standard situation in an international perspective. Overall, the pattern of $i_s^G < \mu_s$ (to use the notation of section 2) is seen in 56% of the years in the United States, and in less than half the time on average in the broader sample. The gap between i_s^G and μ_s is furthermore moderate and quite volatile. Wyplosz also shows that periods of low interest rates are not systematically used to lower the debt burden, which instead increases in half of the observations. This analysis clearly shows that times of low interest rates should not be taken as the norm, but also that there is a high extent of heterogeneity across countries. Some countries benefit from the $i_s^G < \mu_s$ pattern more frequently. This is for instance the case of South Korea (80% of observations) and Switzerland (68% of observations).

3.3.2. *The Swiss case*

We illustrate the pattern in Switzerland in two ways. We first compare the nominal interest rate on government bonds with a maturity of 10 year and the growth rate of GDP since the 1950's.[9] Figure 6 shows this gap using two measures of GDP growth, namely the value in the year (blue line) and the average over the last two years (green line) in order to smooth the short-term growth volatility. We clearly see that the pattern of an interest rate lower than the growth rate is the rule and not the exception. This was clearly the case until the 1970's: the gap averaged -3.27% in the 1950's, -5.30% in the 1960's and -1.91 in the 1970's. The gap then decreased in the 1980's (-1.38%) before turning positive in the 1990's (1.97%). That time corresponds to the decade of low growth that saw a sizable increase in the debt-to-GDP ratio, leading to a policy response in the form of the debt brake. Subsequently, the growth rate has again been higher than the interest rate, both before the crisis (-0.26% in the 2000's) and since 2010 (-1.22%).

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[8] Public debt can even be beneficial in an overlapping generation model, even in the presence of rollover risk for the debt.

[9] The numbers are presented as annual averages for clarity.

Figure 6: Difference interest rate - GDP growth rate

Growth rate of the year — Average growth rate of the last 2 years
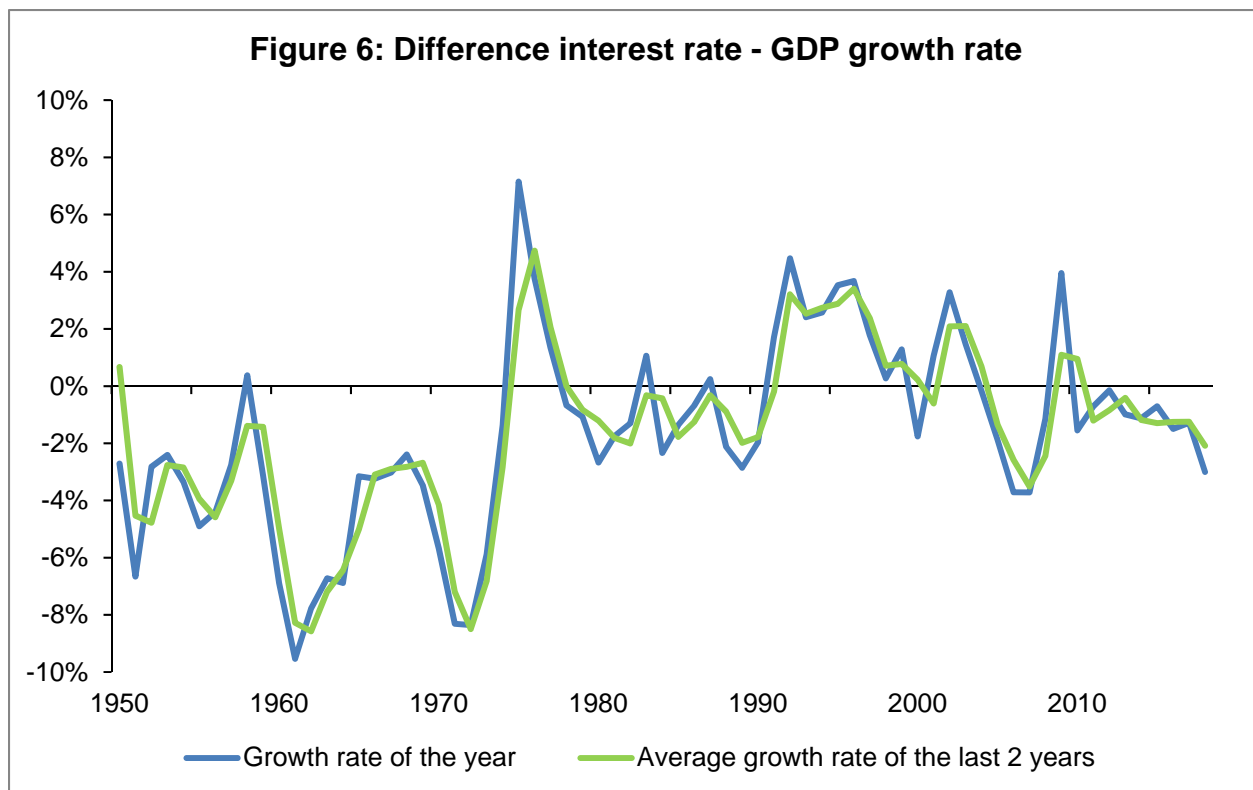
Figure 6 relies on past growth in Switzerland instead of future growth prospects. These prospects are however a more relevant measure to assess the future. This brings us to the second approach in contrasting interest rates and growth rates. We assess growth prospects using the forecasts for Swiss nominal GDP growth in the various issues of the IMF World Economic Outlook (WEO). In addition to the report the IMF publishes a detailed database including forecasts of the main variables at a horizon of 5 years. For example, the October 2018 issue includes actual values until 2017 and forecasts from 2018 to 2023. The various issues of the database are available on the IMF website, with 5 year forecasts starting in 2008. This allows us to track the evolution of Swiss growth prospects. We consider two indicators of nominal GDP forecasts taken from the WEO issued in October of year *t*. The first covers the entire forecast horizon with the annualized growth rate from *t-1* to *t+5*. The second focuses on the last two years of the forecast horizon, which reflect the long term potential growth rate. To do so, we take the annualized growth rate from *t+3* to *t+5*.

Figure 7 shows the difference between the interest rate in Swiss government bonds with a 10 years maturity and the IMF growth forecasts (yellow and red lines). For reference, we also put the difference based on the average growth of the last two years (green line, identical to the one in figure 6). We clearly see that since 2008 the interest rate has been clearly lower than expected growth. The gap has widened and amount to nearly -3% in 2018 (-2.89% based on 2017-2023 growth forecast and -2.65% based on 2021-2023 growth forecasts).

Figure 7: Difference interest rate - GDP growth rate

Legend:
- Average growth (last 2 years)
- IMF forecasts (t-1 to t+5)
- IMF forecasts (t+3 to t+5)
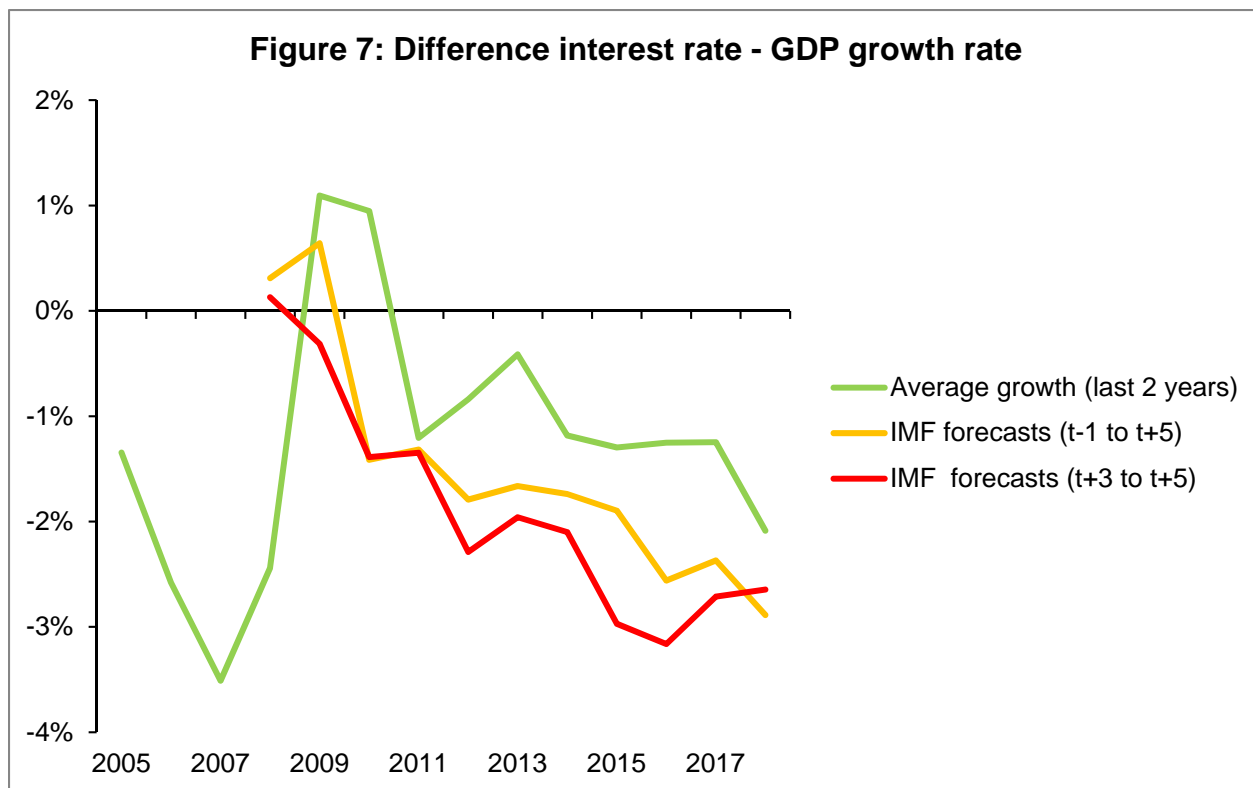
In short, Switzerland is clearly in a situation where the interest rate on government bonds is substantially lower than the GDP growth rate.

3.4.   **Public and private interest rates**

3.4.1. General points

While researchers have clearly shown the large decrease of interest rates on sovereign bonds, the pattern for the return on other assets remains debated. Williams (2007) points out that the rates of return on stocks and private bonds have also decreased. This point is also raised by Rachel and Summers (2019) who show that the interest rate difference between private and public debts has remained globally steady.

Other contributions reach a different conclusion, with a more pronounced decrease of interest rates on government bonds. Caballero, Farhi, and Gourinchas (2017) estimate the risk premium from the return on stocks using a series of models and conclude that it has increased. They infer that the decrease in the interest rate on US government bonds reflects their particular feature as a safe asset. Del Negro and al. (2017) undertake a statistical analysis as well as an analysis based on a model calibrated to reflect the US economy. Both approaches lead to the conclusion that the decrease in sovereign yields is more pronounced than the decrease for other assets. They argue that this reflects the convenience yield offered by sovereign bonds from their usefulness as collateral as discussed above, even in comparison to private bonds with a similar AAA rating. In the context

of Switzerland, Christen and Soguel (2019) present a detailed analysis of the finances of Swiss Cantons (states) and show that the interest rate on their bonds remains well below the return on private assets, specifically the return on pension funds.

3.4.2. *The Swiss case*

A comparison of the interest rates on Swiss Federal government bonds with the rates on private bonds is limited by data availability. We assess the pattern from different angles, namely the difference with the interest rate on other bonds of similar maturity, the difference with rates on mortgages and loans for investment, and the gap relative to the money market rate at a short maturity.

The first measure is the difference between the interest rate on Confederation bonds and the rate on other bonds. Figure 8 shows this difference for bonds with a maturity of 8 years since 2001. We consider three categories of borrowers: Cantons (blue line), banks (green line) and private non-banking firms (industry and trade, red line).

Figure 8: Difference between private yields and yields on Confederation bonds (8 years)
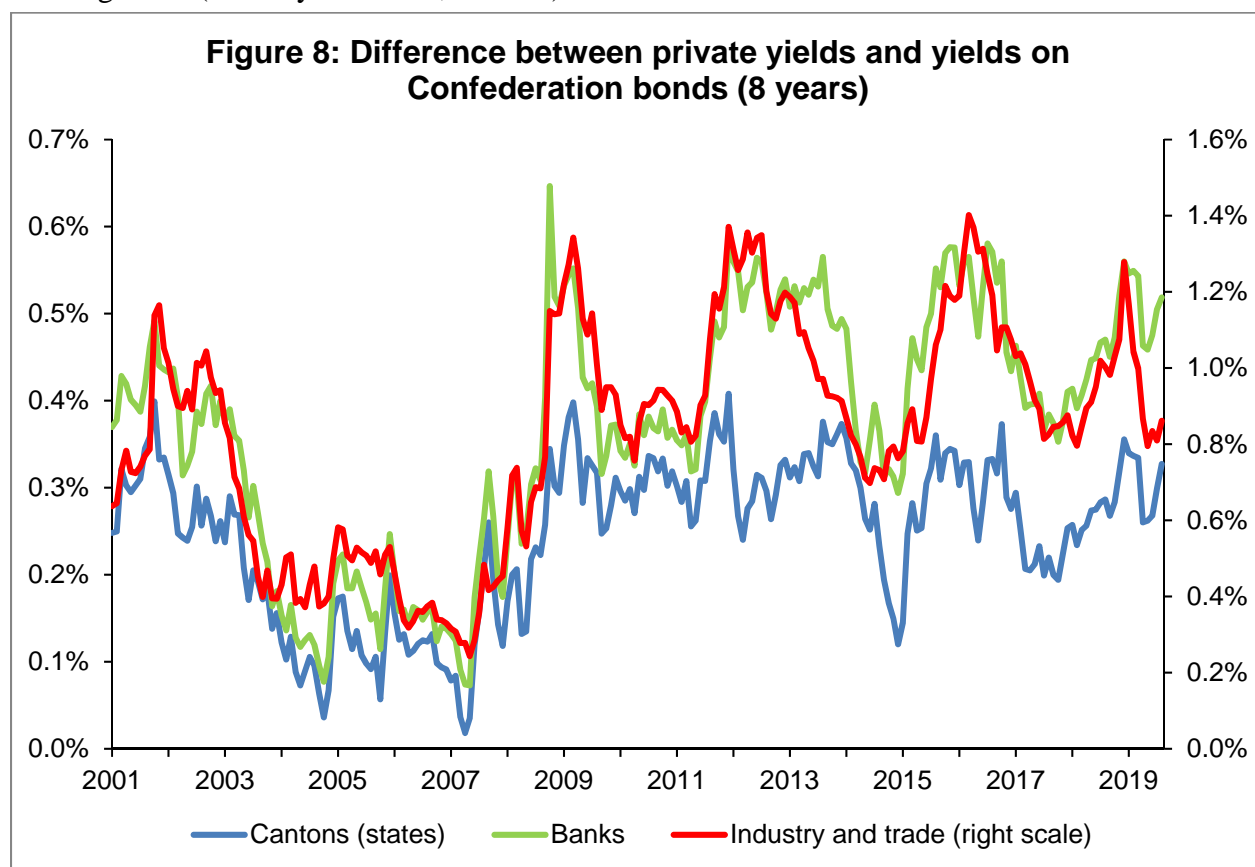
Three points can be taken from figure 8. First, Cantons are unsurprisingly able to borrow on terms that are more favorable than the ones for private bonds, but not as favorable as the terms available to the Confederation. Second, the gap of interest rates relative to the Confederation has increased since the beginning of the crisis, in particular for private borrowers. The average since January

2009 is 0.45% for banks and 1.0% for non-banking firms, compared with 0.16% and 0.42% respectively between January 2004 and December 2007 (the gap for the Cantons moved from 0.11% to 0.29%). A longer perspective however shows a more moderate increase, the gap from January 2001 to December 2002 averaging 0.295 for Cantons, 0.40% for banks and 0.89% for other firms.

Next, we consider the difference between the interest rate on new mortgages and the one on government bonds of the same maturity (figure 9). This difference remained stable since 2015, before showing a clear increase and remaining at a higher value. Between 2010 and 2019 the gap between the mortgage rates and sovereign rates increased by between 0.3% to 0.4%, depending on maturity.

Figure 9: Difference between mortgage rates and yields on Confederation bonds
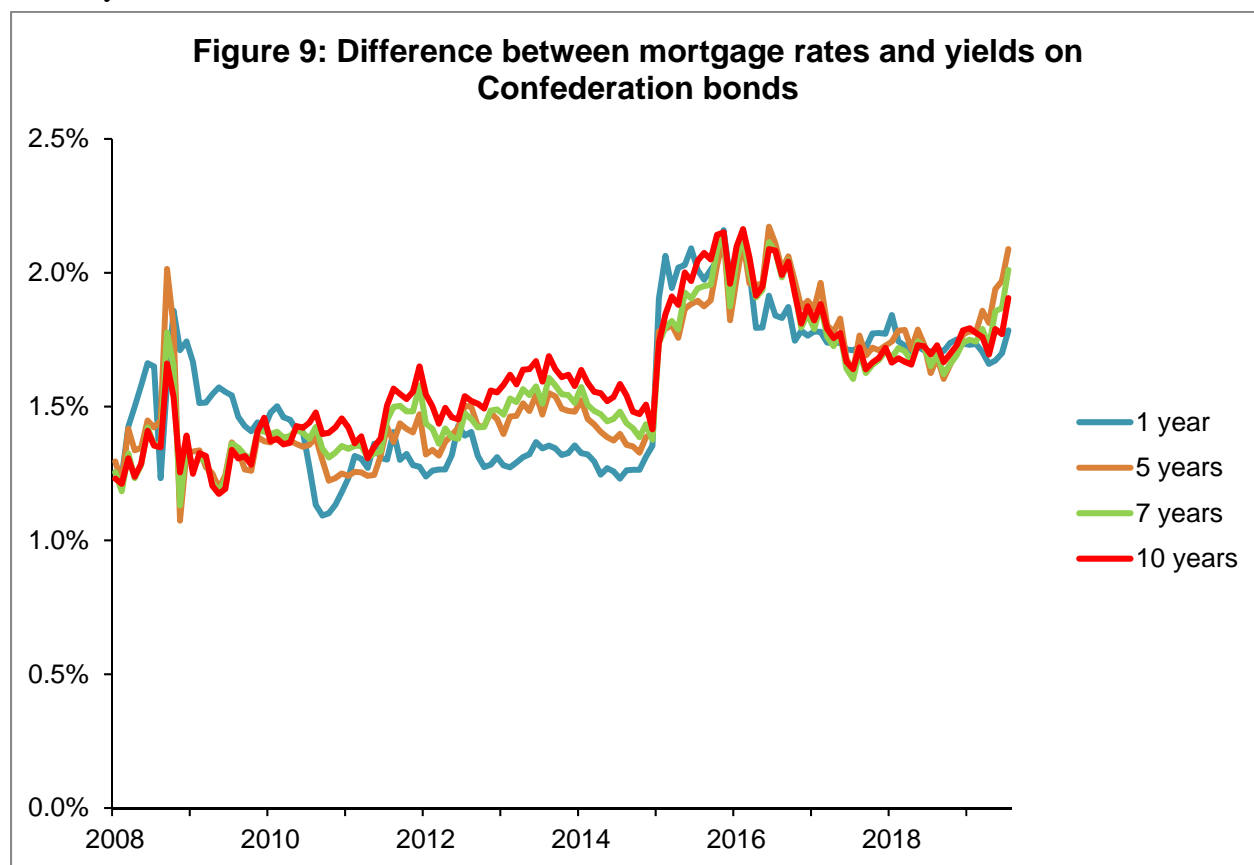
We undertake the same exercise using the interest rate on new credits to firms aimed at funding investment (figure 10). We contrast the rate on loans with a maturity of 6 months to 1 year against the yield on Confederation bonds with a maturity of 1 year (blue line), and the rate on loans with a 5 to 7 years maturity with the average sovereign yield at 5 and 7 years maturity (red line). The pattern is similar to the one for mortgages, with a steady gap until 2015 followed by an increase that has since been partially offset. The gap for loans with a maturity of 6 months to 1 year has increased by 0.4% from 2010 and 2018, while that for loans with a maturity of 5 to 7 years has increased by 0.2%.

Figure 10: Difference between investment credit rates and yields on Confederation bonds
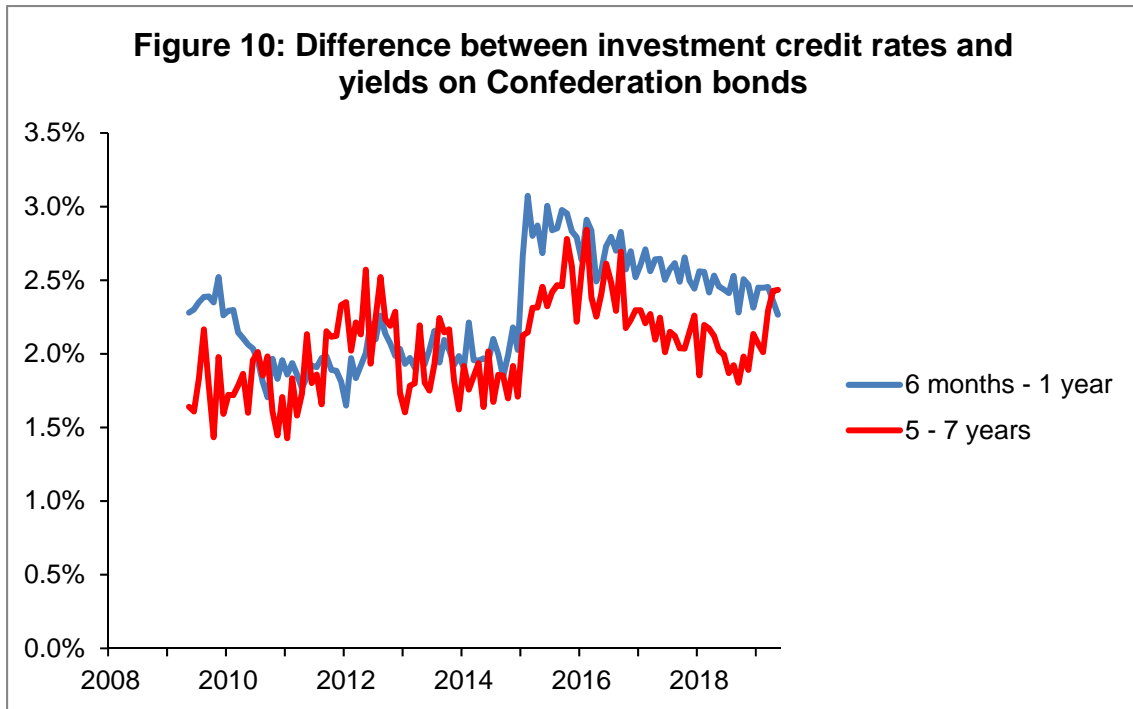
Our analysis so far has focused on the interest rate at medium to long horizons, and we complete it by looking at the short term money market rate. Figure 11 shows the difference between the Swiss franc 12 months Libor and return on Confederation bonds with a maturity of 1 year since 1989. As before, we can see a moderate increase. Abstracting from the extreme values at the height of the crisis, the average gap moved from 0.08% (January 1995 to December 2006) to 0.17% (since January 2011).

Figure 11: Difference between Libor and yield on Confederation bonds (1 year)
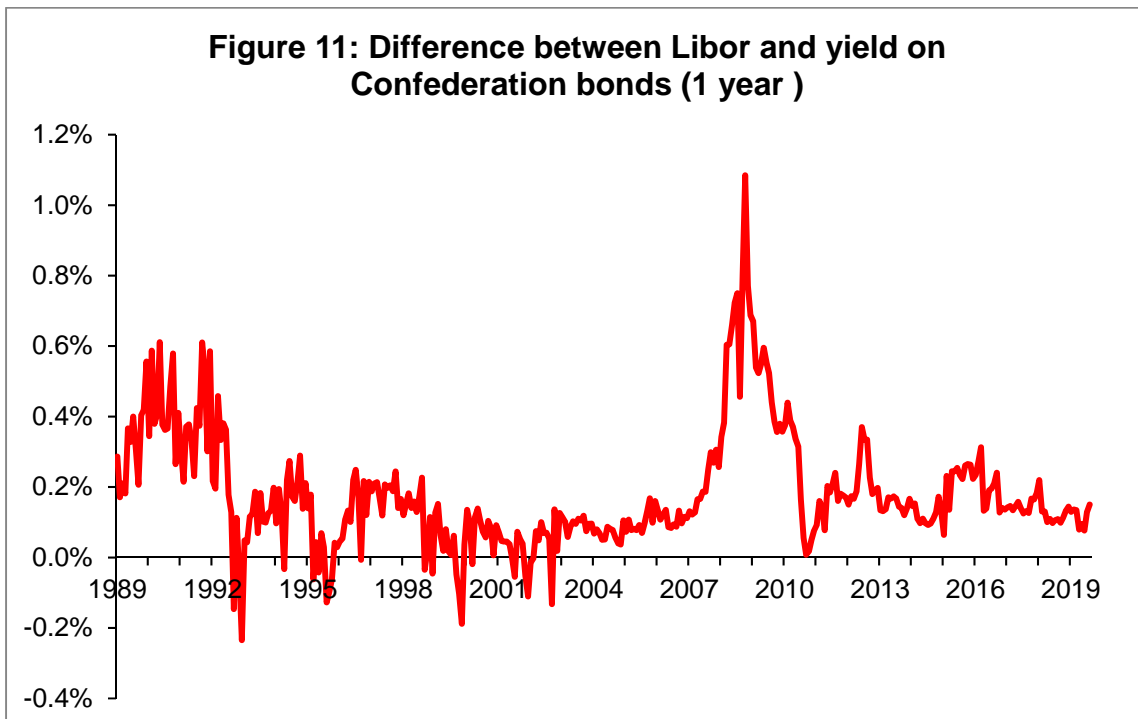
To sum up, bearing in mind the limited coverage of data, we observe an increase of the difference between interest rates for private loans and bonds and the interest rates on Confederation bonds. The increase however is of moderate magnitude. Note that our analysis focused on the cost at which various borrowers can raise funds, and not on the return that the Swiss government could earn from investing. An assessment of that point requires broadening the analysis to other asset categories such as equity investments, and is presented in section 4.

3.5.   Synthesis for Switzerland

3.5.1. Main points

Our analysis of the various aspects identified by the research literature in the context of Switzerland leads to three conclusions:
- The global trend towards lower real interest rates on sovereign bonds is also observed in Switzerland.
- The interest rate on Swiss government bonds is mostly lower than the growth rate of GDP, the 1990's being an exception to this pattern. The gap is substantial and has grown wider in recent years.
- The difference between the funding cost of the Confederation and that of other borrowers has increased over the last ten years, although to a moderate extent.

The driving factors identified in recent studies of the decrease of interest rates mostly reflect persistent forces. The favorable funding environment that the Swiss government has been facing for several years, with a low debt and low interest cost (Soguel 2009), is very likely to last for a long time. The management of public finances should take this point into account. This for instance underlies the IMF (2019) recommendation of a more flexible approach of the debt brake.

3.5.2. Options for economic policy

The favorable funding environment could be put to good use in several ways. We consider three options, namely an increase in the deficit that does not destabilize the debt-to-GDP ratio, an increase in investments, and a reinvestment policy using a sovereign wealth fund, this latter option being detailed in section 4. Our analysis should be seen in a long term perspective as the situation of low interest rates is likely to persist. It is thus distinct from a discussion of using public finances as a tool to smooth the business cycle, which is discussed in section 5.

3.5.2.1. Higher deficit

As indicated above the difference between the interest rate and the GDP growth rate would allow the Swiss Confederation to run a primary deficit while keeping the ratio of debt-to-GDP at a steady value. Recall that equation (2) gives the primary deficit that stabilizes the debt ratio as:[10]

$$d^p = \frac{\mu - i^G}{1 + \mu} b$$

This formula allows us to compute the magnitude of a primary deficit that would keep the debt-to-GDP ratio steady at its actual value of 14.5%. In 2018 the interest rate on Swiss government bonds (10 years maturity) was equal to 0.03%. The IMF forecasts presented in the October 2018 issue of the World Economic Outlook indicate a long term growth of nominal GDP of 2.68%, which gives a gap $\mu_s - i_s^G$ equal to 2.65% (shown in figure 7). Based on these numbers, we get a primary deficit of 0.37% of GDP,[11] which corresponds to CHF 2.6 billion annually. The numbers are similar if we rely on averages over recent years instead of the 2018 values, and are even more favorable if we take the most recent value of the interest rate.[12] Notice that the amount of CHF 2.6 billion per year mirrors the forecasts presented in figure 1 that indicate a debt decrease by CHF 13.6 billion from 2017 to 2022, i.e. CHF 2.7 billion per year.

The Swiss government can thus afford a primary deficit of about CHF 2.6 billion annually while keeping debt at a low share of GDP. This amount could be used for additional spending or tax cuts. While the debate about the appropriate mix of higher spending and lower taxes goes beyond the scope of this paper, we point that either option is preferable to the current policy of paying down the debt, which amounts to investing at a negative rate of return.[13]

A point that is often rightly raised in the debate on the prospects for Swiss public finances is that the country will have to manage the rising cost of health care as well as the funding challenges for the retirement system brought by population ageing. These relevant issues do not undercut our points however. Our analysis shows that a primary deficit is feasible, but says nothing on the amount of taxes and spending leading to the deficit. A given deficit can be the difference between high value of spending and taxes, or low values of both. The increase in the health and retirement

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[10] We consider a long term situation where the interest rates, growth rats, and ratios of the various variables to GDP are constant, and remove the *s* subscript for convenience.

[11] 0,0265 / 1,0268 * 0,145 = 0,37%

[12] The average over the years 2015-2018 gives a value of 2.76% for μ_s and of -0.12% for i_s^G, which implies a deficit of 0.41% of GDP, i.e. CHF 2.8 billion. If we take the average from 2010 to 2018, we get values of 2.83% for μ_s and 0.55% for i_s^G, which gives a deficit of 0.32% of GDP (CHF 2.2 billion). If we take the average of January to July 2019 for the interest rate (-0.38% for i_s^G) the deficit reaches 0.43% of GDP (CHF 3.0 billion).

[13] This point is illustrated by a simple example contrasting two cases. In the first the government repays 5 billion worth of debt which carries a 0% interest rate. In the second one, the government does not repay the debt but invests the 5 billion at a 0% return. Both situations are effectively identical as the net worth of the government has improved by 5 billion and its cash-flow remains unchanged.

costs should be met by policies limiting costs (higher retirement age for instance) or boosting revenues (higher contributions). The ability to run a primary deficit allows for some moderation of the burden stemming from these adjustments. It would by contrast be questionable to reduce the current debt in order to face the future challenges on better terms, as a debt level of 10% of GDP instead of 14% would not change much in terms of handling persistent increases in health and retirement costs.

3.5.2.2. *Additional investments*

A standard rule in public finances is that debt should be used to finance investment. The low financing cost of government bonds implies that the Swiss government could borrow cheaply to invest in a range of projects.

Such an investment could take the form of physical capital (infrastructure, energy efficiency) or human capital (training). Conceptually, the gain from the investment can be measured from the gap between the rate of return on the investment and the funding cost of the government. Computing an estimate of the return of investment is however a complex exercise as some of the returns are indirect. Infrastructure investments support growth, and generate tax revenues in addition to the direct benefit from higher growth. Similarly, training is beneficial for the people directly involved, but also indirectly in the form of jobs created by the spending of trained people. Finally, investing in better energy efficiency generates externalities through reduced pollution. A lowering or simplification of the tax system can also be seen as a form of investment as it raises the incentives for investment. This is particularly the case for the tax treatment of innovation. Computing estimates of the return is however a complex task.

Even though computing estimates of the rates of returns on the various investments goes beyond the scope of this paper, these rates are very unlikely to have decreased in parallel with the interest rates on government bonds. The opposite is more likely given the need for training (in schools and on the job) to prepare the labor force to the challenge of the digital economy, as well as the need for increased energy efficiency in the context of climate change. This increase in rates of returns, combined with the reduction of the interest rate, clearly implies that the net return on these investments has increased in recent years, even though giving a specific numerical value is delicate. The choice between the various investment options will require a much more detailed assessment than the one presented here, and also reflect a political choice.

The investments can be realized within the existing budget procedures, leading to an increase in the ratio of debt-to-GDP (unless they are funded from the primary deficit discussed above). This raises the question of whether the debt burden could become excessive. It would clearly be preferable to face any future economic crisis with a relatively low ratio of debt-to-GDP. Low debt offers the option to face future problems in a more serene way, and the financial value of this option (similar to the value of a call or put financial option) should be included in the analysis. In other

words, a reduction of debt can be seen as precautionary savings to generate more room for maneuver in case of future problems.

Estimating the value of the option offered by a low debt ratio is a complex exercise beyond the scope of this paper. Still, two elements are worth pointing out. First the low (even negative) interest rates on government bonds imply that a policy of precautionary savings through paying down the debt is costly. Second, one needs to take the level of public debt into account. If it represents 60% of GDP (as in the Maastricht criterion) one should carefully think about the option cost of the debt. But Switzerland is in a very different situation given the very low level of debt. It would keep a sizable margin for maneuver even with an increase in the debt-to-GDP ratio, which implies a low value of the option. Espinoza and al. (2015) present a discussion of this aspect and compute estimates of countries' fiscal space, that is the difference between the current debt level and the maximum that the country could bear. They show that Switzerland is one of the countries with the highest margin estimated at 202% of GDP.

An additional point to take into account is that government bonds represent a form of infrastructure for financial markets in the form of a benchmark product used in the pricing of other assets and as collateral. Public debt can then be seen as a central element for the attractiveness of a financial center, and being able to offer such an asset is a competitive advantage for a country such as Switzerland where financial intermediation is an important economic activity. Bacchetta (2017) points that in the current situation, the problem with Swiss debt is actually that its level is too low.

3.5.2.3.   *Financial investments*

One last option for policy is to invest in higher yielding assets, i.e. to create a sovereign wealth fund. Under this scenario the Swiss Confederation would issue bonds and invest the proceedings in other assets. Bacchetta (2017) stresses the benefits that such a fund could bring, and Christen and Soguel (2019) compute estimates on the return that Swiss Cantons could get from following such a strategy. A sovereign fund is an option that is easier to evaluate than other investments as we can rely on financial market data. Setting up the fund would however put in place a structure that is separate from the one used in the standard borrowing procedure by the government. We assess this option in the next section.

4. A sovereign wealth fund for Switzerland?

4.1. Introduction

One of the options available given the low cost of public debt is for the Swiss Confederation to invest in assets yielding a return higher than the interest rate on government bonds. The question of whether Switzerland should set up a sovereign wealth fund, as many other countries have, has been regularly debated in recent years. This interest is largely due to the substantial increase in the balance sheet of the SNB due to the conduct of monetary policy during the crisis that led the central bank to accumulate large amounts of foreign exchange reserves. It is however problematic to link the central bank to a sovereign wealth fund, as these two institutions have fundamentally different mandates. A central bank is tasked with maintaining price and financial stability. This often requires it to adjust its balance sheet in short order, hence the need to hold liquid assets that can easily be sold or bought. A sovereign wealth fund, by contrast, is tasked with generating a good return on its asset over long periods, which translates into a longer horizon and the possibility to invest in assets that are less liquid but yield a higher return. We therefore consider an institution that is entirely distinct from the SNB.

While the majority of sovereign wealth funds are financed by the revenue from natural resources, for instance oil producers in the Middle East and Norway, a country does not need to be a commodity producer to set up a fund. An example is given by Singapore where public funds manage assets abroad that are financed by the savings of the population. In addition, physical assets such as commodities are only one type of resource that a country has. The confidence that global investors have in the country's institution can be thought of as an intangible asset, in the same way as a well-established brand is an asset for a firm.

In this section we assess whether the ability of the Swiss Confederation to borrow at low rates could be used to invest in a portfolio with good return. As discussed at the end of section 3, this approach is distinct from the usual issuance of debt to finance public investments which can be put in place within the existing budgetary procedures. After discussing the particular nature of a fund financed by debt, we assess the prospects based on a broad range of potential investments, and conclude with a discussion of governance aspects which are a major element.

4.2. A particular fund

Existing sovereign wealth funds are long investors whose assets are financed by revenues from past extraction of natural resources or savings accumulated by private agents. A fund financed by government bonds would be a particular case as it would rely on leverage, the bonds issued being liabilities towards investors. As is the case with any leveraged investor the fund should be

careful to ensure that a weak return on its assets does not put it in a position where its assets would durably be worth less that the bonds initially issued to fund it.

While the use of leverage implies a more complex situation than the usual sovereign wealth funds, this aspect can be managed. First, it is a standard issue for all financial intermediaries that invest funds raised from third parties, and is part of their risk management. In addition, leverage is a source of vulnerability when the maturity of liabilities is short, as the fund is then exposed to the risk of funding suddenly drying up. A fund financed by long term bonds has a more substantial room for maneuver. A financing risk remains as investors may only be willing to refinance the bonds at maturity at a higher interest rate. This risk can be managed by sequencing the maturities so that the fund is not exposed to the need of having to refinance a large amount of liabilities in a short time. Furthermore a loss of investors' confidence in the solvency of Switzerland is quite unlikely as long as the Federal government's debt does not rise to a high level. As debt currently stands at 14.5% of GDP, the country has a substantial margin.

The option for the government to benefit from cheap funding costs to invest at a profit has already been proposed for Switzerland. Bacchetta (2017) stresses that Swiss government bonds are a safe asset in high demand from investors. The Confederation can then benefit from a negative risk premium reflecting the confidence that markets grant it. Christen and Soguel (2019) assess a sovereign wealth fund at the level of the Cantons. They recognize that the issuance of additional debt can lead to higher interest rates, and undertake a statistical analysis of the impact of the cantonal debt level on the spread between their interest rate and the one on Federal government bonds. The analysis shows that additional debt leads to an increase in the interest rate paid by the Cantons. The authors then consider the net return of a fund financed by debt and invested in the same portfolio as Swiss pension funds. For each Canton they estimate the debt level that would maximize the return from this leveraged investment. Their results show the presence of a sizable margin, albeit with substantial heterogeneity across Cantons. For the median Canton reaching the optimal investment level requires a tripling of the debt (Christen and Soguel 2019, table 2), leading to an increase of the interest rate by 0.8 percentage point. The income generated by the fund represents 14.5% of the Canton's annual tax revenue. [14] The authors also consider a more cautious strategy where debt is not raised above the value of annual tax revenue. This alternative approach translates into a 57% debt increase for the median Canton, with an additional revenue equivalent to 0.13% of annual tax receipts.

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[14] For the average Canton the additionnal income represents 4.78% of annual revenue, but this average is driven by a few Cantons with very specific financial situations. The median is less sensitive to these outliers.

4.3. **Potential return on the fund**

4.3.1. Portfolios

While assessing the financing cost of a sovereign wealth fund is easily done by taking the interest rate on the Swiss Federal government bonds, the rate of return that can be expected on the assets is more complex to assess. We therefore consider several alternatives. The historical rates of returns for the various assets are presented in figure A.1 in the appendix.

The first two return benchmarks are the returns on Swiss retirement funds. We first consider the median rate of return on Swiss pension funds since 1997, taken from Christen and Soguel (2019) and updated using SwissCanto (2019). The second reference is the return on the compensation fund of the Swiss AVS. The AVS is the pay-as-you-go component of the Swiss payment system, and the contributions received in excess of benefits paid in the past are put in a compensation fund that is invested in a diversified portfolio. The data are from Compenswiss (2018) since 2006, which provides rates of return before and after risk hedging.

The second category of benchmark is based on the performance of assets held by Swiss resident abroad. These returns are computed by Stoffels and Tille (2018) based on the data from the Swiss balance of payments and the net international investment position (NIIP). [15] Given the small size of Switzerland, the domestic investments by a sovereign wealth fund could be large enough to move the market and lower the returns. This issue is not a concern for investments abroad, at the cost of being exposed to fluctuations in exchange rates. As the Swiss franc tends to appreciate, the Swiss franc return on assets denominated in foreign currencies is lowered accordingly. The data from the balance of payments and the external investment position allow us to compute the returns from interest and dividend payments, from capital gains and losses driven by exchange rate fluctuations, and from capital gains and losses due to fluctuations in asset prices. The interest and dividend receipts are taken directly from the balance of payments. The valuation changes driven by exchange rate and asset prices have to be estimated. Stoffels and Tille (2018) construct detailed estimates of these effects since 2000 based on the currency composition of foreign assets held by Swiss investors (as well as foreign investors' holdings of Swiss investments, which we do not consider here), exchange rates, stock prices and bond prices.[16]

The data from the international investment position indicate the values for several categories of investment. The first is the foreign direct investment by multinationals in their foreign affiliates. The second category includes portfolio investment in the form of stocks (including share in

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[15] The financial account in the balance of payments shows the financial flows between Switzerland and the rest of the world, while the NIIP data include the value of investments abroad held by Swiss residents (assets) and the values of investments in Switzerland by foreign residents (liabilities).

[16] The rate of return over a year is computed based on the value of assets at the end of the year, at the end of the previous year, the interest and dividend payments during the year, and changes in exchange rates and asset prices between the end of the previous year and the end of the year.

investment funds) and bonds. Banking positions are the third category, mostly in the form of interbank loans. The final category covers the foreign exchange reserves held by the SNB. We focus on some specific categories. As foreign direct investments cover holdings within a corporate group (unlike portfolio investments) and bank lending consists mostly of short term positions, we focus on investments in the portfolio category (total, in stocks, and in bonds) and the reserves of the SNB. The inclusion of these reserves is done solely to show the return on its portfolio. As indicated above, the mandate of a central bank is fundamentally different from that of a sovereign wealth fund.

The last benchmark for the assets of the fund is given by the return on investments in stocks. We consider the returns on the stock markets of Switzerland, the United States, the euro area, the United Kingdom and Japan. We rely on total return indices, including reinvestment of dividends, taken from Datastream since 1988. These indices are measured in local currencies and we convert them in Swiss franc using the corresponding exchange rates. [17] We also consider an average of the stock market returns in foreign countries weighting them by their share to the overall GDP.

4.3.2. *Average returns and volatility*

To ease the comparison between the various portfolios we compute the returns from 2000 onwards, except for the AVS compensation fund where the data start in 2006. As inflation has decreased from the early 2000's we base our analysis on real rates of returns, deflating the nominal rates by the inflation of the corresponding year. The performance over several years is measured by the average real return (computed as the geometric average of the annual real rates) and the standard deviation of annual real rates of returns.[18]

The average annual real rates of return are presented in figure 12. The first block shows the results for the AVS fund and the pension funds, with rates between 1.5% and 2.3%. The second block presents the figures for the various categories of assets held abroad by Swiss residents, based on the external Net International Investment Position data. The return on overall portfolio assets (0.8%) is lower than the one generated by pension funds. This essentially reflects the returns on stocks, as the investment in bonds generated a return of 1.2%. The return on the reserves of the SNB is higher (1.8%). The relative weak performance of investments abroad largely results from the appreciation of the franc against the other currencies which has been particularly sizable since 2008 (Stoffels and Tille 2018).[19]

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[17] The returns for a given year are based on stock indices and exchange rates in December of each year.

[18] The exact formulas are presented in the appendix.

[19] The stronger return on the SNB reserves compared to the portfolio investments is an interesting aspect. It may result from a favorable investment timing. The central bank increased the share of stocks in its portfolio in the most recent years of the sample, and thus avoided the weak performance of stocks in earlier years that lowered the rate of return for portfolio investment.

Figure 12: Average real rate of return since 2000 (AVS: 2006)

Category	Value
AVS (before hedge)	1.5%
AVS (after hedge)	1.6%
Pension funds	2.3%
NIIP portfolio (total)	0.8%
NIIP portfolio (stocks)	0.7%
NIIP portfolio (bonds)	1.2%
NIIP SNB reserves	1.8%
Swiss stocks	2.9%
Foreign stocks	0.1%
US stocks	1.7%
Euro stocks	-0.4%
UK stocks	-0.6%
Japan stocks	-2.3%
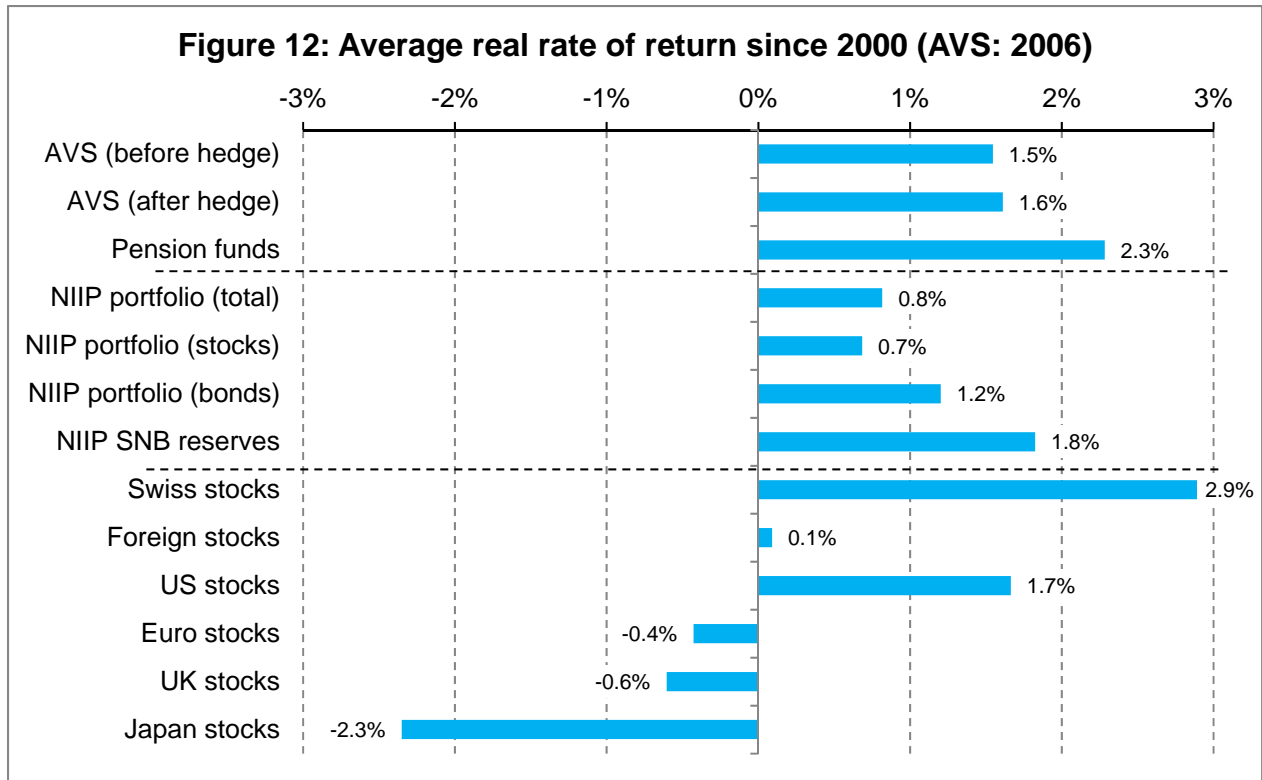
The last block of figure 12 focuses on the returns on stocks. The Swiss market yielded an average return of 2.9%, substantially outperforming foreign markets, especially outside the United States. While a Swiss investor earned a real return (in Swiss terms) of 1.7% on the US market, he suffered negative returns in Europe and especially in Japan. This weak performance of Europe and Japan translates in a real return of essentially zero on a portfolio invested in the various countries in line with their GDP values.

The weak performance of stock markets in figure 12 is in large part due to negative returns in the early 2000's and during the global crisis. The situation is more nuanced if we take a longer sample. Figure 13 shows the average real rate of return since 2000 (blue bars, corresponding to the values in figure 12) and since 1990 (red bars). Stock markets performed much better when we consider a longer horizon, with the exception of Japan that has faced challenging times since the early 1990's. While the average return on the Swiss market (7.1%) still exceeds that of foreign markets (3.4%), the return on these remains sizable, especially in the United States.

Figure 13: Average real rate of return
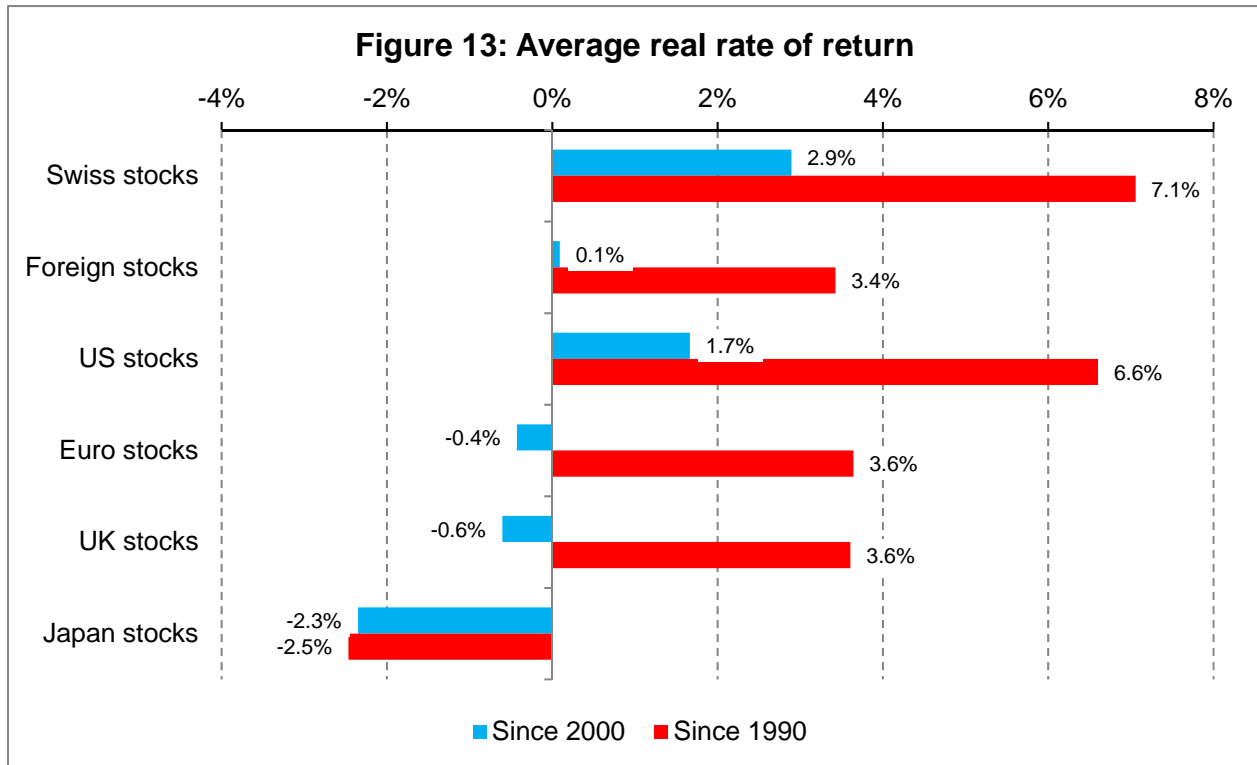
Simply extending the time horizon by a decade raises the real return on foreign stocks by more than 3%. This is due to the fact that stock markets had particularly bad years in the early 2000's and in 2008-2009, as shown in figure A.1 in the appendix. While the NIIP data unfortunately do not allow us to compute the rate of returns since 1990, we can construct an estimate based on some assumptions. The analysis by Stoffels and Tille (2018) shows that stocks accounted for half of the investment in the portfolio category of the NIIP at the beginning of the 2000's. If we consider an average real return on bonds equal to 1.20% over the sample and a real return on stocks equal to 3.68% instead of 0.68%, we obtain an average rate of return on the overall portfolio category in the NIIP data equal to 2.4%.[20]

Broadly speaking, figure 12 indicates a real rate of return between 0.8% (portfolio investment abroad) and 2% (pension funds), or even 2.4% (portfolio investment abroad in the longer sample). Higher returns can be obtained on stock markets, at the cost of a higher exposure to substantially weak returns in some markets.

An assessment of the investment prospects must take the volatility of returns into account. This aspect is presented in figure 14. Blue bars show the standard deviation of annual rates of returns. Unsurprisingly the investments in stocks display the most volatile returns, and the ones on foreign bonds are more stable despite the presence of exchange rate risk. The volatility of portfolios including both stocks and bonds lies between these two extremes. The volatility of the returns on the SNB reserves and the AVS fund (after hedging) stands at around 7.5%, with the returns of

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[20] $0.0244=(1+0.03+0.0068)^\wedge(0.5)*(1+0.012)^\wedge(0.5)-1$

pension funds being steadier. The standard deviation for pension funds should however be taken with some caution: the data indicate the return of the median fund, but this is not the same fund from one year to the next. Thus the rate of return for a given fund can be more volatile than for the median fund.

Figure 14: Standard deviation of real rate of return since 2000 (AVS: 2006)

	1 year	3 years (annualized)	5 years (annualized)
AVS (before hedge)	8.4%	4.7%	3.2%
AVS (after hedge)	7.5%	3.9%	2.4%
Pension funds	6.0%	3.4%	2.2%
NIIP portfolio (total)	8.2%	4.9%	3.1%
NIIP portfolio (stocks)	14.1%	8.9%	5.5%
NIIP portfolio (bonds)	4.5%	2.0%	1.5%
NIIP SNB reserves	7.6%	3.1%	2.1%
Swiss stocks	18.0%	11.0%	6.5%
Foreign stocks	18.9%	12.4%	8.3%
US stocks	17.7%	12.8%	9.7%
Euro stocks	22.5%	13.6%	8.7%
UK stocks	18.3%	11.1%	6.6%
Japan stocks	19.9%	13.2%	8.3%

The volatility of returns at a horizon of one year is not the most appropriate for a sovereign wealth fund with a long term investment horizon. To illustrate the point we also compute the standard deviations of annualized returns over longer horizons, namely 3 and 5 years. For each year in the sample we compute the average return over the last 3 (5) years. We then take the standard deviation of that moving average. The results are shown by the red bars (3 years horizon) and the green bars (5 years). We clearly see that this moderate lengthening of the horizon substantially lowers the volatility of returns. While the equity portfolio still shows the most volatility, this is reduced by a factor of 3 by moving from a one year horizon to a five years one. A bond portfolio remains the safest, and a portfolio with a mix of the two shows a volatility that is higher, though still moderate.

Figure 15 presents the combinations of average real rate of returns (horizontal axis, corresponding to figure 12) and risk measured at the 3 years horizon (vertical axis, corresponding to the red bars in figure 14).

Figure 15: Average return and risk
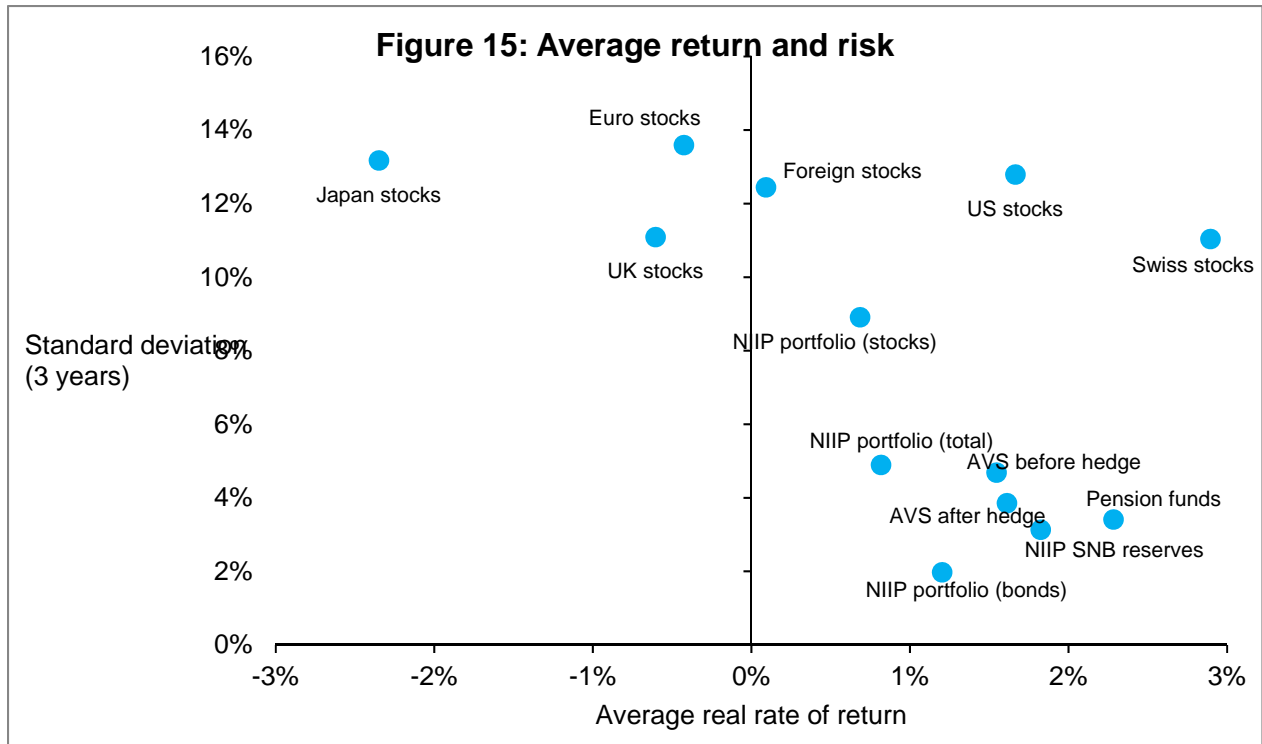
The most interesting portfolios are the ones located in the lower right corner with a high average return for a moderate risk. The portfolios of the AVS funds and median pension funds are in this configuration, as are the reserves of the SNB. The portfolio of foreign bonds also presents an interesting option, although with a lower average return. Stock portfolios display a sizable risk without a clear gain in terms of average returns, except for the Swiss market.

Figure 16: Average return and risk
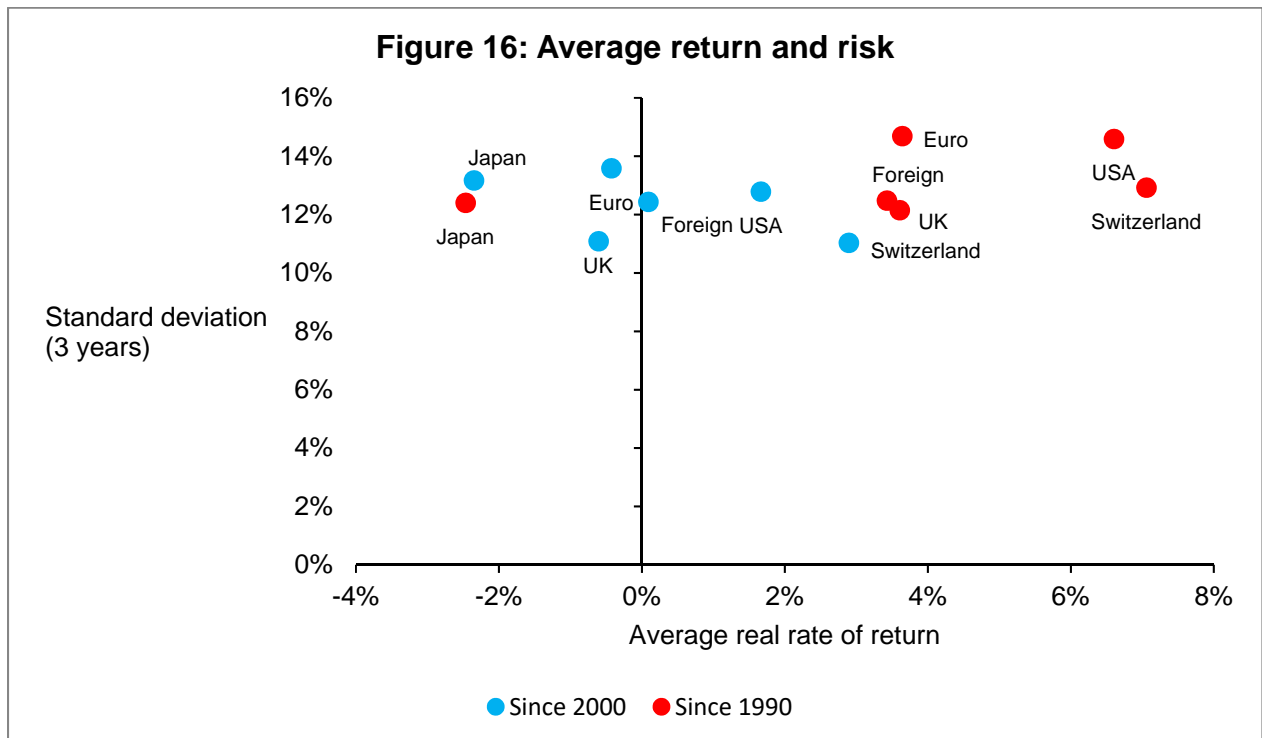
As indicated above, stock portfolios have experienced a weak spell during the crisis of 2008. Figure 16 is built along the same lines as figure 15 and focuses on investment in the stock market. It shows the pattern since 2000 (blue dots, corresponding to figure 15) and since 1990 (red dots). With the exception of Japan, the situation is substantially different over the longer sample, with a higher average rate of return for only a moderate increase in risk (red dots are clearly to the right of the corresponding blue dots, and only moderately above them).

Our analysis shows that diversified funds such as the one of the AVS or pension funds can deliver an average real return of 1.5% to 2%. Investments in foreign markets give average returns between 1.2% (bonds) and 1.8% (SNB reserves), or even 2.4% (overall portfolio over the longer sample). We therefore consider an interval of 1% to 2% for our analysis. These values are relatively conservative as investments in stocks can give higher average returns, but at the cost of an exposure to risk that can weight on returns for long periods.

4.3.3. *How much would a sovereign wealth fund yield?*

As a Swiss sovereign wealth fund would be funded by issuing Confederation bonds, we need to put the 1-2% real return on assets in perspective with the cost of debt. At first we may want to simply take the average real interest rate since 2000, i.e. 1.27% for a 10 years maturity. This leads to a moderate margin between the return on assets and the cost of debt.

This simple approach is however questionable. As we have shown the real interest rate on the Swiss Federal government bonds has clearly decreased over the last twenty years (figure 3), with an average value of 0.07% between 2014 and 2018, and a negative value of -0.9% in 2018 for ten year bonds. The literature has shown that this trend is broadly observed in advanced countries and reflects structural factors. It is therefore likely that the Confederation will be able to borrow at low rates for many years. An interesting aspect is that the downward trend is specific to the interest rate on government bonds. By contrast the real rates of return on the various portfolios analyzed above show no such trend.[21] The decrease in the interest rate on sovereign bonds translates into a higher gap relative to the returns on the various assets.

In addition, the interest rate on a Confederation bond issued today remains valid for the entire maturity, even if the price of the bond on the secondary market subsequently decreases. We consider a nominal interest rate of 0% on government bonds[22] and an inflation rate of 1% in the future. This value corresponds to the middle of the 0-2% range defined as price stability by the SNB. In addition, the forecast of the SNB in its latest quarterly bulleting (SNB 2019) shows that an inflation rate of 1% should be reached by mid-2021. With these figures, we obtain a real interest

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[21] An econometric analysis confirms this point. If we regress the real rate of return of the various investment options on a linear trend, the estimated coefficient is never significantly different from zero. The same regression using the real interest rate on government bonds shows a strongly significant negative coefficient on the trend.

[22] Even though the rate is currently much lower, we take a conservative approach for our computations.

rate of -1% for the Confederation bonds. All in all, a range of -1% to 0% for the real interest rate on government bonds is reasonable.

Our estimates for the real rate of return on the fund's asset and the real interest rate on the bonds used to finance it allow us to compute the returns that the Swiss government would obtain from a sovereign wealth fund (table 1). If the fund amounts to 10% of GDP (CHF 70 billion) we obtain an annual return between 0.1% and 0.3% of GDP, i.e CHF 690 million to CHF 2.07 billion.

Table 1 : profits on a portfolio of 10% of GDP
CHF billion and % of GDP

		Real interest rate on government bonds	
		0%	-1%
Real rate of return on assets	1%	0,69 ; 0,1%	1,38 ; 0,2%
	2%	1,38 ; 0,2%	2,07 ; 0,3%

A fund amounting to 10% of GDP is quite sizable, but not unrealistic as it would bring the debt-to-GDP ratio to 24.5%, which is still a moderate value. In addition the issuance of additional debt would provide financial markets the safe asset that they are craving, a form of financial infrastructure as discussed above.

A more cautious alternative would be to use the reimbursement of the debt forecasted from 2017 to 2022 (CHF 13.6 billion, figure 1) and instead invest it in the fund. The profits would then be between CHF 136 and 408 million.

Our analysis shows that the Swiss Confederation could generate sizable profits by investing along the same lines as pension funds or the AVS fund instead of paying down the debt. Such a sovereign fund would not be a magic wand, as the profits would not be enough to solve the challenges of the cost of pensions or health for instance. It would still bring a useful additional margin.

The computations presented in this section aim at establishing an order of magnitude for the foreseeable profits. The can be substantially refined in more detailed analyses of the investment options to obtain more precise estimates.

4.4. **Governance issues**

A major lesson from the literature on the political economy of public finances is the presence of a deficit bias as the authorities have an incentive to pass the cost of their decisions onto others (Brülhart and al. 2017, Fatás and al. 2019, Wyplosz 2019). In the context of a sovereign wealth fund this implies a risk that investments are chosen based on political considerations rather than on

long term returns. The governance of the fund is thus a central element, both for its setup and its day-to-day management.

As indicated above the fund should be separate from the central bank given the profound difference between their respective mandates. While Norway offers an example of a sovereign wealth fund managed within the central bank, this governance structure has recently come under criticism from Knut Kjaer who headed the fund from 1998 to 2007 (Financial Times 2019b). He stresses the need to have an independent institution manage the fund following the recommendation of an expert committee rather than putting it in the central bank.[23]

While the fund should be separate from the central bank, the two institutions show some parallels in terms of their governance. The role of the central bank is to ensure price and financial stability. As its policies take time to deploy their effect, the institution must conduct its policy looking beyond short term economic fluctuations. The literature on the optimal governance of central banks stresses the need for their independence to shield them from short-sighted political pressures. This independence is granted within a well-defined framework set by the legislative authorities, and comes with a duty of accountability and communication through speeches and regular media communication.

A sovereign wealth fund is faced with similar challenges as it needs to focus on the long term return on its investments, and it is important to protect it from pressures that would steer it away from this mandate. The fund should be managed by an independent entity. At the time of the fund setup, the institution would receive an explicit mandate from the political authorities regarding its objectives. The mandate should specify the horizon of the investments, the decision rules regarding the risk tolerance and the split of investment between domestic and foreign assets. The mandate given by the authorities should focus on setting up the strategic objectives and leave their implementation to the management of the fund. This would ensure that political pressures do not affect the operational conduct of the fund, for instance in choosing specific domestic investments with a risk of favoring politically sensitive sectors. A well-defined mandate would also facilitate the interaction with neighboring countries, as otherwise investments in foreign assets could lead to accusations of political influence of exchange rate manipulation.

The definition of the investment horizon should also ensure that the fund does not come under undue pressures when some of its investments will show losses during times of weakening markets, as such a situation will certainly occur at some point. The entity managing the fund will need to regularly present and motivate its investment choices within the given mandate. Conpenswiss, who

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[23] The potential impact of the fund's investment on exchange rates could affect monetary policy. In the current configuration we can expect that an increase in the supply of safe assets denominated in Swiss franc – issued to finance the fund – leads to a weakening of the franc as it would reduce the scarcity of safe assets. This mechanism, which is hard to precisely quantify, would support the SNB in its efforts to counter the strength of the Swiss franc.

manages the funds of social insurances, offers an interesting example, even though its mandate is not solely geared towards long-term returns.[24]

Another aspect of governance is the procedure for the payment of earnings from the funds to the political authorities. This can also be subjected to political pressures for the funds to disburse its returns faster than it should from a long-term perspective. In addition, the volatile return on some assets can translate into volatile payments, or even to a situation where the value of assets would fall below the amount of sovereign debt that was initially issued to finance the fund. Here also the governance of the central bank offers an interesting benchmark, as the return on its foreign exchange reserves also fluctuates substantially with markets. In Switzerland, the transfer of the SNB profits, beyond the dividend paid to shareholders, is set in a clear and transparent rule.[25] In a first step, some of the profits are put in a « provision for monetary reserves» in order to ensure that the central bank's equity remains at a sufficient level. The remaining profits (or losses) are put in a « provision for future payments», which can have negative balance. The payment to the Confederation and the Cantons is then set based on agreement between the SNB and the Confederation that is renewed every 5 years. This mechanism allows for the payment to be smoothed across years, with the « provision for future payments» acting as a buffer, and to anchor it in a predetermined rule. A similar mechanism could be put in place for a sovereign wealth fund. In the early years of the fund's operations, profits could be used to set up an equity buffer. After that, profits could be put into a provision account from which payments to the government would be drawn based on a preset rule aimed at smoothing them.

Governance issues are essential to ensure that a sovereign wealth fund is soundly managed with a long-term view. These challenges are however not very different from the ones faced by existing institutions, such as the central bank, and can be handled using rules and structures that are in place in these institutions.

A question specific to the Swiss context is whether a fund would be consistent with the debt brake rule. From an economic point of view the answer is yes. While the fund is financed by additional public debt, it is invested in financial assets and thus does not constitute a net liability. In addition, the fund could be financed simply by using the amounts that will instead go towards paying down the debt under the current projections. This would leave the debt unchanged.

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[24] https://www.compenswiss.ch/fr/?page_name=intro
[25] https://www.snb.ch/fr/iabout/snb/annacc/id/snb_annac_profit

5. <u>Impact of temporary policies</u>

5.1.   **Introduction**

The analysis in sections 3-4 focuses on a long term view of the trends in interest rates and their relation to growth. This section completes the analysis by considering the suitability of fiscal policy as a tool to smooth the business cycle, a point that is often debated and has been the object of many recent studies.

The effectiveness of fiscal policy is most often presented in the form of the « fiscal multiplier». This number indicates whether fiscal policy impacts GDP growth, and if so whether there is an effect beyond the direct impact of government spending. We can distinguish between three cases:
- Multiplier equal to 0: GDP is not affected by the policy. The direct impact of higher public consumption is fully offset by a reduction in private consumption or investment, for instance because borrowing by the government diverts funds away from private investment (the so-called « crowding *out* » effect).
- Multiplier between 0 and 1: GDP increases moderately. The direct impact of government spending is only partially offset by a decrease in private demand. Fiscal policy can then stimulate growth, but its effectiveness is limited by the adjustment of consumers and firms.
- Multiplier equal to 1 or higher: GDP increases substantially. The direct impact of public spending is magnified by an increase in consumption or investment. This can be the case if firms are initially in a « wait and see » stance due to uncertain demand. In that case the fiscal expansion acts as a prop to private demand (« crowding *in* » effect).

We start with a review of theoretical considerations before presenting the main findings from the recent literature.

5.2.   **Theoretical aspects**

The starting point of theoretical works is often the Keynesian model that focuses on aggregate demand, under the assumption that the economy does not face supply constraints and instead has under-used resources, due for instance to high unemployment. An increase in government spending raises GDP. This in turn increases the income of households, inducing them to spend more and boosting GDP further. This amplification is however offset by an increase in interest rates which raises the funding cost of firms and reduces investment. The final impact of fiscal policy depends on the relative strength of these mechanisms.

A limitation of the standard Keynesian model is that it focuses on the short term behavior of the economy and abstracts from households' and firms' intertemporal decisions. These decisions

can however materially lower the effectiveness of fiscal policy. The central mechanism is the so-called « Ricardian equivalence ». We illustrate it in the context of a temporary tax cut funded by additional public debt. In the long run the government will raise taxes to pay for the interest on the debt. Households choose their consumption by taking account not only of the short term situation but also on the long term. They foresee the future increase in taxes which will lower their future available income, and choose to save to smooth consumption through time. The additional savings exactly match the extra government debt. The temporary tax cut is thus entirely saved and has no impact on GDP in the short run.

The Ricardian equivalence mechanism rests on the assumptions that households and the government share the same time horizon and can access financial markets on the same terms. If this is not the case fiscal policy has an effect. It can for instance be the case that households face a temporarily low income and would like to borrow, but cannot do so because of credit constraints. A temporary tax cut then offers them the opportunity to increase their resources today at the cost of a lower income in the future, in other words to borrow via the government. This pattern is relevant during a recession, but less so during a boom when households are not constrained. We can therefore expect the effectiveness of fiscal policy to be stronger during recessions than during expansions.

An additional element relevant for the effectiveness of fiscal policy is the reaction of the central bank. Consider the case where a fiscal expansion is only partially offset by lower private demand and raises GDP. The increase in activity leads to inflationary pressures. As the central bank is tasked with ensuring price stability, it reacts by tightening monetary policy to dampen growth. The stimulus from fiscal policy is then offset by a contractionary monetary policy. The reaction by the central bank however takes place provided that it is itself free to move. Consider instead a situation where inflation is too low and the central bank cannot stimulate economic activity (for instance because it is faced with a lower bound on interest rates). The central bank then welcomes the inflationary stimulus from fiscal policy and does not offset it. We can thus expect fiscal policy to be more effective in times where monetary policy is constrained, for instance by a limited ability to push interest rates in negative territory.

The theoretical analysis also underscores the relevance of the exchange rate regime in an open economy, with fiscal policy being more effective in a fixed exchange rate regime. The increase in government spending leads to a higher interest rate (as in a closed economy) which translates into an appreciation of the currency. With a flexible exchange rate this appreciation reduces the competitiveness of exporters and leads to a trade deficit which limits growth. Under a fixed exchange rate regime the central bank has to intervene to counter the appreciation of the currency, and monetary policy takes an expansionary stance. This reinforces the fiscal stimulus leading to a strong effect on growth.

The view of economists on fiscal policy has substantially evolved with the global crisis. Beforehand the profession was broadly skeptical of the usefulness of fiscal policy as a way to handle the business cycle as several empirical studies showed a limited impact. The consensus was that business cycle management was best left to monetary policy. The crisis has led to a reassessment of this view. Fiscal policy has been used, which allowed economists to update the results of their studies.

5.3.   **A contrasted effectiveness**

Recent contributions show that the fiscal multiplier is sensitive to the economic environment and to the specific policies implemented. Ramey (2011) reviews the results from a broad range of papers and finds that the estimates of the multiplier lay between 0.8 and 1.5.[26] This shows that fiscal policy can support growth but with a very heterogeneous impact.

A long standing challenge for the analysis is to correctly identify the causal linkages between public spending and growth. Fiscal deficits tend to increase during recessions as tax revenues drop, unemployment insurance expenditures increase, and the authorities can choose to increase spending in response to the recession. The ensuing positive relation between recessions and fiscal deficits could lead to the erroneous conclusion that higher deficits reduce GDP, or at least to under estimate any positive impact. It is then important to identify increases in fiscal deficits that are not a response to a weakening business cycle. This can be done based on a statistical analysis that estimates the automatic response of deficits to the business cycle and treats deviations from this as exogenous deficits. An alternative method is a more qualitative analysis that assesses whether a higher deficit reflects an explicit choice, looking at specific policy steps (such as the adoption of an additional budget by the government), communication by the authorities, or discussions in the economic press surrounding the deficit increase.

A central question is the extent to which the impact of fiscal deficits depends on the economic environment. As indicated above we can expect policy to have a weak impact if the economy is doing well as productive resources are then fully used, and a strong impact in a recession where public spending uses resources that would otherwise be idle and is not at the expense of private demand. Auerbach and Gorodnichenko (2010) present an analysis that allows for the effect of fiscal policy to depend on the state of the business cycle. They show that the multiplier is higher during recessions than during times of healthy growth. Ramey (2019) stresses that more recent studies point that this result is sensitive to the specific approach adopted by the researchers.[27] Cohen-Setton

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[26] Some studies find a substantially lower multiplier.

[27] The core element of the analysis is to contrast the impact of government spending depending on the initial extent of resource underutilization. A standard measure is the output gap, i.e. the difference between actual GDP and the level that would deliver full employment. The impact of a fiscal expansion in year *t* is stronger if one considers the output gap in year *t* instead of the output gap in year *t-1*. This indicates that the current situation of the economy is the relevant measure. Similarly, the role of the business cycle is weaker if the unemployment rate is used instead of the output gap.

and al. (2019) study the effectiveness for the OECD countries from 1970 to 2006. They identify the situations where an increase in the deficit reflects an explicit policy by combining a statistical approach with a qualitative assessment based on the communication by the authorities and press articles. They also focus on deficit increases that increase a threshold, as small increases can have a more marginal effect. Their analysis gives an estimated multiplier of 1.5 on average, with a sharp contrast between times when the economy grows robustly (with a multiplier of zero) and times of recession (with a multiplier equal to 3).

The specific nature of spending is also important. Public investments, especially in infrastructure, can boost the long-term potential rate of growth. They are particularly appropriate at times where the financing cost of public debt is low, as stress by the IMF (2014).

Corsetti, Meier and Mueller (2012) assess the role of the exchange rate regime. They show that a fiscal expansion is less effective with a flexible exchange rate than with a peg, in line with theory. The difference reflects a deeper contraction of investment under a flexible exchange rate, which is partially offset by an increase in the trade balance thanks to a depreciation of the currency. The composition of growth is thus different from what theory suggests. In addition, the impact of the exchange rate regime on the fiscal multiplier is of a small magnitude.

Ramey (2019) reviews the most recent studies and contrasts the multiplier depending on the specific features of the fiscal policy. The literature finds a range of 0.6 to 1.0 for the multiplier associated with government spending. Other studies consider the impact of tax increases. They find higher multipliers than for spending, with a range between 2 and 3. The studies based on models calibrated to reflect the actual behavior of the economy however find a much lower value for the multiplier following a tax change. Another set of papers focuses on transfers to households. While the impact is moderate in general (multiplier between 0.2 and 0.6) it is much stronger for transfers targeted to households that face borrowing constraints (multiplier close to 2).

The reaction of monetary policy plays an important role. An increase in government spending has a stronger impact, with a multiplier between 1.5 and 2.5, when monetary policy is constrained by the lower bound on interest rates. Cohen-Setton and al. (2019) also find that the role of the business cycle operates largely through a different reaction of monetary policy. In times of healthy growth the central bank raises the interest rate following a fiscal expansion, while it does not do so in times of weak growth. This shows that fiscal policy has a particular role to play when the central bank is less able to stabilize the business cycle. A policy of fiscal stimulus should thus not be conditioned on the state of the business cycle per se, but on the policy margin available to the central bank (Lagervall 2019). This point was recently underscored by Laurence Boone of the OECD in the context of the euro area (Financial Times, 2019a). The recent assessment of the Swiss

This reflects the fact that unemployment tends to lag the business cycle, and the unemployment rate in year *t* is more closely linked to the output gap of year *t-1*. Finally the specific approach to quantify the state of the economy matters (using the probability of being in a recession, instead of a 0-1 dummy for a recession, impacts the results).

economy by the IMF (2019) also emphasizes the need to use the fiscal policy margin in support of monetary policy.

Blinder (2016) shows that the assumptions underlying Ricardian equivalence are rarely met, and fiscal policy has a place in the toolkit used for macroeconomic stabilization. Given that budgetary decision processes can be slow, he recommends relying on strengthened automatic stabilizers, as well as using temporary subsidies for the purchase of durable goods, such as cars.

5.4.   **Fiscal consolidation strategies**

Several studies have focused on the impact of policies aimed at lowering structural deficits. Fatás and Summers (2016) show that the tightening of spending since 2010 in several countries have lowered growth both in the short run and in terms of long run potential. This adverse impact on output is large enough to lead to a higher debt-to-GDP ratio, despite the reduction of the debt itself. IMF (2014) conducts an analysis of episodes where deficits have been reduced through an explicit policy effort, and not merely thanks to a strong growth spell. Such a reduction weighs on growth. The cost can be lowered by an expansionary monetary policy, or through a depreciation of the exchange rate that raises exports. The analysis of the IMF also shows that it is better to lower the fiscal deficit through a reduction in spending than through higher taxes.

Alesina, Favero and Giavazzi (2019) study the impact of a broad sample of episodes where governments put in place specific measures to durably reduce their deficits. While these measures lower growth, the authors point that this cost is temporary. This is especially the case when the deficit is lowered by reducing expenditures. A deficit cut through higher taxes leads to a deeper and longer recession driven by a sharp contraction of investment. The recession is then sufficiently severe to offset the effect of the deficit reduction on the debt-to-GDP ratio. The authors stress that the high cost of the fiscal austerity measures in the euro area reflects the fact that they mostly took the form of increases in taxes.

5.5.   **Synthesis**

The main lesson from the literature on the growth impact of fiscal policy is that the effects are highly heterogeneous. Three points are particularly noteworthy.

- Investment expenditures support growth. However, infrastructure projects take time to be put in place, and their usefulness to handle short term movements in the business cycle is questionable (regardless of their long term benefits).
- Policies targeted to households who face credit constraints are highly effective, as they have a high propensity to spend. An increase in unemployment benefits, or transfers targeted to low income households during a recession is an effective policy to stimulate aggregate demand.

- Fiscal policy is particularly effective when it comes in support of the central banks at a time when monetary policy faces constraints. The crisis has shown that while monetary policy can still operate when interest rates have been lowered to zero or below, the central bank's task is more challenging then. A stimulus from fiscal policy is then welcome and is not offset by a reaction of monetary policy.

A challenge for relying on fiscal policy to handle business cycle movements is that the budgetary decisions can take time. It is then better to rely on automatic stabilizers, a point stressed by Blinder (2016), keeping the option to rely on additional stimulus in case of a particularly deep recession. From this point of view the Swiss mechanism of temporary reductions of working time covered by unemployment insurance and temporary extensions of the benefits duration are fully adequate. An avenue for future analysis would be to strengthen such mechanisms. This could take the form of a negative income tax for low income level, building on the US Earned Income Tax Credit: instead of starting at a 0% marginal rate the scale of the progressive income tax could include a negative rate for the lower income tranches, thereby supporting poorer households.

The literature shows that in normal times monetary policy remains the most appropriate tool for business cycle policy, given its ability to react quickly. The crisis has shown nonetheless that the conduct of monetary policy is more complex when the central bank only has a limited margin to lower interest rates. Given the persistent downward trend in interest rates, we can expect that in the future monetary policy will face this problem more frequently than in the past, and thereby support from fiscal policy is needed. Such support should take place within a clearly specified framework for two reasons. First, political decision processes could be too slow to be effective in a timely manner. Second, the independence of the central bank is a major element for it being able to fulfil its price stability mandate, and it will be important to ensure that the support from fiscal policy does not turn into an excuse to erode this independence. An avenue for future work is the design of an automatic mechanism leading to a more expansionary fiscal stance once the interest rate set by the central bank reaches a set threshold.

6. <u>Conclusion</u>

The financial situation of the Swiss Confederation is likely the envy of finance ministers in several other advanced economies, with a low debt level and no deficit. While this state of affairs is clearly better than facing a high indebtedness, it remains the case that public debt can be too low. This is relevant for Switzerland where the debt-to-GDP ratio is low and has been decreasing for many years, a trend that looks set to continue. Swiss public finances are not under pressure from markets, quite the contrary as investors are willing to pay for the privilege to put their funds with the Swiss government even at long maturities.

This paper shows that the favorable environment is likely to persist. The decrease in interest rates on sovereign bonds is part of a long trend that is broadly seen in advanced economies. The interest rate paid by the Confederation is clearly below the growth rate of GDP, and this pattern is far from unusual in historical perspective. In this context, paying back the debt is a costly policy. Given the low level of interest rate, the Swiss government could afford a sizable budget deficit and still keep the debt steady as a low ratio to GDP. The authorities could also take advantage of the low funding costs and invest in higher return assets, thereby making good use of the intangible asset that is the trust of investors. While setting up such a sovereign investment funds raises several governance issues, they can be handled.

The analysis draws on the results from recent academic contributions and applies them to the Swiss case. For sure several of the elements considered, such as the deficit consistent with a steady debt-to-GDP ratio or the return prospects of a sovereign wealth funds, can be analyzed in more details. This however does not constitute an excuse for a lack of ambitious and costly prudence in the conduct of economic policy. « Yes we can » is a more suitable attitude.

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8.   <u>Appendix</u>

8.1.   **Data sources**

The Swiss Federal Government (Confederation) debt is taken from the Swiss National Bank (SNB) database, based on the figures from the Swiss Federal Finance Office, which indicates the effective amounts from 1991 to 2017 and forecasts from 2018 to 2022. These data are completed by the Swiss Federal Statistics Office (OFS) for the 1990 figures.

SNB, 1991-2022	https://data.snb.ch/fr/topics/uvo#!/cube/pubfin
OFS, 1990-2018	https://www.bfs.admin.ch/bfs/fr/home/statistiques/administration-finances-publiques/depenses-dettes.assetdetail.8247258.html

The growth rate of nominal GDP is taken from the Swiss Secretatariat for Economics Affaires (SECO) since 1980. Data from the OFS are used to extend the SECO numbers back to 1948. The IMF forecasts since 2008 are taken from the World Economic Outlook database.

SECO, 1980-2018	https://www.seco.admin.ch/seco/fr/home/wirtschaftslage---wirtschaftspolitik/Wirtschaftslage/bip-quartalsschaetzungen-/daten.html
OFS, 1948-2017	https://www.bfs.admin.ch/bfs/de/home/statistiken/volkswirtschaft/volkswirtschaftliche-gesamtrechnung/bruttoinlandprodukt.assetdetail.6067517.html
IMF forecasts	https://www.imf.org/en/Publications/SPROLLS/world-economic-outlook-databases#sort=%40imfdate%20descending

The yield on Swiss Confederation bonds are taken from the SNB database since 1986 for several maturities. These figures are completed from the ones from the OFS for the yield on bonds with 10 years maturity since 1979, and the Swiss historical statistics database for yields since 1948.

SNB, 1986-2019	https://data.snb.ch/fr/topics/ziredev#!/cube/rendoblim
OFS, 1979-2018	https://www.bfs.admin.ch/bfs/fr/home/statistiques/monnaie-banques-assurances/marches-financiers.assetdetail.6486664.html
Historical statistics, 1905-1986	https://hsso.ch/get/O.18bc.xlsx

The interest rates on mortgages and investment loans for various maturities, the yields on corporate bonds, and the LIBOR rate are taken from the SNB database.

BNS, mortgages since January 2008	https://data.snb.ch/fr/topics/ziredev#!/cube/zikrepro
BNS, investment loans since May 2009	https://data.snb.ch/fr/topics/ziredev#!/cube/zikredlauf
BNS, yield on private bonds since Janaury 2001	https://data.snb.ch/fr/topics/ziredev#!/cube/rendoblid
BNS, 12-months LIBOR since January 1989	https://data.snb.ch/fr/topics/ziredev#!/cube/zimoma

The returns on the various portfolios in the analysis of the sovereign wealth funds come from several sources. The returns on portfolio assets held abroad by Swiss resident investors are taken from Stoffels and Tille (2018), updated with 2018 figures. The yield of the AVS retirement fund is taken from the website of Compenswiss and its annual reports. The median return of Swiss pension

funds is taken from Christen and Soguel (2019) and updated based on the annual study of pension funds by SwissCanto. MSCI total return indices on stock markets (including reinvested dividends) are from Datastream and are adjusted for exchange rates from the SNB database to compute returns in Swiss francs. GDP data used for the weighting of foreign returns are taken from the IMF World Economic Outlook database.

Assets from the Swiss net international investment position, Stoffels and Tille (2018), 2000-2018.	https://ideas.repec.org/a/usg/auswrt/201869011-40.html
AVS investment fund, 2006-2018	https://www.compenswiss.ch/asset/fr/?page_name=aaperf
Median return of Swiss pension funds, Christen and Soguel (2019) and SwissCanto (2019, 2015)	https://sjes.springeropen.com/articles/10.1186/s41937-019-0030-x https://www.swisscanto.com/media/pub/1_vorsorgen/pub-107-pks-2019-resultat-fra.pdf https://www.swisscanto.com/media/pub/1_vorsorgen/pub-106-pks-2015-resultat-fra.pdf
MSCI « total performance » indices 1988-2018	Datastream : MSSWITL(RI) (Suisse), MSUSAML(RI) (USA), MSEMUIL(RI) (Euro), MSUTDKL(RI) (Royaume Uni), MSJPANL(RI) (Japon)
Exchange rate indices 1988-2018	https://data.snb.ch/fr/topics/ziredev#!/cube/devwkieffim https://data.snb.ch/fr/topics/ziredev#!/cube/devwkibiim
Nominal GDP in US dollar, 1988-2018, IMF	https://www.imf.org/external/pubs/ft/weo/2019/01/weodata/index.aspx

8.2. **Public debt dynamics**

At the beginning of a time period (year, quarter) denoted by s the government inherit a debt accumulated in the past. We denote the nominal amount (in francs) of this debt by B_{s-1}. The government pays interest on these liabilities at a rate i_s^G.[28] It raises an amount T_s of taxes and undertakes an amount G_s of spending. The primary deficit (before interest payments) is denoted by $D_s^p = G_s - T_s$. The total deficit is funded by additional debt leading to an amount B_s of debt at the end of the period s :

$$B_s - B_{s-1} = G_s - T_s + i_s^G B_{s-1} \qquad (A.1)$$

The amounts in equation (A.1) are measured in francs. The burden of the dent must however be measured taking account of the country's income. The GDP generated in period s is denoted by Y_s. We can thus rewrite (A.1) with variables expressed as ratio to GDP, denoting these ratios by lower-case letter. For instance, the ratio of debt-to-GDP is $b_s = B_s/Y_s$. This leads to:

$$b_s = g_s - t_s + \frac{1 + i_s^G}{1 + \mu_s} b_{s-1} \qquad (A.2)$$

μ_s is the growth rate of nominal GDP $\mu_s = Y_s/Y_{s-1} - 1$. It appears because initial debt B_{t-1} is scaled by the previous period GDP. From (A.2) we get the following dynamic equation for the dent-GDP ratio:

$$b_s - b_{s-1} = d_s^p + \frac{i_s^G - \mu_s}{1 + \mu_s} b_{s-1} \qquad (A.3)$$

The analysis can easily be extended to a situation where the government invests in financial assets in addition to borrowing. Specifically, the government holds assets of value F_{s-1} at the beginning pf period s which yield and interest rate i_s^P. The relation (A.1) then becomes:

$$(B_s - F_s) - (B_{s-1} - F_{s-1}) = G_s - T_s + i_s^G B_{s-1} - i_s^P F_{s-1} \qquad (A.4)$$

where $B_s - F_s$ is the net debt taking account of financial assets. This relation is written in terms of ratios relative to GDP as follows:

$$(b_s - f_s) - (b_{s-1} - f_{s-1}) = g_s - t_s + \frac{i_s^G - \mu_s}{1 + \mu_s}(b_{s-1} - f_{s-1}) - \frac{i_s^P - i_s^G}{1 + \mu_s} f_{s-1} \qquad (A.5)$$

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[28] The index G indicates that the interest rate applies to government bonds.

8.3. A simple macroeconomic model

8.3.1. *Main features*

8.3.1.1. *Consumer's utility*

We consider a standard macroeconomic model where the country is inhabited by a representative agent who maximizes an infinite horizon utility. Utiliy reflects consumption C and the holdings of government bonds X^G (expressed as a ratio to consumption). The direct utility provided by government bonds is a simple way to model the convenience yields they provide in form of a safe liquid asset. This approach is akin to the standard money in the utility specification. The intertemporal utility from the point of view of the initial period 0 is:

$$U_0 = \sum_{s=0}^{\infty} \frac{1}{(1+\sigma)^s} \left[ln(C_s) + \frac{\gamma}{1-\epsilon} \left(\frac{X_s^G}{C_s} \right)^{1-\epsilon} \right]$$

where σ is the discount factor, a higher value of σ indicating higher impatience. The parameter γ reflects the utility weight of government bonds. We take a log utility of consumption for simplicity.

8.3.1.2. *Production and firms' optimization*

Goods are produced by a firm that uses capital K and labor L. For simplicity we consider that the labor supply is constant. The production function includes total factor productivity A that grows at a constant rate μ. We consider a standard Cobb-Douglas specification:

$$Y_s = (A_s)^{1-\alpha} (K_{s-1})^{\alpha} (L)^{1-\alpha} \qquad \alpha \leq 1$$

where capital is indexed by the period in which it was built, s-1. The firm pays a wage rate w and a capital rental cost r. We normalize the price of goods to unity so that the wage and rental rates are in real terms. The profits during period s are:

$$Y_s - r_s K_{s-1} - w_s L$$

The profit maximization by the firm leads to the standard equalization of marginal returns to marginal costs:

$$r_s = \alpha (A_s)^{1-\alpha} (K_{s-1})^{\alpha-1} (L)^{1-\alpha} = \alpha \frac{Y_s}{K_{s-1}}$$

$$w_s = (1-\alpha)(A_s)^{1-\alpha}(K_{s-1})^{\alpha}(L)^{\alpha} = (1-\alpha)\frac{Y_s}{L}$$

8.3.1.3. *Government*

The government raises an amount T_s of taxes and spends an amount G_s. It pays an interest rate i_s^G on its debt B_{s-1}. It also holds an amount F_{s-1} of private bonds that are claims on the household and pay an interest rate i_s^P. The dynamics of net debt is given by equation (4) in the text:

$$B_s - F_s = G_s - T_s + (1 + i_s^G)B_{s-1} - (1 + i_s^P)F_{s-1}$$

8.3.1.4. Household's optimization

The household supplies a constant amount of labor to the firm. It owns the capital and can invest in building additional capital. Capital depreciates at a rate δ. In addition to government bonds, the household can hold private bonds. We denote the amount held by X_s^P paying an interest rate i_s^P.

The resources of the household in period s are the labor income $w_s L$, the capital rental income $r_s K_{s-1}$, the depreciated capital returned by the firm $(1 - \delta)K_{s-1}$, and the returns on sovereign and private bonds $(1 + i_s^G)X_{s-1}^G$ and $(1 + i_s^P)X_{s-1}^P$. These resources are used for consumption C_s, taxes T_s, building of new capital K_s,, and savings into sovereign and private bonds X_s^G and X_s^P. The flow budget constraint is then:

$$C_s + T_s + K_s + X_s^G + X_s^P = w_s L + r_s K_{s-1} + (1 - \delta)K_{s-1} + (1 + i_s^G)X_{s-1}^G + (1 + i_s^P)X_{s-1}^P$$

The household chooses the holdings of capital, sovereign and private bonds to maximize her utility subject to the budget constraint.[29] This leads to three optimality conditions. The first two are the standard Euler conditions for the investment in capital and private bonds :

$$\frac{C_{s+1}}{C_s} = \frac{1 + i_{s+1}^P}{1 + \sigma} \quad ; \quad \frac{C_{s+1}}{C_s} = \frac{1 + r_{s+1} - \delta}{1 + \sigma}$$

The growth rate of consumption reflects the return on private bonds – equal to the return of capital – adjusted for the discount rate.

The third optimality condition is the Euler condition for the investment in sovereign bounds, combined with the corresponding condition for private bonds. It shows that the investment in sovereign bonds reflects their direct contribution to utility as well as the spread between the returns of sovereign and private bonds, $i_{s+1}^P - i_{s+1}^G > 0$:

$$\frac{X_s^G}{C_s} = \left(\gamma \frac{1 + i_{s+1}^P}{i_{s+1}^P - i_{s+1}^G} \right)^{\frac{1}{\epsilon}}$$

As government bonds have a direct utility benefit, they give a lower return than private bonds in equilibrium ($i_{s+1}^P > i_{s+1}^G$). Otherwise government bonds would strictly dominate private bonds, and if anything the household would want to take a large short position in private bonds to invest

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[29] We consider that the household takes the consumption level that scales the utility from sovereign bonds holdings as given for simplicity.

in government bonds. The term $1/\epsilon$ reflects how sensitive the demand for sovereign bonds is to the spread between rates of returns. The lower ϵ, the more sensitive the demand is to the interest rate differential, and the lower the change in the return gap that is needed to deliver a given portfolio reallocation between government and private bonds.

If government bonds deliver no direct utility ($\gamma = 0$) they become identical to private bonds ($i^P_{s+1} = i^G_{s+1}$) and the relation above is irrelevant.

8.3.1.5.   *Market equilibria*

The equilibrium of the bond markets requires that government bonds are held by households and that private bonds held by the government correspond to the liabilities of households: [30]

$$B_s = X^G_s \quad ; \quad F_s + X^P_s = 0$$

The equilibrium of the market for good is obtained by adding up the household's and government's budget constraints and using the equilibrium conditions of bond markets, as well as the fact that the sum of payments to factors is equal to GDP. GDP is then used for household's consumption, government spending, and capital accumulation net of depreciation:

$$Y_s = C_s + G_s + K_s - (1 - \delta)K_{s-1}$$

8.3.2.   *Balanced growth path*

8.3.2.1.   *Ratios relative to GDP*

We focus on the solution when the economy is on a balanced growth path. Capital, consumption, government spending, GDP and investment holding then all grow at the rate of productivity μ. The ratios of the variables to GDP are then constant and denoted as follows:

$$k = \frac{K_{s-1}}{Y_s} \quad ; \quad c = \frac{C_s}{Y_s} \quad ; \quad g = \frac{G_s}{Y_s} \quad ; \quad t = \frac{T_s}{Y_s} \quad ; \quad b = \frac{B_s}{Y_s} \quad ; \quad f = \frac{F_s}{Y_s}$$

The interest rates on government and private bonds are also constant and equal to i^G and i^P respectively. The rental cost of capital is constant and equal to r.

As private consumption grows at the same rate as productivity, the interest rate on private bonds reflects this growth rate and the discount factor:

$$1 + i^P = (1 + \sigma)(1 + \mu)$$

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[30] If the government holds no private bonds, the equilibrium amount is $X^P_s = 0$ and the only role of private bonds is to generate a private interest rate i^P_s.

This implies that the interest rate on private bonds is always larger than the growth rate of GDP: $i^P > \mu$.

The rental cost of capital also reflects the growth rate and the discount rate. Using the firm's optimal choice, we get the ratio of capital to GDP:

$$k = \frac{\alpha}{r} = \frac{\alpha}{(1+\sigma)(1+\mu) - (1-\delta)}$$

The ratio of private consumption to GDP follows from the equilibrium of the market for goods, and is affected by the exogenous ratio of government spending to GDP:

$$c = 1 - g - k(\delta + \mu)$$

8.3.2.2. *Interest rate on government bonds*

The last step is to solve for the interest rate on government bonds. We do so using two relations. The first reflects the household's portfolio choice :

$$\frac{b}{c} = \left(\gamma \frac{1+i^P}{i^P - i^G}\right)^{\frac{1}{\epsilon}}$$

This relation shows that the interest rate i^G is low (for a given interest rate on private bonds) when the ratio of public debt to consumption is low, as there is then less need to induce the household to hold government bonds, and the utility impact of government bonds is high.

The second relation is the budget constraint of the government:

$$0 = g - t + \frac{i^G - \mu}{1+\mu} b - \frac{i^P - \mu}{1+\mu} f$$

Taken together these two relations give the interest rate i^G and one out of the three variables that characterize public finances (t, b, f) taking the other two variables as given. We choose to take the government's debt and financial assets, b and f, as given and let the taxes t to adjust as needed for the government's budget constraint to hold. This implies:

$$i^G = i^P - \left(\frac{c}{b}\right)^\epsilon \gamma(1+i^P) \quad ; \quad t = g - (c)^\epsilon (b)^{1-\epsilon} \gamma(1+\sigma) + \frac{i^P - \mu}{1+\mu}(b-f)$$

The interest rate on government bonds is always lower than the rate in private bonds:

$$i^G - i^P = -\left(\frac{c}{b}\right)^\epsilon \gamma(1+\sigma)(1+\mu) < 0$$

The interest rate on government bonds can also be lower than the growth rate of GDP if the ratio between private consumption and public debt is high enough:

$$i^G - \mu = \left[\sigma - \left(\frac{c}{b}\right)^\epsilon \gamma(1+\sigma)\right](1+\mu)$$

The impact of government debt on taxes and the primary balance depends on the weight of the bonds in the household's utility. Consider an increase in the gross debt without any change in the net debt (an identical increase in b and f). This change has no impact on t when government bonds provide no direct utility ($\gamma = 0$), as government and private bonds are then identical.

When government bonds impact the utility ($\gamma > 0$) an identical increase in b and f impacts taxes, but in a way that depends on how sensitive the household's portfolio allocation is to the interest rate differential, as indicated by the term ϵ. Two offsetting effects are at work. First, as $i^G < i^P$ an increase in public debt that is reinvested in private bonds generates an income stream for the government that lowers taxes. Second, the increase in debt b requires a higher interest rate i to induce the household to switch her portfolio towards government bonds, leading to a higher interest rate cost for the government and higher taxes. If $\epsilon = 1$ the two effects cancel out and taxes are unchanged. If $\epsilon < 1$ the portfolio choice of the household is very sensitive to the interest rate, and a moderate increase in the interest rate is enough to induce the needed portfolio reallocation. In that case a higher public debt leads to lower taxes.

8.3.2.3. *Numerical examples*

We illustrate the model with a serie of numerical examples. Given the stylized nature of the model, the results should not be seen as a fine calibration matching the Swiss economy but as an illustration of the various mechanisms.

In our basis scenario, we set the discount rate σ at 2%, and the growth rate μ also at that value. This gives an interest rate on private bonds i^P of 4.04%. The capital depreciation rate δ is set at 2%, and we take a share of capital in production α equal to 30%. This gives a value of 4.97 for the capital to GDP ratio. We set the ratio g of government spending to GDP at 20% giving a ratio c of private consumption to GDP of 60%.

We set the ratio b between gross government debt-to-GDP at 20% and consider that the government holds no assets, $f = 0$. We take a value of 0.5 for ϵ, the sensitivity of the portfolio choice to the interest rate gap, and set the direct utility impact of government debt γ to 0.003 so as to get a spread of 0.54 percentage points between the two interest rates. The interest rate on government bonds i^G is then equal to 3.50% and exceeds the growth rate. Keeping the ratio of government debt-to-GDP constant requires a primary surplus of 0.29% of GDP.

We now consider the impact in changing the various parameters. The tables below show the effect on the interest rates and the primary budget deficit. The first column in each table corresponds to the baseline case described above.

A decrease in government gross debt reduces the interest rate on government bonds and widens the gap relative to the interest rate on private bonds (which itself is unchanged).

Gross debt b, %GDP	20	15	10	5
Private rate i^P, %	4.04	4.04	4.04	4.04
Government rate i^G, %	3.50	3.42	3.27	2.96
Spread $i^G - i^P$, %	-0.54	-0.62	-0.77	-1.08
Rate-growth gap $i^G - \mu$, %	1.50	1.42	1.27	0.96
Primary deficit $g - t$, %GDP	-0.29	-0.21	-0.12	-0.05

An increase in the private bond holdings by the government has no impact on interest rates. It allows for a reduction of the primary surplus need to stabilize the net debt.

Assets f, %GDP	0	5	10	15
Private rate i^P, %	4.04	4.04	4.04	4.04
Government rate i^G, %	3.50	3.50	3.50	3.50
Spread $i^G - i^P$, %	-0.54	-0.54	-0.54	-0.54
Rate-growth gap $i^G - \mu$, %	1.50	1.50	1.50	1.50
Primary deficit $g - t$, %GDP	-0.29	-0.19	-0.09	0.01

An increase in both the assets and the liabilities of the government reduces the spread between the interest rates, as well as the primary balance required to stabilize the debt (marginally).

Gross debt b, %GDP	20	25	30	35
Assets f, %GDP	0	5	10	15
Private rate i^P, %	4.04	4.04	4.04	4.04
Government rate i^G, %	3.50	3.56	3.60	3.63
Spread $i^G - i^P$, %	-0.54	-0.48	-0.44	-0.41
Rate-growth gap $i^G - \mu$, %	1.50	1.56	1.60	1.63
Primary deficit $g - t$, %GDP	-0.29	-0.28	-0.27	-0.26

An increase in the household's patience (a lower discount rate) reduces both interest rates. The effect is stronger for the rate on private bonds and lowers the spread between the interest rates (marginally). The gap between the interest rate and the growth rate is lower, which in turn decreases the primary surplus requires for debt stabilization.

Discount rate σ, %	2	1.5	1.0	0.5
Private rate i^P, %	4.04	3.53	3.02	2.51
Government rate i^G, %	3.50	3.00	2.50	2.01
Spread $i^G - i^P$, %	-0.54	-0.53	-0.52	-0.50
Rate-growth gap $i^G - \mu$, %	1.50	1.00	0.50	0.01
Primary deficit $g - t$, %GDP	-0.29	-0.20	-0.10	0.00

An increase in the direct impact of government bonds on the utility lowers the interest rate on government bonds without any effect on the rate on private bonds. This reduces the primary surplus needed for debt stabilization.

Utility weight γ	0.003	0.004	0.005	0.006
Private rate i^P, %	4.04	4.04	4.04	4.04
Government rate i^G, %	3.50	3.32	3.14	2.96
Spread $i^G - i^P$, %	-0.54	-0.72	-0.90	-1.08
Rate-growth gap $i^G - \mu$, %	1.50	1.32	1.14	0.96
Primary deficit $g - t$, %GDP	-0.29	-0.26	-0.22	-0.19

A decrease in the growth rate of the economy lowers all interest rates and has little effect on their difference, as well as on the spread between the interest rates and growth (and thereby on the primary surplus).

Growth rate μ, %	2.0	1.5	1.0	0.5
Private rate i^P, %	4.04	3.53	3.02	2.51
Government rate i^G, %	3.50	2.99	2.48	1.96
Spread $i^G - i^P$, %	-0.54	-0.54	-0.54	-0.55
Rate-growth gap $i^G - \mu$, %	1.50	1.49	1.48	1.46
Primary deficit $g - t$, %GDP	-0.29	-0.29	-0.29	-0.29

8.4.   Returns on the sovereign wealth fund's assets

The data on the returns on the AVS fund, the Swiss pension funds, and the portfolio assets in the net international investment position all give values for the nominal returns for a year t that we denote by i_t.

The total return index on the stock market of country p is denoted by Ind_t^p, measured in the country's currency. The exchange rate index, in terms of foreign currency per Swiss franc, is denoted by FX_t^p. Both indices are measured in December. The nominal return is computed as follows:

$$i_t^p = \frac{Ind_t^p/FX_t^p}{Ind_{t-1}^p/FX_{t-1}^p} - 1$$

The real returns are computed by dividing the nominal returns by the Swiss inflation rate π_t between December of year t-1 and December of year t:

$$r_t = \frac{1 + i_t}{1 + \pi_t} - 1$$

The values of r_t for the different assets are illustrated in figure A.1.

The average annual return between the end of year t-1 and the end of year t+h, denoted by $\bar{r}_{t,t+h}$, is computed by taking the geometric average of annual returns (i.e. the arithmetic average if the logs of $1 + r_s$): [31]

$$\bar{r}_{t,t+h} = \left(\prod_{s=t}^{t+h}(1 + r_s)\right)^{1/h} - 1 = exp\left(\frac{1}{h}\sum_{s=t}^{t+h} ln(1 + r_s)\right) - 1$$
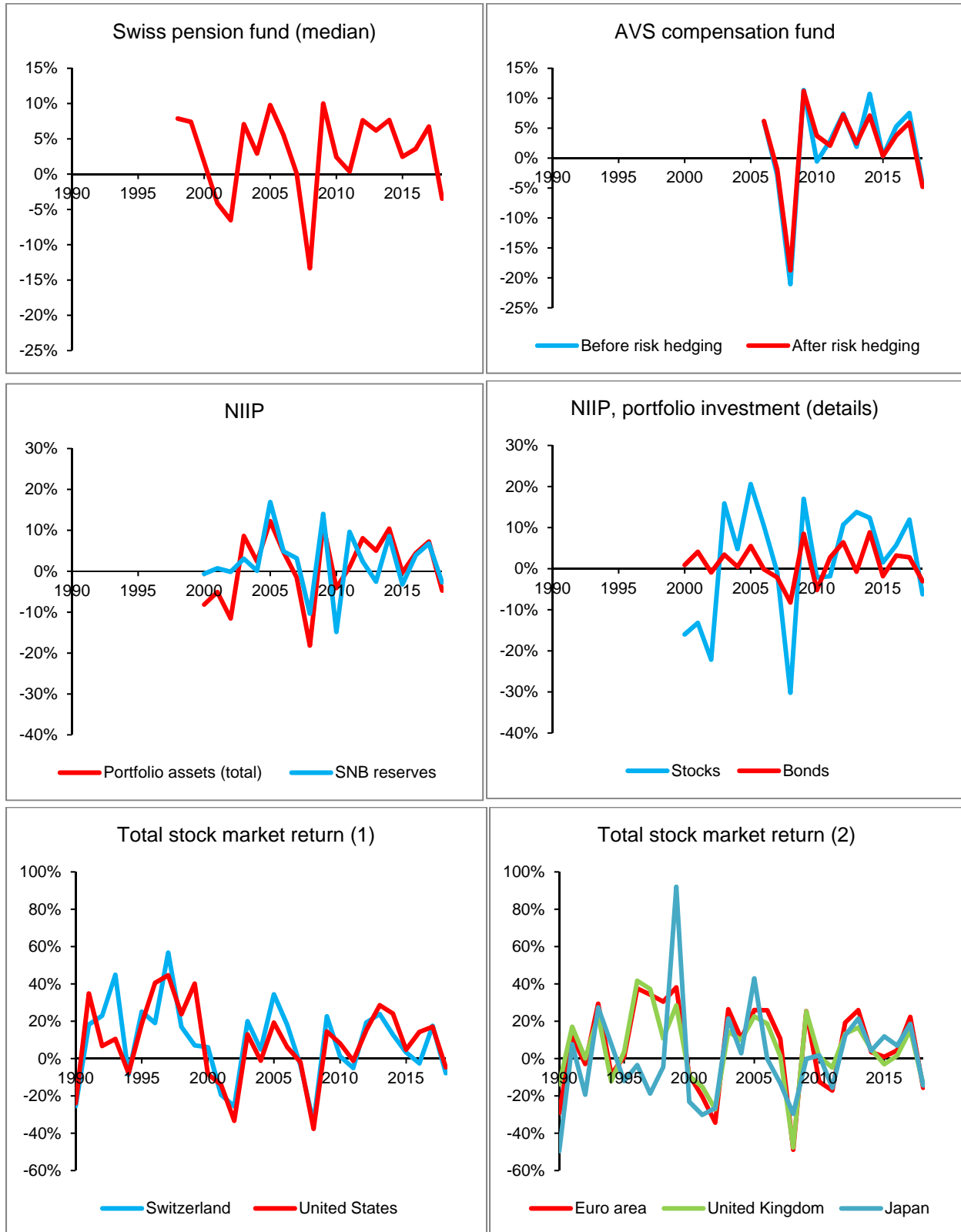
The volatility of returns is measured by the standard deviation of r_s :

$$\sigma_{t,t+h} = \left(\frac{1}{h}\sum_{s=t}^{t+h}\left(r_s - \frac{1}{h}\sum_{s=t}^{t+h}r_s\right)^2\right)^{1/2}$$

This standard deviation is computed for returns over a year. We can also compute it for returns over 3 or 5 years by replacing r_s by $\bar{r}_{s-2,s}$ and $\bar{r}_{s-4,s}$ respectively.

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[31] $\bar{r}_{t,t+h}$ is the appropriate measure. It differs from the arithmetic average of annual returns $(1/h)\sum_{s=t}^{t+h} r_s$ which gives a biased picture when returns are volatile. We illustrate this with a simple example of returns over two years. In a first case the return is 15% per year. In a second case the return is 30% in the first year and zero in the second year. An investor that puts in 100 ends up with 132.25 after two years in the first case and 130 in the second case. The arithmetic average of returns is 30% in both cases, while $\bar{r}_{t,t+h}$ is equal to 15% and 14.02% respectively.

Figure A.1 : Real return on assets

NIIP : net international investment position.