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Negative Interest Rate Policy in Switzerland

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ABSTRACT

Objective: The purpose of this study is to present a review of the negative interest rate policy of the Swiss National Bank (SNB) after the outbreak of the financial crisis, in the context of falling real interest rates. Furthermore, the article demonstrates the implications of this unconventional monetary policy for the Swiss economy as well as the financial market stability.

Research Design & Methods: The study is completely based on literature research. The analysis should be interpreted as being mainly suggestive since empirical research based on a quantitative analysis was not conducted. This article examines and reviews extensive arguments and evidence of 97 scientific articles. The descriptive evidence presented has a strong focus on the situation in Switzerland.

Findings: In economic literature, the discussion about transmission mechanisms of the monetary policy is conducted through several channels: the interest rate channel, the ex-change rate channel and other asset price channels. In Switzerland, the impacts of the negative interest rate policy (NIRP) implemented in 2015 can so far be felt in increasing credits, especially in mortgage claims. The net income of Swiss banks from the commission and service business fell. Moreover, the exchange rate of the Swiss Franc against the Euro could be stabilised to a certain degree.

Implications & Recommendations: A negative interest rate policy has an immediate impact on short-run and long-run interest rates and on banks' interest rate margins. Currently, monetary policy is taking a turn, especially in the US. However, the leeway for higher rates in Switzerland is limited due to the interest rate differential between short-term Eurozone and Swiss money market rates.

Contribution & Value Added: This article provides insights into the determinants of real interest rates and into the short-run effects of NIRP on the Swiss economy.

Article type: research paper

Keywords: real interest rates; unconventional monetary policy; monetary transmission channels; asset price bubbles; financial stability

JEL codes: E44, E52, E58

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INTRODUCTION

In the aftermath of the financial crisis, the negative interest rate policy (NIRP) went from being a theoretical possibility to becoming practical reality in many advanced economies. An increasing number of central banks have taken unconventional measures, which relied on asset purchases as key instruments. Some started offering targeted longer-term refinancing operations and introduced negative interest rates. NIRPs were implemented as an unprecedented move by the central banks of Bulgaria, Denmark, the Eurozone, Hungary, Sweden, Japan and Switzerland, with different stated motivations. It is in light of this development that this article aims to first examine the causes of the period of unusual low interest rates based on a broad literature survey.

The article starts with an explanation of saving-investment balances (Blanchard, 2014; Bernanke, 2015; Borio, Disyatat, Juselius, & Rungcharoenkitkul, 2017; Carvalho, Ferrero, & Nechio, 2016; Bean, Broda, Itō, & Kroszner, 2015). Recently, the Bank for International Settlements (BIS) examined the empirical link between the real interest rate and saving-investment variables. The analysis covering 19 countries goes back to the 19th century (Borio *et al.*, 2017). For this time period only, a tenuous link between real rates and saving-investment determinants can be observed. Hence, the analysis is expanded to the relationship between monetary policy and the real interest rate. The main finding of this analysis is that in the long-term sample, monetary policy regimes such as the gold standard, Bretton Woods and inflation targeting go hand in hand with significant shifts in the real interest rates (Borio *et al*., 2017).

As a next step, the monetary policy of the Swiss National Bank (SNB) is described. The NIRP of the Swiss National Bank is explained by the SNB in the context of the global trend of falling real interest rates and the global saving-investment imbalances (Jordan, 2016). The goal of the NIRP of the SNB is to boost inflation and to counteract an undesirable appreciation of the Swiss Franc (IMF, 2017). In the pre-crisis era, the SNB conducted its monetary policy by steering the three-month Swiss Franc Libor as a target rate. Monetary policy only had an indirect influence on all other financial market variables as these are often affected by movements in the short-term interest rate. As the financial crisis unfolded, forward guidance and negative interest rates were applied. Forward guidance is aimed at influencing medium and long-term interest rates by providing information on the expected development of short-term interest rates (Maechler, 2017).

In economic literature, the discussion about transmission mechanisms of the monetary policy is conducted through several channels: the interest rate channel, the exchange rate channel and other asset price channels (Mishkin, 1996). Hence, the remaining sections of this report are dedicated to these transmission channels. The interest rate channel is the key monetary transmission mechanism in the basic Keynesian IS-LM model. Friedman (1957), Ando and Modigliani (1963), Mundell (1963) and Fleming (1962) describe the interest rate channel and its impact on demand and aggregate output. The exchange rate channel also involves interest rate effects. Mishkin (1996) and Boivin, Kiley and Mishkin (2010) provided evidence about the neoclassical link between short-term policy interest rates and the exchange rate. Moreover, Taylor (1993) and Smets (1995) point out that smaller, more open economies tend to have larger effects through the exchange rate channel.

In addition to the interest rate and the exchange rate channels, the monetary policy also affects the economy through asset prices, wealth and risk effects. Higher liquidity usually goes hand in hand with an accommodative monetary policy, increasing the demand for assets and boosting asset prices. Similarly, lower discount rates increase the present values of assets and hence asset prices. With respect to the wealth effect channel, higher stock and real estate prices increase the total wealth of households and thus incentivise the purchase of additional assets, driving up asset prices. Moreover, lower policy rates put pressure on long-term interest rates. Consequently, the yield on government bonds declines, forcing investors to move into riskier and higher yielding assets to generate appropriate returns. Such a development could potentially lead to an asset prices bubble, raising the question about the role of central banks in dealing with asset prices. In this context, a long-lasting debate exists between proponents of the 'leaning against the wind' policy asking central banks to fight off the build-up of asset price bubbles, and the proponents of the 'cleaning up' policy requiring policy-makers to wait until the asset price bubble bursts and then supporting the economy with an accommodative money policy. Both proponents offer compelling arguments. Nevertheless, there is a wide consensus among economists that central banks should not only rely on conventional and unconventional polices, but also on macroprudential measures.

MATERIAL AND METHODS

The purpose of this study is to present a review of the negative interest rate policy of the Swiss National Bank (SNB) after the outbreak of the financial crisis, in the context of falling real interest rates. Furthermore, the article demonstrates the implications of this unconventional monetary policy for the Swiss economy as well as the financial market stability.

The study is completely based on literature research. The analysis should be interpreted as being mainly suggestive since empirical research based on a quantitative analysis was not conducted. This article examines and reviews the extensive arguments and evidence of 92 scientific articles. The descriptive evidence presented has a strong focus on the situation in Switzerland.

LITERATURE REVIEW

Negative Policy Rates

A key question for policy makers and financial markets' participants is: 'Why are interest rates so low and where are interest rates headed?'. The persistent decrease in long-term interest rates since the beginning of the 21st century nurtured the view that there has been a substantial decrease of the natural rate into negative territory (Laubach & Williams, 2015). Starting the discussion about real interest rates, Wicksell (1936) conceptualised the natural rate of interest as the rate at which the price level is stable. According to Holston, Laubach and Williams (2017), the 'equilibrium' real interest rate provides a benchmark for monetary policy. The Swiss National Bank (SNB) refers to this development to explain the negative interest policy established in 2015 (Jordan, 2016).

Determinants of Real Interest Rates

This part examines the causes of the unusual low interest rates. The conventional view is that global real interest rates are driven by investment-saving imbalances. The decline falls into three broad categories: an increase in propensity to save; a reduction in the propensity to invest; and shifts in the demand and supply for different types of assets (Borio *et al*., 2017). Blanchard (2014) points out that global savings and investments play a key role in determining real interest rates. Bernanke (2015) explains his saving glut hypothesis through increased savings in emerging economies. Borio *et al*., (2017) also find reasons for a saving glut in the development of the population in emerging economies and their underdeveloped emerging markets. Bean *et al*. (2015) concentrate on shifts in the distribution of income.

Shifts in investments can be understood by analysing different supply factors (Borio *et al*., 2017). According to Gordon (2014), the weak productivity growth brought advanced economies to a period of stagnation. However, other researchers doubt that the rate of innovation has slowed permanently (Mandel & Swanson, 2017).

After the financial crisis, the demand for safe assets increased (Blanchard, 2014). Bean *et al*. (2015) and Broadbent (2016) put forward that the likelihood or size of bad outcomes as well as negative expectations about future growth benefit investment in safe assets. The view that real interest rates are determined by saving-investment imbalances is supported by Eichengreen (2015), Bernanke (2015) and the Council of Economic Advisors (2015).

Recently published research about the explanation of real interest rates through saving-investment imbalances shows that there is no evidence for this theory. Borio *et al*. (2017), Lunsford and West (2017) and Hamilton, Harris, Hatzius and West (2016) discovered a correlation between demographic measures and real interest rates. In many other variables they found weak evidence overall.

Borio *et al.* (2017) argue that monetary factors play a key role in determining real interest rates. According to Forbes, Kirkham and Theodoridis (2017), monetary policy has an impact on nominal and real interest rates while the interest rate is less responsive. Danthine (2017), the IMF (2017) and Jordan (2016) describe the negative interest rate policy in Switzerland.

Channels of Monetary Policy Transmission

Mishkin (1996) puts forward the importance of the interest rate channel as the key monetary transmission mechanism. This transmission channel is also described by Friedman (1957), Ando and Modigliani (1963), Mundell (1963), Fleming (1962), Blanchard (2017), Mankiw (2017) and Samuelson (2009). The SNB (2017) and the Swiss Bankers Association (2017) describe the transmission channel in Switzerland.

According to Mishkin (2017), Krugman, Obstfeld and Melitz (2014), Blanchard (2017) and Mankiw (2017) the exchange rate channel also involves interest rate effects. Thorbecke and Kato (2017) investigated the effect of exchange rate effects on Swiss exports and the profitability of Swiss firms. Their regression results indicate that exports in specific sectors will be harmed by an appreciation of the Swiss franc. However, Straubhaar (2015) points out that the Swiss economy is resistant to exchange rate fluctuations.

DSGE models play a dominant role in macroeconomic research. They stand for 'dynamic stochastic general equilibrium'. According to Blanchard (2016), the earliest DSGE

model, representing an economy without distortions, was the Real Business Cycle model developed by Edward C. Prescott and focused on the effects of productivity shocks. In later incarnations, a wider set of distortions and a wider set of shocks has come to play a larger role, and current DSGE models are best seen as large-scale versions of the New Keynesian model, which emphasizes nominal rigidities and a role for aggregate demand. The effects to aggregate demand arising from a monetary shock are discussed by Sims (1986). Bernanke and Blinder (1992) and Christiano, Eichenbaum and Evans (1996,1999) used vector auto regressions and orthogonalised innovations to the federal funds rate to estimate the effects of a shock to monetary policy.

Monetary Policy, Asset Prices and Financial Stability

Boivin *et al*. (2010) claim that interest rates have an impact on asset prices and on real economic activity while Arteta, Kose, Stocker and Taskin (2016) scrutinise the effects of interest rate cuts on the economy under positive and negative interest rate environments. In accordance with Assenmacher-Wesche and Gerlach (2008), Brunnermeier and Schnabel (2015) argue that too low interest rates for a prolonged period increase the risk of financial market imbalances and could lay the cornerstone for subsequent asset price bubbles. The relationship between interest rates and asset prices was also analysed by Rigobon and Sack (2002), Hott and Jakipii (2012), and Bordo and Landon-Lane (2013).

Hannoun (2015) describes the influence of negative interest rates on the yields of Swiss government bonds and the associated consequences for investors such as pension funds. According to Bini Smaghi (2009), Issing (2009), and Stiglitz (2016), low or negative interest rates encourage risk taking and expose the economy to a greater risk of financial instability. Jordan (2013) reports the difficulties of the Swiss National Bank in fighting against emerging asset price imbalances in Switzerland.

Monetary Policy and Asset Price Bubbles

Bernanke and Gertler (2001), Bordo and Wheelock (2004), Kohn (2007, 2009), and Christiano *et al*. (2008) argue that central banks should ignore asset price movements unless they pose a threat to price stability and real economic activity. In accordance with Bini Smaghi (2009) and Issing (2009), they claim that central banks should only intervene after the burst of an asset price bubble and hence adopt a 'cleaning up' policy. In contrast, proponents of the 'leaning against the wind' policy such as Cecchetti, Genberg, Lipsky, & Wadhwani (2000), Borio and Lowe (2002), Bordo and Jeanne (2002), Platen and Semmler (2009), and Smets (2014), want the central banks to intervene pre-emptively by raising interest rates and hence preventing the build-up of an asset price bubble.

Juselius, Borio, Disyatat and Drehmann (2016) present an augmented Taylor rule by adding a financial cycle variable. Alessi and Detken (2009) found well performing early warning indicators for asset price bubbles and Galí (2014) and Blot, Hubert and Labondance (2017) differentiate between fundamental and speculative components of these bubbles. Borio and Lowe (2002), Kuttner (2011) and Brunnermeier and Schnabel (2015) describe the relevance of macro-prudential measures in mitigating financial crises. In accordance with the policy of the Swiss National Bank, Ozkan and Unsal (2014) and Arteta *et al*. (2006) propose using a policy mix of monetary and macro-prudential measures to ensure monetary and financial stability.

DISCUSSION

Negative Policy Rates

In the aftermath of the economic and financial crisis, the central banks of advanced market economies introduced different unconventional policies to provide additional monetary stimulus. They lowered policy rates effectively to the zero lower bound (ZLB). Five central banks – Danmarks National Bank (DN), the European Central Bank (ECB), Sverige Riksbank, the Bank of Japan (BoJ) and the Swiss National Bank (SNB) – decided to push their policy rates below zero, traditionally seen as the lower bound for nominal interest rates (Bech & Malkhozov, 2016).

In January 2015, the Swiss National Bank (SNB) discontinued the minimum exchange rate against the Euro, and at the same time lowered the interest rate on banks' sight deposits at the SNB to -0.75%. As an explanation for this negative interest rate policy, the SNB cites two reasons. Firstly, the global equilibrium interest rate has fallen over recent decades. Secondly, since the financial crisis, monetary policy worldwide has been expansionary as a result of low inflation and weak economic recovery (Jordan, 2016). To explain this unusual procedure of the central banks, this section starts with the discussion of an economic concept that plays a key role in the current debate about monetary policy: the equilibrium real interest rate.

The key question for monetary policy makers is how the interest rates are going to develop in the future. In the long run, economists assume that nominal interest rates will tend toward some 'equilibrium' or 'natural' real rate of interest plus an adjustment for expected long-run inflation (Williams, 2003). The bad news is that the natural rate of interest is not observable but must be inferred from data. What exactly is the natural rate of interest?

Wicksell invented the idea of a natural interest rate more than 100 years ago: 'There is a certain rate of interest on loans which is neutral in respect to commodity prices, and this tends neither to raise nor to lower them'. According to Wicksell, the definition of equilibrium real interest rate is: 'the rate needed to maintain output at its natural rate and constant inflation.' (Wicksell, 1936, translation from 1898 text, p. 102). The natural real rate of interest provides a benchmark for measuring the stance of monetary policy, with policy being expansionary if the short-term real interest rate lies below and with policy contractionary if the short-term real interest rate lies above the natural rate (Holston *et al*., 2017). This role is illustrated clearly in monetary policy rules such as the Taylor rule (Taylor, 1993). In reality, the SNB controls a short-term nominal interest rate and has only an indirect and temporary influence on long-term real interest rates which influence investment decisions. Long-term real interest rates are primarily determined by saving and investment decisions and hence by market forces (Jordan, 2016).

Figure 1 shows the evolution of the long-term real interest rate in Switzerland. It is based on the development of the ten-year yield on Confederation bonds. If the central bank wishes to stimulate the economy and increase inflation, it cuts the policy rate. Since inflation does not react immediately, real interest rates temporarily fall below the equilibrium rate. This leads temporarily to higher growth and more inflation. 'Temporarily' means that if monetary policy was to target real interest rates below the equilibrium rate on a sustained basis, inflation would continue rising but this policy would not result in higher real growth in the long term. For the mandate of price stability to be fulfilled, the policy

rate must be set such that, at the desired inflation rate, the real interest rate corresponds with the equilibrium rate in the medium term (Jordan, 2016).

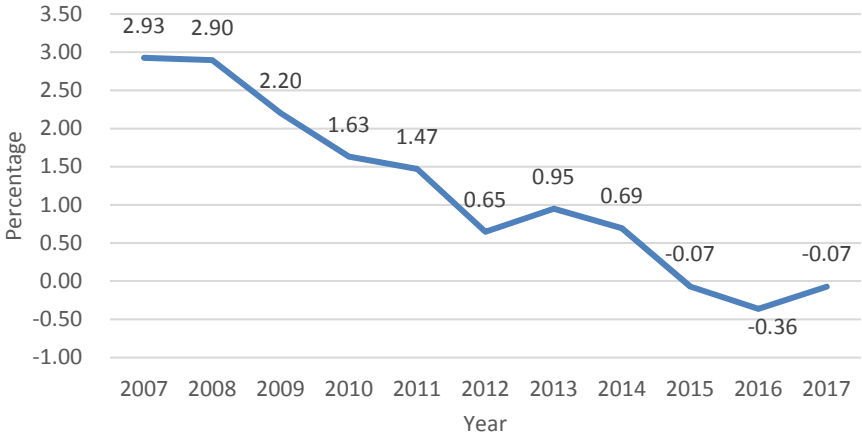

Figure 1. Long-term interest rates
Source: OECD (2018) Long-term interest rates (indicator).

It is possible that the real equilibrium interest rate in Switzerland is lower today than it was in the past. Real interest rates have been falling globally for a considerable time. According to Blanchard (2014), national real interest rates are determined in the global market. This conclusion is based on the loanable funds theory (LFT) and the presumption is that the evolution of real interest rates reflects changes in underlying saving-investment determinants (Borio *et al.*, 2017). The modern theory of international macroeconomics by Obstfeld and Rogoff (1996) and Mankiw (2013) is also based on this theory.

On this basis, Blanchard (2014) describes four factors that determine the global real interest rate. The first factor is the supply schedule for loanable funds, namely global saving. The second factor is the demand schedule for loanable funds, namely global investment. The third factor is the relative demand for safe versus risky assets. According to the LFT, these three factors determine the natural rate of interest. The fourth factor, monetary policy, results in temporary deviations from this rate. In the long-run, monetary policy is neutral. The next section starts with a narrative approach regarding the first three factors.

Determinants of Real Interest Rates

Global Saving

A higher propensity to save can be induced by many reasons. One of the reasons is the demographic challenge of ageing population, especially in advanced economies but also in China and other emerging ones. If economies are financially integrated, these global variables matter as well. According to Bernanke's saving glut hypothesis (2005), desired saving in emerging economies has put downward pressure on real rates globally.

The population in Switzerland is ageing rapidly and the country has one of the highest proportions of older people in the world. In 2015, 23.6% of the population was 60 years or

older. This percentage will continue to increase to 30.6% in 2030 and 34.5% in 2050. Growth rates will be particularly high in the population age group 80 years and older (Bonk, 2016).

People at retirement age will need to accumulate a larger stock of savings in order to finance their retirement spending. Additionally, if interest rates stay persistently low, households may be concerned about future household incomes. They may increase savings and reduce consumption to compensate for the shortfall. A possible argument against this conclusion could be that this effect is independent of the level of interest rates. But it may become much more visible and prominent when interest rates are unusually and persistently low (Borio *et al*., 2017). In Switzerland, there is a high level of gross savings in percentage of GDP, compared to other advanced economies like Germany and the USA. Gross savings are defined as gross national income minus total consumption, plus net transfers. China's high propensity to save is outstanding and is one main reason for driving down global interest rates. There are several causes for the high propensity to save in China: a mix of demographic change because of the 'one-child-policy', the lack of household safety nets and underdeveloped financial markets (Borio *et al*., 2017). Otherwise, according to Carvalho *et al*. (2016), demographic dynamics has an offsetting effect on interest rates through the increasing capital-labour ratio.

Bean *et al*. (2015) point out that another possible driver of a higher propensity to save comes from shifts in the distribution of income. In many countries, the distribution of income has become more unequal over the past three decades. The cause of this rise in inequality is still a matter of debate. Partly, it is because of increased competition from labour-rich developing countries, such as China, which weakened the bargaining power of unskilled workers in advanced economies. But a greater effect may be due to technological developments, particularly in information and communication technology, which led to the automation of jobs of unskilled workers. Irrespective of the cause, if high-income individuals have a higher propensity to save, then the aggregate propensity to save will increase. It must be observed, however, that the rise in income inequality started two decades before the long-term real interest rate began to decrease. This suggests that it may be less of a driver of the decline in the long-term of real interest rates (Bean *et al*., 2015).

Global Investment

Shifts in investment can be induced by several factors. These factors are the relative supply of labour and capital, population growth, investment profitability, productivity growth and the relative price of capital to that of output. If capital becomes cheaper, for example, due to technological advances, this means that less investment is needed to maintain the same level of production (Borio *et al.,* 2017). Productivity growth has been weak in advanced economies over the past few years and yet there is no consensus about the future development of productivity. According to Gordon (2014), advanced economies may have entered a period of 'secular stagnation'. He argues that the fundamental advances of the Industrial Revolution were unique and cannot be repeated. Mandel and Swanson (2017) point out that the Information Age has just begun and that the 10-year productivity draft is almost over. Hence, Borio *et al*. (2017) place little weight on the argument that the rate of innovation has slowed permanently.

As there has been a steady fall in the rate of the growth of the working-age population since the mid-1980s, labour force growth has consequently fallen back. The impact

of this development on investment is potentially complex. It translates into a lower required rate of growth of the capital stock, which would reduce capital demand. In contrast, however, a relative scarcity of labour will tend to substitute capital for labour, thus raising investment. The net impact on the demand for capital is therefore unclear. As the fall in population growth rates seems to predate the fall in real interest rates by a decade or more, it seems unlikely to be a major contributor to the decline in the world real interest rate (Bean *et al*., 2015).

Moreover, the argument about falling relative prices of capital goods and the impact on long-term interest rates fails the timing test. The relative price of investment goods has been falling since the 1970s and the downward trend of real interest rates started in the 1990s (Bean *et al*., 2015). Additionally, Reinhart and Rogoff (2009) verified that after severe crises, it takes a long time to recover and business remains reluctant to undertake investment.

Demand for Safe Versus Risky Assets

A shift in preferences towards safe assets or a reduction in their supply can be expected to lead to an upward pressure on the price of safe assets and a fall in their yields. In fact, as a consequence of the financial crisis, the demand for safe assets has increased. One cause for this behaviour could be an increase in risk (Blanchard, 2014). Bean *et al*. (2015) argue that it is more the increase in likelihood or size of bad outcomes. Broadbent (2016) analysed the behaviour of investors in Great Britain between 2002 and 2016. The outcome of his analysis is the outperformance of safe assets. He argues that the gap between the yields on equities and bonds depends positively on risk premium and negatively on expected growth. If investors revise down their central expectation of future growth, or if they see more risks, it benefits bonds and penalises equities.

In addition, during the years preceding the crisis, banks had run down their holding of liquid assets to extraordinary low levels. New regulations for the banking system increased the demand for safe assets and will continue to do so in the coming years. Finally, central bank asset purchases also led to higher asset prices and lower corresponding yields (Bean, 2015).

Does empirical evidence support the hypothesis that saving-investment imbalances have driven real interest rates to such a low level? The narrative about real interest rates and the relationship to the determinants is vast, including Eichengreen (2015), Bean *et al*. (2015), Bernanke (2015), and the Council of Economic Advisors (2015), to name but a few.

The other possibility is calibration – it uses theory to identify factors behind shifts in real interest rate trends and data to calibrate the corresponding structural models (Borio *et al*., 2017). Relevant literature exists by Gangnon, Johannsen and Lopez-Salido (2016), Carvalho *et al*. (2016), Thwaites (2015), and Vlieghe (2017). In these papers, theory dictates the relationship and the data are used to gauge their quantitative importance conditional on the theory being true (Borio *et al*., 2017). Another approach is filtering: equilibrium real interest rates are anchored to some economic relationship, as suggested by Holston *et al*. (2017), Laubach and Williams (2015), Justiniano and Primiceri (2010), and Johannsen and Mertens (2016).

According to Borio *et al*. (2017), these studies have provided estimates of the extent to which saving-investment determinants can explain real interest rate movements conditional on the theory, but there is no convincing evidence supporting the underlying the-

ory itself. It is important to confront the hypothesis more directly with the data, by systematically examining the relationship between real interest rates and observable variables. There are few studies covering the recent phase of declining rates. One of these is a study by Lunsford and West (2017) who focused on the United States for the period between 1890 and 2015 and evaluated the correlation between real interest rate in the United States and over 20 variables that have been hypothesised to influence real rates. They discovered that real interest rates are correlated with demographic measures, similar to the correlation with labour force hours growth that is positive. In many other variables they found weak evidence overall, especially GDP growth, consumption and total factor productivity. Hamilton *et al.* (2016) also examined the behaviour, determinants and implications of the equilibrium level of the real federal funds rate. The authors find weak evidence overall, though they do find some support for demographic variables.

Saving-Investment Imbalances: A Critical Approach

The Role of Real Factors

Borio *et al*. (2017) examined the direct link between real interest rates and the determinants postulated by the saving-investment framework, based on data starting in the 19th century for 19 economies. The key determinants in the analysis of Borio *et al*. (2017) that had a positive expected relationship with real rates are: marginal product of capital, output growth, productivity growth, dependency ratio, and relative price of capital. Determinants with a negative expected relationship are: life expectancy, inequality and risk premium. As a determinant, population growth has positive and negative impacts on real rates. Any cross-border effects (à la global saving glut) are captured to the extent that shifts in saving and investment can be traced back to the set of explanatory variables and countries considered. Owing to the lack of measures suitable for a long-horizon analysis, the safe-asset-shortage channel of (modern-day) emerging markets is not included in the analysis.

The outcome of the analysis is that there is only a tenuous link between real interest rates and observable proxies or the main saving-investment determinants. Some variables, notably demographics, show some of the expected relationship with real interest rates in some subsamples. The subsamples are the gold standard, the inter-war period, the post-war period, the pre-Volcker period and the post-Volcker period. Especially in the post-Volcker period, the results appear consistent with the standard narrative, but they clearly fail to survive once the sample is extended. If global factors are included in the analysis, they represent more improvement compared to the domestic ones, but the instability generally persists. The dependency ratio is significant and correctly designed in the sub-samples prior to the most recent one, but it is not significant over the full sample. Additionally, inequality performs well in the full sample and in the post-war sub-samples. However, in all other cases, the common trends in real interest rates and the saving-investment variables are highly unstable (Borio *et al*., 2017). As a result, no single real factor, or combination of such factors, can consistently explain the long-term evolution of real interest rates. This holds at both the domestic and global levels.

The Role of Monetary Factors

If the first three factors of Blanchard's (2014) analysis – global saving, global investment and demand for safe versus risky assets – fail to stay in a stable relationship with the real interest rate, the discussion has to consider the fourth factor, monetary policy. After the

global financial crisis (GFC), monetary policy drove down nominal interest rates and, with stable inflation rates, also real interest rates. The saving-imbalances theory implies that monetary policy is not relevant for the determination of the real interest rate. Monetary policy is 'neutral' in the long run (Patinkin, 1956).

Going beyond the standard factors, Borio *et al*. (2017) examine the question whether monetary policy plays a more important role than typically believed. Central banks set the nominal long-term interest rates through signals of future policy rates and asset purchases. On the other hand, market participants adjust their portfolios based on the expectations of monetary policy. Hence, interest rates reflect the interplay between the central bank's reaction function and private sector beliefs and behaviour. Saving-investment imbalances influence market rates indirectly through the interaction between the central bank and private sector agent's decisions. As a consequence, over the intervening period, real interest rates would reflect monetary determinants rather than saving-investment determinants.

A persistent influence on real interest rates through monetary policy may occur through two channels: the first is the inflation process and the second consists of the interaction between the central bank and the financial cycle.

Forbes *et al.* (2017) verified that the UK inflation dynamics is less responsive to economic slack and hence monetary policy than originally thought. If the inflation rate is below target and there is no second-round-effect while wages drive prices up, this could be the result of the global loss in labour's pricing power. In this case, there would be a one-off impact on the price level, but only a temporary effect on inflation. If monetary policy goes on to push up inflation, nominal and also real interest rates tend to decrease.

The second channel could be expressed through the broad agreement that price stability is not sufficient for financial stability. With the background of price stability, the central bank will react with expansionary policy after a bust, while not reacting to financial imbalances. This will also drive down nominal and real interest rates. With the combination of increasing debt after the bust, it would become harder to raise interest rates (Borio *et al*., 2014). Based on the standard framework, this would look like an exogenous decline in the natural rate. In fact, it would simply reflect the interaction of monetary policy with the economy (Borio *et al.,* 2017).

The recent experience with the effective lower bound stresses that monetary policy was largely unresponsive to economic developments and yet, there was no inflation spiral. Similarly, the unexpected easing of financial conditions failed to bring inflation back to target.

Borio *et al*. (2017) investigate the link between real interest rates and monetary factors in two ways. The first one examines the different monetary regimes and their relationship to real interest rates. The second takes a global perspective and explores the relative importance of global saving-investment determinants and global monetary factors.

One important outcome is that monetary regimes are significantly associated with shifts in the level of real interest rates. One possible explanation is that changes in monetary policy regimes may be associated with changes in risk premia, in particular in inflation risk premia. Monetary policy regimes, such as the gold standard, Bretton Woods and inflation targeting, go hand-in-hand with significant shifts in real interest rates. At a global level, the influence of external factors on countries' real interest rates reflects the importance of the financially dominant countries' role as global monetary anchors rather than common variations in global saving-investment determinants. This suggests that co-

movements in real interest rates across countries are more closely related to the monetary policy of global anchor countries than to the global saving glut (Borio *et al.,* 2017). The result of Borio *et al*. (2017) can be summarised as follows: the saving-investment framework may not serve as a reliable guide to understand real interest rate developments. And inflation may not be a sufficient reliable signal of where real interest rates are relative to some unobserved natural level. Monetary policy and financial factors may have an important bearing on persistent movements in real interest rates.

The monetary policy of the Swiss National Bank (SNB) is discussed in this section in the context of low real interest rates as a global trend. As a central bank of a small open economy (SOE), the SNB implements its policy by steering the interest rate level on the money market.

As described in the previous sections, these are real rates that have been negative in a number of countries over time. However, these are is negative nominal rates that are new. The goal of the negative interest rate policy (NIRP) in Switzerland has been hybrid: NIRPs were introduced to support growth and inflation by reducing the attractiveness of Swiss-franc denominated assets, thereby stemming appreciation pressures (IMF, 2017). Most SOEs have interest rates that are higher than the rates in major advanced economies. This is not the case in Switzerland, with a safe haven currency and hence a risk premium that is negative. According to Danthine (2017), since the advent of the Euro, and until the end of 2007, the safe haven premium took the form of an interest rate difference of minus 1.7 percentage points on average (measured by the difference between the rate of 3-month Libor in CHF and in Euro). Table 1 displays a short chronology of monetary events in the aftermath of the financial crisis.

Table 1. Chronology of the events established by the SNB's unconventional monetary policy

Date	Programme	Description
August 2007	The SNB lowers key interest rates and expands the liquidity supply to the interbank markets.	Tension on the money market becomes evident.
Beginning of 2009	The SNB lowers the target range for the three-month Libor to between 0.0% and 0.75%. The SNB starts an unconventional policy: long-term repos and purchase of Swiss franc-denominated bonds issued by domestic, private-sector borrowers.	Increasing demand for safe investment in Swiss francs.
March 2009	The short-term interest rate is reduced to near zero. The SNB starts to purchase foreign exchange.	More upward pressure against the Swiss franc. Monetary conditions are tightening.
Spring 2010	The SNB conducts extensive foreign currency purchases.	First escalation in the Euro area debt crisis.
First half of 2011	The SNB conducts further extensive foreign currency purchases.	Different Euro area countries are being dragged into the crisis. Deterioration of the global economic outlook. Uncertainty in the financial markets.
August 2011	The SNB narrows the target range for the Libor between 0.0% and 0.25%. The SNB expands banks' sight deposits significantly.	The upward pressure on the Swiss Franc remains high.

Date	Programme	Description
6 September 2011	Introduction of the minimum exchange rate for the Franc against Euro. Announcement of the SNB that it would no longer tolerate a EUR/CHF exchange rate below CHF 1.20.	The upward trend of the Swiss franc becomes more intensive. Risk of a deflationary trend emanating from the overvaluation of the Swiss franc.
5 January 2015	Discontinuation of the minimum exchange rate. Introduction of a negative interest rate on commercial banks' deposits at the SNB of minus 75bp.	The ECB decides about further monetary easing in the Euro area from mid-year onwards. The Euro depreciates sharply, with high pressure on the Swiss Franc.

Source: own elaboration based on Zurbrügg (2015).

The introduction of a minus 75 basis points (bp) interest rate on commercial banks deposits at the SNB in January 2015 reinstated a (moderate) negative differential. But it remained smaller than in the period before the crisis. Hence, the SNB announced that the policy would be complemented with discretionary foreign exchange interventions (Danthine, 2017). Consequently, the SNB is already the central bank with the largest balance sheet in relation to the GDP. In the discussion about the current low interest rates in Switzerland, the SNB also refers to the global trend of globally falling interest rates in the last decades. According to the SNB, this trend is based upon the saving-investment imbalances. Jordan (2016) argues that the propensity to save is increasing due to population ageing and the integration of China into global financial markets. The willingness to invest may also have fallen because of heightened uncertainty over future economic conditions, expectations of lower productivity growth and the transformation of industrial economies into service economies.

Channels of Monetary Policy Transmission

In a modern financial system, monetary policy affects the real economy through several channels. Mishkin (1996) provides an overview of the transmission mechanisms of monetary policy. He discusses the traditional interest rate channel, exchange rate channels and other asset price channels.

Interest Rate Channel

According to Mishkin (1996), the interest rate channel is the key monetary transmission mechanism in the basic Keynesian IS-LM textbook model. Expansionary monetary policy leads to falling real interest rates, which lowers the cost of capital and hence increases investment spending. Consequently, aggregate demand and output increase. Later research recognized that not only businesses' decisions are affected but also consumers' decisions about housing and consumer durable expenditure. In this framework, consumer and business decisions are based on the real rather than the nominal interest rate. But monetary policy is conducted through nominal interest rates. Therefore, how can changes in the short-term nominal interest rate result in a corresponding change in the real interest rate in both short-term and long-term bonds? The answer lies in sticky prices. In this case, lower short-term nominal interest rates also lower short-term real interest rates. But how can the change in the long-term interest rate be explained? The expectations hypothesis

of the term structure, which states that the long-term interest rate is an average of expected future short-term interest rates, suggests that the lower short-term real interest rates lead to a fall in the long-term interest rates. Thus, lower real interest rates lead to rises in business fixed investment, residential housing investment, consumer durables expenditure and inventory investment, all of which produces the rise in aggregate output (Mishkin, 1996). This transmission channel was also described by Friedman (1957), Ando and Modigliani (1963), Mundell (1963) and Fleming (1962). Blanchard (2017) refers to this effect as the direct effect of the interest rate on investment. Similarly, Mankiw (2017), as well as Samuelson *et al*. (2009) explain the demand side behaviour in open economies through the interest rate channel. The consensus that emerged from the empirical literature about DSGE models by Sims (1986), Bernanke and Blinder (1992), Christiano *et al*. (1996, 1999) was that an expansionary monetary policy shock corresponding to a decline in the U.S. federal funds rate led to expansions in consumption, employment, investment, output and capital utilisation, as well as relatively small rises in inflation and real wages (Christiano, Eichenbaum, & Trabandt, 2017).

Monetary policy can still be effective even when the nominal interest rates have already been driven down to zero. With nominal interest rate at zero, if an expansion in the money supply raises the expected inflation, the real interest rate will decrease, stimulating spending through the interest rate channel.

The interest rate of -0.75% charged by the SNB on sight deposits has ensured the traditional interest rate differential between Switzerland and foreign countries will be maintained. The relevant money market rates remained close to the interest rate on sight deposits. At the end of 2017, both the interest rate for secured overnight money – the Swiss Average Rate Overnight (SARON) – and the three-month Swiss Franc Libor stood at -0.75% (SNB, 2017).

Long-term capital market interest rates have again risen since December 2017. The yields on ten-year Swiss government bonds have been back in positive territory since mid-January 2017. In mid-March they stood at 0.1% compared to -0.1% in December 2017. Yields on Swiss government bonds with maturities under 9 years remained in negative territory. The real interest rate estimation – based on the development of ten-year yields of Swiss government bonds and inflation expectations for the same time horizon – shows a low, but positive level (SNB, 2018).

According to the Swiss Bankers Association, at the end of 2016, bank deposits totalling CHF 234 billion were subject to negative interest rates in Switzerland. Negative interest rates had an industry-wide dampening effect on banks' interest rate margins. As a result, the deposit business has little room for manoeuvre (Swiss Bankers Association, 2017). Domestic mortgage loans continued to rise, amounting to CHF 949.3 billion (up 2.7% or CHF 24.6 billion) in 2016. Thus, they comprised over 30% of the aggregate balance sheet total. Apart from the big banks category (down 0.3% to CHF 260.6 billion), all bank categories registered an increase in domestic mortgage claims. Other forms of credit, which are reported in the balance sheet under amounts due from customers, receded by CHF 21 billion to CHF 573.3 billion. They account for approximately one fifth of the aggregate balance sheet total. The main reason for the decrease was the decline in amounts due from foreign customers. Amounts due from domestic customers, by contrast, rose by CHF 6.5 billion to CHF 158.2 billion (SNB, 2016).

In 2016, the aggregate operating net income of banks in Switzerland fell by 3.2% to CHF 62.5 billion. Compared to the previous year, net income from the interest-earning business declined by 2.7%. One reason for this were the negative interest rates. However, as in the previous year, net income from the interest-earning business made the largest contribution to aggregate operating net income despite this decline. Due to customers' high sensitivity to prices, the banks' ability to pass negative interest rates on to customers through higher commissions was limited. As a result, net income from the commission and service business fell by 6.7% in 2016 (Swiss Bankers Association, 2017).

Exchange Rate Channel

The growing internationalisation of economies brought more attention to monetary policy transmissions through exchange rate effects. This channel also involves interest rate effects. Mishkin (1996) describes the exchange rate channel as follows: a falling domestic real interest rate makes domestic currency deposits less attractive compared to deposits denominated in foreign currencies, leading to a fall in the value of the domestic currency. This makes domestic goods cheaper than foreign goods, causing a rise in net exports and hence in aggregate output (Mishkin, 1996). Krugman *et al*. (2014), Blanchard (2017) and Mankiw (2017) also discuss the exchange rate effect of a change in the interest rate. Taylor (1993) and Smets (1995) discuss the fact that smaller, more open economies tend to have larger effects through this channel.

In Switzerland, a small open economy managing the exchange rate, the SNB, is fighting a heroic battle based on two elements: the negative interest rate of -0.75% on banks' sight deposits held at the SNB and the willingness to intervene in foreign exchange market. As described above, lower interest rates make investments in Swiss francs less attractive. The Franc depreciates and makes Swiss goods cheaper abroad and increases net exports. Historically, Switzerland always had lower interest rates than most other countries, especially in Europe. According to the SNB, the interest rate differential reflects the lower average inflation compared to other countries, as well as the political stability and credible monetary policy. Investors are prepared to hold Swiss franc investments at lower yields. Since the outbreak of the GFC, the interest rate differential has become ever narrower. With the introduction of the negative interest rate in June 2014 in the Euro area, it even turned negative. The rate cut in Switzerland in January 2015 restored the original interest rate differential and helped reduce pressure on the Swiss franc (Jordan, 2016).

Figure 2 shows the real broad effective exchange rate. It is now back at roughly the same level as before the discontinuation of the minimum-exchange rate (January 2015), although it remains above its long-term average. Together with the willingness of the SNB to intervene in the foreign exchange markets, it has helped to ensure that the Swiss franc has not strengthened further uncertainty, for example, in the wake of the British EU referendum (Jordan, 2016).

Switzerland is a small open economy with a large trading sector, in which exports contribute around 50% to GDP and imports account for about 40%. Movements in the exchange rate have a certain impact on domestic economic development. Thorbecke and Kato (2017) investigated how exchange rate changes affect Swiss exports and the profitability of Swiss firms. According to their findings, in the past Switzerland had the most advanced export structure in the world. Watches and pharmaceutical products rank first and third, in terms

of product sophistication, and 41% of Swiss exports in 2014 was in these categories. According to OECD measures, 53% of Swiss manufacturing exports in 2014 were classified as high technology goods. This was two-to-five times higher than the corresponding values for the G7 countries. According to Thorbecke and Kato (2017), there is no evidence that an appreciation of the Swiss franc would reduce exports of the most sophisticated products, watches and pharmaceutical products. But, on the other hand, exports of specialised machinery, precision instruments, machine tools, and other goods produced using Swiss engineering are vulnerable to appreciations. Regarding the profitability of Swiss firms, exchange rate appreciations cannot only reduce export volume but also compress the profit margins of exporters by forcing them to reduce Swiss franc export prices. Their regression results indicate that a 10% appreciation of the Swiss nominal effective exchange rate caused Swiss franc export prices for capital goods to fall by 4% while for precision instruments the decline is more than 4%. On the other hand, Swiss franc prices do not fall because of an appreciation of the Swiss nominal effective exchange rate. Thus, profit margins of companies producing medium-high-technology products were squeezed, but not for companies producing high-technology-products (Thorbecke & Kato, 2017).

Figure 2. Real Broad Effective Exchange Rate for Switzerland
Source: Bank for International Settlements, Real Broad Effective Exchange Rate for Switzerland (RBCHBIS), retrieved from FRED, Federal Reserve Bank of St. Louis, 24 January 2018.

Another finding by Thorbecke and Kato (2017) is that GDP increases in import countries cause large increases in Swiss exports. There is a tight relationship between Swiss exports and global GDP. This led Thorbecke and Kato to the conclusion that Switzerland should have a strong interest not only in the movements of the exchange rate but also in the economic welfare of its trading partners. It should foster this by maintaining free trade and scientific exchanges with developed countries and by sharing its expertise in areas such as healthcare and education with developing countries. According to Straubhaar (2015), the Swiss economy has proven that it is able to compensate for the external appreciation of the Swiss franc in the medium and long term through internal (cost) devaluations. The key asset of the Swiss economy is the high flexibility of small and medium-sized

businesses and their workforces. They adapt quickly and effectively with a mix of cost savings, productivity improvements and innovations of all kinds to changing macroeconomic conditions. Why should this ability continue to be also the case in the future? Straubhaar offers some arguments. Firstly, the strong Swiss franc reduces costs for imports, which finally reduces costs of production for goods and services. Secondly, the strong Swiss franc leads to low interest rates. This allows more capital-intensive production, which increases productivity and international competitiveness. Thirdly, falling consumer prices increase the real purchasing power of wages and therefore increase flexibility for wage adjustments. Moreover, labour-intensive activities might be shifted abroad. This would provoke incentives for new and higher added-value activities. Finally, a strong recovery in the Eurozone will stimulate the Swiss economy since almost half of Swiss exports are sold in this area. To summarise: in the past, currency appreciations have strengthened Swiss companies. In theory, within a flexible system, central banks should leave the process of determining appropriate exchange rates to the currency markets (Straubhaar, 2015).

Monetary Policy, Asset Prices and Financial Stability

For decades, the relationship between monetary policy and asset prices has been of great interest for central banks and academics as asset price bubbles pose a threat to economic and financial stability. In this context, two interrelated questions arise. Firstly, what is the impact of monetary policy on asset prices and financial stability? Secondly, how (if at all) should monetary policy-makers respond to asset price bubbles?

It is vital for monetary policy-makers to understand the influence of monetary policy on the economy and inflation. One way to describe the impact of monetary policy on the economy is the monetary transmission mechanism. This is one of the most thoroughly researched fields of monetary economics. Boivin *et al*. (2010) claim that interest rates affect asset prices and real economic activity through various transmission channels, such as the interest rate channel, the exchange rate channel, or the wealth effect channel. Lately, many central banks (including the Swiss National Bank) reduced their policy rates almost to zero or even below zero. Arteta *et al*. (2016) argue that cutting interest rates to a level slightly below zero should cause the same effects as a rate reduction in a positive interest rate environment. Brunnermeier and Schnabel (2015) pointed out that interest rates that are set too low for a prolonged period of time increase the risk of financial market imbalances substantially and could plant the seeds for new asset price bubbles.

Asset prices also play an important role in the wealth effect channel of monetary transmission. Boivin *et al*. (2010) claim that expansionary monetary policy normally drives up prices of assets like bonds, stocks and real estate. The resulting increase in the households' total wealth could then stimulate consumption and real economic activity. The influence of monetary policy on financial markets was also described by Rigobon and Sack (2002). In conformity with this point of view, Assenmacher-Wesche and Gerlach (2008) found that monetary policy has a significant impact on asset prices, particularly in comparison to its effect on inflation and aggregate output. Thus, asset prices should be included in inflation and growth forecasts of central banks, which was already suggested by Issing (2009). Hott and Jakipii (2012), Assenmacher-Wesche and Gerlach (2008), as well as Bordo and Landon-Lane (2013) could all empirically prove the significance of the relationship between interest rates and financial assets such as stocks and real estate.

In a state of expansionary monetary policy, asset prices are not only driven by increasing money supply and improved economic conditions but also by the positive influence of lower discount rates on asset valuations (asset valuation channel). Valuations of many financial assets (including bonds, stocks and real estate) are based on present value calculations, which are highly sensitive to changes of the underlying discount rates. Hannoun (2015) argues that low or negative interest rates reduce discount rates. Thus, applying these lower discount rates to future cash flows, such as dividends and rents, increases the values of the respective assets. Moreover, expansionary monetary policy may improve the economic outlook and thus lead to higher expected cash flows. Under the regime of negative interest rates, not only does the valuation of financial assets become economically meaningless, but also the valuation of financial derivatives (e.g. interest rate swaps) is affected and hence distorted. Apart from causing surging asset values, decreasing discount rates lead to rising liability values. This is particularly challenging for pension funds as increased pension liabilities amplify the risk of facing a shortfall.

Boivin *et al.* (2010) claim that whenever short-term policy rates are cut long-term interest rates decline too as they are linked to future short-term rates. Asset purchasing programmes (quantitative easing) pursue the same aim of lowering long-term interest rates and yields of government bonds to stimulate the economy. Because of the implementation of a negative interest rate policy in Switzerland, the yields on Swiss government bonds have also fallen below zero, as Hannoun (2015) describes. Due to the persistently low or even negative yielding Swiss government bonds, institutional investors (including insurance companies, asset managers, and pension funds) struggle to generate adequate returns. Hannoun mentions that particularly pension funds, which are legally constrained to both hold a certain amount of low-risk assets and to guarantee contractually promised minimum yields, are under considerable pressure.

Bini Smaghi (2009) argues that another consequence of low or negative yields on government bonds is that many investors search for higher yields while shifting their portfolio toward riskier or less liquid assets (risk-taking channel). This may lead to a convergence between the expected returns of risky and low-risk assets and hence reduces credit spreads. Excessive risk-taking may cause asset bubbles in financial markets and expose the economy to a greater risk of financial instability (Issing, 2009; Stiglitz, 2016).

Hannoun (2015) contends that negative policy rates impact the profitability of banks by narrowing net interest margins. In Switzerland, many banks passed on negative interest rates to their commercial and institutional clients. However, only few Swiss banks imposed negative interest rates on private clients. Negative interest rates essentially penalise savers for their deposits and reward borrowers for raising debt capital. Even though some banks in Switzerland passed on negative interest rates on their commercial and institutional clients, the interest rates charged on loans and mortgages never went below zero. Bini Smaghi (2009) remarks that low interest rates on debt capital combined with a state of increased values of collaterals (associated with higher asset valuations) drive up demand for credit. He claims that the greater availability of debt capital and the increased willingness to take risk boosts asset prices like stocks as well as real estate and sets a dangerous self-sustaining vicious cycle in motion. Turner (2017) points out that even current macroprudential policies fail to mitigate increased interest rate and liquidity risk exposures of financial intermediaries. Given the scale of the interest rate

and liquidity risks in the books of financial firms, the impact of increasing interest rates becomes more severe and unpredictable.

Brunnermeier and Schnabel (2015) argue that the historical emergence of asset bubbles is often preceded or accompanied by expansionary monetary policy, lending booms, capital inflows or financial innovations. They emphasize that crises are most severe when accompanied by a lending boom and high leverage of market participants, and when financial institutions participate in the buying frenzy. Turner (2017) adds that the radical expansionary monetary policies since the latest financial crisis could create difficulties for future monetary policy. He fears far-reaching economic consequences once the extraordinary monetary stimulus is removed. One should keep in mind, as he says, that the recessions in the aftermath of the tech bubble in 2000 and the financial crisis in 2007-09 were both caused by asset price collapses rather than inflation. He suggests that policy-makers need to be forward-looking and pay attention to potential risks and imbalances; including those created by their own monetary policies. Jordan (2013) mentions that the Swiss National Bank cannot address the emerging imbalances in the Swiss equity and real estate market by raising interest rates given the accommodative monetary policies of other advanced economies, exchange rate concerns and the modest current and expected inflation.

Whenever increasing asset prices degenerate into a bubble, the question about the role of central banks in dealing with asset price misalignments experiences a revival. There is a long-lasting debate between proponents of the 'leaning against the wind' policy requesting central banks to deflate asset price bubbles, and proponents of the 'cleaning up' policy demanding that policy-makers wait until the asset price bubble collapses and then implementing an accommodative monetary policy. The next section elaborates these contradictory stances.

Monetary Policy and Asset Price Bubbles

According to Rigobon and Sack (2004), a bubble reflects a significant value deviation of an asset from its fundamental value. Asset price bubbles are problematic for numerous reasons. Firstly, asset price bubbles may lead to an undesirable misallocation of capital. Secondly, they pose a threat to the macroeconomic and financial stability. Thirdly, the collapse of asset price bubbles could lead to a recession in the aftermath. Finally, the credibility as well as effectiveness of monetary policy might be impaired if central banks are unable to confront asset price bubbles (Blot *et al*., 2017).

It is widely accepted among policy-makers that central banks should set policy rates in response to inflation and output gap. In fact, Bernanke and Gertler (2001), Bordo and Wheelock (2004), Kohn (2007, 2009), and Christiano *et al*. (2008) argue that central banks should ignore asset price movements unless they pose a threat to price stability and real economic activity. This consensus view relies on the following three arguments: (i) Asset price misalignments are usually associated with strong inflationary pressure. Thus, central banks that focus on inflation automatically reduce the risk of asset price bubbles. (ii) Central banks are not able to identify asset price bubbles in the early stage with an appropriate degree of confidence as they do not have better information than the financial markets. Additionally, not all fundamental factors driving asset prices are directly observable. (iii) Moderate interest rate increases may not be sufficient to contain asset price bubbles. On the other hand, strong policy-rate hikes are not a viable option as they would pose serious risks to the economy. Moreover, Kohn (2009) points out that the detection of a bubble

and subsequent policy reactions (interest rate increase) might occur at a time when the bubble bursts on its own. This could amplify the negative effect of the bubble's collapse. Hence, Bini Smaghi (2009) and Issing (2009) claim that central banks should be ready to intervene aggressively by cutting policy rates after the crash of asset prices to support the economy and to minimise the probability of deflation ('cleaning up' policy).

However, many economists take a different view, such as Cecchetti *et al*. (2000), Borio and Lowe (2002), Bordo and Jeanne (2002), Platen and Semmler (2009), and Smets (2014). They argue that low and stable inflation is not a guarantee of financial stability. Therefore, central banks should systematically incorporate asset prices into their policy-making processes to improve the effectiveness of monetary policy. As the collapse of an asset price bubble may lead to a financial and economic crisis, they urge central banks to intervene pre-emptively by raising interest rates and hence preventing the build-up of an asset price bubble ('leaning against the wind' policy). The authors point out that the associated deviations from the Taylor rule should prevent episodes of deflation and recession which may occur after the bursting of an asset price bubble. Juselius *et al*. (2016) presented an augmented Taylor rule by adding a financial cycle variable. This enables to take financial developments systematically into account. However, the alleged unavailability of timely warning indicators is not per se a hindrance to implementing a 'leaning against the wind' policy as Alessi and Detken (2009) found well performing early warning indicators. By contrast, Bernanke and Gertler (2001) argue that the 'leaning against the wind' policy only performs well if central banks know that the boom is driven by 'irrational exuberance' and a collapse of asset prices is imminent. These are both highly unlikely assumptions. Additionally, Blot *et al*. (2017) suggest that movements in asset prices driven by fundamentals should be disentangled from movements resulting from the speculative component. Furthermore, Galí (2014) claims that increasing interest rates as a response to asset price bubbles cause opposing effects on fundamental and non-fundamental components of asset bubbles. Thus, when it comes to rational asset price bubbles, the 'leaning against the wind policy' may be counterproductive and might cause higher bubble fluctuations as well as adverse effects on the economy. Berlemann and Freese (2013) mention that tightening of the monetary policy could deflate house and flat prices while increasing rental prices and thus inflation.

Assenmacher-Wesche and Gerlach (2009) found that, for different countries and periods, interest rate shocks generally have a significant influence on both stock and housing markets. However, they discovered that the stock market in Switzerland is not influenced by monetary policy, whereas the real estate market significantly reacts to interest rate movements. Borio and Lowe (2002) claim that closer cooperation between monetary and prudential authorities is important, not only during the crisis, but also to prevent their emergence. In accordance with this point of view, Brunnermeier and Schnabel (2015) suggest that macroprudential measures can be successful in mitigating crises. They argue that the main advantage of macroprudential interventions is that such measures are much more targeted than policy rates adjustments. The reason for this is the possibility to directly influence sectors where asset price misalignments emerge. In line with this argument, Kuttner (2011) states that macroprudential regulation is more appropriate than interest rates interventions to warrant financial stability. Ozkan and Unsal (2014) as well as Arteta *et al*. (2016) propose using a policy mix of monetary and macroprudential policies to ensure monetary and financial stability. Consequently, the Swiss National Bank activated a 1% countercyclical buffer on

risk-weighted mortgage loans as of September 2013 which was then increased to 2% as of June 2014. This buffer should force financial institutions to accumulate additional equity and ultimately prevent a potential overheating of the Swiss housing market. The future will tell whether this policy mix in Switzerland will prevent upcoming crises.

CONCLUSIONS

Real interest rates have been on a downward trend throughout much of the past 30 years. There are different analytical strands to explain the determinants of these falling interest rates. Prevailing explanations refer to saving-investment imbalances. However, recent studies indicate that persistent shifts in real interest rates coincide with changes in monetary regimes. As a result, monetary policy should be evaluated in this context. The negative interest rate policy (NIRP) of the SNB implemented in 2015 is explained using different transmission channels. Although the time period between the implementation of the negative interest rate policy in Switzerland and the actual analysis is very short, in summary it can be said that the market rates (short-term and long-term) remained close to the policy rate. As a consequence, interest rate margins of the Swiss banks fell industry-wide. All bank categories registered an increase in domestic mortgage claims. Other forms of credits decreased, especially the amounts due from foreign customers. In 2016, aggregate operating net income for banks in Switzerland fell by 3.2%.

As Switzerland is a small and open economy, the exchange rate plays an important role in international trade relations. Monetarists support interventions by the SNB with respect to the exchange rate of the Swiss Franc. However, there are also economists who argue that, in the past, currency appreciations strengthened Swiss companies and hence the Swiss National Bank should leave the Swiss Franc to float freely, especially given the flexible exchange rate system.

In addition to the interest rate and exchange rate channels, monetary policy has a significant impact on asset prices, which affects the aggregated output through the wealth effect channel. The negative interest rates in Switzerland incentivised investors to allocate their capital into riskier and higher yielding assets to generate appropriate returns. Consequently, the stock and real estate markets were fuelled and are showing indications of overheating. The impact of monetary policy on asset prices is manifold and could even lead to asset price bubbles. The long-lasting debate about the role of central banks in dealing with asset price bubbles remains unsolved and hence will be continued in the future. The ability of the Swiss National Bank to increase interest rates to avoid the build-up of asset price bubbles is limited as a restrictive policy would put upward pressure on the Swiss Franc, leading to a conflict of interest. The Swiss National Bank does not only rely on conventional and unconventional monetary policies but also on macroprudential interventions which should reduce the misalignment of real estate prices in Switzerland. The future will show whether this policy mix will be successful.

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