c a h i e r d e r e c h e r c h e d u C R E G

Forecasting inflation in Switzerland after the crisis : the usefulness of a monetary and financial condition index

Cyriac Guillaumin, Guillaume Vallet

Cahier de recherche du Creg, n° 2017.02

Novembre 2017

CREG – Centre de Recherche en Économie de Grenoble
Faculté d'Économie de Grenoble – UGA, CS 40700, 38058 Grenoble Cedex 9
Tél : +33 (0)4 76 82 56 92 ; E-mail : creg@univ-grenoble-alpes.fr
http://creg.univ-grenoble-alpes.fr/

Forecasting Inflation in Switzerland after the Crisis: The Usefulness of a Monetary and Financial Condition Index

Cyriac Guillaumin[*]

Guillaume Vallet[**]

[*] University Grenoble Alpes, 1241 rue des Résidences, 38400 Saint-Martin d'Hères, France. Email: cyriac.guillaumin@univ-grenoble-alpes.fr. Tel: +33 (0)4 76 82 59 89. Fax: +33 (0)4 76 82 59 95.

[**] (Corresponding author) CREG, University Grenoble Alpes, 1241 rue des Résidences, 38400 Saint-Martin d'Hères, France. Email: guillaumin.vallet@univ-grenoble-alpes.fr. Tel: +33 (0)4 76 82 57 65. Fax: +33 (0)4 76 82 59 95.

Abstract: The aim of this paper is to build a monetary and financial condition index in order to perform inflation forecasts. Focusing on the Swiss case, in which inflation forecasts are at the core of the central bank's strategy, we test several monetary and financial variables that play a fundamental role in the monetary transmission mechanism to inflation rate. The weights for the index are derived from two methodologies: an aggregate demand equation, and the impulse responses function of inflation to financial shocks from a VAR model. Using an augmented index, we apply a multistep forecasting methodology and compare our results between the model, which includes the index, and a benchmark autoregressive model. We obtain significant results, at short term (four and five quarters), in the sense that the model with the index, whatever the methodology used, always outperforms the benchmark model. Our results support the idea that the central bank should define its monetary policy by taking into account the price of financial assets. Therefore, our findings could be useful in improving monetary policy guidance in Switzerland.

Keywords: monetary and financial conditions, monetary policy, global financial crisis, inflation forecast.

JEL classification: E44, E47, E52, E58.

1. Introduction

The *subprime* crisis that began in 2007, and then the 2008–9 financial crisis, have forced central banks to go beyond their original objectives or strategies and to use new tools to handle monetary policy within a context of zero interest rate policies (ZIRP). The challenge for central banks now is to be able to normalize their monetary conditions while taking into account what has changed following the Global Financial Crisis (GFC), as well as respecting their main mission, which is, for the majority of central banks in developed countries, reaching price stability. In particular, they must deal with the supervision of assets markets in the conduct of their monetary policy (Bilbiie, 2008; Bilbiie and Straub, 2012). To sum up, central banks must define new guidelines with which to anchor agents' anticipations and to deal with new tools in order to be both predictable and reliable, especially when realizing inflation forecasts.

The large literature on the monetary transmission mechanism analyzes many monetary tools.[2] Among these tools, the monetary condition index (MCI) is increasingly used by central banks. The MCI takes into account both the interest rate and exchange rate channels by weighting them in the implementation of its monetary policy. The central bank assumes that they are the main channels of its monetary policy to be considered in order to fulfil its objectives. If the MCI is mostly used to provide more information about the stance of its monetary policy – its degree of loosening or tightening – regarding the main objective of the central banks, it can also be built to realize inflation forecasts. It is especially useful for small open economies, because the MCI acts like a path to price stability once inflation forecasts have been prepared (Guender, 2009). Realizing inflation forecasts implies determining a scenario for future inflation, which acts like a "compass" for the SNB (Rich, 2000; Kugler and Rich, 2002). For the SNB, such a role is played by interest rate targeting (the three-month Swiss franc LIBOR). Nevertheless, the use of interest rates has become insufficient to realize good inflation forecasts regarding the zero-bound context, as well as assets market developments (Reichlin and Baldwin, 2013). This justifies the creation of a new MCI that would integrate current financial variables, without changing the functioning monetary framework (Gerlach, 2013). Indeed, monetary policy influences the economy by altering the financial conditions that affect economic behavior and the structure of the financial system is a key determinant of the importance of various channels transmission (Hatzius et al., 2010).

[2] See, for example, Boivin et al. (2010) and/or Hatzius et al. (2010) for a literature review.

Several authors have addressed this issue, stressing the necessity to build a "broadened" MCI that will be the "natural extension" of the MCI (Angelopoulou et al., 2013). Gauthier et al. (2004) deal with financial condition indexes (FCI), adding to short-term interest rate and exchange rate (the "basis"), financial variables such as property and equity prices, bond yield risk premiums, as well as long-term interest rates. Others use the change in credit availability, corporate bond spreads and household wealth, in addition to the "basis" (Guichard et al., 2009). After the GFC, Hatzius et al. (2010) build a new FCI including a broad range of quantitative and survey-based indicators (yield curve, credit spreads, etc.) and they find that the FCI have a good performance in order to predict the future economic activity. Likewise, Chow (2013) uses the "basis" in addition to credit expansions and asset prices (stock prices and house prices). Finally, Lack (2006) reiterates the importance of building an FCI with these variables because of the change in monetary conditions. Focusing on Switzerland, Lack (2006) indicates that there has been a growing influence of the rise in credit on the boom of real estate prices in this country, which the Swiss National Bank (SNB) must take into account.

Indeed, regarding the relation between building FCIs and inflation forecasts, the Swiss case is particularly relevant for several reasons. First, the GFC has shown the likelihood of a negative "international financial trilemma" leading to bad credit in Switzerland, due to the rise in the monetary base. As the importance of the credit channel is higher when interest rates are close to 0 per cent in Switzerland (Zurlinden, 2005), the SNB must be extremely cautious about the rise in credit on some assets markets. Second, some Swiss assets markets have indeed been marked by a sharp rise in prices, especially the real estate market, as in other countries that are concerned with quantitative easing policies.[3] Recently, Altermatt and Baeriswyl (2015) highlighted the rise in credit to Swiss economic agents by banks that have more cash flow with the SNB's monetary policy and are able to invest more easily in such a market. Indeed, we must bear in mind that Swiss economic agents are sensitive to mortgage credit, and the latter amount represents 116 per cent of the GDP: this implies that residential investment and house prices are usually more responsive to monetary policy shocks in countries such as Switzerland that have more developed mortgage markets (Calza et al., 2013). In other words, like other central banks, the SNB has to monitor sector-specific credit growth (Brunnermeier and Sannikov, 2013).

[3] For example, between 2009 (beginning with the SNB's massive interventions) and 2015, the stock prices index and house prices index have progressed by 8.0 per cent and 14.6 per cent, respectively, while prices in the Swiss economy have decreased (-9.0 per cent between January 2009 and April 2015).

Therefore, this paper will address the following issue. To what extent could the construction of a monetary condition index including financial variables be useful for the SNB in terms of improving its inflation forecasts? To answer this question, our aim is to build an augmented MCI, taking into account the "new" transmission channels of the [unconventional] monetary policy.

The rest of the paper is organized as follows. Section 2 describes the empirical model. Section 3 presents the results. Section 4 concludes.

2. Methodology

In this section, we detail the construction of, first, the monetary condition index, and, second, the monetary and financial condition index.

The monetary condition index (MCI hereafter) is one of the three main approaches taken in the literature for measuring the monetary policy stance.[4] In the case of the SNB, the MCI is a useful tool for analysing the intended impact of changes in monetary policy instruments on inflation.

The MCI at time t is constructed as a weighted average of changes in the domestic interest rate and in the exchange rate, relative to their values in a base period. The MCI at time t, noted MCI_t, can be written as:

$$MCI_t = \varphi_i(i_t - i_B) + \varphi_e(e_t - e_B) \quad (1)$$

where i_t is the short-term interest rate, e_t is the log of the effective exchange rate (where a rise in e_t represents an appreciation in the effective exchange rate), and i_B and e_B are, respectively, the levels of the interest rate and the effective exchange rate in a given base period (benchmark period). These references reflect "neutral" economic conditions (Freedman, 1994). The MCI can be defined in either real or nominal terms. The traditional literature favors the approach in real, rather than nominal, terms, for several reasons. First, macro-econometric models are based on real-term variables (e.g. competitiveness is measured by the real exchange rate). Second, nominal variables can be difficult to interpret in the medium term where inflationary effects can pass through the output gap. On the other hand, the evolution of nominal variables conveys more ambiguous information than real variables (for example, the Bank of Canada uses a nominal monetary condition index, which is built with a nominal short-term interest rate and a nominal exchange rate).[5] However, the use of a

[4] The use of the MCI, as an operational target for monetary policy, was first introduced by the Bank of Canada (see, for example, Freedman, 1994).

[5] See, for example, Aubert (2003) for a literature review.

real-term indicator is, from a practical point of view, more complicated. Indeed, it is available less readily than a nominal indicator. Finally, from a short-term perspective, the nominal indicator seems to be equivalent to the real indicator.

The coefficients φ_i and φ_e are the MCI's weights, that is, the weight of the interest rate and the effective exchange rate, respectively, in the MCI. The ratio φ_i/φ_e corresponds to the relative impact of the interest rate and effective exchange rates in a medium-run policy (such as output or inflation). For example, a ratio of 3:1 means that a variation of 100 basis points of the interest rate, for a constant exchange rate, has the same impact on the MCI as a variation of 3 per cent of the exchange rate, for a constant interest rate. The relative weights with which the individual components are included in the MCI are not directly observable and must be estimated using econometric techniques. The MCI therefore largely depends on the specification and assumptions of these estimations. Furthermore, Battini and Turnbull (2002) posit that there are four main methods for estimating the MCI's weights:

- **Simulations in large-scale macro-econometric models.** Large-scale macro-econometric models[6] are used by central banks and/or governments. They are superior to the other methods because more variables are taken into account and, unlike in the reduced equation approach, structural shocks can be constructed.
- **Reduced-form aggregate demand equation.** The weights of the exchange rate and the interest rate are derived by estimating an aggregate demand equation. Most MCI estimations are, however, based on a reduced-form aggregate demand equation. Reduced-form models usually consist of a demand equation relating the output to the interest rate, the exchange rate and, possibly, some other explanatory variables. This approach has been chosen by most central banks that publish an MCI. The advantages of this approach are its simplicity in terms of data requirements and econometric modelling.
- **Trade share-based MCIs.** The weight of the exchange rate is based on the long run exports-to-GDP ratio, and the interest rate weight is one minus this ratio.
- **VAR impulse responses functions.** The weights of the exchange rate and the interest rate are obtained by estimating a reduced VAR model. Their advantage lies in the fact that they are not based on a particular view of the transmission mechanism. This method was introduced by Goodhart and Hofmann (2001).

[6] For example, NiGEM, INTERLINK. See, for example, Peeters (1998) or Mayes and Virén (2000). Simulations in large-scale macro-econometric models are discussed in Costa (2000).

However, there are some drawbacks to the use of the MCI as a measure of the stance on monetary policy. First, the construction of the MCI assumes that both the interest rate and the exchange rate are monetary policy instruments. This is not always the case. In practice, they can be operational targets (Bindseik, 2004). Second, even if the MCI were an operational target, it would not be appropriate in the case where non-policy variables might play a role in determining changes in both the interest rate and exchange rate (Eika et al., 1996; Ericsson et al., 1998).[7] Finally, the literature on the transmission channels of monetary policy has largely been developed since the 1990s. Other channels such as the credit channel and stock price channel have been studied and developed.[8] For example, Leeper et al. (1996), Bernanke and Gertler (1999), Bernanke et al. (1997) and Christiano et al. (1999) studied the transmission channels of US monetary policy.[9] Furthermore, McCarthy and Peach (2002) underline that the influence of monetary policy on the real estate market has recently increased. Even if it takes more time to occur than in previous decades, its impact is more persistent, in particular through the credit channel, and this could have an impact on inflation.

Moreover, the GFC showed that new monetary policy transmission channels have been developed for both emerging countries and developed countries (Chen et al., 2011; Landeau, 2013). In particular, the price of assets (financial or real) seems to be important (Giese and Tuxen, 2007).[10] On this point, there is a debate about the role of the banking sector and the credit channel in the transmission of monetary policy. According to Boivin et al. (2010), it has become less important than it used to be in the past. In particular, residential investment seems to be tied more to interest rates than to credit availability. On the contrary, some authors stress that such a channel is likely to be of greater relevance than it was in previous decades. Indeed, the emergence of a plurality of new instruments and players on financial markets has entailed a more prominent role for banking intermediates (ECB, 2010). It is difficult to draw conclusions on this point but, as Boivin et al. (2010) recognize, the credit channel is likely to play a great role in the transmission of monetary policy because of the quantitative easing measures. The link between real and financial sectors is complex, as stressed by Bernanke and Gertler (1995), Bernanke et al. (1997) and Boivin (2002).[11]

[7] These two contributions describe the main criticisms of the MCI.
[8] Angeloni et al. (2003) conducted a large literature review on this topic.
[9] Leeper et al. (1996), Bernanke et al. (1997) and Christiano et al. (1999) estimated different VAR models or SVAR models using restrictions (linked to the economics theory or the observation of facts) in order to study the responses of the US monetary policy to different shocks.
[10] See, for example, Alessi and Detken (2011) for a literature review.
[11] These authors used VAR models or SVAR models with restrictions. Bernanke and Gertler (1995) used different VAR models to study the credit market channel of monetary policy transmission, but they also analyzed this topic and the consequences on the real economy of both facts and data. These authors demonstrate

Indeed, as the former Governor of the Bank of Japan, M. Shirakawa, argues, central banks themselves may have influenced such a trend since the beginning of the crisis. Indeed, ZIRP and low prices – even deflation – entail expectations that a low interest rate environment will continue. Thus, investors become more interested in the "search for yield" activity and are indirectly supported by the central banks, which seek to increase trade on financial markets as a result of the rise in prices. The central banks, in particular, want long-term interest rates to decrease through their actions in order to reduce the risk premium (Joyce et al., 2012; Rogers et al., 2014). In the zero lower-bound context, the central banks seek to enhance the link between short- and long-term interest rates to modify expectations (Boivin et al., 2010).

The problem is that their actions can reinforce the credit channel and lead to new bubbles, while the "real" economy delays recovery: "While aggressive monetary easing is definitely needed after the bursting of bubbles, its side effects and limits should also be taken into consideration" (Shirakawa, 2013, pp. 382). To put it another way, there is a new threat to "the stability of the financial system and consequently that of the real economy and prices" (Shirakawa, 2013, pp. 378). Such a framework is particularly relevant in a small open economy where the prices of assets can be influenced by unconventional domestic and foreign monetary policies as a result of the openness.

Another important issue is to assess the extent to which the commodity prices channel impacts monetary policy reactions because, as Furlong (1989) argues, commodity prices can help to improve inflation forecasting.[12] There are lively debates about this question among economists, since the implications of commodity price shocks are less than clear-cut. On the one hand, according to Ano Sujithan et al. (2013), such prices have a negative effect on short-term interest rates, and this impact has increased since the 2008–9 financial crisis. Moreover, Kilian and Lewis (2011) highlight that the central banks should consider price commodity shocks in their monetary policy reaction function because a stable and long-term relationship is likely to exist between the inflation rate and the price of some commodities (Worthington and Pahlavani, 2007).

On the other hand, several authors contest such a linkage (Blomberg and Harris, 1995; Furlong and Ingenito, 1996), and consider, on the contrary, that price commodities are poor predictors of inflation (Evans and Fisher, 2011). Indeed, if such a linkage exists for developing countries, it tends to be less relevant for developed economies (Cecchetti and

---

that a shock on the real GDP contemporaneously affects the stock market index, but not vice versa. This link is also assumed for emerging markets in Sato et al. (2011). See, for a literature review, BIS (2011).

[12] See also, for example, Ferraro et al. (2015).

Moessner, 2008; De Gregorio, 2012): either commodity prices are too volatile to play a significant role in monetary policy decision-making (Lunieski, 2009), or the credibility of the central banks of developed countries is sufficiently strong to contain inflationist pressures coming from this source (Evans and Fisher, 2011; IMF, 2011). This is especially pertinent for the SNB, as highlighted above.

To sum up, studies of the effects of unconventional monetary policy have been conducted more recently. All these studies (Gagnon et al., 2010; Bauer and Rudebusch, 2011; Neely, 2013; Rogers et al., 2014) show that quantitative easing can create inflation, not only on the goods and services market but also on other markets such as the stock price market, the house price market and the bond market.

From this perspective, the basic indicator, built only from short-term interest rates and the exchange rate, can be expanded by the introduction of additional monetary and financial variables. Goodhart and Hofmann (2001) were the first to introduce asset prices in the measurement of monetary policy stance in order to capture the credit channel.[13] Moreover, Stock and Watson (2003) show that asset prices play an important role in forecasting inflation. Thus, following the seminal work of Goodhart and Hofmann (2001), we built a new monetary condition index including financial variables. Thus, the monetary condition index becomes a monetary and financial condition index (MFCI hereafter) that comprises interest rates, exchange rates and includes the following financial variables: credit growth, house prices index, stock prices index, and long-term interest rates (10 years).[14]

Using an augmented version of equation (1), the MFCI can be written as:

$$\begin{aligned} MFCI_t = \varphi_i(i_t - i_B) + \varphi_e(e_t - e_B) + \varphi_{sp}(sp_t - sp_B) + \varphi_{hp}(hp_t - hp_B) \\ +\varphi_{cre}(cre_t - cre_B) + \varphi_{ilt}(ilt_t - ilt_B) \end{aligned} \tag{2}$$

where *sp*, *hp*, *cre* and *ilt* are, respectively, the stock price index, the house price index, the credit to the private non-financial sector and the long-term interest rate. sp_B, hp_B, cre_B and ilt_B, are the level of each variable in a given base period (benchmark period). We calculated each variable of the given period using the Hodrick-Prescott filter.[15]

[13] See also Hatzius et al. (2010) for a vast literature review on financial conditions indexes.

[14] In line with the quoted debate regarding the impact of commodity price movements on inflation, we also introduced a commodity price variable following Killian and Lewis (2011). We successively tested several variables as a commodity: oil price (Brent in US dollar), CRB index, Reuter and Moody indexes, and a commodity index from the IMF.

[15] The choice of the smoothing parameter is important as stressed by Agénor et al. (2000) and Rand and Tarp (2002). However, these authors discuss the choice of the smoothing parameter for emerging countries such as the study of business cycles. Here, we do not study the business cycle. But, as the HP filter is sensitive to this choice, we used different values in the smoothing parameter, following Canova (1998) and Pedersen (2001). Results, available from the authors upon request, are very similar.

In order to determine the weights of each variable in the MFCI, we used the two most robust econometric techniques.[16] First, we estimate a reduced-form of the aggregate demand equation and, second, we use the impulse response functions from a VAR model.

Beyond this "technical" issue, it is important for the SNB's new MCI to be built through a new temporality. Given that Switzerland is currently deflation-nearer, implementing monetary policies aimed at price stability should also fix anticipation about reflation in a longer temporality than the current one (three years).

We used quarterly data from 1990Q1 to 2014Q3. The data (short- and long-term interest rates, Swiss Market Index) came from the database of the SNB. Following the SNB, we used the LIBOR as the (nominal) short-term interest rate. The nominal effective exchange rate and credit expansion (i.e. credit to the private non-financial sector) were taken from the Bank of International Settlements (BIS). Finally, we use the index of house prices established by the Federal Reserve Bank of Dallas.

As noted below, both the MCI and MFCI can be defined in either real or nominal terms. We decided to use nominal variables instead of real variables, as it is standard to compute the nominal value of an index for the forecasting of inflation in the short term (Mayes and Viren, 2001). Figure 1 plots the series used in our paper for the period 1990Q1 to 2014Q3. All variables, with the exception of interest rates (3 months and 10 years), have been turned into a logarithm. GDP, consumer prices and real estate prices have been deseasonalized.[17]

INSERT FIGURE 1 ABOUT HERE

We studied the order of integration of the series by applying the ADF and PP unit root tests.[18] All series are integrated of order one. Hence, we applied first differences to all variables in order to induce stationarity in all series.

Figure 1 includes three shaded areas corresponding to, respectively, the crash of the dot-com bubble (high tech crash),[19] the financial crisis (Lehman Brothers collapse) and the European crisis (sovereign and banking crises), which also include the adoption of a CHF/EUR peg by the SNB. The choice of these three periods was the result of several detailed investigations, because a lively debate exists about when the crisis began and ended. To this end, we decided

[16] See, for example, Angelopoulo et al. (2013) or Manning and Shamloo (2015), for a discussion.
[17] We used the Census X-12 method.
[18] Detailed results of unit root tests are available upon request from the authors. We also applied unit root tests with multiple structural breaks (following the methodology of Bai and Perron (2003)), which are also available upon request from the authors.
[19] During this period, we were also able to introduce the 11/9/2001 attacks.

to use the VIX (the implied volatility on the S&P500 stock index) to specify clearly the period of financial crisis. Indeed, the VIX is generally considered to be a good indicator of global risk aversion, as well as a gauge for the financial cycle, not only in the US but also worldwide (Rey, 2015). We defined the periods of crisis as being when the VIX rose above the level of 25. We set this threshold following Coudert and Mignon (2013). Therefore, we determined the following periods:

- Crash of the dot-com bubble: from 2001Q2 to 2002Q3;
- Lehman Brothers collapse: from 2008Q3 to 2009Q3;
- European crisis: from 2010Q3 to 2011Q3.

For these three periods, dummies were introduced into each of our estimations.

3. Empirical Results

3.1. Deriving MCI and MFCI weights

MCI weights are calculated using two methodologies.[20] The first is based on a reduced-form of the aggregate demand equation (AD equation, ADE hereafter) and is the most popular form used to obtain the MCI (and MFCI) weights. The second is based on the impulse response functions from a VAR model (VAR model). In their seminal work, Goodhart and Hofmann (2001) used the Cholesky factorization with a single order of the VAR. We did not use the Cholesky factorization, which is sensitive to the ordering of the variables in the VAR. We decided to use the generalized IRF (GIRF) developed by Pesaran and Shin (1998). Their approach does not require the orthogonalization of shocks and is invariant to the ordering of the variables in the VAR.

For each of these two methodologies, we estimated two models using data in gap and data not in gap, as in Rudebusch and Svensson (1998). Thus, the gap of each variable was calculated using the HP filter with a smooth parameter of 1600. We also decided to include two auxiliary variables in each of our models: the VIX and the oil price. Indeed, the VIX might have an impact on the variables introduced in the MCI and/or the MFCI (Fratzscher et al., 2014). Moreover, as Switzerland can easily be considered as a small open economy (Rosenkranz et

[20] We do not select large-scale macro-econometric models, even if they are often considered to be superior, because they are quite unwieldy and difficult to run. Reduced-form models have modest requirements (while the impact of transmission channels appear to be easily identified) and VAR framework imposes minimal structure with no particular view on transmission mechanisms (and they are useful in order to capture dynamic interactions between variables).

al., 2014), we decided, as a robustness check, to include oil price as a component of the MFCI.[21] The estimation of the MCI weights is presented in Table 1.

INSERT TABLE 1 ABOUT HERE

The weights used by the IMF are 0.75 and 0.25 for the interest rate and exchange rate, respectively. The ratio φ_i/φ_e, namely 3:1 here, indicates that a 1-percentage point interest rate change has three times the effect of a 1 per cent change in the exchange rate. Our results are consistent, for each methodology, for data in gap and data not in gap. The ratio φ_i/φ_e was included between 5:1 and 4:1 for the AD equation[22], and between 2:1 and 1:1 for the VAR model. For the AD equation, our results were very close to those of the IMF. Estimations taken from the VAR model were slightly different. The ratio φ_i/φ_e was lower, that is, the coefficient of the interest rate was lower and the coefficient of the exchange rate higher. All three estimates show that the weight of the interest rate is systematically superior to that of the exchange rate. Even if Eika et al. (1996) or Ericsson et al. (1998) demonstrated that these weights are subject to uncertainty, our estimations were consistent with the literature (see, for example, Belke and Polleit, 2011).

Then, we constructed the MCI based on the IMF's weights (MCI (IMF)) and on our own weights with the two methodologies (MCI (ADE) and MCI (VAR)). Each MCI was expressed in standard score. Figure 2 presents our results.

INSERT FIGURE 2 ABOUT HERE

The three indexes are very close to one another and the correlation coefficient between them is 0.999 (significant at 1%). It also seems that a positive correlation[23] exists between the MCI and the inflation rate (calculated as the four-quarter inflation rate),[24] as noted in Figure 3.

INSERT FIGURE 3 ABOUT HERE

[21] We tested different oil price variables: the Brent oil price and the crude oil price. We also tested the impact of commodity price using the Moody's index, the Reuter's index, the CRB index and the commodity index from the IMF. Results, available upon request from the authors, are very similar.

[22] We used the Newey and West (1987) correction to obtain a consistent covariance estimator in order to correct the residual autocorrelation.

[23] The coefficient of the correlation was exactly 0.88 (significant at 1%).

[24] We preferred to use a four-quarter inflation rate rather than a quarterly inflation rate because year-on-year inflation is a much more relevant measure of inflation when it comes to policy decisions. Moreover, quarterly inflation contains a substantial amount of noise that is filtered out when taking four-quarter differences.

We then estimated equation (2) based on the MFCI. Equation (2) was also estimated using two methodologies: the aggregate demand equation (AD equation) and the VAR model. Each methodology was employed with and without data in gap. The reduced-form equation (including those based on the gap) was based on a particular view of the transmission mechanisms. The VAR model offers an alternative way to estimate MFCI weights. Following Lütkepohl (2013), the optimal lag order of the VAR was chosen using the Hannan-Quinn (HQ) information criteria. [25] To estimate weights, we employed the impulse response functions (IRFs) of inflation to each monetary and financial shock. Therefore, we estimated a VAR model using all the variables in equation (2).[26] As noted by Pesaran and Shin (1998), the IRFs are sensitive to the ordering of the variables. We used the GIRF, as they are independent of the specific ordering of variables in the VAR model. We took a weighted average of each variable in the VAR to build the MFCI. The weight assigned to each financial variable was derived based on the cumulative responses of inflation to a one standard deviation shock to that variable. Table 2 indicates the weights of each MFCI estimated following this procedure.

INSERT TABLE 2 ABOUT HERE

First, the weight of the long-term interest rate is significant (whatever the methodology). Sometimes, the weight of the long-term interest rate is greater than that of the short-term interest rate. Second, the weight of the house price index is more important with the VAR methodology than with the aggregate demand equation. Third, house prices, whatever the methodology, seem to play a more important role than stock prices. Fourth, the weight of the credit variable appeared to be significant when we introduced this variable in our estimation. MFCIs can be decomposed to see how the different financial and monetary components contribute to movements in the index. Nevertheless, if we analyze the contributions of the index components to the MFCI growth, we see that any variable has a contribution that is equal to 0 (Figure 4).

INSERT FIGURE 4 ABOUT HERE

[25] All VAR models and IRF are available upon request from the authors.

[26] We also estimated equation (2) introducing each variable in the MFCI, one at a time. Detailed results are available upon request from the authors.

Since the aim of this paper is not to have multiple MFCIs, we decided to select only one model for each methodology, that is for each one, the "best" model, following two steps. The first step was to select the "optimal" model (1, 2, 3 or 4). In our different estimations, model 3 seemed to be the most appropriate. Indeed, the VIX, the oil price and the dummy variables were all significant. We also used the R^2 of the regression and the significant level of each coefficient.[27] The second step was to know what kind of data to select: with or without gap. As Table 3 shows, for each methodology, the results are very close, both with data in gap and without gap. Figure 5 shows that our four MFCIs were very close. Following all these results, we were able to build two MFCIs with data not in gap: one with the AD equation (MFCI1); and one with the VAR model (MFCI2).

INSERT FIGURE 5 ABOUT HERE[28]

Figure 6 displays the MFCIs obtained with equation (2) for Switzerland. The results obtained with the AD equation and the VAR model were very similar (the correlation coefficient was 0.99 – significant at 1%). As for the MCI, it seems that a positive correlation exists between the MFCI and the inflation rate, as noted in Figure 6.

INSERT FIGURE 6 ABOUT HERE

3.2. Forecast Performance of monetary and financial conditions

In this section, we investigate the ability of the MFCI to produce out-of-sample forecasts inflation.[29] We use "pseudo" out-of-sample methodology that rely on the same specification use above, but estimated recursively through the forecast period. In order to perform the "pseudo" out-of-sample exercise, we chose the h-steap ahead methodology to forecast inflation. A common framework is adopted for generating out-of-sample forecasts distinguishing two models:

- An autoregressive model (AR model), i.e. a benchmark model:

$$INF_{t+h} = \alpha + \beta(L)INF_t + \varepsilon_t \quad (3)$$

[27] Detailed results are available upon request from the authors.
[28] In each MFCI, we used weights issued from model 3.
[29] We also run in-sample tests. First, we calculated the dynamic correlation of the MFCI with future inflation (cross-correlation). Second, we estimated a bivariate VAR with the MFCI and the inflation rate and computed the IRF of inflation rate to MFCI shocks. Finally, we performed a Ganger causality test. Detailed results are available upon request from the authors. However, as noted by Cechetti (1995), a good forecasting performance in-sample does not guarantee the same results out-of-sample.

- An autoregressive model augmented with the MFCI (AR+MFCI model):

$$INF_{t+h} = \alpha + \beta(L)INF_t + \gamma(L)MFCI_t + \varepsilon_t \quad (4)$$

In model (4), if $\gamma(L) = 0$, inflation is a pure autoregressive model (AR model). If $\beta(L)$ and $\gamma(L)$ are different to zero, inflation is forecast with an autoregressive model augmented with the MFCI (AR+MFCI model).

More precisely, the approach is as follows. Forecasts at time period t are constructed by estimating the coefficients from models (3) or (4) using sample from 1990Q1 to 2005Q4. These estimated coefficients are then used to forecast at time period $t + h$, with $h = 1,2 \ldots,8$. The process is repeated to construct forecasts at time period $t + 1$, and so on through the end of the sample (2014Q3).

$\beta(L)$ and $\gamma(L)$ are polynomials in the lag operator L. The determination of the number of lags in $\beta(L)$ and $\gamma(L)$ is subject to discussion. First, we were able to estimate the number of lags, $\beta(L)$ and $\gamma(L)$, separately using information criterion. We could also impose the same number of lags in $\beta(L)$ and $\gamma(L)$ and estimate the optimal number of lags using information criterion. In our case, we decide to estimate the number of lags, $\beta(L)$ and $\gamma(L)$, separately and to choose the optimal number of lags using the Bayesian information criteria (BIC). The number of lags in $\beta(L)$ and $\gamma(L)$ was chosen over the full sample, where in both cases the number of lags ranged between 0 and 6.

At each forecast horizon, from $h = 1$ to $h = 8$, a separate forecast equation was estimated by OLS. Then, for each horizon, we computed the root mean square error (RMSE) to assess the forecasting performance of the MFCI.[30] The RMSE was compared between the autoregressive model (i.e. model (3), in which $\gamma(L) = 0$: AR model) and the augmented autoregressive model (model (4), in which $\gamma(L) \neq 0$: AR+MFCI model). A ratio inferior to 1 demonstrated the superiority of the model with the MFCI (i.e. model (4)). We then implemented the Diebold and Mariano (1995) test of equal predictive ability by comparing the RMSE of the model with the MFCI with those of the benchmark model. We tested the null hypothesis of equal predictive ability. The ratio between the RMSE from the AR+MFCI model and the RMSE from the benchmark model is computed in Table 3. To assess statistical significance, we used the modified Diebold-Mariano statistics proposed by Clark and McCraken (2001).

INSERT TABLE 3 ABOUT HERE

[30] Another measure is the mean absolute error (MAE). Using the MAE, our results are similar.

When the ratio between the RMSE of the AR+MFCI and the RMSE of the AR model is inferior to 1, we concluded that the AR+MFCI model forecasts better than the AR benchmark model. Our results indicate that the hypothesis of equal predictive accuracy between AR model and AR+MFCI model is rejected at conventional significance levels for $h = 1,2,3,4$ for the MFCI estimated with an AD equation, and for $h = 1,2,3,4,5$ for the MFCI estimated with a VAR model. These findings suggest that the AR model augmented with the MFCI is better than the AR model, i.e. the benchmark model, when predicting up to 4 or 5 quarters ahead. We inferred that the information included in future inflation summarized in the MFCI is manifested in its good forecast performance.

4. Concluding Remarks and Perspectives

In this paper, we investigated whether a monetary and financial condition index is useful in forecasting inflation and hence guiding monetary policy in Switzerland. To this end, we extended the initial monetary condition index, which is a weighted average of the short-term interest rate and the exchange rate, to financial variables. We built a monetary and financial condition index (MFCI) that comprises the short-term interest rate, the long-term interest rate, the exchange rate, credit expansion, the stock price index and the house price index. The choice of these financial variables was motivated by the key role they play in the monetary policy transmission channels and on global prices. Our goal was to see whether the MFCI is efficient in the framework of the SNB's inflation forecast targeting. Whatever the choice of the methodology for estimating weights, our MFCIs yielded strong results and seemed to impact inflation significantly. Our MFCI yielded significant short-term results (four and five quarters) in the sense that it contains useful and predictive information regarding inflation. Given the nature and the importance of the GFC, these informations could be introduced in the new MFCI to improve monetary policy guidance in Switzerland and will be an especially important ingredient in the inflation forecasts of the SNB.

Our results also support two important ideas that are likely to be relevant for future research. First, the central bank should define its monetary policy by taking into account the price of financial assets. Indeed, following the different crises (financial, economic and European), several central banks developed a macro-prudential approach to supervision and regulation (Borio, 2003; Bernanke, 2011; Kahou and Lehar, 2017[31]). Macro-prudential supervision takes into account the interactions among individual financial institutions, as well as the feedback

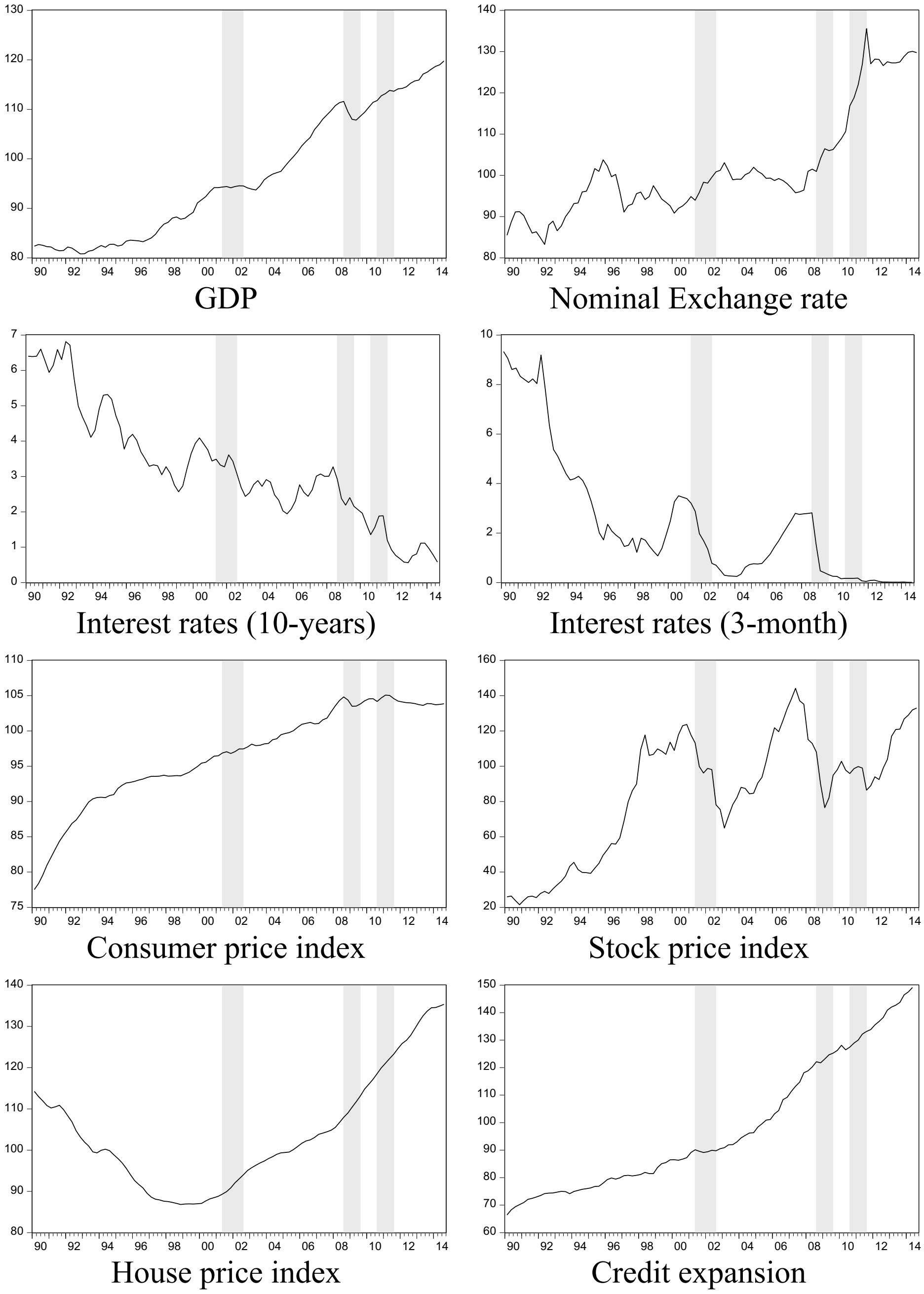
[31] See also, for example, Galati and Moessner (2012).

loops of the financial sector with the real economy, including the costs that systemic risk entails in terms of output losses. Our results support the idea that central banks should define their monetary policy, not only with "traditional" objectives and intermediate targets, but also by taking into account the impact of financial variables. The monetary policy reaction function should include the price of financial assets. The development of macro-prudential tools is in line with such a proposal.

Second, the SNB's decision in January 2015 to substitute its peg to the euro – implemented between 2011 and 2015 – using a negative interest rate, raises important issues. The Swiss central bank has possibly entered uncharted territory with such a policy in the sense that it is difficult to forecast a clear impact of negative interest rates on macroeconomic variables. Indeed, a threshold has been crossed with a shift from zero interest rate policies (ZIRP) to negative interest rate policies (NIRP). Consequently, on the one hand, channels of interest rates, as well as credit, can be disturbed in Switzerland because of the associated current context of the liquidity trap (Pollin, 2012). Moreover, the status of a safe haven currency of the Swiss franc (Ranaldo and Söderlind, 2010), leading to a relative "hypertrophy" of its store of value function, prevents the negative interest rate from triggering the expected principle of "melting money", which is necessary to foster trade and then increase growth in prices in a deflationary environment. On the other hand, as the SNB has been imitated by other central banks since January 2015 (Sweden, Denmark, Japan and the ECB with a marginal deposit rate), Pandora's box could have been opened: in the current sluggish economic context, it is likely to create hysteresis effects. This could be harmful for the SNB's inflation forecasts, jeopardizing its forward guidance path when it is, more than ever, necessary to secure it, as mentioned earlier (Kool and Thornton, 2012). Finally, inflation forecasts in Switzerland – as well as elsewhere – must now rely on new principles, because the line between conventional and unconventional monetary policies has been blurred with the recent crisis (Borio and Disyatat, 2010), and this will certainly continue in the near future.

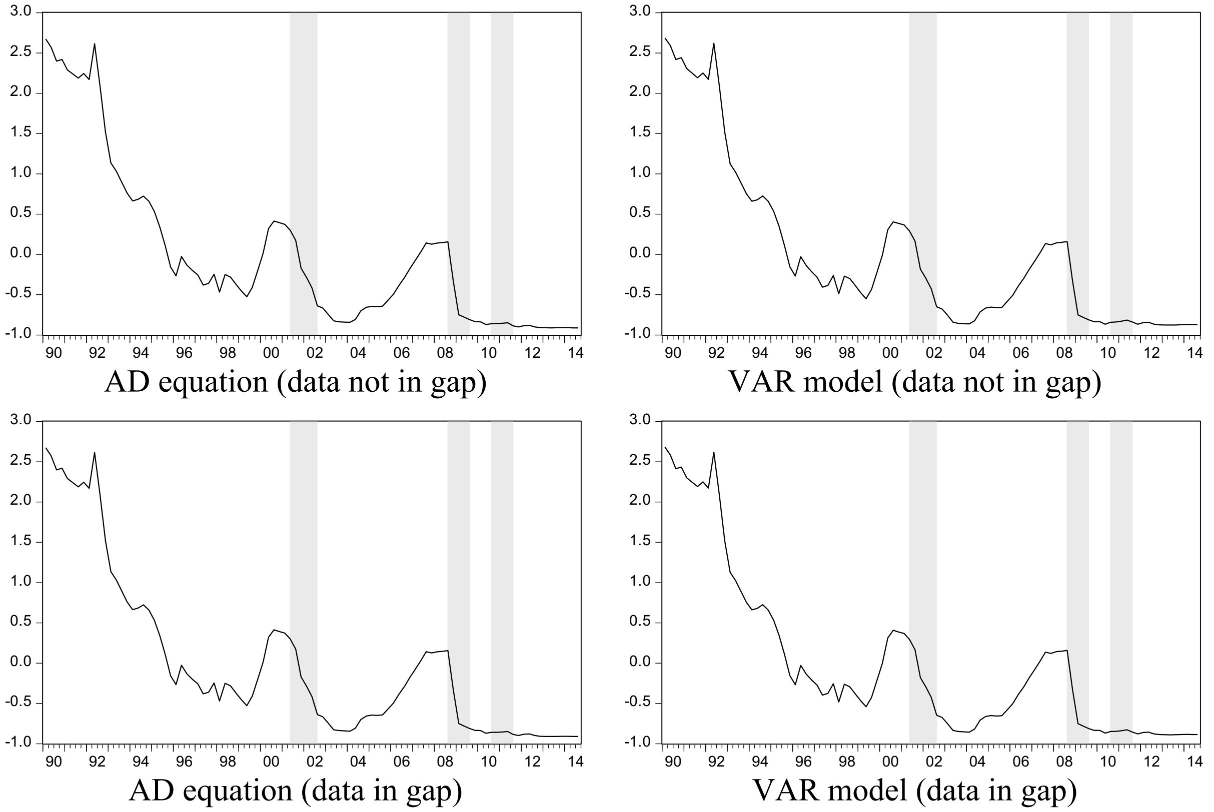
Tables and Figures

Figure 1: Data used



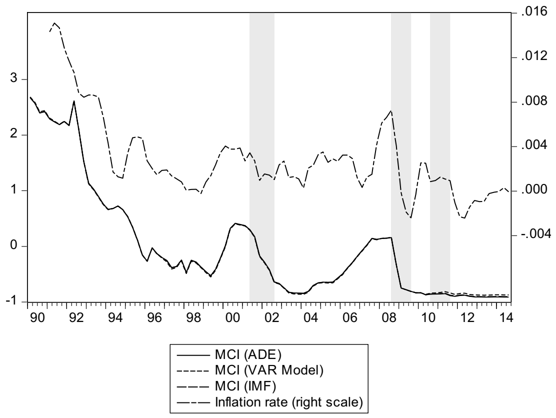
Notes: all data, except interest rates, are expressed in base 100: 2005. GDP, consumer price index and house price index have been deseasonalized (see section 2). Shaded areas indicate crisis (see section 2).

Figure 2: Monetary Condition Indexes



Note: Authors'own calculations. MCI are expressed in standard score. Shaded areas indicate crisis (see section 2).

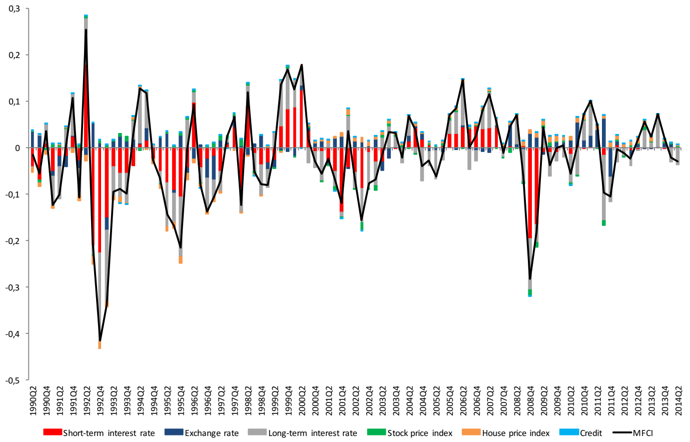
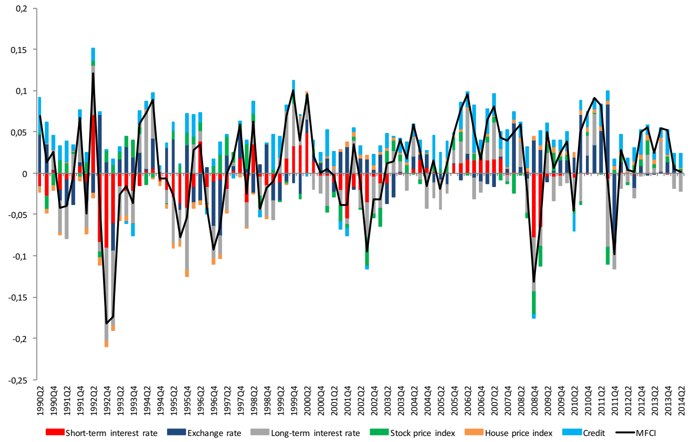
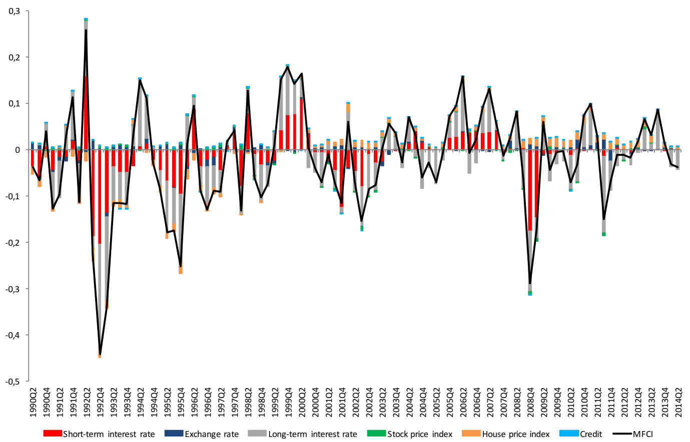
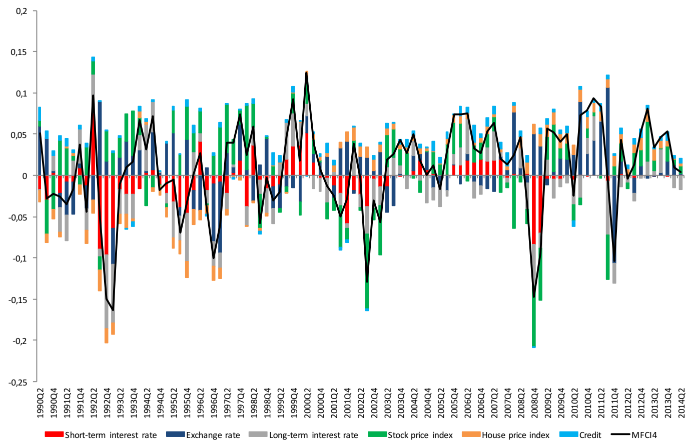
Figure 3: Monetary Condition Indexes and Inflation rate



Note: MCI are expressed in standard score.
Shaded areas indicate crisis (see section 2).

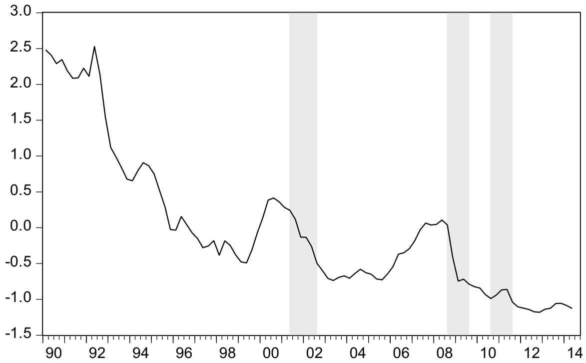
Figure 4: Contributions to MFCIs growth

MFCI estimated from Model 3 (cf. Table 2) with…

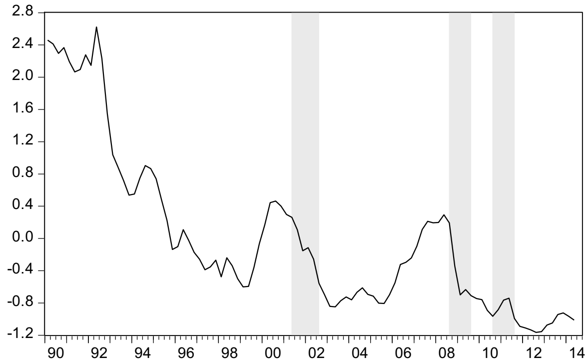
	an AD equation	a VAR Model
Data in gap		
Data not in gap		

Note: Authors'own calculations.

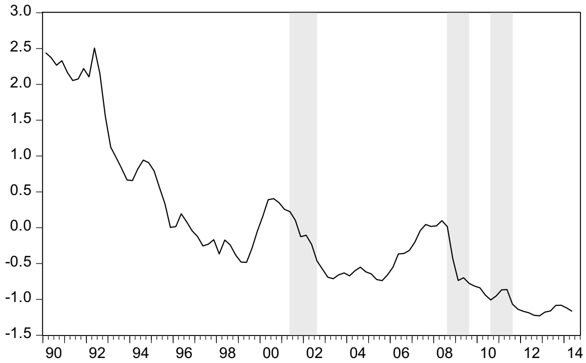
Figure 5: Monetary and Financial Condition Indexes



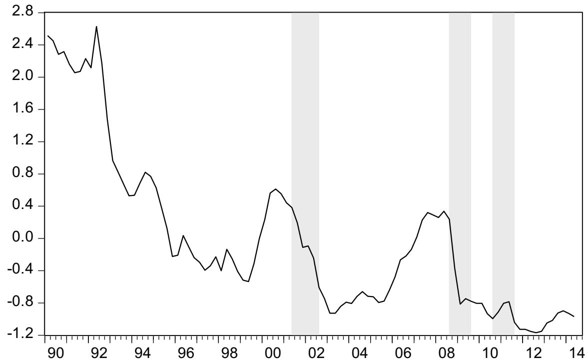
AD equation (data not in gap)



VAR model (data not in gap)



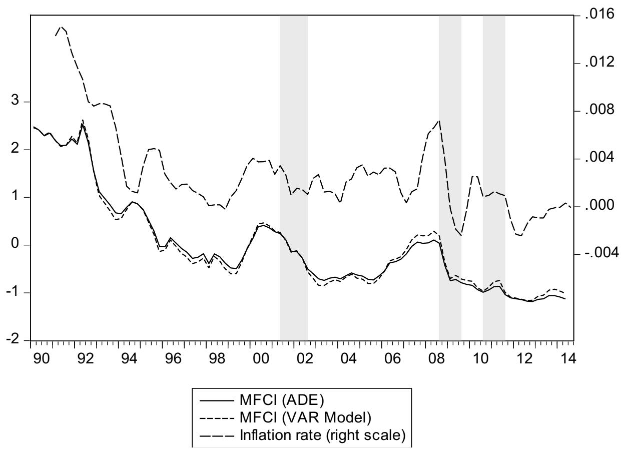
AD equation (data in gap)



VAR model (data in gap)

Note: Authors'own calculations. MFCI are expressed in standard score. Shaded areas indicate crisis (see section 2).

Figure 6: Monetary and Financial Condition Indexes and Inflation rate



Note: MFCI are expressed in standard score.
Shaded areas indicate crisis (see section 2).

Table 1: MCI weights

	φ_i	φ_e	φ_i/φ_e	φ_i	φ_e	φ_i/φ_e
	AD equation			VAR model		
IMF	0.75	0.25	3:1	-	-	-
Data not in gap						
Model 1	0.82	0.18	5:1	0.70	0.30	2:1
Model 2	0.81	0.19	4:1	0.63	0.37	2:1
Model 3	0.81	0.19	4:1	0.56	0.44	1:1
Model 4	0.79	0.21	4:1	0.53	0.47	1:1
Data in gap						
Model 1	0.82	0.18	5:1	0.59	0.41	1:1
Model 2	0.82	0.18	5:1	0.62	0.38	2:1
Model 3	0.80	0.20	4:1	0.64	0.38	2:1
Model 4	0.79	0.21	4:1	0.68	0.32	2:1

Note: Model 1, 2, 3 and 4 correspond, respectively, to the estimation of coefficients φ_i and φ_e which include the ViX, the oil price and three dummies (see section 2 for the details) in the aggregate demand (AD) equation and in the VAR model. In the VAR model, coefficient φ_i and φ_e are based on the average impact of a one-unit shock to each variable (including in the VAR) on inflation over the following twelve quarters. We use the Generalized IRF proposed by Pesaran and Shin (1998).

Table 2: MFCI weights

	$\varphi_{i_{st}}$	φ_e	$\varphi_{i_{lt}}$	φ_{sp}	φ_{hp}	φ_{credit}	$\varphi_{i_{st}}$	φ_e	$\varphi_{i_{lt}}$	φ_{sp}	φ_{hp}	φ_{credit}
	AD equation						VAR model					
Data not in gap												
Model 1	0.40	0.11	0.31	0.04	0.12	0.02	0.19	0.11	0.19	0.10	0.11	0.30
Model 2	0.53	0.16	0.14	0.03	0.12	0.01	0.20	0.13	0.24	0.03	0.18	0.21
Model 3	0.40	0.11	0.32	0.03	0.11	0.02	0.16	0.15	0.19	0.08	0.06	0.36
Model 4	0.49	0.18	0.19	0.03	0.08	0.03	0.18	0.16	0.23	0.03	0.14	0.25
Data in gap												
Model 1	0.35	0.03	0.41	0.03	0.16	0.02	0.18	0.21	0.14	0.21	0.11	0.16
Model 2	0.35	0.03	0.41	0.03	0.14	0.03	0.17	0.20	0.17	0.19	0.11	0.16
Model 3	0.36	0.04	0.38	0.02	0.17	0.02	0.17	0.19	0.15	0.21	0.15	0.13
Model 4	0.34	0.04	0.39	0.03	0.16	0.04	0.17	0.16	0.20	0.19	0.13	0.15

Note: Model 1, 2, 3 and 4 correspond, respectively, to the estimation of coefficients $\varphi_{i_{st}}$, φ_e, $\varphi_{i_{lt}}$, φ_{sp}, φ_{hp} and φ_{credit} which include the ViX, the oil price and three dummies (see section 2 for the details) in the aggregate demand (AD) equation and in the VAR model. In the VAR model, coefficient φ_i and φ_e are based on the average impact of a one-unit shock to each variable (including in the VAR) on inflation over the following twelve quarters. We use the Generalized IRF proposed by Pesaran and Shin (1998).

Table 3: Inflation forecasting comparison

Forecast horizon (quarter)	MFCI1	MFCI2
1	0.9696^{***}	0.9551^{***}
2	0.9703^{***}	0.9558^{***}
3	0.9716^{**}	0.9561^{***}
4	0.9766^{*}	0.9581^{**}
5	0.9707	0.9587^{**}
6	0.9722	0.9593
7	0.9737	0.9599
8	0.9739	0.9601

Note: the null hypothesis of equal forecast accuracy between the AR benchmark model versus the AR+MFCI model is rejected at 1% (***), 5% (**) or 10% (*).

References

Agénor, P.-A., McDermott, J., Prasad, E.S., 2000, "Macroeconomic fluctuations in developing countries: Some stylized facts", *The World Bank Economic Review*, 14 (2), pp. 251-285.

Alessi, L., Detken, C., 2011, "Quasi Real Time Early Warning Indicators for Costly Asset Price Boom/Bust Cycles: A Role for Global Liquidity", *European Journal of Political Economy*, 27 (3), pp. 520-533.

Angeloni, I., Kashyap, A., Mojon, B., 2003, *Monetary Transmission in the Euro Area: A study by the Eurosystem Monetary Transmission Network*, Cambridge University Press.

Angelopoulou, E., Balfoussia, H., Gibson, H., 2013, "Building a Financial Conditions Index for the Euro Area Countries. What Does It Tell Us About the Crisis?", *ECB working paper 1541*, European Central Bank.

Altermatt, L., Baeriswyl, R., 2015, "Effets de l'expansion de la monnaie centrale sur le bilan des banques suisses", *Quarterly Bulletin*, Swiss National Bank, pp. 35-45.

Ano Sujithan, K., Avouyi-Dovi, S., Kolial, L. 2013, "Does Monetary Policy Respond to Commodity Prices Shocks?", *working paper*, University of Paris Dauphine.

Aubert, N., 2003, "Les indices des conditions monétaires", *Economie Internationale*, 96, pp. 63-102.

Bai, J., Perron, P., 2003, "Computational and analysis of multiple structural change models", *Journal of Applied Econometrics*, 18 (1), pp. 1-22.

Battini, N., Turnbull, K., 2002, "A Dynamic Monetary Conditions Indices for the UK", *Journal of Policy Modeling*, 24 (3), pp. 257-281.

Bauer, M.D., Rudebusch, G., 2011, "The Signaling Channel for Federal Reserve Bond Purchase", *working paper 2011-21*, Federal Reserve Bank of San Francisco.

Belke, A., Polleit, T., 2011, *Monetary Economics in Globalized Financial Markets*, Springer.

Bernanke, B., 2011, "Implementing a Macroprudential Approach to Supervision and Regulation", *Federal Reserve Bank of Chicago*, 47th annual conference on bank structure and competition.

Bernanke, B., Gertler, M., 1995, "Inside the Black Box: The Credit Channel of Monetary Policy Transmission", *Journal of Economic Perspectives*, 9 (4), pp. 27-48.

Bernanke, B., Gertler, M., 1999, "Monetary policy and asset price volatility", *Economic Review*, Federal Reserve of Kansas City.

Bernanke, B., Gertler, M., Watson, M., 1997, “Systematic Monetary Policy and the Effects of Oil Price Shocks”, *Brookings Papers on Economic Activity*, 1, pp. 91-142.

Bilbiie, F.O., 2008, “Limited Asset Markets Participation, Monetary Policy and (Inverted) Aggregate Demand Logic”, *Journal of Economic Theory*, 140 (1), pp. 162-196.

Bilbiie, F.O., Straub, R., 2012, “Asset Market Participation, Monetary Policy Rules and the Great Inflation”, *ECB working paper 1438*, European Central Bank.

Bindseil, U., 2004, “The Operational Target of Monetary Policy and the Rise and Fall of Reserve Position Doctrine”, *ECB working paper 372*, European Central Bank.

BIS, 2011, “The transmission channels between the financial and real sectors: a critical survey of the literature”, *BIS working paper 18*, Bank for International Settlements.

Blomberg, S.B., Harris, E.S., 1995, “The Commodity-Consumer Price Connection: Fact or Fable?”, *Federal Reserve Bank of New York Economic Review*, 1 (3), pp. 21-38.

Boivin, J., 2002, “Assessing changes in the monetary transmission mechanism: A VAR approach”, *Federal Reserve Bank of New York Economic Policy Review*, 1 (8), pp. 97-111.

Boivin, J., Kiley, M.T., Mishkin, F.S., 2010, “How has the monetary transmission mechanism evolved over time?”, *NBER working paper 15789*, National Bureau of Economic Research.

Borio, C., 2003, “Towards a macroprudential framework for financial supervision and regulation?”, *BIS working paper 128*, Bank for International Settlements.

Borio, C., Disyatat, P., 2010, “Unconventional Monetary Policies: An Appraisal”, *The Manchester School*, 78 (S1), pp. 53-89.

Brunnermeier, M., Sannikov, Y., 2013, “Reviving ‘Money and Banking’”, in Reichlin L., Baldwin R. (eds), *Is Inflation targeting Dead? Central Banking after the Crisis*, CEPR, pp. 95-103.

Calza, A., Monacelli, T., Stracca, L., 2013, “Housing Finance and Monetary Policy”, *Journal of the European Economic Association*, 11 (1), pp. 101-122.

Canova, F., 1998, “Detrending and Business Cycle Facts”, *Journal of Monetary Economics*, 41 (3), pp. 475-512.

Cecchetti, S., 1995, “Inflation Indicators and Inflation Policy”, *NBER working paper 5161*, National Bureau of Economic Research.

Cecchetti S.J., Moessner, R., 2008, “Commodity prices and inflation dynamics”, *BIS Quarterly Review*, pp. 55-66.

Chen, Q., Filardo, A., He, D., Zhu, F., 2011, “International Spillovers of Central Bank Balance Sheet Policies”, *BIS working paper 66*, Bank for International Settlements.

Chow, H.K., 2013, "Forecasting Inflation with a Financial Conditions Index: The Case of Singapore", *Annals of Financial Economics*, 8 (2), pp. 1-18.

Christiano, L., Eichenbaum, M., Evans, C., 1999, "Monetary policy shocks: what have we learned and to what end", in Taylor J., Woodford M. (eds), *Handbook of Macroeconomics*, Elsevier, New York.

Clark, T.E., McCracken, M.W., 2001, "Tests of equal forecast accuracy and encompassing for nested models", *Journal of Econometrics*, 105 (1), pp. 85-110.

Costa, S., 2000, "Monetary Conditions Index", *Economic Bulletin*, Banco de Portugal, pp. 97-106.

Coudert, V., Mignon, V., 2013, "The forward premium puzzle and the sovereign default risk", *Journal of International Money and Finance*, 32 (C), pp. 491-511.

De Gregorio, J., 2012, "Commodity Prices, Monetary Policy and Inflation", *IMF Economic Review*, 60 (4), pp. 630-633.

Diebold, F.X., Mariano, R.S., 1995, "Comparing predictive accuracy", *Journal of Business and Economic Statistics*, 13, pp. 253-263.

ECB, 2010, "The ECB's response to financial crisis", *Monthly Bulletin*, October, pp. 59-74.

Eika, K., Ericsson, N., Nyomen, R., 1996, "Hazards in Implementing a Monetary Conditions Index", *Oxford Bulletin of Economics and Statistics*, 58 (4), pp. 765-790.

Ericsson, N., Jansen, E., Kerbeshian, N., Nyomen, R., 1998, "Interpreting a Monetary Condition Index in Economic Policy", *BIS conference paper 6*, Bank for International Settlements.

Evans, C.L., Fisher, J.D.M., 2011, "What are the implications of rising commodity prices for inflation and monetary policy?", *Chicago Fed Letter*, 286.

Ferraro, D., Rogoff, K., Rossi, B., 2015, "Can oil prices forecast exchange rates? An empirical analysis of the relationship between commodity prices and exchange rates", *Journal of International Money and Finance*, 54, pp. 116-141.

Fratzscher, M., Schneider, D., Van Robays, I., 2014, "Oil Prices, Exchange Rates and Asset Prices", *ECB working paper 1689*, European Central Bank.

Freedman, C., 1994, "The Use of Indicators and of the Monetary Conditions Index in Canada", in Balino T.J.T., Cotarelli C. (eds), *Frameworks for Monetary Stability: Policy Issues and Country Experiences*, International Monetary Fund, pp. 458-476.

Furlong, F., 1989, "Commodity Prices as a Guide for Monetary Policy", *Federal Reserve Bank of San Francisco Economic Review*, 1, pp. 21-38.

Furlong, F., Ingenito, R., 1996, "Commodity Prices and Inflation", *Federal Reserve Bank of San Francisco Economic Review,* 1, pp. 27-47.
Gagnon, J., Raskin, M., Remache, J., Sack, B., 2010, "Large-scale Asset Purchases by the Federal Reserve: Did they Work?", *working paper 0441*, Federal Reserve Bank of New York.
Galati, G., Moessner, R., 2012, "Macroprudential policy – A Literature Review", *Journal of Economic Surveys*, 27 (5), pp. 846-878.
Gauthier, C., Graham, C., Liu, Y., 2004, "Financial Conditions Indexes for Canada", *Bank of Canada working paper 22*, Bank of Canada.
Gerlach, S., 2013, "Is Inflation Targeting passé?", in Reichlin L., Baldwin R. (eds), *Is Inflation targeting Dead? Central Banking after the Crisis*, CEPR, pp. 37-43.
Giese, J.V., Tuxen, C.K., 2007, "Global Liquidity, Asset Prices, and Monetary Policy: Evidence from Cointegrated VAR models", *mimeo*, University of Oxford.
Goodhart, C., Hofmann, B., 2001, "Asset Prices, Financial Conditions and the Transmission of Monetary Policy", Paper presented at the conference *Asset Prices, Exchange Rate and Monetary Policy*.
Guender, A.V., 2009, "Monetary Conditions Index", in Reinert K.A., Rajan R.S., Glass A.J. (eds), *The Princeton Encyclopedia of the World Economy*, Princeton University Press, pp. 777-779.
Guichard, S., Haugh, D., Turner, D., 2009, "Quantifying the Effect of Financial Conditions in the Euro Area, Japan, United Kingdom and United States, *OECD working papers 677*.
Hatzius, J., Hooper, P., Mishkin, F., Schoenholtz, K., Watson, M., 2010, "Financial Conditions Indexes: A Fresh Look After the Financial Crisis", *NBER working paper 16150*, National Bureau of Economic Research.
IMF, 2011, "Target What You Can Hit: Commodity Price Swings and Monetary Policy", *World Economic Outlook: Slowing Growth, Rising Risks*, pp 101-103.
Joyce, M., Miles, D., Scott, A., Vayanos, D., 2012, "Quantitative easing and unconventional monetary policy. An introduction"*, Economic Journal*, 122 (564), pp. 271-288.
Kahou, M.J., Lehar, A., 2017, "Macroprudential policy: A review", *Journal of Financial Stability*, 29, pp. 92-105.
Killian, L., Lewis, L., 2011, "Does the Fed Respond to Oil Price Shocks?", *Economic Journal*, 121, pp. 1047-1072.
Kool, C.J.M., Thornton, D.L., 2012, "How Effective is Central Bank Forward Guidance?", *working paper* 63, Federal Reserve Bank of St-Louis.

Kugler, P., Rich, G., 2002, "Monetary Policy Under Low Interest Rates: The Experience of Switzerland in the late 1970's", *Swiss Journal of Economics and Statistics*, 138 (3), pp. 241-269.

Lack, C.P., 2006, "A financial conditions index for Switzerland", *BIS papers 19*, Bank for International Settlements.

Landau, J.-P., 2013, "Global Liquidity: Public and Private, Paper presented at the conference *Global Dimensions of Unconventional Monetary Policy*, Federal Reserve Bank of Kansas City.

Leeper, E., Sims, C. A., Zha, T., 1996, "What Does Monetary Policy Do?", *Brookings Papers on Economic Activity*, 2, pp. 1-63.

Lunieski, C., 2009, "Commodity Price Volatility and Monetary Policy Uncertainty: A GARCH Estimation", *Issues in Political Economy*, 19, pp. 108-124.

Lütkepohl, H., 2013, *Introduction to multiple time series analysis*, Springer.

McCarthy, J., Peach, R.W., 2002, "Monetary Policy Transmission to Residential Investment", *Federal Reserve Bank of New York Economic Policy Review*, May, pp. 139-158.

Manning, J., Shamloo, M., 2015, "A Financial Conditions Index for Greece", *IMF working paper 15/220*, International Monetary Fund.

Mayes, D., Viren, M., 2001, "Financial Conditions Indexes", *discussion papers 17*, Bank of Finland.

Neely, C.J., 2013, "Unconventional Monetary Policy Had Large International Effects", *working paper 2010-08D*, Federal Reserve Bank of St-Louis.

Newey, W.K. and West, K.D., 1987, "A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix", *Econometrica*, 55 (3), pp. 703-708.

Pedersen, T.M., 2001, "The Hodrick-Prescott Filter, the Slutzky Effect, and the Distortionary Effect of Filters", *Journal of Economic Dynamics and Control*, 25 (8), pp. 1081-1101.

Peeters, H.M.M., 1998, "Monetary conditions in Europe: A methodological analysis", *DNB Staff Reports 27*, De Nederlandsche Bank.

Pesaran, H.H., Shin, Y., 1998, "Generalized impulse response analysis in linear multivariate models", *Economics Letters*, 58 (1), pp. 17-29.

Pollin, R., 2012, "The Great US Liquidity Trap of 2009-11: Are we Struck Pushing on Strings?", *Review of Keynesian Economics*, Inaugural Issue, pp. 55-76.

Ranaldo, A., Söderlind, P., 2010, "Safe Haven Currencies", *Review of Finance*, 14 (3), pp. 385-407.

Rand, J., Tarp, F., 2002, “Business Cycles in Developing Countries: Are they Different?”, *World Development*, 30 (12), pp. 2071-2088.

Reichlin, L., Baldwin, R., 2013, “Introduction”, in Reichlin L., Baldwin R. (eds), *Is Inflation targeting Dead? Central Banking after the Crisis*, CEPR, pp. 10-30.

Rey, H., 2015, “Dilemma not Trilemma: The global financial cycle and monetary policy independence”, *NBER working paper 21162*, National Bureau of Economic Research.

Rich, G., 2000, “Monetary Policy Without Central Bank Money: A Swiss Perspective”, *International Finance*, 3 (3), pp. 439-469.

Rogers, J.H., Scotti, C., Wright, J.H., 2014, “Evaluation asset-market effects of unconventional monetary policy: a cross-country comparison”, *Board of Governors of the Federal Reserve System*, *International Finance Discussion Papers*.

Rosenkranz, P., Straumann, T., Woitek, U., 2014, “A small open economy in the Great Depression: the case of Switzerland”, *working papers 164*, Department of Economics, University of Zurich.

Rudebusch, G., Svensson, L., 1998, “Policy Rules for Inflation Targeting”, *NBER working paper 6512*, National Bureau of Economic Research.

Sato, K., Zhang, Z.Y., McAleer, M., 2011, “Identifying Shocks in Regionally Integrated East Asian Economies with Structural VAR and Block Exogeneity”, *Mathematics and Computers in Simulation*, 81, pp. 1353–1364.

Shirakawa, M., 2013, “Central banking: before, during and after the crisis”, *International Journal of Central Banking*, 9 (51), pp. 373-387.

Stock, J., Watson, M., 2003, “Forecasting output and inflation: the role of asset prices”, *Journal of Economic Literature*, 41 (3), pp. 788-829.

Worthington, A., Pahlavani, M., 2007, “Gold investment as an inflationary hedge: cointegration evidence with allowance for endogenous structural breaks”, *Applied Financial Economics Letters*, 3 (4), pp. 259-262.

Zurlinden, M., 2005, “Credit in the monetary transmission mechanism: An overview of some recent research using Swiss data”, *Swiss National Bank Economic Studies 1,* Swiss National Bank.