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Are Weekly Inflation Forecasts Informative?*

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Abstract

Are weekly inflation forecasts informative? Although several central banks review and discuss monetary policy issues on a bi-weekly basis, there have been few attempts by analysts to construct systematic estimates of core inflation that supports such a decision-making schedule. The timeliness of news releases and macroeconomic revisions are recognized to be an important information source in real-time estimation. We incorporate real-time information from macroeconomic releases and revisions into our weekly updates of monthly Swiss core inflation using a common factor procedure. The weekly estimates for Swiss core inflation find that it is worthwhile to update the forecast at least twice a month.

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I. Introduction

Are weekly inflation forecasts informative? Inflation forecasts play a fundamental role in monetary frameworks that declare price stability as the primary goal of monetary policy. For many central banks, price stability is defined quantitatively and the monthly Consumer Price Index (CPI) is the measure of reference. Despite the recognition that daily releases of macroeconomic information are important for real-time forecasting, inflation forecasting is conducted mostly at the quarterly and on rare occasions at the monthly frequency. Although several central banks, including the European Central Bank and the Swiss National Bank, review and discuss monetary policy issues on a bi-weekly basis, there have been no attempts by analysts to construct inflation forecasts that supports such a decision-making schedule.[1]

The aim of this paper is to produce real-time estimates of monthly core inflation at a frequency higher than monthly and show that intra-monthly updates improves the information content. The concept of exploiting asyn-

[1]Independent of their scheduled press releases and monetary policy statements, the Board of the European Central Bank and the Swiss National Bank hold regularly scheduled meetings that discuss monetary policy and conjunctural issues on a bi-weekly basis. The Board of the Bank of Japan meets twice in April, June, and October. The Board of the Riksbank also meets twice a month on rare occasions.

chronous data releases for updating the forecast is not new. It has been used by Evans (2005) and Giannone *et al.* (2007) to explain the information shocks to quarterly GDP nowcasts.[2] However, the idea of weekly inflation forecasting as a policy tool has not been previously considered. The empirical framework employs the dynamic common factor methodology of Forni *et al*. (2000 and 2005) to Swiss inflation from 1994 to 2004: a period where Swiss (annual) inflation averaged less than 1.0%.[3] Our challenge is thus to show that it is possible to construct a useful measure of core inflation for real-time policymaking even in a low inflation environment, see Stock and Watson (2007).

Successive releases of weekly information are found to improve the monthly nowcast of Swiss core inflation. Empirical tests show that it is worthwhile to update the nowcast at least twice a month. This evidence says that policy-makers should make full use of the real-time flow of information stemming

[2]See also Altissimo et al. (2007). They consider monthly data set to make statements about quarterly GDP for the euro area.

[3]Coincident indexes based on monthly panels have established themselves as popular measures of core inflation. Empirical estimates of monthly core inflation include Stock and Watson (2002) for the United States, Cristadoro *et al*. (2005) for the euro area, Gosselin and Tkacz (2001) for Canada, and Camacho and Sancho (2003) for Spain.

from data releases and revisions to economic series: a concept that we call sequential information flow.

The paper is organized as follows. The estimation framework is presented in section II. Next, the main features of our data set and the decisions motivating our choices are discussed in section III. The empirical estimates of the monthly Swiss coincident index for core inflation are presented in section IV. The same section includes a discussion on the properties of smoothness, stability, and forecasting. This is done to show that the information from the intra-monthly updates stem from sequential information flow and not from model instability. Weekly nowcasts of monthly core inflation are presented in section V. Final remarks on the importance of sequential information flow are offered in section VI.

II. The estimation framework

The forecasting model relies on data reduction techniques that can handle real-time panels updated on a weekly basis.[4] We follow the estimation procedures of Forni *et al.* (2000), Cristadoro *et al.* (2005), and Altissimo *et al.*

[4]In a similar construct, Amstad and Fischer (2005) consider daily updates to examine the impact of import prices on inflation.

(2001). Below, we offer an informal outline of the estimation procedure and refer the reader to the individual papers for specific details.

As in Forni *et al*. (2000) and following their notation, we assume that the factor structure has N variables in the generic panel, $\mathbf{x}_t = (x_{1,t}, x_{2,t}, \cdots, x_{N,t})'$, where our variable of interest, $x_{1,t} = \Delta ln(P_t)$, is monthly Swiss CPI inflation. Next, monthly inflation is assumed to be the sum of two unobservable components: a signal $x^*_{1,t}$ and a component capturing short run dynamics, seasonality, measurement error, and idiosyncratic shocks $e_{i,t}$

$$x_{1,t} = x^*_{1,t} + e_{1,t}. \tag{1}$$

The signal uses available information (i.e., past and present information defined by the variables in the weekly panels). Next, it is assumed that the variables in the panels can be represented as the sum of two stationary, mutually orthogonal, unobserved components. The first component is the common component, $\chi_{i,t}$, which is assumed to capture a high degree of co-movement between the variables in the panel. The second component is the idiosyncratic component, $\xi_{i,t}$. The common component is defined by q common factors, u_{ht}, that are possibly loaded with different coefficients and (finite) lag structures, say of order s. Formally, Forni *et al*. (2005) specify $x_{i,t}$ as a generalized dynamic factor model:

$$x_{i,t} = \chi_{i,t} + \xi_{i,t} = \Sigma_{h=1}^{q}\Sigma_{k=0}^{s} b_{i,h,k} u_{h,t-k} + \xi_{i,t}, \tag{2}$$

where $\xi_{i,t}$ is the idiosyncratic component and $\chi_{i,t} = x_{i,t}$ - $\xi_{i,t}$ is the common component.[5]

The stationary of the common component allows $\chi_{1,t}$ to be decomposed into the sum of waves of different periodicity. Cristadoro *et al.* (2005) propose to disentangle $\chi_{1,t}$ into a short-run component, $\chi_{1,t}^{S}$, and a long-run component, $\chi_{1,t}^{L}$, by aggregating waves of periodicity smaller or larger than a defined critical period, τ. In term of equations (1) and (2) for monthly inflation, this yields

$$x_{1,t} \quad = \quad x_{1,t}^{*} + e_{1,t} = \chi_{1,t}^{L} + \chi_{1,t}^{S} + \xi_{1,t}. \tag{3}$$

The objective of the procedure is to estimate the common (long-run) component of monthly inflation, $x_{1,t}^{*} = \chi_{1,t}^{L}$, and to purge the short-run and the idiosyncratic component, $e_{1,t} = \chi_{1,t}^{S} + \xi_{i,t}$, from $x_{1,t}$.

The procedure by Cristadoro *et al.* (2005) involves three steps. The first step estimates the common factors. In particular, the cross spectra

[5] Hereafter, we refer to them as 'idiosyncratic' and 'common'. Note, the latter refers to the common component, χ_{it}, and not to the common factor, $f_t = (f_{1,t}, \cdots, f_{q,t})'$.

for the common long-run component of monthly inflation, $\chi^L_{1,t}$, is estimated. The second step computes the implied covariances of $\chi^L_{1,t}$ and the factors, by integrating the cross-spectra over a specified frequency band (see below). The last step involves performing a linear projection of the common component at low frequency on the present and the lags of the common factors:

$$\hat{\chi}^L_{1,t} = Proj[\chi^L_{1,t}|u_{h,t-k}, h = \{1, \cdots, q; k = 0, \cdots, s\}]. \quad (4)$$

To generate the nowcasts and forecasts, we apply the shifting procedure for the covariance matrix by Altissimo *et al.* (2001); see Appendix B.4 on filling in unbalanced panels.[6] Altissimo *et al.* (2001) compute values of $\chi_{i,t}$ in equation (2) g months ahead by individually shifting out each series in $x_{i,t}$ in a way that the most recent observation aligns g months ahead. Afterwards the generalized principal component is evaluated for the realigned $x_{i,t}$.

An important step in our procedure is the application of the band-pass filter at $\tau = 2\pi/12$ before projecting. This generates a smoothed common (long-run) component and is motivated on two grounds. The first reason is that statistical measures of core inflation seek to eliminate short-run shocks to generate a trend-like index of inflation. This implies that core inflation

[6]Giannone *et al.* (2007) offer an alternative procedure for forecasts of the common component based on the Kalman filter, which are qualitatively the same.

should exhibit lower volatility and greater persistence than inflation measured by the CPI. The second reason for smoothing with the band-pass filter is that we want to filter the seasonal component from non-seasonally adjusted data. Smoothing with the band-pass filter at $\tau = 2\pi/12$ for a shifted (i.e., forecasted) panel six months ahead implies that the seasonal component will be purged from the nowcast without suffering serious end-of-sample biases.

III. The data

All series in the panel are from 1993:5 to 2004:5 and are taken from the data bank of the Swiss National Bank (SNB). The main blocks are prices (178 series), money (9 series), financial (45 series), labor (14 series), survey (30 series), trade (98 series), consumption (16 series), and foreign (49 series) for a total of 434 variables. Amstad and Fischer (2005) provide an overview of the individual series and their transformations. A large share of the data is systematically reviewed by SNB economists and thus can be regarded as replicating the contours of a data-rich environment in which the central bank operates.

To motivate why weekly estimates of core inflation could be informative, consider Swiss data releases for the month of December 2003. Of the 434 series in our panel, 274 variables were released in the first week and 111 in the third week.[7] The bunched releases suggest that estimates of core inflation may change considerably as new information comes in after the first and third week of December 2003.[8] This conjecture is tested in the empirical section on real-time estimates of monthly core inflation.

The broad-based panel means that data series are subject to revisions. On average 117 (26.9%) variables are revised per year. The revised series are primarily monetary and credit aggregates along with labor market data. Data revisions in Switzerland are heterogenous and do not follow a distinct pattern. Thus, our weekly estimates for monthly core inflation are capturing information from data releases and data revisions.

Three decisions motivated the construction of our broad-based panel. The

[7]There may be months were the clustering falls in other weeks. Further, the SNB enters the newly released series in its data bank immediately upon arrival. Thus, the lumpiness of the data releases reflects information flow from the point of the empirical practitioner. It cannot be excluded that delays exist between the time of the data's public release to the time they are sent to the SNB.

[8]Kliesen and Schmid (2004) show a frequency distribution for U.S. releases of 35 macroeconomic variables. Their results support the clustering phenomena of data releases on specific days.

first was to work with daily and monthly data.[9] Although the SNB's official forecasts are at the quarterly frequency, the decision not to work with frequencies greater than a month is intentional for the exercise described in the introduction. We are concerned with the problem of how to weigh the most recent information against what we already know at regular intervals less than a month. The SNB is systematically confronted with this issue, because the Board reviews its monetary policy decisions on a bi-weekly basis. This explains why the weekly interval between the SNB's interest rate decisions listed in calendar weeks in Table 1 does not follow a recognizable pattern.

A second concern in constructing the panel was to define the sample length of the so-called low-inflation regime. It is only since the early 1990s that most OECD countries, including Switzerland, have experienced a prolonged period of price stability. A time period under 10 years was felt to be too restrictive for the estimation procedure and hence a starting date of May 1993 that coincided with the CPI basket revision was selected.

Third, we sought the largest possible panel with monthly data in the hope

[9]The daily data are financial variables. Forni *et al*. (2003) show that monthly financial variables are important in their forecasts for inflation and output.

to eliminate the idiosyncratic component and to ensure a dynamic structure that captures sufficient variables that lead and lag Swiss CPI inflation. The panel does not include series that are splined from the quarterly level. Thus, potentially relevant sources of real activity such as (quarterly) Swiss GDP and (quarterly) Swiss industrial production are not considered.[10]

An explicit intention in constructing the panel was to transform the series as little as possible. First, no seasonal filtering is undertaken. As discussed in the previous section, seasonality is handled through band-pass filtering and the shifting procedure of Altissimo *et al.* (2001). The motivation for this decision is because of seasonal filtering's reliance on future information and is therefore inconsistent with real-time diagnosis.[11] Second, potential redundant information through newly generated variables, say the creation of interest rate spreads or real balances, impose a choice on the researcher to throw them out before the model is estimated. This route was not taken here. Rather, whenever possible, the model was first estimated using the

[10]The Swiss GDP estimates rely heavily on monthly surveys, which are included in the panel. This explains in part that our estimates for core inflation remain unchanged when introducing splined quarterly GDP.

[11]This obviously comes at a cost, because $\hat{\chi}_{i,t|t+k}$ suffers from a larger idiosyncratic component stemming from seasonality. This issue is discussed in the next section.

original series and then the transformed data were introduced and tested at a later stage.

Several data transformations, however, were necessary at the initial stages of estimation. The series were filtered in the following manner. First, to account for possible heteroskedasticity logarithms were taken for nonnegative series that were not in rates or in percentage units. Second, to account for stochastic trends the series were differenced if necessary.[12] Third, the series were taken in deviation from the mean and divided by their standard deviation to remove scalar effects.

IV. Monthly estimates of Swiss core inflation

Before discussing the weekly updates to the monthly nowcasts, we provide monthly estimates of Swiss core inflation and establish properties of smoothness, stability, and forecasting. This is done for two reasons. The first is to show that core inflation fulfills the standard properties exhibited in Cristadoro *et al.* (2005) and other studies of monthly inflation. The second is

[12]Each variable was first visually inspected for breaks. Those that suffered from realignment shifts (i.e., new variable definitions) were thrown out. In a second stage, tests for unit roots were performed to determine the proper order of integration.

to show that the jumps in the intra-monthly innovations, discussed in the next section, stem primarily from sequential data flow and not from model instability.

The monthly model of core inflation is specified with two dynamic factors and twelve static factors.[13] The applications of the band-pass filter are at $\tau = \{\pi,\ 2\pi/12, \text{ and } 2\pi/24\}$. The different levels of smoothing defining $\chi^L_{1,t}$ are depicted as $SC(0)$, $SC(12)$, and $SC(24)$.[14] We argue in the next subsection that our preferred model, $SC(12)$, offers an attractive mix between smoothness and the ability to capture information stemming from inflation's dynamics.

The discussion of the monthly estimates is organized as follows. First, several observations regarding the level of smoothness for $SC(12)$ are offered. Next, the preferred estimate is matched with actual inflation and other commonly used measures of core inflation. Thereafter, we demonstrate that $SC(12)$ holds up well in a forecasting exercise with other measures. Last, our estimate of $SC(12)$ is discussed in the context of recent interest rate changes.

[13] We find that first two factors account for almost 30% of the variance of the data.

[14] Another way of understanding our annual inflation measures is that $SC(12)$ is close to a centered MA(6) of annual inflation at t.

Defining the proper level of smoothness

Figure 1 plots annualized inflation rates of monthly $SC(0)$, $SC(12)$, and $SC(24)$ from 1994:5 to 2003:12. During this period, CPI inflation averaged 0.8% and the smoothed estimates fluctuate in a tight band between 0.5% and 1.2%. A visual inspection finds only slight differences between the smoothed estimates of $SC(12)$ and $SC(24)$. This observation is supported by the descriptive statistics offered in Table 2. A noteworthy feature arising out of the graph and the descriptive statistics is that $SC(0)$ is considerably more volatile than the smoothed estimates of $SC(12)$ and $SC(24)$.

Three differences in the dynamics set the smoothed estimates apart from the non-smoothed estimate. Each suggests that some smoothing is preferable. First, consider the contrasting profile between the $SC(0)$ and the $SC(12)$ estimates when the 1995 VAT tax was first introduced in Switzerland. We know with hindsight that the introduction of this tax should only have a temporary effect on inflation. The estimate for $SC(0)$ reacts strongly to the consumption tax, whereas for $SC(12)$ it is mild. Second, as in the case of taxes, some smoothing may be necessary if core inflation is influenced by revisions to the CPI basket in May 2000. Figure 1 also shows that the monthly changes of the non-smoothed estimate increases considerably after the May 2000 revision to the CPI basket, whereas the short-run dynamics of the smoothed estimates do not. This suggests that a smoothed measure of core inflation may be helpful for monetary policy analysis, particularly when considering the post 2000 period. Third, the seasonally adjusted panel influences the estimates of $SC(0)$ but not those of $SC(12)$. To understand the role of seasonality, Figure 2(a, b, and c) plots the monthly change of $SC(0)$, $SC(12)$, and $SC(24)$ against their seasonally adjusted equivalents. The plots show that seasonal adjustment of $x_{i,t}$ is able to reduce the volatility of $SC(0)$, but it still suffers from excess volatility after the 2000 CPI revision. In contrast, the estimates for $SC(12)$ show that the differences are slight between the seasonally-adjusted panel and the non seasonally-adjusted panel. Because we are interested in working with a real-time data set that is continuously updated and not subject to forward information assumptions due to seasonal filtering, this motivates our preference to work with a non seasonally-adjusted panel for $SC(12)$.[15]

A feature of the core measures, $SC(0)$, $SC(12)$, and $SC(24)$, is that

[15] As a further check on the influence of non seasonally adjusted data on $\hat{\chi}_{1,t|t+k}$, we compared the estimates of the (long-run and short-term) band filtered estimate, i.e. $\hat{\chi}^{L}_{1,t|t+k}$ against $\hat{\chi}_{1,t|t+k}$ - $\hat{\chi}^{S}_{1,t|t+k}$, and found little difference in the estimates.

they deviate from the CPI inflation between 1997 to 1999. This is not due to smoothing but to special circumstances that made prices behave anti-cyclically with economic activity. First, there was a technology shock in telecommunications and a strong decline in oil prices. The CPI subcomponent for telephone and telecommunication fell by 65% in the three years. Second, as CPI inflation fell, real economic activity was rising. For example, the number of unemployed fell from 205 501 registered persons in 1997:1 to 91 041 registered persons in 1999:12.

Next, let us consider how $SC(12)$ matches up with traditional measures of core inflation. Figure 3 plots annual inflation rates measured by four different indexes: the $SC(12)$, the CPI index, the trimmed mean with 15% cut-off tails, and CPI minus food and energy.[16] The traditional measures of core inflation, i.e., trimmed mean and CPI minus food and energy, exhibit considerable increases in short-term volatility after the 2000 CPI revision and the 1995 VAT increase. Instead, $SC(12)$ is smoother than the other core measures. The ratio of the standard deviations of one index over the others is one way to express the $SC(12)$'s gain in smoothness. There is a reduction

[16]See Faber and Fischer (2000) for the merits of the trimmed mean versus CPI minus food and energy in Switzerland.

of 64% in the standard deviation of $SC(12)$ with respect to the CPI minus food and energy, 52% for the trimmed mean, and 63% for the median of the CPI basket (figures taken from Table 2).[17]

Forecasting performance

Crucial for any core inflation measure is its short-run forecasting performance of CPI inflation. First, we test the accuracy of the annual CPI inflation forecasts in two ways. The usefulness of $SC(12)$ against alternative measures of core inflation is first tested using out-of-sample forecasts from a simple bivariate model for annual CPI inflation, π_t: an AR(p) model plus one of three core inflation measures, π_t^{core}. The core measures are $SC(12)$, trimmed mean with +/- 15% cutoff tails, and CPI minus food and energy. The second approach uses the random walk forecast for CPI inflation as the benchmark. Atkeson and Ohanian (2001) find that the naive model outperforms a wide combination of NAIRU Phillips curve models for the United States.[18] The benchmark models together with core inflation can be tested with the fol-

[17]Note, there is also considerable variance reduction for $SC(0)$ against the other measures, again see Table 2. This highlights the defects of traditional measures of core inflation that do not encompass information beyond CPI and its subcomponents.

[18]See also Gavin and Mandal (2003) for an alternative test of the naive's performance against inflation forecasts of the Blue Chip, the Greenbook, and the FOMC members.

lowing specification:

$$\pi_{t+g} \quad = \quad \alpha + \sum_{i=0}^{p} \beta_i \pi_{t-i} + \gamma \pi_t^{core},$$

by setting $p = 5$, 2, or 0.

The results of the CPI inflation forecasts are documented in Table 3. The sample for CPI inflation is estimated from 1994:5 to 1999:12. The RMSE's from the out-of-sample forecasts are from 2000:1 to 2003:12. The forecasting horizon runs from six months to two years; i.e., $g = \{6, 12, 18, 24\}$ in the regression equation. We compare the CPI inflation forecasts with and without core inflation by examining the ratio RMSE(π_{t+g})/RMSE($Benchmark$). In the benchmark regressions, γ is set to zero in the AR(6), the AR(3), and the naive forecasts. A ratio greater than one indicates that the benchmark models outperform the regression models with core inflation.

The RMSEs reveal that the CPI forecasts with $SC(12)$ outperform forecasting models with other core measures at all horizons and by a considerable margin in most cases. The ratios with $SC(12)$ are always smaller than those with the trimmed mean followed by those with CPI minus food and energy. This result reinforces the view that information outside the CPI basket is important for predicting CPI inflation. The RMSEs also reveal that $SC(12)$ offers information beyond the simple benchmark models: the ratios with

$SC(12)$ are always less than one. On average the forecasts with $SC(12)$ are 15% better than the benchmark forecasts. This includes forecasting results against the naive model: a non standard result particularly when inflation is low.[19]

V. Weekly estimates of monthly core inflation

In the previous section, the stability of $SC(12)$ at the monthly frequency was demonstrated through the properties of smoothness and forecasting.[20] The next step is to show that we can go further by considering the information flow at the intra-month level. In this section, we turn to real-time diagnosis of $SC(12)$ by showing that weekly estimation in real time is informative.[21] First, the weekly innovations of the backcasts provide information that is statistically significant. Second, the weekly updates for $SC(12)$ can be used

[19]The RMSE results are underpinned by Diebold and Mariano (1995) sign tests. The null hypothesis that the forecasts with $SC(12)$ are the same as the benchmark forecasts, is strongly rejected. An open issue not pursued here (proposed by a referee) is to determine whether the level of smoothing in $SC(12)$ as opposed to $SC(0)$ improves the forecast.

[20]End-of-sample stability is preserved through the shifting procedure of Altissimo *et al.* (2001).

[21]Our estimation analysis considers only the first four weeks of each month. Each weekly nowcast re-estimates the model.

as a tool to identify turning points.

Are weekly nowcasts informative?

To answer this question, our strategy uses Wilcoxon rank tests on the weekly innovations of the nowcasts, $SC(12)_{t|j,t}$, and the backcasts, $SC(12)_{t|j,t+k}$ for $k > 0$, to determine whether sequential information flow is pertinent for week j in month t. The tests are performed on weekly estimates of $SC(12)$ using two sets of weekly panels: real-time panels from 2003:10 to 2004:5 (resulting in 35 separate weekly panels) and a 'pseudo' real-time panel from 2001:1 to 2003:9 (142 weekly panels). The pseudo panels are constructed such that it follows the same pattern of data releases as the months 2004:4 and 2004:5. The motivation for the pseudo real-time panel stems from the limited length of the real-time panel.[22]

As a first step, it is important to show that the weekly innovations, $\epsilon_{t|1,t+k} = \hat{\chi}^L_{1,t|1,t+k} - \hat{\chi}^L_{1,t|4,t+k-1} = SC(12)_{t|1,t+k} - SC(12)_{t|4,t+k-1}$ (i.e., the difference in the core's estimate from the first week of month $t+k$ and the estimate of $SC(12)$ for the fourth week of month $t+k-1$), $\epsilon_{t|2,t+k} = SC(12)_{t|2,t+k} -$

[22]The difference between pseudo and real panel lies in the treatment of the financial variables. The (daily) financial data do not properly account for potential responses to new information stemming from data releases in the pseudo panel.

$SC(12)_{t|1,t+k}$ and so on, do not suffer from unstable estimates of $SC(12)_{t|j,t+k}$ and $SC^*_{t|j,t+k}$. The latter measure of core inflation, $SC^*_{t|j,t+k}$, is based on estimated parameters fixed at the second week of January each year. Under the null hypothesis that the population means of $SC(12)_{t|t}$ and $SC^*(12)_{t|t}$ are the same, the asymptotic p-values of the rank tests for the real-time panel and the pseudo real-time panel are 0.15% and 0.24%. This evidence is consistent with the view that the weekly estimates of $SC(12)$ do not suffer from parameter instability.

Next, the rank tests of the weekly innovations are presented in Table 4. For both panels, the innovations from the first week are found to provide new information that is not encompassed in the preceding weeks. The p-values of the rank tests are less than 10% for the nowcasts and less than 5% for the backcasts. There is also evidence that new information is coming in during the fourth week. The p-values of the rank tests between $\epsilon_{t|2,t+k}$ and $\epsilon_{t|4,t+k}$ are significant at the 5%. From these results, we conclude that it is worthwhile to re-estimate $SC(12)$ at least twice a month.[23]

[23]Because of the changing nature of Swiss revisions, we are unable to make precise statements that attribute the information source during the first week (i.e., primarily CPI releases) and fourth week (i.e., trade and import price releases).

Tests for directional change

Next, we analyze the ability of the $SC(12)$ nowcasts to predict the future direction of monthly CPI inflation. We evaluate whether the nowcast in week 4 of month t predicts turning points better than the nowcast in week 1 of month t. If successive weekly nowcasts of $SC(12)$ for the same month predict turning points better across time, this is evidence that real-time information improves the updated nowcast of $SC(12)$.

Our test for predicting directional change follows Fisher *et al.* (2002). Let $\hat{D}_{t+g}$ be the predicted directional change in inflation g periods ahead. We define $\hat{D}_{t+g}$ as follows for $g = \{6,\ 12,\ 18,\ \text{and}\ 24\}$:

$$\hat{D}_{t+g} = \begin{cases} +1 & \text{if } SC(12)_{t|j,t} \text{ for weeks } j = \{1 \text{ to } 4\} > \pi_t \\ -1 & \text{otherwise} \end{cases}$$

where $\hat{D}_{t+g}$ = +1 indicates a forecasted increase in inflation and $\hat{D}_{t+g}$ = -1 indicates a decrease. Actual changes in inflation are defined analogously. Let D_{t+g} be the actual direction of change in inflation g periods ahead for

$$D_{t+g} = \begin{cases} +1 & \text{if } \pi_{t+g} > \pi_t \\ -1 & \text{otherwise} \end{cases}$$

To measure the directional change performance of the $SC(12)$ model, we calculate the percentage of directional predictions that are correct (PDPC).

This percentage is defined as

$$PDPC = \frac{1}{T}\Sigma_{t=1}^{T} I(\hat{D}_{t+g} = D_{t+g}) \quad (5)$$

where the indicator function, I, is equal to 1 when its argument is true (i.e., $\hat{D}_{t+g} = D_{t+g}$) and 0 otherwise.

Table 5 presents the PDPC values for the real-time sample and the pseudo sample. The PDPC increases successively within the month for each forecasting horizon, except for the forecast for 24 months ahead with the pseudo sample. This result says that the ability to predict directional changes improves as real-time information is incorporated in the weekly nowcasts.[24]

To determine whether the change in the PDPC between the first and the fourth week is statistically significant, a rank test is performed between the first and fourth week of the same month. The p-values of this test, distributed $\chi^2(1)$, are given in the column under the heading rank(w1=w4) in Table 5. Although we observe an improvement in the PDPC values between the first and fourth week, the difference in PDPCs is not statistically significant. The p-values are all greater than 30%. We attribute the non-significance result

[24]There is no clear evidence that the PDPC deteriorates as the length of the forecast horizon increases. This reflects the fact that the ability to predict turning points depends on the dynamics of CPI inflation.

to the short sample and the low inflation environment.

VI. Concluding Remarks

The paper's aim is to show that (real-time) weekly estimates of monthly core inflation are informative. The sequential information flow of real-time data releases and macroeconomic revisions are shown to provide useful information for the nowcast at the weekly frequency. The statistical tests of the weekly innovations find that it is worthwhile to re-estimate the monthly nowcast at least twice a month. The evidence for identifying monthly turning points confirms the importance of timely information but this result is not statistically significant.

The analysis was conducted for a sample where inflation averaged less than one percent. During periods of higher inflation, we conjecture that intra-monthly estimates of inflation should become more informative. Our procedure of weekly updates allows policymakers and analysts to determine whether newly arrived information pushes the weekly estimates of core inflation in a well-defined direction for a specific period. The ability to identify these types of intra-monthly dynamics are particularly important for business cycle analysis, because central bankers are reluctant to undertake policy changes on the basis of two or three monthly observations.

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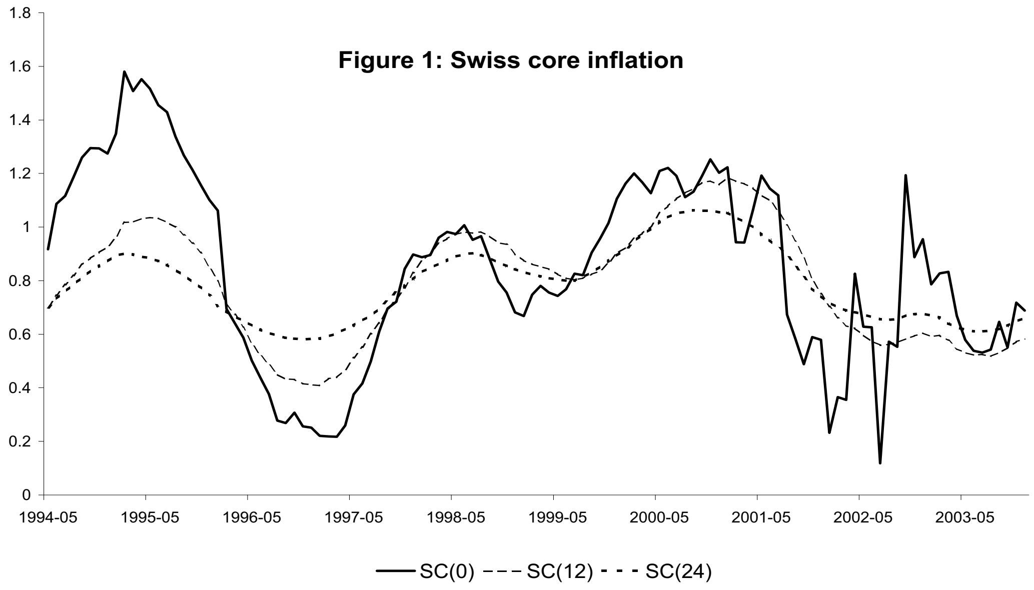

Note: SC( ) denotes three different levels of smoothing of Swiss core inflation

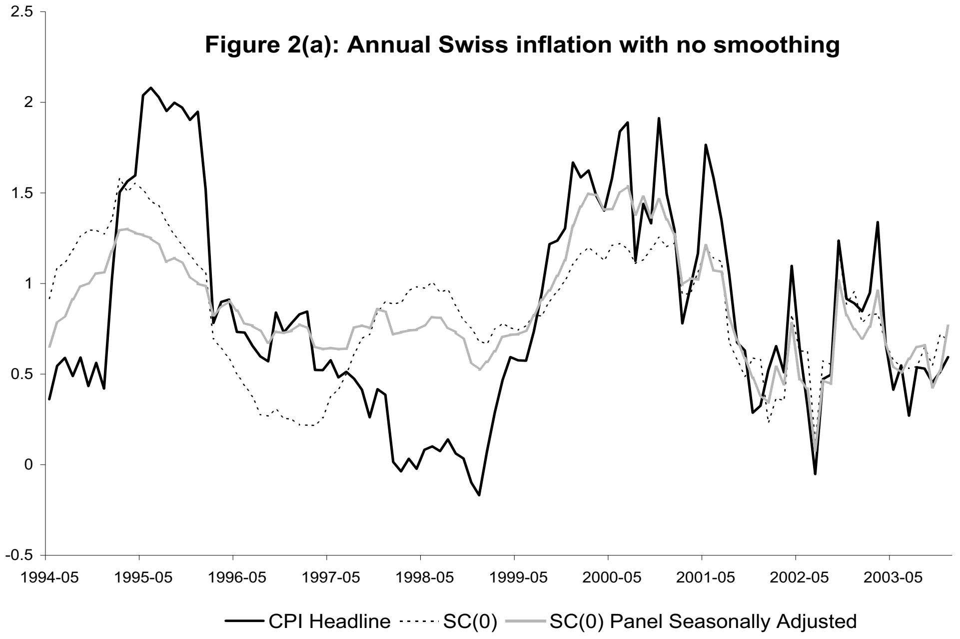
Figure 2(a): Annual Swiss inflation with no smoothing
2.5
2
1.5
1
0.5
0
-0.5
1994-05
1995-05
1996-05
1997-05
1998-05
1999-05
2000-05
2001-05
2002-05
2003-05
CPI Headline
SC(0)
SC(0) Panel Seasonally Adjusted

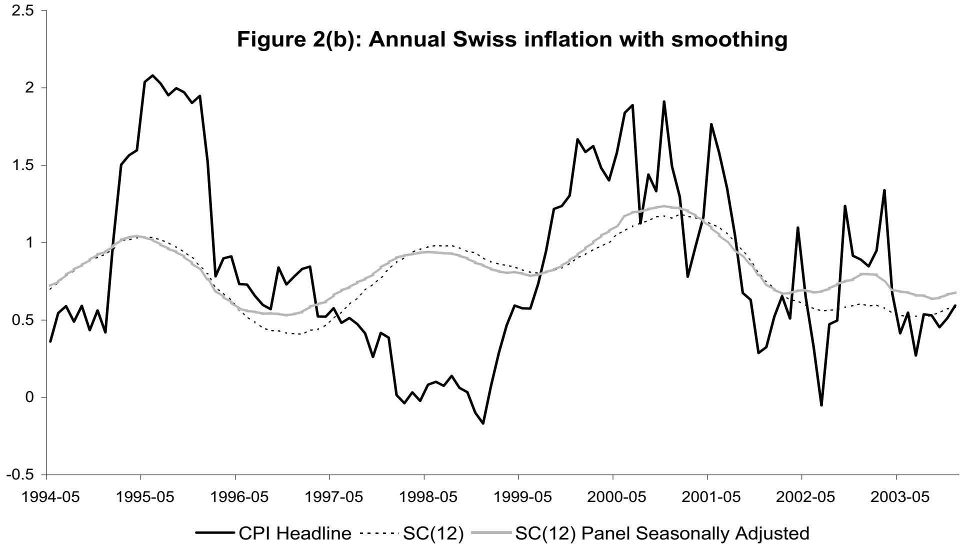
Figure 2(b): Annual Swiss inflation with smoothing
2.5
2
1.5
1
0.5
0
-0.5
1994-05
1995-05
1996-05
1997-05
1998-05
1999-05
2000-05
2001-05
2002-05
2003-05
CPI Headline
SC(12)
SC(12) Panel Seasonally Adjusted

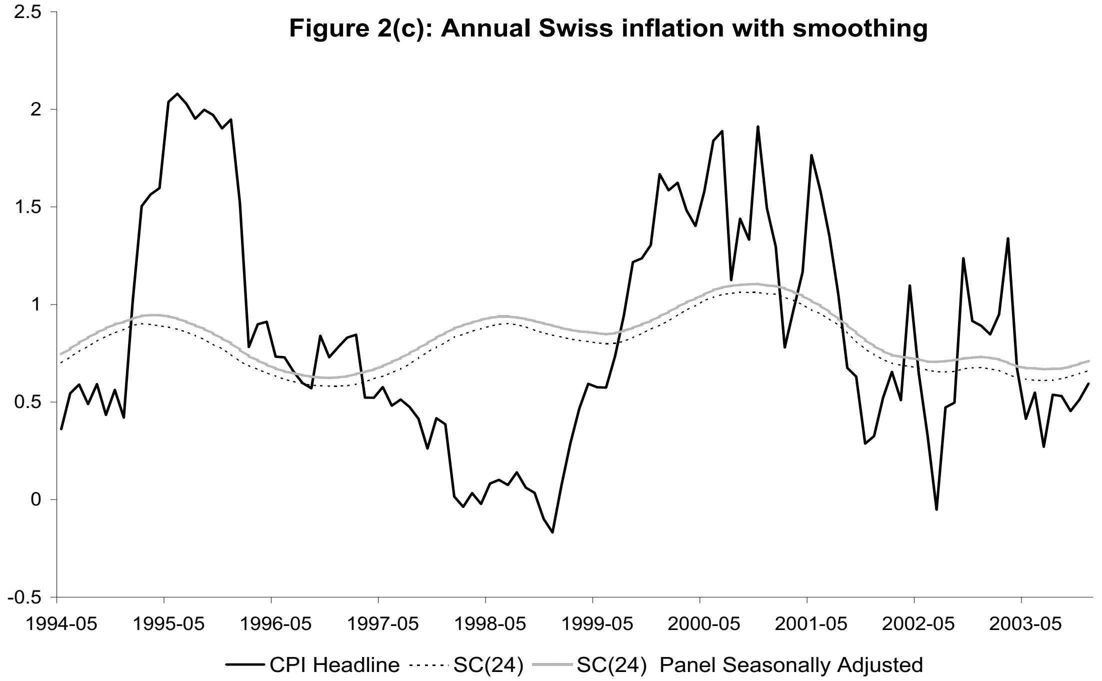

Figure 2(c): Annual Swiss inflation with smoothing
2.5
2
1.5
1
0.5
0
-0.5
1994-05
1995-05
1996-05
1997-05
1998-05
1999-05
2000-05
2001-05
2002-05
2003-05
CPI Headline
SC(24)
SC(24) Panel Seasonally Adjusted

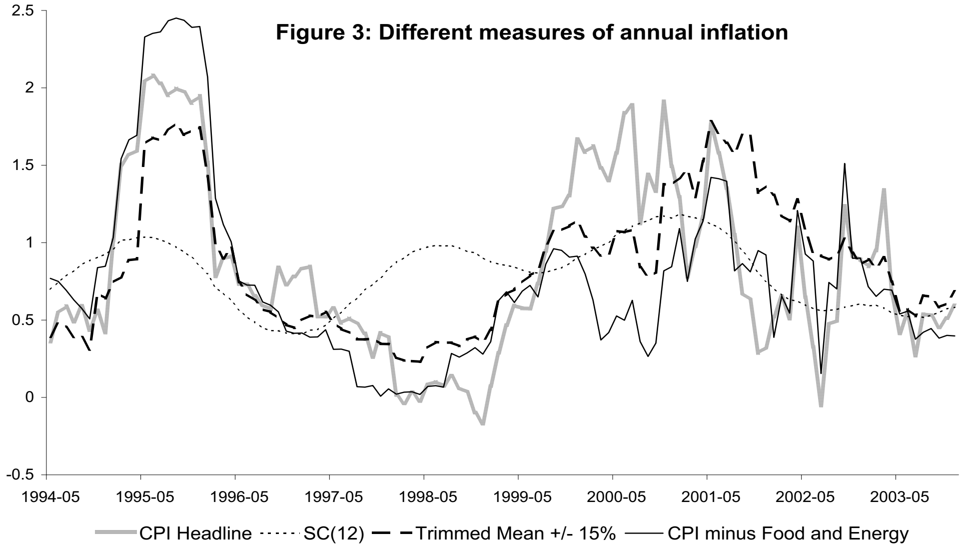

Figure 3: Different measures of annual inflation

Table 1: SNB's target range for the three-month Libor 2000-2004

target range of 3m Libor rate	date of change	calender week	day of the week
1.75 - 2.75	3.2.2000	5	Thursday
2.50 - 3.50	23.3.2000	12	Thursday
3.00 - 4.00	15.6.2000	24	Thursday
2.75 - 3.75	22.3.2001	12	Thursday
2.25 - 3.25	17.9.2001	38	Monday
1.75 - 2.75	24.9.2001	39	Monday
1.25 - 2.25	7.12.2001	49	Friday
0.75 - 1.75	2.5.2002	18	Thursday
0.25 - 1.25	26.7.2002	30	Friday
0.00 - 0.75	6.3.2003	10	Thursday

Table 2: Descriptive statistics of annual inflation

	CPI	$CPI-X$	*trimmed mean*	CPI *median*	$SC(0)$	$SC(12)$	$SC(24)$
1994:5 to 2003:12							
mean	0.84	0.77	0.86	0.78	0.85	0.84	0.83
max	2.08	2.45	1.78	1.98	1.57	1.22	1.09
min	-0.17	0.01	0.23	0.00	0.25	0.48	0.062
std. dev.	0.58	0.59	0.44	0.57	0.32	0.21	0.13
Skewness	0.51	1.42	0.58	0.16	0.16	-0.01	0.21
Kurtosis	2.32	4.76	2.29	2.11	2.16	1.96	2.08

Table 3: Out-of-sample performance of annual inflation from 2000:1 to 2003:12

$$\pi_{t+g} = \alpha + \sum_{i=0}^{p} \beta_i \pi_{t-i} + \gamma \pi_t^{core} \qquad RMSE(\pi_{t+h})/RMSE(Benchmark)$$

	h=6	*h*=12	*h*=18	*h*=24
Benchmark: AR(6) i.e., p = 5				
SC(12)	0.839	0.991	0.901	0.804
Trimmed mean	0.972	1.374	1.399	1.254
CPI minus food and energy	2.857	3.099	2.273	1.501
Benchmark: AR(3) i.e., p = 2				
SC(12)	0.7323	0.956	0.945	0.812
Trimmed mean	1.001	1.089	1.346	1.372
CPI minus food and energy	3.045	2.890	2.314	1.608
Benchmark: Random Walk Model i.e., p = 0				
SC(12)	0.828	0.818	0.817	0.819
Trimmed mean	1.445	1.129	1.279	1.126
CPI minus food and energy	2.290	2.780	2.114	1.290

Notes: Inflation, π_t, is annual CPI inflation and annual core inflation, π_t^{core}, is $SC(12)$, *trimmed mean*, and *CPI minus food and oil*. Values are RMSEs ratios between the model forecasts with π_t^{core} and the benchmark forecasts. The out-of-sample forecast is from 2000:1 to 2003:12 and is based on information from 1994:5 to 1999:12. The value for p is either 5, 2, 0, depending on whether the benchmark model (with $\gamma = 0$) is $AR(6)$, $AR(3)$ or the random walk model.

Table 4: Wilcoxon rank-sum tests of the weekly innovations

pseudo real panel

	$\epsilon_{t\|2,k} = \epsilon_{t\|1,k}$	$\epsilon_{t\|3,k} = \epsilon_{t\|2,k}$	$\epsilon_{t\|4,k} = \epsilon_{t\|3,k}$	$\epsilon_{t\|4,k} = \epsilon_{t\|2,k}$	$\epsilon_{t\|4,k} = \epsilon_{t\|1,k}$	$\epsilon_{t\|3,k} = \epsilon_{t\|1,k}$
$k = t$	0.082	0.773	0.461	0.052	0.352	0.089
k=t+1	0.019	0.125	0.074	0.010	0.493	0.031
k=t+2	0.002	0.043	0.004	0.000	0.051	0.001
	$\epsilon^*_{t\|2,k} = \epsilon^*_{t\|1,k}$	$\epsilon^*_{t\|3,k} = \epsilon^*_{t\|2,k}$	$\epsilon^*_{t\|4,k} = \epsilon^*_{t\|3,k}$	$\epsilon^*_{t\|4,k} = \epsilon^*_{t\|2,k}$	$\epsilon^*_{t\|4,k} = \epsilon^*_{t\|1,k}$	$\epsilon^*_{t\|3,k} = \epsilon^*_{t\|1,k}$
k=t	0.095	0.333	0.393	0.089	0.768	0.160
k=t+1	0.020	0.477	0.308	0.009	0.459	0.020
$k = t + 2$	0.001	0.052	0.002	0.000	0.003	0.002

real panel

	$\epsilon_{t\|2,k} = \epsilon_{t\|1,k}$	$\epsilon_{t\|3,k} = \epsilon_{t\|2,k}$	$\epsilon_{t\|4,k} = \epsilon_{t\|3,k}$	$\epsilon_{t\|4,k} = \epsilon_{t\|2,k}$	$\epsilon_{t\|4,k} = \epsilon_{t\|1,k}$	$\epsilon_{t\|3,k} = \epsilon_{t\|1,k}$
k=t	0.039	0.796	0.863	0.004	0.791	0.014
k=t+1	0.113	0.796	1.000	0.011	1.000	0.018
k=t+2	0.093	0.796	0.729	0.009	0.731	0.018
	$\epsilon^*_{t\|2,k} = \epsilon^*_{t\|1,k}$	$\epsilon^*_{t\|3,k} = \epsilon^*_{t\|2,k}$	$\epsilon^*_{t\|4,k} = \epsilon^*_{t\|3,k}$	$\epsilon^*_{t\|4,k} = \epsilon^*_{t\|2,k}$	$\epsilon^*_{t\|4,k} = \epsilon^*_{t\|1,k}$	$\epsilon^*_{t\|3,k} = \epsilon^*_{t\|1,k}$
k=t	0.222	1.000	1.000	0.113	0.931	0.113
k=t+1	0.161	0.666	0.605	0.139	0.604	0.190
k=t+2	0.161	0.222	1.000	0.154	0.422	0.094

Notes: The weekly innovations of the nowcasts are $\epsilon_{t|1,t} = SC(12)_{t|1,t}$ - $SC(12)_{t-1|4,t-1}$, $\epsilon_{t|2,t} = SC(12)_{t|2,t}$ - $SC(12)_{t|1,t}$ and so on. The innovations, which are generated from $SC(12)_{t|jt}$ based on estimated parameters fixed at the second week of January each year, are denoted as $\epsilon^*_{t|j,t}$. The pseudo real panel is from 2001:1 to 2003:9 and the real panel is from 2003:10 to 2004:5.

Table 5: Tests for directional change (PDPC)

real panel 2003:10 to 2004:5

	week 1	week 2	week 3	week 4	rank(w1=w4)
6 months ahead	0.75	0.75	0.75	0.875	0.52
12 months ahead	0.875	0.875	0.875	1	0.30
18 months ahead	0.875	0.875	0.875	1.00	0.30
24 months ahead	0.875	0.875	0.875	1.00	0.30

pseudo panel 2001:1 to 2003:9

	week 1	week 2	week 3	week 4	rank(w1=w4)
6 months ahead	0.576	0.576	0.667	0.667	0.45
12 months ahead	0.758	0.818	0.848	0.848	0.35
18 months ahead	0.576	0.606	0.606	0.606	0.80
24 months ahead	0.606	0.576	0.606	0.606	1.00

Notes: Values are the percentage of directional predictions that are correct (PDPC) based on equation (3). Rank(w1=w4) gives the *p*-values from a rank test ($\chi^2(1)$) that compares whether week 1's PDPC is equal to week 4's PDPC under the null.

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