

A real-time GDP data set for Switzerland

Severin Bernhard

SNB Economic Studies

9/2016



Legal Issues

DISCLAIMER

Economic Studies represent the views of the author(s) and do not necessarily reflect those of the Swiss National Bank.

COPYRIGHT©

The Swiss National Bank (SNB) respects all third-party rights, in particular rights relating to works protected by copyright (information or data, wordings and depictions, to the extent that these are of an individual character).

SNB publications containing a reference to a copyright (© Swiss National Bank/SNB, Zurich/year, or similar) may, under copyright law, only be used (reproduced, used via the internet, etc.) for non-commercial purposes and provided that the source is mentioned. Their use for commercial purposes is only permitted with the prior express consent of the SNB.

General information and data published without reference to a copyright may be used without mentioning the source. To the extent that the information and data clearly derive from outside sources, the users of such information and data are obliged to respect any existing copyrights and to obtain the right of use from the relevant outside source themselves.

LIMITATION OF LIABILITY

The SNB accepts no responsibility for any information it provides. Under no circumstances will it accept any liability for losses or damage which may result from the use of such information. This limitation of liability applies, in particular, to the topicality, accuracy, validity and availability of the information.

ISSN 1661-142X (printed version)

ISSN 1661-1438 (online version)

© 2016 by Swiss National Bank, Börsenstrasse 15,
P.O. Box, CH-8022 Zurich

A real-time GDP data set for Switzerland⁺

Severin Bernhard*

⁺ The author is grateful to Marcel R. Savioz, Bernd Schips, an anonymous referee, and various others at the Swiss National Bank (SNB) for helpful comments and discussions, and the entire team of the SNB library for their assistance while collecting the data. This study has been carried out within the context of a research project on real-time data of the SNB. The views expressed in this study are those of the author and do not necessarily reflect those of the SNB.

* Swiss National Bank, Börsenstrasse 15, P.O. Box, CH-8022 Zurich; severin.bernhard@snb.ch

Contents

1. Introduction	3
2. Swiss GDP	5
2.1 History of national accounts and benchmark revisions	5
2.2 Release schedule and specific releases	6
3. Data set	7
4. Description of releases and revisions	8
5. Unbiasedness and efficiency	11
6. A closer look at the mid-nineties	14
7. Concluding remarks	16
References	17
A. Real-time terminology	19
B. History of Swiss GDP	20
Swiss national accounts (annual values)	20
Quarterly values	23
C. Data set	24

Abstract

This economic study presents and analyses newly collected real-time data for Swiss GDP. It extends existing data sets by covering annual and quarterly aggregate GDP values for a longer sample, with vintages starting in 1971 (annual) and 1983 (quarterly). The analysis comprises a graphical and statistical description of quarterly GDP releases and tests for unbiasedness and efficiency of the revisions. Overall, revisions can be large and substantial, and early releases tend to underestimate GDP growth. Yet statistical tests on unbiasedness provide only limited evidence for a statistically significant bias. Additional tests point at some degree of informational inefficiency for selected revisions, and show that absolute revisions neither improve nor deteriorate over time. Most findings are consistent with existing literature. However, a closer look at revisions during the mid-nineties, a period characterised by large revisions, shows that annual and benchmark revisions can affect quarterly revisions considerably (and thus the results above). In addition, this closer look illustrates the difficulties with interpreting the recent business cycle in the presence of revisions.

JEL classification: C22, C82, E32, E37, E52

Keywords: GDP revisions, national accounts, monetary policy

1. Introduction

Revisions to macroeconomic variables can affect policy-making considerably. Cuche-Curti et al. (2008) for instance show that GDP revisions “risk[s] introducing a pro-cyclical bias in monetary policy decisions,” and that this effect varies over time. In line with their results, Kugler et al. (2004) show that GDP measurement errors can affect the volatility trade-off between inflation and output growth for central banks.

More generally, macroeconomic decisions are always made conditional on a corresponding information set. If these information sets are subject to revisions, the policy-maker does not know the ‘true’ information set *ex ante*. Over time, data may be revised, the information set may change, and decisions made in real time may no longer seem optimal *ex post*. Real-time data sets shed light on two issues in this regard. First, they allow the policy-maker to evaluate the size of previous revisions, and hence estimate the statistical reliability of the current values to be revised. Second, real-time data sets allow the policy-maker – or any other researcher interested in the evaluation of past decisions – to better replicate previous information sets and hence evaluate past decisions more accurately.

Real-time data sets exist for several years and countries. For the US, for instance, two large and well-known real-time data sets have been publicly available since 1999 at the Federal Reserve Bank of Philadelphia and the Federal Reserve Bank of St. Louis. Other real-time data sets include that of the Euro Area Business Cycle Network and the OECD Real-Time Data and Revisions Database. The availability of real-time GDP values for Switzerland, however, is limited. The OECD Real-Time Data and Revisions Database covers vintages for Swiss GDP back to 1999, and has been extended by Fernandez et al. (2011) using printed publications of the OECD Main Economic Indicators (MEI). The State Secretariat for Economic Affairs (SECO) released a real-time data set in 2015 (Indergand and Leist, 2014) that covers vintages back to 2002 for several variables (including unemployment and selected GDP components). To the best of our knowledge, other publicly available sources for Swiss real-time GDP data do not exist.

Among the first to analyse Swiss GDP revisions were Ruoss and Savioz (2002), using annual real-time GDP values in their evaluation of Swiss GDP forecasts. The authors showed that early GDP releases were unbiased but not fully informationally efficient. The aforementioned studies from Kugler et al. and Cuche-Curti et al. focus on the effects of GDP revisions on monetary policy. Cuche-Curti et al. also provide an initial analysis of real-time values and show that growth rates are quite large and tend to underestimate later releases, and that early estimates are smoother than final estimates.¹ A series of studies were recently published at the KOF Swiss Economic Institute, focusing on the predictability of GDP revisions (Siliverstovs, 2011a), the dating of business cycles using real-time GDP data (Siliverstovs, 2011b), or generating now-casts for Swiss GDP (Siliverstovs, 2012).²

1 Cuche-Curti et al. (2008) used an early version of this data set, using data between 1995 and 2005. The authors focused on annualised quarter-on-quarter growth rates, while we analyse year-on-year growth rates.

2 This study focuses on real-time data for Swiss GDP, and hence primarily covers real-time economic literature for Switzerland. For an extensive survey of the literature on real-time analysis in general, we refer to Croushore (2011) or Croushore’s updated compilation of real-time

The purpose of this study is twofold. First, we provide official GDP releases for an extended sample and several variations of GDP. Briefly summarised, the data set covers aggregate annual and quarterly GDP values measured as nominal and real levels and growth rates, and starts in 1971Q1 for annual values and in 1983Q1 for quarterly values. Second, we also provide an initial analysis of the unbiasedness and efficiency of these GDP releases. In doing so, we assess several findings of the existing literature on Swiss GDP revisions. Last but not least, we take a closer look at revisions during the mid-nineties to illustrate the difficulties in interpreting the recent business cycle, and the large impact annual and benchmark revisions can have on (these results for) quarterly revisions.

We highlight several findings. First, the graphical and statistical description shows that revisions can be large and substantial, in particular when the last release is involved. The latter points to a large impact of benchmark revisions. Second, all revisions considered are positive on average, hence early releases tend to underestimate GDP growth. The statistical tests on unbiasedness, however, provide only limited evidence for a statistically significant bias. Third, the tests on weak informational efficiency point to some degree of serial correlation in the revisions. Fourth, there is no evidence for an improvement or a deterioration of absolute revisions over time. Fifth, and finally, a closer look at the mid-nineties reveals that the revisions can seriously hamper the interpretation of the current business cycle, and hence monetary policy. Overall, our findings are in line with the literature. We confirm earlier findings that revisions can be large and substantial and that early releases underestimate GDP growth. In contrast, the particular finding of Cuche-Curti et al. regarding the smoothness of the early releases does not hold for the entire sample (for year-on-year growth rates).

However, all (statistical) findings should be interpreted against the close link between quarterly, annual and benchmark revisions, as illustrated for the mid-nineties. A large and substantial share of the quarterly revisions during this period corresponds to revisions to annual GDP values, and in particular to the benchmark revision of 1997. Thus the various benchmark revisions between 2003 and 2008 thus could, for instance, explain the repeated upward revision of quarterly values during this period, and thereby drive the statistical results. A full investigation of this link is, however, beyond the scope of this study.

The study is structured as follows. It starts with a brief overview of Swiss GDP and real-time terminology, and a summary of the data set. The next two sections contain the graphical and statistical description, and the tests on unbiasedness and efficiency. The last section provides a closer look at revisions during the mid-nineties. The conclusion provides a summary and outlines further research.

literature, “Literature on real-time data analysis”, accessible on his website, <https://facultystaff.richmond.edu/~dcrousho/>. Links to other data sets are also available on his website under the ‘data’ section.

2. Swiss GDP

Two institutions currently estimate Swiss GDP values. SECO estimates and publishes quarterly values, while the Swiss Federal Statistical Office (SFSO) is responsible for annual values. This section summarises the history of annual and quarterly national accounts, then addresses the relationship between annual and quarterly values, and finally specifies several particular releases used in the subsequent analysis. While doing so, we introduce the main terms of real-time notation. The section is intentionally kept short – for additional details and references, please refer to appendix A (real-time terminology) and appendix B (national accounts).

2.1 History of national accounts and benchmark revisions

Table 1 summarises the history of national accounts for annual and quarterly values. The first official *annual values* for a social product were published in 1941. In 1963/1964, the SFSO published the first national accounts, based on the normalised system of the Organisation for European Economic Co-operation (OEEC) and the income and expenditure approaches. In 1971, however, the divergence between these two approaches grew too large and the publication of national accounts was forced to stop. During these years, the SFSO did publish a (provisional) social product, but without the full sequence of accounts that accompanies regular national accounts publications. In 1976, the SFSO resumed the publication of national accounts, which was still primarily based on the OEEC system, but also including several elements of the upcoming ESA78 (European System of National and Regional Accounts). The implementation of the production approach for annual values was one of the major improvements of ESA78, which was completed in 1997. Such an implementation of a new standard for national accounts represents a so-called *major benchmark revision*.

The next major benchmark revision was the implementation of ESA95 in 2003. One of its main differences to ESA78 – besides numerous changes in concepts and methodology – was the calculation of real values: instead of referring to a fixed year, real GDP now consists of chained values. From 2003 onwards, the SFSO applied two *minor benchmark revisions*, which generally contain changes to particular elements of national accounts or implement new or changed base statistics. In 2007, the SFSO included new insurance sector-related statistics. In 2012, the SFSO implemented the new classification of economic activities (NOGA2008). Note that although such minor revisions seem less relevant in terms of methodology, they may cause substantial changes in levels. For instance, with the minor revision of 2012, the GDP value for 2010 was revised upwards from CHF 550 to CHF 574 billion.

The first *quarterly estimates* for Swiss GNP were published in 1966 by the SFSO and covered the main expenditure components. The interruption of national accounts in 1971 also affected the publication of quarterly values. Not until 1980 were quarterly GDP series published again, including re-calculations for the years 1963–1980. These early series still focused on the expenditure approach. In 1987, the federal government transferred the responsibility for quarterly GDP values to the Bundesamt für Konjunkturfragen (merged with other government offices and renamed SECO in 1999). In 1997, the implementation of ESA78 led to an adjustment of several estimation methods. Briefly summarised, (quarterly) GDP components were estimated

Table 1: HISTORY OF SWISS NATIONAL ACCOUNTS

<i>Year</i>	<i>Event</i>
1941	First official values for national income and social product
1963/1964	Publication of first national accounts values, based on the normalised system of the OEEC
1966	Publication of first quarterly values
1971–1976	No publication of national accounts due to divergences between the income and expenditure approaches – only provisional values for the social product published
1976	Resumption of national accounts, still primarily based on OEEC system, also including several elements of ESA78
1980/1983	Resumption of quarterly estimates for GDP (by the Basler Arbeitsgruppe für Konjunkturforschung at the IAWF, and the SFSO)
1987	Former SECO is granted responsibility for quarterly estimates
1997	Implementation of ESA78 Production approach for annual values
2003	Implementation of ESA95
2003–2005	Implementation of ESA95 for quarterly values
2006	Production approach for quarterly values
2008	Income approach for quarterly values
2014	Implementation of ESA2010

This table provides a brief summary of the history of Swiss national accounts. For additional details, such as a list of minor revisions, please refer to section 2.1 and appendix B.

using the expenditure approach, while aggregate GDP was estimated using production indicators directly. The implementation of ESA95 occurred between 2003 and 2005 and involved several adjustment steps. The production and income approach for quarterly values were implemented in 2006 and 2008, respectively. Other minor revisions occurred in 2007 and 2012 (see annual values), 2009 and 2011 (seasonal adjustment), and 2013 (electricity trading).

In September 2014, the SFSO and SECO implemented ESA2010, the most recent system of national accounts. This major benchmark revision included changes for investment (research and development, and military expenditure) and improved the link between the national accounts and the balance of payments. For quarterly values, SECO also introduced a much more thorough treatment of calendar and seasonal factors.

2.2 Release schedule and specific releases

SECO and the SFSO publish their values according to different schedules. SECO publishes the quarterly GDP values at the end of the second or beginning of the third month of the following quarter. For example, it published the first value (*release, estimate*) for 2001Q4 (*period, date*) in February or March 2002 (*vintage*) – the parentheses indicate the relevant real-time notation. In September, the SFSO publishes the annual values for the previous year, for instance in September 2002 for 2001. Note that once an annual value has been published or revised, the four relevant quarters need to be adjusted in order to match the annual value. The difference between two releases for the same period is called a *revision*.

Based on these two schedules, we specify several particular releases for annual values. The first annual value for 2001, for instance, emerged from the sum of the four relevant quarters, and was ‘published’ by SECO in February or March 2002 (*SECO release*). In September 2002, the SFSO published the first ‘official’ release (*SFSO1*). Annual values remain provisional for two years, and the SFSO thus eventually revised the period in September 2003 and 2004 (*SFSO2* and *SFSO3* release). Ignoring further benchmark revisions, the *SFSO3* release is considered to be ‘final’. For this particular period 2001, however, we know that several benchmark revisions occurred between the *SFSO3* release in 2004 and the most recent SFSO value of the data set, the *last release*, released in September 2014.

Quarterly releases thus not only get revised due to updated statistical series or benchmark revisions, but also due to releases or revisions of the corresponding annual SFSO value.³ If either the *SFSO1* release is different to the *SECO* release, or any further SFSO release revises an earlier one, the corresponding four quarters adjust. Quarterly values thus remain ‘provisional’ until the third release of the corresponding annual value. With a quarterly vintage frequency, as used in this study, this corresponds to the fourteenth release for first quarters. For second, third and fourth quarters, this corresponds to releases thirteen, twelve and eleven. We again specify several releases for description and evaluation, and take the *first* release, the releases after one year (*one-year, 1y*), two years (*two-year, 2y*) and three years (*three-year, 3y*), and the *last* release. For additional details and a graphical illustration of the releases, please refer to appendix A.

3. Data set

The data set contains annual and quarterly values for aggregate Swiss GDP – measured as nominal and real levels and growth rates. All values are non-seasonally adjusted. Vintages start in 1983Q1 for quarterly values and 1971Q1 for annual values, and end in 2014Q3. First periods covered by vintages are 1948 for annual values and 1965Q1 for quarterly values. Before 1995 – when we started to use printed publications to extract GDP values – most vintages provided GDP values for about three years only. Using selected longer vintages, re-calculations at certain points in time, and assuming no benchmark revisions, we can increase the number of values covered by those vintages considerably, to around fifteen years minimum for quarterly values (see appendix C for details). The vintage frequency is set to quarters, where the current vintage includes all available knowledge of the corresponding quarter. Hence, the ‘cut-off’ date is at the end of the third month. For a precise timing of these releases, we provide a table with publication days, extracted from announcements in Swiss newspapers (Table 7 in appendix C).

The data set is available on the SNB website, under <http://www.snb.ch>, *Research, SNB Economic Studies, ‘A Real-Time GDP Data Set for Switzerland’*.

3 According to the Bundesamt für Wirtschaft und Arbeit (1998), reasons for revisions are changes in the national accounts methodology, and revisions or updates to statistical series. For quarterly values, additional reasons are revisions to the corresponding annual values, and – for seasonally adjusted values – the re-estimation of seasonal coefficients and of (ARIMA) parameters.

4. Description of releases and revisions

Henceforth, we describe and analyse year-on-year growth rates for quarterly, non-seasonally adjusted real GDP. Chart 1 gives two examples to provide an initial impression. The left graph shows the growth rates of two consecutive vintages 1996Q2 and 1996Q3, while the right graph plots all releases for 1994Q2. Clearly, the interpretation of economic conditions can change noticeably within one quarter, but also over all vintages and well beyond the corresponding SFSO3 release. Note that both examples have been selected manually in order to emphasise *possible* revisions, and are by no means representative for the entire sample.

Chart 2 depicts the first, one-year, two-year and last release. At first sight, the large deviations and temporarily different pattern of the last release stand out. Benchmark revisions thus appear to have a noticeable effect, in particular for earlier periods. This fact is, however, not very surprising given the increased number of potential benchmark revisions for earlier periods. The first, one-year and two-year releases show a similar pattern overall, despite several noticeable deviations in the first release, during the mid-nineties, for example. The higher ‘fit’ of the one-year and two-year releases relative to the first and one-year releases points to a decreasing effect of additional information on releases. We further see various repeated upward revisions, for instance during the mid-2000s. The three-year release does not change findings substantially and has been dropped from the chart to enhance readability.

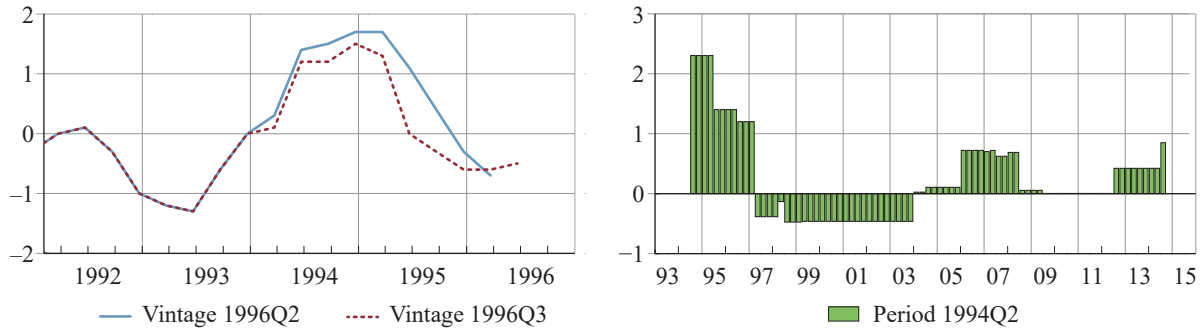
Chart 3 plots all specified releases as scatter plots. The graphs in the first row compare the releases stepwise, while the second row compares all releases to the last release. Overall, they confirm the findings of the previous chart. The fit increases through the stepwise comparisons, while any comparison to the last release reveals wide scattering. There seems to be no systematic deviation from the diagonal, despite a tendency to the lower right in various graphs. This tendency corresponds to the upward revisions found in the previous chart.

How large are the *revisions* for these specific releases? We calculate revisions as the difference between the more recent and the earlier release. Hence, if the first release is higher than the one-year release, then the first to one-year revision is negative.

Chart 4 depicts the revisions between the specified releases. The upper graph again contains the stepwise revisions, the lower graph all revisions compared to the last release (hereafter referred to as compared-to-last revisions). Not surprisingly, given the previous charts, the compared-to-last revisions are particularly large and volatile for early periods. The stepwise revisions are smaller in absolute terms, but still reach values close to 2pp. As expected, we find substantial stepwise revisions during the mid-nineties, in particular regarding the first release. The repeated upward revisions during the mid-2000s mean that, for almost all quarters between 2003 and 2008, the changes are positive. Last but not least, the chart suggests that most revisions are serially correlated. The next section discusses this issue more thoroughly with respect to the weak informational efficiency of the releases (revisions are expected to be serially correlated up to a certain lag).

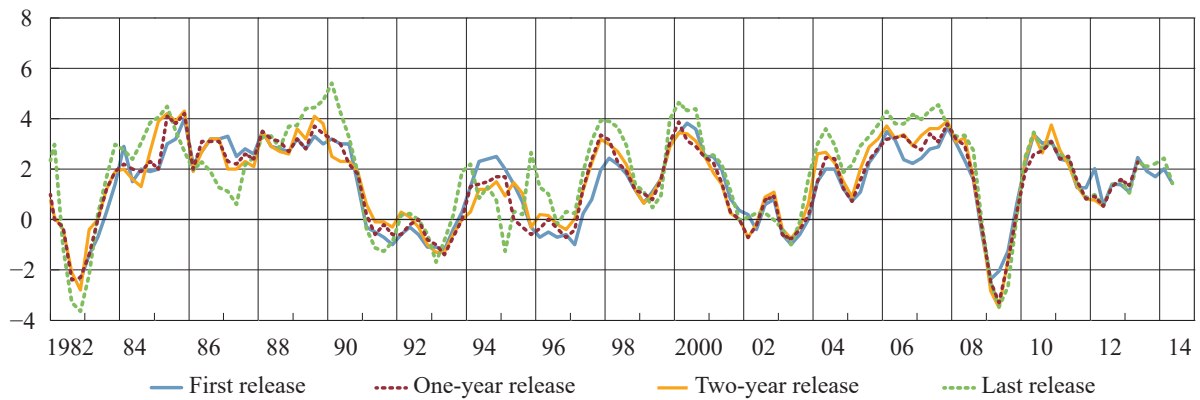
Table 2 provides a statistical summary of the revisions. The first six columns represent standard summary statistics, the minimum, maximum, median, mean, standard deviation (StDev) and median absolute deviation (MAD). The last three columns show the percentages of correctly ‘predicted’ signs for growth rates or

Chart 1: TWO EXAMPLES



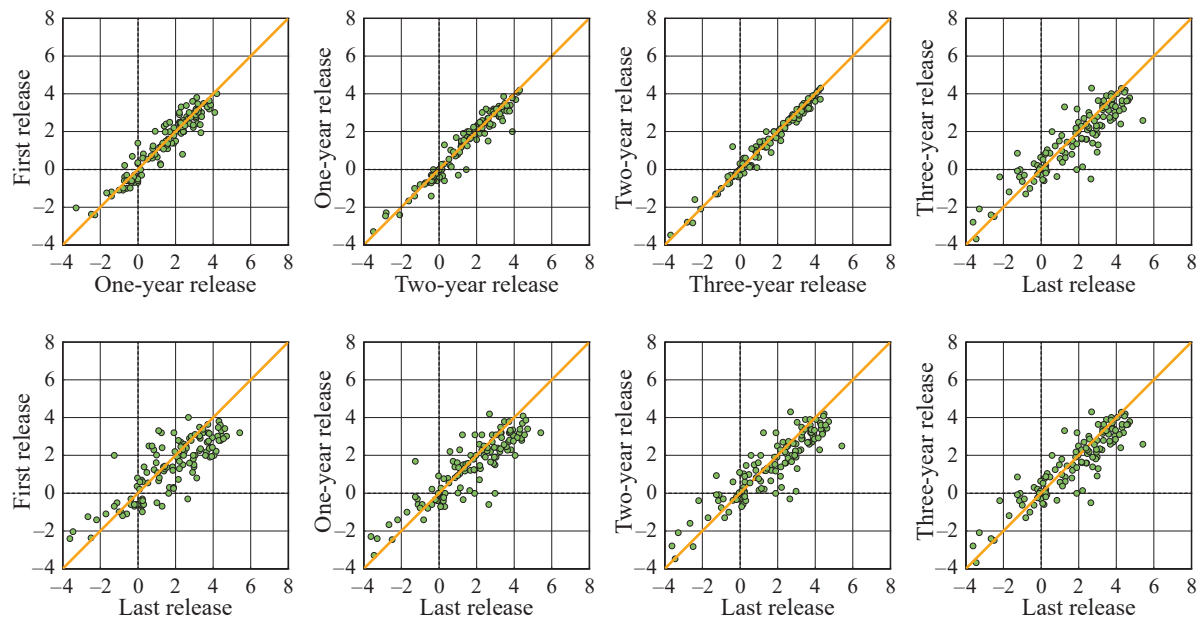
This chart depicts year-on-year growth rates for quarterly, non-seasonally adjusted real GDP.

Chart 2: FIRST, ONE-YEAR, TWO-YEAR AND LAST RELEASE



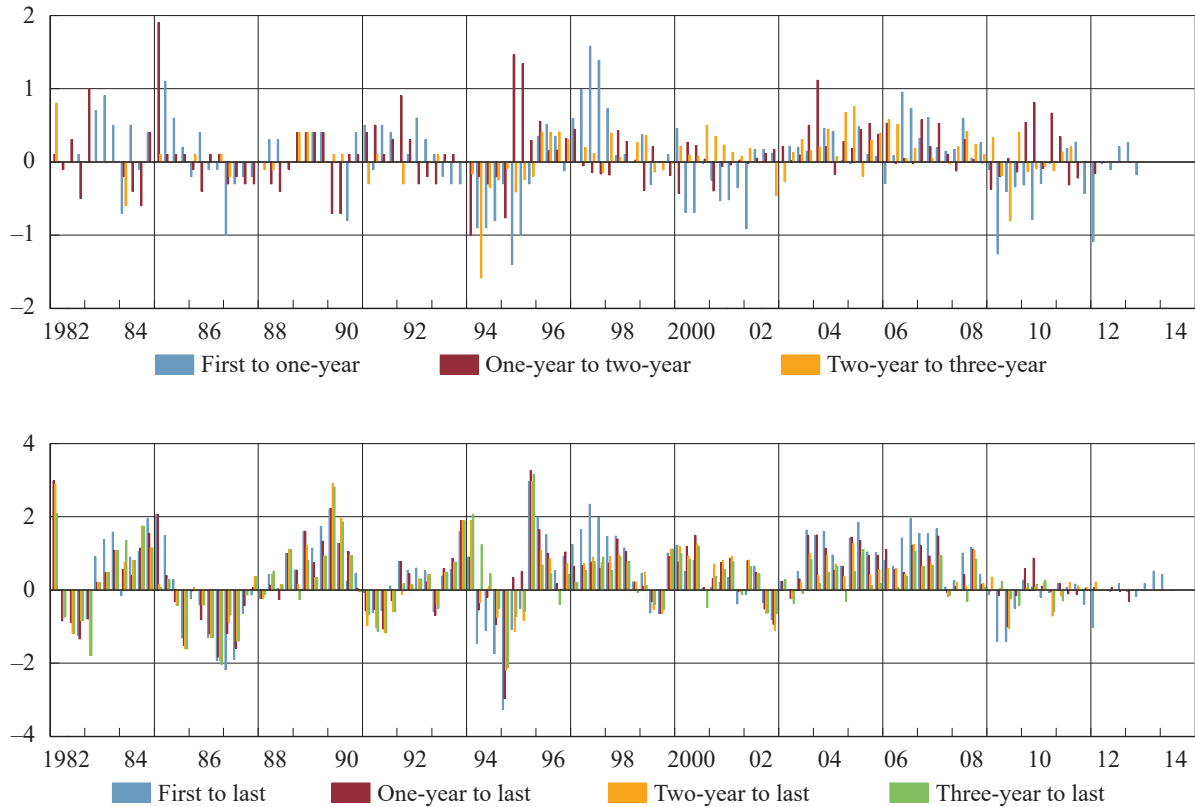
This chart depicts year-on-year growth rates for quarterly, non-seasonally adjusted real GDP.

Chart 3: SCATTER PLOTS FOR SELECTED RELEASES



This chart depicts year-on-year growth rates for quarterly non-seasonally adjusted real GDP.

Chart 4: REVISIONS OF SPECIFIC RELEASES



This chart depicts revisions of year-on-year growth rates for quarterly non-seasonally adjusted real GDP. The first chart shows stepwise revisions, the second chart compared-to-last revisions.

changes in growth rates.⁴ The signs are either taken from the growth rates themselves (S_{GRT}), the difference between the growth rate for the current and the previous quarter (S_{LP}), or the difference between the growth rate for the current quarter and the corresponding quarter in the previous year (S_{PY}). Based on the previous analysis, we expect the statistics to improve in a stepwise manner from the first-year release to the three-year release, and to deteriorate if the last release is involved. The table broadly confirms these expectations.

The mean and median are positive for almost all revisions. Hence, early releases tend to underestimate late releases. While this difference is small for one-step stepwise revisions, in particular from two to three-year, it increases for compared-to-last revisions. The deviation is largest for the first to last revision, and decreases towards the three-year release. The difference between the minimum and the maximum is much smaller for stepwise revisions than for compared-to-last revisions. Within the stepwise revisions, however, the statistics do not generally improve from the first to the three-year release. The standard deviation (StDev), a measure for the ‘typical’ revision, ranges between 0.3pp and 1pp, and thus varies considerably for different revisions. These numbers are rather large, compared to a mean of the first release

4 For each pair of releases, a dummy equals one if both releases, for instance the first and the one-year releases, predict the same sign for the growth rate for any given period, and zero otherwise. The summary statistic then takes the average of this dummy.

Table 2: STATISTICAL SUMMARY

Revision	Min.	Median	Mean	Max.	StDev	MAD	S _{GRT}	S _{LP}	S _{PY}
<i>Stepwise revisions</i>									
First to one-year	-1.40	0.02	0.04	1.58	0.50	0.30	0.92	0.83	0.89
One-year to two-year	-1.00	0.04	0.09	1.90	0.42	0.24	0.93	0.88	0.89
Two-year to three-year	-1.59	0.00	0.05	0.80	0.29	0.10	0.97	0.91	0.93
<i>Compared-to-last revisions</i>									
First to last	-3.26	0.41	0.38	2.95	1.04	0.63	0.89	0.71	0.75
One-year to last	-2.96	0.33	0.34	3.25	0.92	0.55	0.86	0.70	0.80
Two-year to last	-2.20	0.22	0.26	2.96	0.89	0.56	0.91	0.71	0.81
Three-year to last	-2.11	0.20	0.22	3.16	0.86	0.56	0.88	0.74	0.82

This table provides summary statistics for year-on-year growth rates for quarterly non-seasonally adjusted real GDP. The last five columns represent standard deviation (StDev), median absolute deviation (MAD) and three measures for the percentages of correctly ‘predicted’ signs for growth rates or changes in growth rates (see text for further details).

of 1.4pp. The percentage of correctly anticipated growth rates lies between 86% and 97%. Not surprisingly, it drops when looking at the change in growth rates and compared-to-last revisions. The difference to the previous year seems to be more accurately measurable than the difference to the last period, in particular for the comparison to the last release. This finding corresponds to the change in the pattern of the last release in Chart 2.

Summarising this section, revisions can be large and substantial, and are positive on average. Thus, early releases tend to underestimate later releases. The revisions also seem to be serially correlated, but the question of whether they are not therefore weakly informationally efficient is a matter for the next section. Any comparison to the last release leads to larger and more volatile revisions.

5. Unbiasedness and efficiency

This section tests whether the releases are unbiased, weakly informationally efficient, or whether they decrease or increase over time in absolute terms. We consider stepwise revisions only and drop the compared-to-last revisions, for three main reasons. First, benchmark revisions are often forced by changes in national accounts methodology and are exogenous to some extent. Thus, they may interfere with our evaluation and interpretation of the (ex-ante) unbiasedness and efficiency. Nevertheless, they are relevant for policy-makers and researchers often relying on last releases. Second, the last release will probably change with upcoming benchmark revisions that lead to re-calculations for earlier periods. Hence, any finding related to last releases may also change through time. Third, more recent periods exhibit fewer benchmark revisions than earlier periods, or ones that are equal to them. Hence, comparing the first to the last release would imply comparing revisions influenced by several benchmark revisions (for instance for the period 1983Q1) to revisions

uninfluenced as yet by any benchmark revision.⁵ At the same time, we include three additional stepwise revisions that cover more than four vintage quarters, namely the first to two-year, one-year to three-year, and first to three-year revisions. The tests on unbiasedness and weak informational efficiency follow Stekler (2004).

Regarding the test on (weak) informational efficiency, several issues can lead to serially correlated revisions. First, releases or revisions of annual values lead to a contemporaneous adjustment of the four relevant quarters. This can lead to serial correlation up to lag three. Second, benchmark revisions can lead to contemporaneous revisions for several years (and hence quarters). Third, and more generally, external shocks can lead to revisions to several periods or releases at the same time. However, the number of lags to which a *revision* can be serially correlated without being (weakly) informationally inefficient should only depend on the number of vintage quarters between the two releases. Put differently, the first to one-year revision should only reveal serial correlation up to lag three. An external shock in 1994Q4, for instance, affects three first to one-year revisions: for 1994Q2, 1994Q1 and 1993Q4. The first release for 1994Q3 and the one-year release for 1993Q3 were both published in 1994Q4 and should incorporate the shock already. We nevertheless increase the number of lags by one, for two reasons. First, national accounts are complex, and GDP estimates may require some time to fully account for any kind of external shocks. An external shock in February 1994, for instance, may not lead to a full adjustment of the first release for 1993Q4. Second, for several years, annual values were published in late September and the corresponding quarterly values were adjusted with the release of the GDP value for the third quarter, instead of the second quarter. Hence, the lag may be different for some periods. Summing up, we allow and control for serial correlation up to lag four for the stepwise revisions spanning four quarters (e.g. first to one-year), and accordingly for the other stepwise revisions. (Weak) informational efficiency tests thus require that the revisions are not correlated *beyond* these lags, while Newey-West standard errors take account of the serial correlation up to these lags (and eventual heteroscedasticity).

Table 3 summarises the results.⁶ The coefficients of panel 1, equivalent to the mean of the statistical summary, are significant for two out of the six revisions. Hence, although all means are positive, there is only limited evidence for a significant underestimation of late releases. Panel 2 addresses the (weak) informational efficiency by means of serial correlation beyond the lags specified above. The coefficients L_1 and L_2 correspond to lags five and six for the first three columns, nine and ten for column four and five, and thirteen and fourteen for the last column. Overall, revisions are weakly informationally efficient measured by these equations, but for the first to three-year revision. Joint F-tests on the two lags confirm this finding but also point to some inefficiency for the fourth column, the first to two-year

5 Cuche-Curti et al. (2008) took care of this issue, to some extent, by shortening the sample by the most recent periods.

6 Initial tests on normal distribution, stationarity and serial correlation of the revisions provide evidence for stationarity and serial correlation up to the lags specified in the previous paragraph. The tests on normally distributed revisions provide mixed results. For the two-year to three-year revision, all tests reject the null hypothesis of normal distribution. For all other revisions, at least one test does not reject. Thus, overall we assume that it is acceptable to use the Newey-West HAC standard errors, but due to this, we do interpret significances with additional caution.

Table 3: UNBIASEDNESS, EFFICIENCY AND IMPROVEMENT OVER TIME

	First to 1y	1y to 2y	2y to 3y	First to 2y	1y to 3y	First to 3y
<i>Panel 1: Unbiasedness</i>						
(Intercept)	0.0377 (0.59)	0.0863† (0.05)	0.0470 (0.18)	0.1281 (0.21)	0.1444* (0.03)	0.1937 (0.13)
<i>Panel 2: Weak informational efficiency</i>						
(Intercept)	0.0227 (0.75)	0.1004† (0.06)	0.0409 (0.26)	0.1437 (0.15)	0.1686* (0.02)	0.2412† (0.07)
L_1	0.0706 (0.39)	-0.1407 (0.13)	0.0849 (0.30)	-0.1223 (0.23)	-0.0848 (0.32)	-0.1961 (0.15)
L_2	0.0299 (0.73)	0.0211 (0.82)	0.0190 (0.70)	-0.1396 (0.28)	-0.0054 (0.93)	-0.1316* (0.04)
<i>Panel 3: Improvement of absolute revision over time</i>						
(Intercept)	0.3974** (0.00)	0.3679** (0.00)	0.0737* (0.04)	0.6002** (0.00)	0.4127** (0.00)	0.6561** (0.00)
Trend	-0.0005 (0.52)	-0.0011 (0.16)	0.0017** (0.00)	-0.0015 (0.15)	-0.0002 (0.82)	-0.0007 (0.64)
<i>Panel 4: Improvement of absolute revision over time (incl. squared trend)</i>						
(Intercept)	0.3285** (0.00)	0.3445** (0.00)	0.0385 (0.48)	0.6378** (0.00)	0.4186** (0.00)	0.6360** (0.00)
Trend	0.0028 (0.51)	0.0001 (0.99)	0.0034 (0.16)	-0.0034 (0.48)	-0.0005 (0.91)	0.0003 (0.96)
Trend2	-0.0000 (0.42)	-0.0000 (0.74)	-0.0000 (0.48)	0.0000 (0.67)	0.0000 (0.95)	-0.0000 (0.88)

This table provides estimation results for year-on-year growth rates for quarterly, non-seasonally adjusted real GDP. Values in parentheses are p-values for the corresponding coefficient. The significance levels are 1%, 5% and 10% (**, * and †). *First* denotes the first release, *1y* the release after one year, *2y* after two years and *3y* after three years. L_1 and L_2 correspond to lags five and six for the first three columns, nine and ten for the fourth and fifth, and thirteen and fourteen for the last column.

revisions.⁷ Thus, broadly summarised, there appears to be some weak informational inefficiency in terms of serial correlation. Finally, Panels 3 and 4 address the question whether absolute revisions decrease over time. The tests do not point to increasing or decreasing revisions (in absolute terms) but for the two to three-year revision, where absolute revisions apparently increase over time. This result, however, can be partly explained by the fact that annual SFSO3 releases were rarely revised for early periods, and hence quarterly values' revisions for the three-year release were often small or zero.⁸ As SFSO3 releases are revised more often in more recent periods

7 Tests including lags four, eight and twelve also support the finding of some weak informational inefficiency.

8 This fact could also effect the results for panel 2, the tests on serial correlation. Tests with a shortened sample (from 1995 onwards), however, confirm overall the results for the entire sample.

(regularly or due to benchmark revisions), this leads to a positive coefficient for the trend in absolute revisions.⁹

This study provides an initial analysis of the releases and revisions, and does not explicitly account for specific measures of robustness. Nevertheless, we want to highlight several issues regarding the *interpretation* of the results. First, based on the graphical illustration, the underestimation seems to be sample dependent: the charts reveal repeated upward revisions for the years 2003 to approximately 2007. This leads to a second issue, the effect of benchmark revisions. Benchmark revisions not only affect releases beyond the three-year releases, but may affect all releases, and hence revisions, temporarily. Referring to the particular period of 2003–2007, the major and several minor benchmark revisions during those and the subsequent years may have led to the repeated upward revisions. Hence, controlling for the link between quarterly, annual and benchmark revisions may change (the interpretation of) our findings considerably. The next section sheds more light on this issue for the mid-nineties.

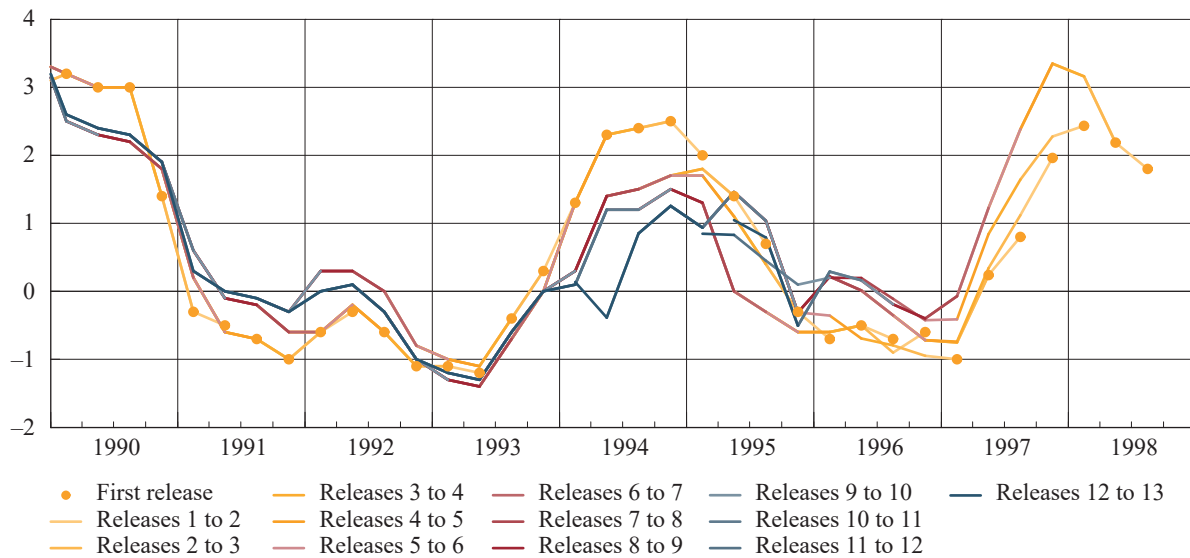
6. A closer look at the mid-nineties

The graphical description revealed noticeable revisions for early releases during the mid-nineties. It thus provides an interesting case for two questions raised above. First, we illustrate how GDP revisions can hamper the interpretation of the business cycle in real time and hence possibly affect policy-making, for example in the spirit of Cuche-Curti et al. (2008). Second, we show how annual and benchmark revisions can affect quarterly releases. Besides these two issues, this period is also important for Switzerland since it is characterised by low or negative growth rates and rising unemployment.

In order to provide a real-time look at the mid-nineties, Chart 5 plots each vintage for the real GDP growth rate between 1990Q1 and 1998Q4 as a single line (vintages shortened to three years to enhance readability). The dot at the right-hand side of each line represents the first release published by this vintage. The segments of the lines are coloured according to their release: Orange from first to one-year, red from one-year to two-year, and blue from two-year to three-year. Vertical shifts in lines represent revisions. For example, the vintage of 1998Q2 revealed a growth rate of 2.4% for the period 1998Q1 (first release, dot at 1998Q1) and 2.2% for the period 1997Q4. This represents an upward revision for 1997Q4, since the first release (dot) for 1997Q4 showed a growth rate of 2.0%. Following this vintage backwards, we see that it provided upward revisions for almost all quarters covered. Another useful example is the period 1994Q2: Early releases provided high growth rates (orange), but they were consistently revised downwards by subsequent releases (first red, then blue). During this period, national accounts were changed once, in 1997Q2, with the

9 Using absolute values for the dependent variable leads to a skewed distribution of the residuals, and hence complicates the inference on all coefficients. To a certain extent, the relatively large number of values (slightly more than one hundred) mitigates this issue. In order to increase the reliability of the (significance) results, we applied both bootstrapping and transformation methods. Both methods provide comparable results in terms of the sign (and size, if applicable) and the significance of the standard T-tests.

Chart 5: A CLOSER LOOK AT THE MID-NINETIES



This chart depicts all vintages from 1990Q1 to 1998Q4 for quarterly, non-seasonally adjusted real GDP growth rates. Each vintage is represented by a line with coloured segments (see caption for colours). In order to enhance readability, vintages are cut off after three years. Vertical shifts in lines represent revisions: In September 1995 (line starting with the dot at 1995Q2), for instance, the entire line shifts downwards, i.e. growth rates for the last two years had been revised downwards by almost one percentage point.

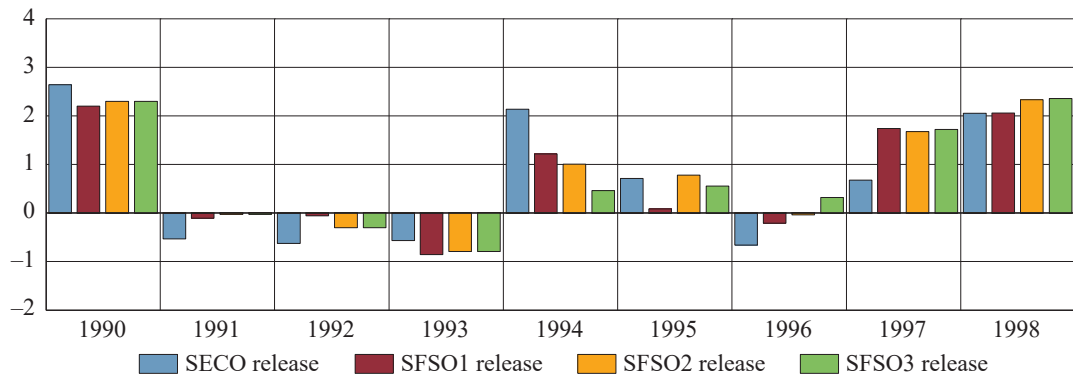
first release (dot) for the quarter 1997Q1. Note that annual releases were published late for the years 1990 to 1993, leading to adjustments of quarterly values in the fourth quarter instead of the third.

The chart can be separated into four parts: the decline in economic growth from 1990–1992, the recovery in 1994, the second decline from 1995–1996, and the upswing in 1997. For the first three parts, first releases overestimated later releases in absolute terms. Phrased differently, early releases were more ‘volatile’ than later releases. Both declines seemed to be recessions at first sight, but were then upwards substantially. In hindsight (blue lines, for instance), both recessions turned out to be periods of low or zero growth. The recovery in 1994 appeared to be substantial – first estimates suggested high growth rates of more than 2.5% – but these growth rates were repeatedly revised downwards. Already as of 1995Q3, the growth rates were revised downwards by almost one percentage point (for several subsequent quarters). Looking at the three years’ releases, the average growth rate over this period is even lower: around 0.5%. In contrast, the upswing in 1997 was underestimated in absolute terms. The recovery seemed rather weak, but was revised upwards repeatedly. For instance, the first release for 1997Q3 was approximately 0.8%, while further releases revealed a growth rate of approximately 2.5%. Such substantial revisions for several subsequent quarters may have led to noticeable changes in the assessment of current economic conditions and inflation dynamics. As Cuche-Curti et al. show, this may have further changed the current monetary policy stance.

In order to assess the link to annual and benchmark revisions, Chart 6 depicts the four specific releases for the individual annual values, placed within the year for which they are released. The periodicity of the graph is thus annual. The blue

bars represent the SECO releases, the other three bars the SFSO releases one, two and three. For instance, the blue bar for 1994 shows that SECO published an annual value of approximately 2.1 % for 1994 in March 1995, while the SFSO revised this annual GDP value downwards to approximately 1.2 %, 1 % and 0.5 % in September 1995, 1996 and 1997.

Chart 6: FOUR SPECIFIC ANNUAL RELEASES



This chart depicts four growth rate releases for annual, non-seasonally adjusted real GDP.

A comparison between Chart 5 and 6 shows the close link between quarterly and annual values, and the (potential) impact of benchmark revisions. The difference between the SFSO1 and the SECO release for 1994 in Chart 6, for instance, amounts to approximately 0.9%. This corresponds, at least graphically, to the strong downward revision of all four quarterly growth rates for 1994 in September 1995 (dot at 1995Q2). This close relationship between annual and quarterly revisions holds for almost all years. Furthermore, the overwhelming part of the annual revision occurs between the SECO and SFSO1 releases. Revisions between the SFSO releases are less frequent and less substantial, with two exceptions: 1994 and 1995. This, in turn, points to a noticeable effect of the benchmark revision in 1997 – this benchmark revision affected the SFSO1 release for 1996, the SFSO2 release in 1995 and the SFSO3 release in 1994, all three of which were subject to large revisions.

7. Concluding remarks

This economic study provides an extended data set for Swiss real-time GDP data. It shows that early releases for quarterly real GDP growth rates tend to underestimate real GDP growth, but provides only limited evidence that they are statistically significantly biased. The revisions further show some informational inefficiency through serial correlation, and neither increase nor decrease in absolute terms over time. Overall, our results are in line with previous research.

The graphical analysis in the last section confirms the (expected) close link between annual, benchmark, and quarterly revisions, at least during the mid-nineties. Thus annual and benchmark revisions can affect our results for quarterly values considerably. The various benchmark revisions between 2003 and 2008 may, for

instance, partly explain the repeated upward revision of quarterly values during this period. However, since a full investigation of this link is beyond the scope of this study, we can only interpret our results cautiously with respect to this issue.

The study further shows how (large) GDP revisions hampered the interpretation of the business cycle during the mid-nineties. A replication of the study by Cuچه-Curti et al. with an extended sample could, for instance, address this question more thoroughly, in particular the effect of such revisions on monetary policy.

Last but not least, note that all results involving the last release may change over time as each benchmark revision gives rise to adjustments to the figures. The stepwise results are, in contrast, much more stable, as only the most recent releases are affected by upcoming benchmark revisions.

References

- Basler Arbeitsgruppe für Konjunkturforschung, BAK. 1980. Vierteljährliche Nationale Buchhaltung – Rückrechnung 1983–1980.
- Basler Arbeitsgruppe für Konjunkturforschung, BAK. 1982. Dokumentation der Einzelnen Bearbeitungsschritte zur Konstruktion der Vierteljährlichen Nationalen Buchhaltung der Schweiz der BAK.
- Bundesamt für Wirtschaft und Arbeit. 1998. Die Quartals-schätzungen des Bruttoinlandproduktes auf Grundlage der revidierten Volkswirtschaftlichen Gesamtrechnung (ESVG78).
- Croushore, Dean. 2011. Frontiers of Real-Time Data Analysis. *Journal of Economic Literature* 49(1): 72–100.
- Croushore, Dean and Tom Stark. 2001. A Real-Time Data Set for Macroeconomists. *Journal of Econometrics* 105(1): 111–130.
- Cuچه-Curti, Nicolas, Pamela Hall and Attilio Zanetti. 2008. Swiss GDP Revisions: A Monetary Policy Perspective. *Journal of Business Cycle Measurement and Analysis* 4(2).
- Fernandez, Adriana Z., Evan F. Koenig and Alex Nikolsko-Rzhevskyy. 2011. A Real-Time Historical Database for the OECD. Globalization and Monetary Policy Institute Working Paper 96, Federal Reserve Bank of Dallas.
- Indergand, Ronald and Stefan Leist. 2014. A Real-Time Data Set for Switzerland. *Swiss Journal of Economics and Statistics (SJES)* 150(IV): 331–352.
- KOF Swiss Economic Institute. 1997. KOF Konjunktur Aktuell 1997/7.
- Kugler, Peter, Thomas J. Jordan, Carlos Lenz and Marcel R. Savioz. 2004. Measurement Errors in GDP and Forward-Looking Monetary Policy: The Swiss Case. Discussion Paper Series 1: Economic Studies 31/2004, Deutsche Bundesbank.
- Ruoss, Eveline and Marcel Savioz. 2002. How accurate are GDP forecasts? An empirical study for Switzerland. *Swiss National Bank Quarterly Bulletin* 3: 42–63.
- Siliverstovs, Boriss. 2011a. Are GDP Revisions Predictable? Evidence for Switzerland. KOF Working Papers 281.
- Siliverstovs, Boriss. 2011b. Dating Business Cycles in a Historical Perspective: Evidence for Switzerland. KOF Working Papers 284.
- Siliverstovs, Boriss. 2012. Keeping a Finger on the Pulse of the Economy: Nowcasting Swiss GDP in Real-Time Squared. KOF Working Papers 302.

- State Secretariat for Economic Affairs. 1997. Die neue Volkswirtschaftliche Gesamtrechnung.
- State Secretariat for Economic Affairs. 2005. Technische Notiz: Neuerungen ab dem 3. Quartal 2005.
- State Secretariat for Economic Affairs. 2006. Technische Notiz: Produktionskonto auf Quartalsbasis und neue BIP-Quartalsreihe.
- State Secretariat for Economic Affairs. 2007. Technische Notiz: Revision der Quartalsschätzung im Sommer 2007.
- State Secretariat for Economic Affairs. 2008a. Technische Notiz: Bruttoinlandsprodukt, Bruttonationaleinkommen und verfügbares Bruttoeinkommen nach Einkommensansatz.
- State Secretariat for Economic Affairs. 2008b. Technische Notiz: Revision der Quartalsschätzung im Sommer 2008.
- State Secretariat for Economic Affairs. 2012a. Informationsnotiz: Revision der BIP-Quartalsschätzungen.
- State Secretariat for Economic Affairs. 2012b. Technische Notiz: BIP-Quartalsschätzungen.
- State Secretariat for Economic Affairs. 2013. Anpassung der Systematik der Aussenhandelsdaten mit Elektrizität und Auswirkung auf die BIP-Quartalsschätzung.
- State Secretariat for Economic Affairs. 2014. Impact of the 2014 revision and transition to ESA 2010 on the Swiss QNA.
- Stekler, Herman O. 2004. The Rationality and Efficiency of Individuals' Forecasts. In *A Companion to Economic Forecasting*, eds. Michael P. Clements and David F. Hendry. Blackwell Publishing.
- Swanson, Norman. 1996. Forecasting Using First-Available Versus Fully Revised Economic Time-Series Data. *Studies in Nonlinear Dynamics & Econometrics* 1(1).
- Swiss Federal Statistical Office. 1967. Konzeption, Methoden und Quellen der Nationalen Buchhaltung der Schweiz. Beiträge zur Schweizerischen Statistik – Heft 36.
- Swiss Federal Statistical Office. 1971a. Nationale Buchhaltung. Statistisches Jahrbuch der Schweiz.
- Swiss Federal Statistical Office. 1971b. Stand der Nationalen Buchhaltung 1970. Statistisches Jahrbuch der Schweiz.
- Swiss Federal Statistical Office. 1976. Nationale Buchhaltung. Statistisches Jahrbuch der Schweiz.
- Swiss Federal Statistical Office. 1978. Revidierte Reihen der Nationalen Buchhaltung der Schweiz 1948–1976, sowie Produktionskonto 1970. Beiträge zur Schweizerischen Statistik – Heft 46.
- Swiss Federal Statistical Office. 1983. Brutto-Inlandsprodukt der Schweiz, Quartalswerte: Schätzverfahren, sowie Ergebnisse 1968–1982. Beiträge zur Schweizerischen Statistik – Heft 101.
- Swiss Federal Statistical Office. 1987. Das Bruttoinlandsprodukt der Schweiz im 4. Quartal 1986. Der Wirtschaftsspiegel 1987/3.
- Swiss Federal Statistical Office. 1997. Volkswirtschaftliche Gesamtrechnung: Methoden und Konzepte.
- Swiss Federal Statistical Office. 2003. Volkswirtschaftliche Gesamtrechnung: Eine Einführung in Theorie und Praxis.

- Swiss Federal Statistical Office. 2007. Revision der Volkswirtschaftlichen Gesamtrechnung: Wichtigste Änderungen.
- Swiss Federal Statistical Office. 2012a. Revision der Volkswirtschaftlichen Gesamtrechnung 2012: Wichtigste Änderungen.
- Swiss Federal Statistical Office. 2012b. Volkswirtschaftliche Gesamtrechnung der Schweiz 2010: Revidierte Daten für die Analyse der makroökonomischen Lage der Schweiz.
- Swiss Federal Statistical Office. 2014. VGR-Revision 2014: Wichtigste Änderungen und Auswirkungen.

A. Real-time terminology

Real-time data sets consist of several *vintages*, where each vintage represents the knowledge a researcher had about a certain variable at a given date in the past. Vintages are also called snapshots of macroeconomic data available at any given date in the past (Croushore and Stark, 2001). Each vintage covers a certain range of dates in the past, also referred to as *periods*. The values published by vintages for periods are called *releases* or *estimates*. Each period hence is subject to a series of releases through time. *Revisions* are generally referred to as the difference between two releases. Table 4 illustrates these main terms. The sand-coloured column represents the vintage of 1997Q1. The grey-coloured column represents the vintage of 2013Q1, which corresponds to the last release for this data set. The blue-coloured row is the series of releases for the period 1996Q1.

Table 4: TERMINOLOGY: VINTAGES AND RELEASES

	1996				1997				...	2014
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		Q3
1995Q3	0.4	0.4	-0.3	-0.3	-0.3	1.0	1.0	1.0	...	0.2
1995Q4	-0.3	-0.3	-0.6	-0.6	-0.6	-0.3	-0.3	-0.3	...	2.7
1996Q1	—	-0.7	-0.6	-0.6	-0.6	-0.4	0.2	0.2	...	1.3
1996Q2	—	—	-0.5	-0.5	-0.5	-0.7	0.0	0.0	...	1.0
1996Q3	—	—	—	-0.7	-0.9	-0.8	-0.4	-0.4	...	-0.2
1996Q4	—	—	—	—	-0.6	-0.9	-0.7	-0.7	...	0.3
1997Q1	—	—	—	—	—	-1.0	-0.7	-0.7	...	0.2
⋮										⋮
2014Q2	—	—	—	—	—	—	—	—	...	1.4

Benchmark vintages, or benchmark revisions, represent changes in the methodology for national accounts. If such changes occur, GDP values are often recalculated for older periods based on the updated methodology. This may lead to revisions for all periods covered by the benchmark vintage. Benchmark revisions are often referred to as *major* and *minor revisions*.

Generally, Swanson (1996) classifies economic data into three categories: preliminary, first-reported or unrevised data; partially revised or real-time data; and fully revised or final data. Adapting his notation leads to two releases, both widely used, namely the *first or initial release* and the *last or final release*. The first release is the first value that is published for any given period, while the last release is the most recent estimate for GDP (covered by the data set). Note that the last release itself is time dependent. If a researcher repeats this analysis at some point after autumn 2014, the last release may have changed due to the upcoming major benchmark revision. In order to simplify the analysis, researchers generally extract specific releases, in our case those of section 2. We refer to the quarterly releases one-year, two-year and three-year as ‘fixed lag’ releases, since the number of vintages between the two releases is constant (four quarters for the one-year release, for instance). The same holds for the annual SFSO1, SFSO2 and SFSO3 releases. Quarterly releases that depend on the vintage, in contrast, for instance those at the time of the corresponding annual SFSO release, would exhibit a varying lag for different periods.

Tables 5 and 6 illustrate the specific releases from section 2. In Table 5, the blue-shaded releases represent the SECO release, derived from the four quarters of the relevant year. The sand-coloured values represent the first, second and third SFSO release. The grey-shaded values are the last releases. The blue-shaded releases in Table 6 are the ‘fixed-lag’ first, one-year, two-year and three-year releases. The sand-coloured values represent the release of the relevant annual value. The grey-shaded values are again the last releases.

Note that the terminology can be different or extended, depending on the research question. For instance, the study by Cuche-Curti et al. (2008) relies on real-time output gap estimates. The authors calculate one output gap series per vintage, then collect specific releases from the output gap vintages. For the comparison to non-real-time data, the authors also calculate output gaps recursively (or on a rolling basis) using the last release. These estimates are called quasi real-time. For further details, please refer to their study.

B. History of Swiss GDP

Swiss national accounts (annual values)

The first official estimates for national income and net social product were released in 1941 by the institution which would go on to become the SFSO, building on private estimates for 1924 and 1929. The inclusion of additional statistical series led to (the beginnings of) the first Swiss national accounts, providing values for the gross social product, consumption and investment from 1954–1959. The concepts underlying those values, however, did not correspond to international standards. In 1961, the SFSO redefined the components of the social product, in collaboration with other institutions, and decided to move from national income statistics to a (fully developed) national accounts framework. The first values based on these national accounts, using the income and expenditure approaches, were published in 1964 for the year 1938, and the years between 1948 and 1963. The underlying definitions of transactions and aggregates, and to some extent also sectors, coincided with the normalised

Table 5: SPECIFIC RELEASES FOR ANNUAL SWISS GDP

	1995				1996				1997				2014	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		Q3
1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.8	-0.8	-0.8	...	-0.9
1992	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.1	-0.1	-0.1	...	0.0
1993	-0.9	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.5	-0.5	-0.5	...	-0.1
1994	2.1	2.1	1.2	1.2	1.2	1.2	1	1.0	1.0	0.5	0.5	0.5	...	1.3
1995	—	—	—	—	0.7	0.7	0.1	0.1	0.1	0.8	0.8	0.8	...	0.5
1996	—	—	—	—	—	—	—	—	-0.7	-0.7	-0.2	-0.2	...	0.6
⋮														⋮
2013	—	—	—	—	—	—	—	—	—	—	—	—	...	1.9

Table 6: SPECIFIC RELEASES FOR QUARTERLY SWISS GDP

	1995				1996				1997				2014	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		Q3
1994q1	1.3	1.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	...	2.2
1994q2	2.3	2.3	1.4	1.4	1.4	1.4	1.2	1.2	1.2	-0.4	-0.4	-0.4	...	0.8
1994q3	2.4	2.4	1.5	1.5	1.5	1.5	1.2	1.2	1.2	0.9	0.9	0.9	...	1.3
1994q4	2.5	2.5	1.7	1.7	1.7	1.7	1.5	1.5	1.5	1.3	1.3	1.3	...	0.8
1995q1	—	2	1.8	1.8	1.7	1.7	1.3	1.3	1.3	0.9	0.9	0.9	...	-1.3
1995q2	—	—	1.4	1.4	1.1	1.1	0	0.0	0.0	1.5	1.5	1.5	...	0.3
1995q3	—	—	—	0.7	0.4	0.4	-0.3	-0.3	-0.3	1.0	1	1	...	0.2
1995q4	—	—	—	—	-0.3	-0.3	-0.6	-0.6	-0.6	-0.3	-0.3	-0.3	...	2.7
1996q1	—	—	—	—	—	-0.7	-0.6	-0.6	-0.6	-0.4	0.2	0.2	...	1.3
1996q2	—	—	—	—	—	—	-0.5	-0.5	-0.5	-0.7	0	0.0	...	1.0
1996q3	—	—	—	—	—	—	—	-0.7	-0.9	-0.8	-0.4	-0.4	...	-0.2
1996q4	—	—	—	—	—	—	—	—	-0.6	-0.9	-0.7	-0.7	...	0.3
1997q1	—	—	—	—	—	—	—	—	—	-1	-0.7	-0.7	...	0.2
1997q2	—	—	—	—	—	—	—	—	—	—	0.2	0.2	...	1.9
1997q3	—	—	—	—	—	—	—	—	—	—	—	0.8	...	3.2
⋮														⋮
2014q2	—	—	—	—	—	—	—	—	—	—	—	—	...	1.4

system of the OEEC, the predecessor of the OECD. The production approach, in contrast, had to be skipped, due to the lack of (reliable) statistical series on production. In 1970, the divergence between the income and the expenditure approaches grew too large and the SFSO ceased publishing national accounts figures. It was not until 1976 that the SFSO published revised national accounts – still primarily based on the OEEC system and the income and expenditure approaches, but with several elements of the upcoming ESA78 (European adaption of the System of National Accounts 1968) already implemented. In the interim, the SFSO published provisional

values for the social product only, based on the expenditure approach.¹⁰ This interruption from 1971–1976 sharply increased interest in the production approach. Although the SFSO published a production account for 1970 in 1975, regular annual production accounts were still not possible. References for this first paragraph are to be found in the references section under Swiss Federal Statistical Office (1967, 1971b,a, 1976, 1978, 1997).

By 1997, the ESA78 had been fully implemented. Despite the release of an updated version of the European adaption of SNA (ESA95) in 1996, the SFSO decided to implement ESA78 first, for two reasons. First, the transition to ESA95, in particular its final form, which had not yet been published, would have required too much time. Second, the SFSO expected to gain valuable information from the implementation of ESA78. The transition to ESA95 was scheduled for 2001. The revision in 1997 put considerable emphasis on the production approach, based on several modifications to the required base statistics made in the early nineties. Note that the implementation of the production approach related to annual values only – the next section provides more details concerning the approaches for quarterly values. For additional details on the implementation of ESA78 see Swiss Federal Statistical Office (1997), State Secretariat for Economic Affairs (1997), or KOF Swiss Economic Institute (1997). Originally scheduled for 2001, the implementation of ESA95 was accomplished in 2003. Apart from numerous changes in concepts and methodology, ESA95 also introduced a new concept for the calculation of real values: Instead of referring to a fixed year, real GDP now consisted of chained values. For additional details on (the implementation of) ESA95 see Swiss Federal Statistical Office (2003, 2007).

In September 2014, the SFSO (and SECO) implemented the most recent system of national accounts, the ESA2010. This benchmark revision included substantial changes for investment (research and development, and military expenditure) and improved the link between the national accounts and the balance of payments. For additional details, refer to Swiss Federal Statistical Office (2014) and State Secretariat for Economic Affairs (2014).

The revisions of 1997, 2003 and 2014 are major ones. However, the SFSO also implemented two other, minor revisions to the national accounts between 2003 and 2014. In 2007, the SFSO applied a minor revision that (primarily) contained new or changed base statistics, such as insurance sector-related statistics. In 2012, the SFSO (primarily) adopted the new classification of economic activities (NOGA2008). Note that although such minor revisions seem less relevant in terms of methodology, they may cause substantial changes in levels. For instance, with the minor revision of 2012, the GDP value for 2010 was revised upwards from CHF 550 to CHF 574 billion. For further details, see Swiss Federal Statistical Office (2007, 2012b,a) or the previous section.

10 National accounts generally consist of a set of accounts and tables, measured using several approaches, while the SFSO only published selected series for these years.

Quarterly values

The first quarterly estimates for Swiss GNP were published in 1966 by the SFSO and covered periods back to 1962. With the interruption of the national accounts in 1971, however, quarterly values again became unavailable for a further few years. It was not until 1980 that the Basler Arbeitsgruppe für Konjunkturforschung at the University of Basel (today BAK Basel Economics) published quarterly GDP series for the years from 1963–1980. In 1983, the SFSO also resumed publishing quarterly GDP values, covering the years back to 1967. Note that although the series from these two institutions were not fully synchronised, both institutions focused on the expenditure approach. The SFSO also provided seasonally adjusted series. For further details see Swiss Federal Statistical Office (1971b, 1983) and Basler Arbeitsgruppe für Konjunkturforschung (1980, 1982). In 1987, the federal government transferred the responsibility for quarterly GDP values to the Bundesamt für Konjunkturfragen (merged with other government offices and renamed SECO in 1999) (Swiss Federal Statistical Office, 1987).

Since these first series, quarterly GDP estimates have undergone several revisions. The implementation of ESA78 in 1997 represented a first major revision, involving the implementation of ESA78 and the adjustment of several estimation methods. Briefly summarised, GDP components were estimated using the expenditure approach, while aggregate GDP was estimated using production indicators directly. The residual of these two approaches was captured by changes in inventories. See Bundesamt für Wirtschaft und Arbeit (1998) and KOF Swiss Economic Institute (1997) for further details. In 2003, SECO began to implement ESA95, the second major revision. First, quarterly values had to be adjusted to changes in annual values (2003–2004), and historical values back to 1980 were published (first quarter of 2005). Second, the expenditure components of GDP were revised, but, as yet, no quarterly series based on ESA95 were published. In the first quarter of 2006, the quarterly production accounts were finished, and a new quarterly GDP series based on ESA95 was published. For more details, see State Secretariat for Economic Affairs (2005) and State Secretariat for Economic Affairs (2006). Note that the income approach had not been implemented for quarterly series up to 2008, and that seasonal adjustment methods also underwent a revision during the implementation of ESA95. The third and most recent major revision occurred in September 2014. While applying all changes highlighted in the section on annual values, SECO also introduced a more thorough treatment of calendar and seasonal effects in quarterly accounts. See State Secretariat for Economic Affairs (2014) for further details.

In general, all revisions of annual national accounts also affect quarterly national accounts. Quarterly national accounts were thus also affected by the two minor revisions from 2007 and 2012. For further details, see State Secretariat for Economic Affairs (2007) and State Secretariat for Economic Affairs (2012b,a) or the previous section. Due to the different nature of quarterly national accounts, however, SECO applied several additional, minor revisions. These included (with the main changes in parentheses): 2006 (production account), 2008 (income approach), 2009 and 2011 (seasonal adjustment) and 2013 (electricity trading). The main references for these revisions are State Secretariat for Economic Affairs (2007, 2008b,a, 2012b,a, 2013).

C. Data set

We used both printed and electronic sources to collect the real-time data. Electronic files (from SECO) are available back to 1995. Before 1995, we used five printed sources to increase the availability of values and to be able to cross-check the values. The sources are the publications *Wirtschaftsspiegel* and *Statistisches Jahrbuch der Schweiz* from the SFSO, electronic files and the publication *Die Volkswirtschaft* from the SECO, the publication *Monthly Statistical Bulletin* from the SNB, and the publication *Konjunktur Aktuell* from the KOF Swiss Economic Institute. Selected single series were extracted from other publications, such as those of the Swiss Federal Statistical Office (1983).

We aggregated the various publication frequencies to quarterly vintages, where the quarter captures the knowledge at the end of the quarter. To allow a more precise timing of the releases, publication days are provided for a selection of quarterly and annual values in Table 7. These publication days were extracted from corresponding articles in two Swiss newspapers, the *Neue Zürcher Zeitung* (NZZ, online archive back to 1993) and *Le Journal de Genève* (accessed by the historic archive of *Le Temps*). Overall, we collected four variations of aggregate GDP, all non-seasonally adjusted: nominal level, nominal growth rate, real level and real growth rate. No GDP components were collected.

Table 7: PUBLICATION DATES

<i>Quarterly values (SECO)</i>							
Period	Publ. date	Period	Publ. date	Period	Publ. date	Period	Publ. date
1982	1 —	1983	1 04.07.1983	1984	1 —	1985	1 21.06.1985
	2 —		2 —		2 21.09.1984		2 20.09.1985
	3 —		3 20.12.1983		3 21.12.1984		3 23.12.1985
	4 30.03.1983		4 20.03.1984		4 22.03.1985		4 24.03.1986
1986	1 23.06.1986	1987	1 05.06.1987	1988	1 03.06.1988	1989	1 02.06.1989
	2 19.09.1986		2 18.09.1987		2 —		2 19.09.1989
	3 —		3 04.12.1987		3 —		3 30.11.1989
	4 —		4 04.03.1988		4 03.03.1989		4 27.02.1990
1990	1 07.06.1990	1991	1 04.06.1991	1992	1 1)	1993	1 04.06.1993
	2 31.08.1990		2 —		2 28.08.1992		2 31.08.1993
	3 30.11.1990		3 —		3 01.12.1992		3 01.12.1993
	4 05.03.1991		4 03.03.1992		4 05.03.1993		4 24.02.1994
1994	1 2)	1995	1 10.06.1995	1996	1 12.06.1996	1997	1 13.06.1997
	2 08.09.1994		2 08.09.1995		2 18.09.1996		2 16.09.1997
	3 09.12.1994		3 13.12.1995		3 10.12.1996		3 10.12.1997
	4 04.03.1995		4 12.03.1996		4 12.03.1997		4 13.03.1998
1998	1 11.06.1998	1999	1 08.06.1999	2000	1 08.06.2000	2001	1 07.06.2001
	2 08.09.1998		2 10.09.1999		2 14.09.2000		2 19.09.2001
	3 10.12.1998		3 09.12.1999		3 07.12.2000		3 13.12.2001
	4 11.03.1999		4 09.03.2000		4 08.03.2001		4 07.03.2002
2002	1 06.06.2002	2003	1 05.06.2003	2004	1 27.05.2004	2005	1 02.06.2005
	2 12.09.2002		2 04.09.2003		2 10.09.2004		2 09.09.2005
	3 28.11.2002		3 27.11.2003		3 26.11.2004		3 01.12.2005
	4 27.02.2003		4 05.03.2004		4 03.03.2005		4 02.03.2006

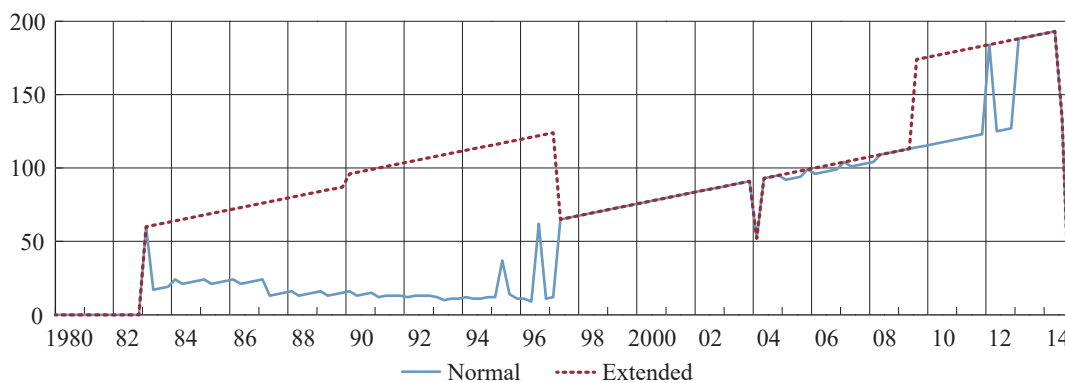
<i>Quarterly values (SECO)</i>							
Period	Publ. date	Period	Publ. date	Period	Publ. date	Period	Publ. date
2006	1 01.06.2006	2007	1 31.05.2007	2008	1 02.06.2008	2009	1 02.06.2009
	2 07.09.2006		2 04.09.2007		2 02.09.2008		2 01.09.2009
	3 01.12.2006		3 30.11.2007		3 04.12.2008		3 01.12.2009
	4 06.03.2007		4 04.03.2008		4 03.03.2009		4 02.03.2010
2010	1 01.06.2010	2011	1 31.05.2011	2012	1 31.05.2012	2013	1 30.05.2013
	2 02.09.2010		2 01.09.2011		2 04.09.2012		2 03.09.2013
	3 02.12.2010		3 01.12.2011		3 29.11.2012		3 28.11.2013
	4 02.03.2011		4 01.03.2012		4 28.02.2013		4 27.02.2014
2014	1 28.05.2014						
	2 30.09.2014						

<i>Annual values (SFSO)</i>							
Period	Publ. date	Period	Publ. date	Period	Publ. date	Period	Publ. date
1989	22.09.1990	1990	21.09.1991	1991	19.09.1992	1992	18.09.1993
1993	03.09.1994	1994	05.09.1995	1995	04.09.1996	1996	12.09.1997
1997	09.09.1998	1998	11.09.1999	1999	13.09.2000	2000	07.09.2001
2001	02.09.2002	2002	02.09.2003	2003	02.09.2004	2004	03.09.2005
2005	01.09.2006	2006	01.09.2007	2007	30.08.2008	2008	29.08.2009
2009	27.08.2010	2010	27.08.2011	2011	31.08.2012	2012	29.08.2013
2013	30.09.2014						

This table contains the dates of publication for the first release of quarterly and annual values. For the sources, please refer to the text. Comments: 1) no precise date, but release was known at 12.06.1992; 2) NZZ at 28.6.1994: ‘as recently published’.

Chart 7 provides the number of values per vintage for the real GDP growth rate. The blue line represents the raw data set, as collected from the sources. We ‘extend’ the vintages (red line) for real GDP growth rates by recalculating growth rates from levels, wherever feasible, and copying selected longer vintages – generally recalculations by the SFSO or other institutions. For the latter, we assume that the corresponding vintages were subject to no benchmark revisions.

Chart 7: LENGTH OF REAL GDP GROWTH RATE VINTAGES



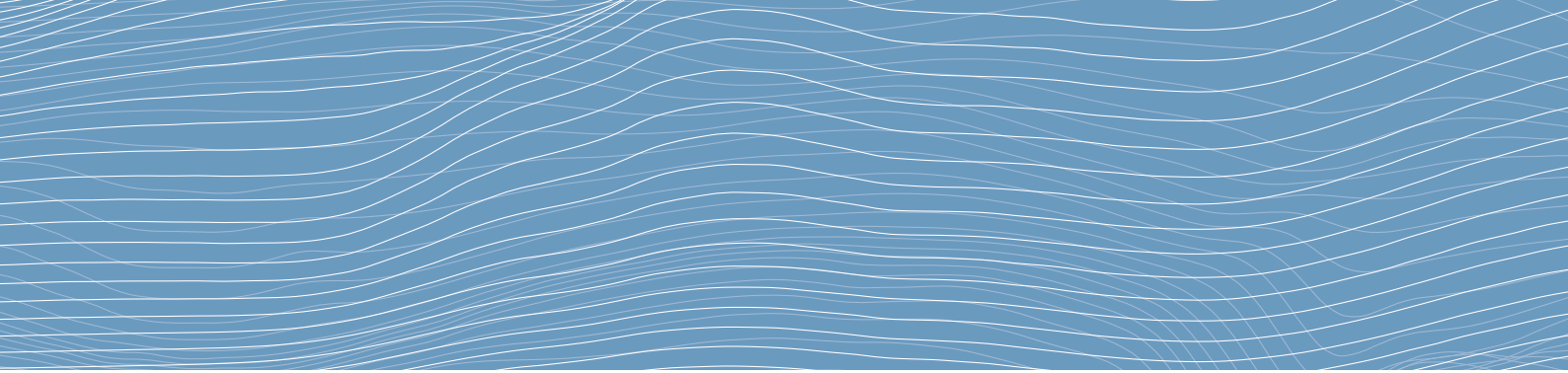
SNB Economic Studies

- 09/2016 Severin Bernhard: A real-time GDP data set for Switzerland
- 08/2014 Barbara Rudolf and Mathias Zurlinden: A compact open economy DSGE model for Switzerland
- 07/2013 Marco Huwiler and Daniel Kaufmann: Combining disaggregate forecasts for inflation: The SNB's ARIMA model
- 06/2009 Katrin Assenmacher-Wesche and M. Hashem Pesaran: A VECX* model of the Swiss economy
- 05/2009 Nicolas Alexis Cuche-Curti, Harris Dellas and Jean-Marc Natal: A dynamic stochastic general equilibrium model for Switzerland
- 04/2007 Jonas Stulz: Exchange rate pass-through in Switzerland: Evidence from vector autoregressions
- 03/2007 Ernst Baltensperger, Philipp M. Hildebrand and Thomas J. Jordan: The Swiss National Bank's monetary policy concept – an example of a 'principles-based' policy framework
- 02/2006 Caesar Lack: Forecasting Swiss inflation using VAR models
- 01/2005 Mathias Zurlinden: Credit in the monetary transmission mechanism: An overview of some recent research using Swiss data

As of issue 8/2014, the publication series is called *SNB Economic Studies* (previously: Swiss National Bank Economic Studies).

All SNB Economic Studies are available for download at: www.snb.ch, Research

Subscriptions or individual issues can be ordered at:
Swiss National Bank
Library
P.O. Box
CH-8022 Zurich
Phone: +41 44 631 32 84
Fax: +41 44 631 81 14
E-mail: library@snb.ch



SCHWEIZERISCHE NATIONALBANK
BANQUE NATIONALE SUISSE
BANCA NAZIONALE SVIZZERA
BANCA NAZIUNALA SVIZRA
SWISS NATIONAL BANK

