Covid-19 outbreak and beyond: A retrospect on the information content of registered short-time workers for GDP now- and forecasting.

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Covid-19 outbreak and beyond: A retrospect on the information content of registered short-time workers for GDP now- and forecasting.

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Abstract

We document whether a simple, univariate model for quarterly GDP growth is able to deliver forecasts in a crisis period like the Covid-19 pandemic, which may serve cross-checking forecasts obtained from elaborate and expert models used by forecasting institutions. We include shocks to the log number of short-time workers as timely available current-quarter indicator. Yearly GDP growth forecasts implied by quarterly forecasts serve cross-checking, in particular at the outbreak of the pandemic.

Keywords: Bayesian analysis, Covid-19, pseudo real-time, ordinances, SECO, KOF.
JEL-Code: C32, C53, E23, E27

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[†]All data and programs are available upon request. I thank Milen Arro for her help with the collection of forecasts released by the State Secretariat of Economic Affairs and KOF Economic Institute.

1 Introduction

In the parent paper, Kaufmann (2020) (KA20 in the following) exploited the timely available number of short-time workers to obtain a now- and forecast of quaterly GDP growth at the outbreak of the Covid-19 pandemic. In a first univariate auto-regression, the log number of monthly short-time workers was purged from the systematic component, to obtain the shocks or innovations to the series. Monthly innovations were cumulated to quarterly shocks, which entered contemporaneously and with lags a second univariate regression fitted to quarterly GDP growth. It turned out that shocks explained an additional 24% of variation in GDP growth, and the model forecasted well the decline in quarterly level GDP during the financial crisis. At the time, the model forecasted a maximum decline in quarterly GDP of -5.7%, with a highest forecast density interval (HFDI) of -9.5% to -2.9%. The forecast was quite in line with those published by forecast institutions in Switzerland, like the State Secretariat of Economic Affairs (SECO) or KOF Economic Institute (KOF).

The pandemic has lasted much longer than first expected in 2020. To curb the first wave of infections, most countries followed lockdown strategies, imposing very strict social distancing measures. The benefit of reducing new infections to a very low number within two to three months came at very high economic and social costs. Moreover, even very strict and longer-lasting lockdown strategies pursued in neighbouring countries proved unsuccessful in preventing resurgent infection waves. Switzerland has experienced five waves, the fifth ongoing with a record-high incidence exceeding 4,000 (compared to roughly 160 (300) in April 2020 (2021)). Although more infectious, recent mutations of the Sars-Cov-2 virus have proven to be less aggressive. Against the background of an increasing share of population vaccinated or recovered, the virus is expected to become endemic.

During the last two years, Switzerland never re-installed as strict social distancing measures as during the first half year of 2020.[1] Subject to quarantining and testing rules, persons could always move freely. Beginning 2021, re-installed federal restrictions concerned mainly restaurants and recreational businesses, without imposing a complete shutdown, however. For example, while indoor dining was prohibited, restaurants were allowed to provide take-away and later on again outdoor dining services. The maximum number of

[1] See Bundesrat (2020a) for the federal ordinance on measures to combat the Covid-19 epidemic. For an overview of changes in measures from April 27 to November 30 2020 see the table published online by the Federal Office of Public Health,
https://www.bag.admin.ch/dam/bag/en/dokumente/mt/k-und-i/aktuelle-ausbrueche-pandemien/2019-nCoV/covid-19-tabelle-lockerung.pdf.download.pdf/Easing_of_measures_and_possible_next_steps.pdf,
and for changes since December 1 to date https://www.bag.admin.ch/dam/bag/en/dokumente/mt/k-und-i/aktuelle-ausbrueche-pandemien/2019-nCoV/tabelle-aenderungen-massnahmen.pdf.download.pdf/Changes_measures.pdf (Accessed as of January 31 2022).

persons per group, or imposed indoor social distancing measures were successively relaxed during Spring 2021. To counteract the negative effect of ongoing cantonal and re-installed federal restrictions, the Federal Government prolonged or reactivated some of the simplified administrative procedures installed in Spring 2020 to apply for and obtain short-time work benefits, like cancelling the waiting time, offering summary settlement, extending the eligibility period, or disregarding earnings from secondary employment.[2] After the unprecedented increase to 1.4 million short-time workers in April 2020,[3] numbers decreased to a quarter million (254,000) in October. In November, the number of short-time workers started increasing again to reach over half a million (524,000) in February 2021. Since then, numbers have decreased, reaching 48,000 in October 2021.

Two consecutive years of more or less severe Covid waves alongside with volatile restriction regimes rendered forecasting GDP difficult. In the present paper, we use the approach presented in KA20, and based on a pseudo real-time exercise, we evaluate how a simple univariate model fares in obtaining GDP forecasts during a crisis period as experienced during the past two years. We will compare these forecasts to those published in real-time by Swiss economic forecasting institutions.

The next section presents the data and outlines the econometric procedure. Section 3 discusses the results, and Section 4 concludes.

2 Data and econometric procedure

2.1 Data

Figure 1, Panel (a), plots the monthly number of short-time workers on a logarithmic scale.[4] The data downloaded from www.amstat.ch as of January 9 2022, cover the period January 2004 to October 2021. The series is concatenated with data from a pdf-file published on the website of the State Secretariat of Economic Affairs (SECO), to obtain a sample starting in January 2000. We see the unprecedented increase to 1.4 and 1.1 million in, respectively, April and May 2020. As Covid-related restrictions successively were relaxed from June 2020 onwards, numbers decreased to roughly 254,000 in October 2020. To curb the second wave of infections starting in Fall 2020, restrictions were re-

[2] See Bundesrat (2020b), for the version in place and past changes to the federal ordinance on measures related to the unemployment insurance during the Covid-19 epidemic (available in German, French and Italian). See Brühlhart et al. (2020) for an evaluation of businesses' recourse to Covid-19 related financial support during 2020.

[3] As of May 2020, 1.9 million employees were pre-registered for short-time work in April.

[4] Here, I use the term workers rather than employees, as in March 2020, additional groups like self-employed and employed managing staff became as well eligible for short-time work benefits.

installed first canton-wise, and ultimately country-wide towards the end of 2020. Against the background of ongoing restrictions, the number of short-time workers increased again to reach 524,000 in February 2021. Since April 2021, the number of short-time workers has decreased continuously to around 48,000 in October 2021, a level comparable to the peak during the financial crisis.

Obviously, the extreme volatility in short-time workers transmits directly into productive capacity. Panel (b) of Figure 1 plots quarterly GDP growth, downloaded from the SECO website as of January 9 2022. The drop by 6% in the second quarter 2020 is unprecedented, more than twice as large as the drop at the onset of the financial crisis. Unlike the financial crisis shock, the Covid-19 shock is expected to have a transitory effect on level GDP. The large negative growth rate in the second quarter was offset by an equally large rebound in the third quarter of 2020. In retrospect, the negative effect of the Covid-19 outbreak has been much milder than expected early in 2020. Quarterly GDP figures published by SECO imply a decrease in real GDP by 2.5% for 2020,[5] whereas in April (May) 2020 SECO (KOF) forecasted GDP to drop by 6.7% (5.5%).

Obviously, high volatility in production renders now- and forecasting GDP growth during a crisis very difficult. When a large sector of an economy like the service sector faces recurrently changes between regimes of tight and looser restrictions, current and future outcomes become less predictable. In the following, we assess whether the simple univariate model used in KA20 provides yearly GDP forecasts that could serve cross-checking forecasts obtained from more elaborate and expert models.

2.2 Model and forecasting equations

We first fit an autoregressive process to the log number of short-time workers n_t^s

$$n_t^s = \mu_n^s + \varphi_1 n_{t-1}^s + \cdots + \varphi_l n_{t-l}^s + \nu_t^s,\ \nu_t^s \sim \text{i.i.d.} N(0, \delta^2) \tag{1}$$

where $t = 1, \ldots, T_n$ is a monthly time index. Cumulate within-quarter monthly shocks to obtain a quarterly series of shocks to short-time workers, $\nu_t^q = \sum_{j=0}^{2} \nu_{t-j}^s$. This series captures the unsystematic or news component in short-time workers. Included along with four lags in an univariate autoregressive regression fitted to quarterly GDP, these shocks explained additional 24% of data variation (KA20). However, estimates suggest that lags of shocks in short-time workers have no marginal effect on current-quarter GDP growth, see Equation (8) in KA20 where highest posterior density intervals are roughly centered

[5] In August 2021, the Federal Statistical Office, which reports GDP at the yearly frequency, published a drop in GDP by 2.4% for 2020 (https://www.bfs.admin.ch/bfs/de/home/statistiken/volkswirtschaft/volkswirtschaftliche-gesamtrechnung/bruttoinlandprodukt.html, accessed on January 31).

at zero. In the following analysis, we take into account that unusually large shocks nevertheless may have a more persistent effect on GDP growth in following periods. We proceed by cumulating shocks in short-time workers up to m lagged quarters, $\nu^q_{t,m} = \sum_{j=0}^{m} \nu^q_{t-j}$, and add this information to explain variation in current-quarter GDP growth y_t:

$$y_t = \mu_y + \theta \nu^q_{t,m} + \phi_1 y_{t-1} + \cdots + \phi_p y_{t-p} + \sum_{j=1}^{3} \psi_j D_{jt} + \varepsilon_t,\ \varepsilon_t \sim \text{i.i.d} N(0, \sigma^2) \qquad (2)$$

where $t = 1, \ldots, T$ is a quarterly time index, and D_{jt} represent quarterly dummies. Specification (2) provides the basis to forecast quarterly GDP growth from quarter F onwards, $F > T$. For posterior inference, m is specified such that first-quarter forecasts y_F include the information of shocks to short-time workers cumulated since the outbreak of the pandemic, i.e. since the first quarter 2020, see details in the following subsection. Posterior inference of Equations (1) and (2) is obtained by Bayesian Markov chain Monte Carlo methods, see the sampling steps described in Subsection 2.3 of KA20. The mean across draws of residuals ν^s_t flow into $\nu^q_{t,m}$.

We obtain forecasts and the forecast distribution by a posterior predictive analysis, using the posterior sample of parameters:

$$y_{F+h} = \hat{\mu}_y + \hat{\theta} \nu^f_{F+h,m} + \hat{\phi}_1 y_{F+h-1} + \hat{\phi}_p y_{F+h-p} + \sum_{j=1}^{3} \hat{\psi}_j D_{jt} + \hat{\varepsilon}_{F+h},\ h = 0, \ldots, H \qquad (3)$$

where F is the starting quarter of the forecast window, y_{F+h-j} is observed if $F+h-j < F$. The hat indicates that a forecast series (or projection) is obtained for each posterior draw of parameters; note that we incorporate model uncertainty $\hat{\varepsilon}_{F+h}$, drawing from $N(0, \hat{\sigma}^2)$. Shocks $\nu^f_{F+h,m} = \sum_{j=1}^{m} \nu^q_{F+h-j}$ cumulate ν^s_t for $t < T_n$, and $\nu^s_t = 0$ for $t > T_n$.

2.3 Forecasting procedure

In the following pseudo-real time exercise, we produce dynamic quarterly GDP growth forecasts up to horizon H based on Equation (3), starting with a so-called nowcast for quarter F, where F runs from the first quarter 2020 (the outbreak of the Covid pandemic) to the fourth quarter of 2021, $F = 2020Q1, \ldots, 2021Q4$. Using these quarterly forecasts, we derive implied forecasts for yearly GDP growth rates.

During a highly volatile crisis, we may have to make specific choices as regards the sample to use for estimating Equations (1) and (2). In Panel (a) of Figure 1 we observe that the Covid outbreak manifests as a one-time, huge shock in short-time workers, without apparently changing autoregressive dynamics. Therefore, we expect posterior inference

of Equation (1) to remain quite stable, even if the sample end T_n extends beyond the first quarter 2020. On the other hand, Panel (b) shows that the volatility in GDP growth remains persistently higher after the Covid outbreak, and comes along with a considerable change in dynamics when compared with historical figures. We expect estimates of Equation (2), in particular estimates of autoregressive coefficients, to highly depend on the sample window chosen. Extending T beyond the first quarter 2020, most likely would reverse the sign of an usually positively estimated first-order autoregressive coefficient. Ultimately, this would induce unusual dynamics into forecasts starting in periods following the first quarter 2020. Against the background of these considerations, we proceed as follows.

To obtain the series of shocks ν_t^s, we estimate Equation (1) applying an expanding window up to including the most recent available observation n_t^s in quarter F, i.e. up to the observation of the third month in quarters we nowcast GDP growth, except for the last sequence, where only the observation of the first month, namely October 2021, is available. Note that numbers of short-time workers in fact are released with a lag of three months, which means that in real-time, the most recent observations would have to be completed by pre-registered data, if available. Based on results in KA20, we set $l = 3$. Figure 2, Panel (a), plots the mean in-sample one-step ahead forecast errors, cumulated within-quarter to ν_t^q, obtained by expanding the sample size T_n up to the starting forecast quarter F, $F = 2020Q1, \ldots, 2021Q4$. As expected, expanding the estimation window beyond the first quarter of 2020 does not have a large effect on estimates, and shocks are not revised substantially either.

As motivated above, we estimate Equation (2) based on a fixed window, i.e. the sample end T is always the fourth quarter of 2019. According to results in KA20, we set $p = 2$. As we move F in Equation (3) further into 2020 and 2021, we expand the window over which we accumulate shocks, $m = F - T - 1$, in order to estimate the marginal effect of $\nu_{t,m}^q$ on current-quarter GDP growth. The nowcast y_F^f thus includes the effect of $\nu_{F,F-T-1}^q$, i.e. the effect of all shocks cumulated since the first quarter 2020. The dots in Panel (a) of Figure 1 represent $\nu_{F,F-T-1}^q$, and Panel (b) plots the posterior distribution of θ conditional on specified shocks $\nu_{t,F-T-1}^q$, $F = 2020Q1, \ldots, 2021Q4$. The marginal effect of shocks decreases as F moves further ahead. The result confirms that Equation (2) with a specification of m depending on F is able to incorporate the notion that the marginal effect of a (large) shock cumulated into $\nu_{t,m}^q$ diminishes the further back in time it occurred.

3 Forecasts

Using Equation (3), we produce forecasts of quarterly GDP growth over sequential forecast windows starting in $F = 2020Q1, \ldots, 2021Q4$ and ending eight quarters ahead, $H = 8$. The implied mean forecasts for log-level quarterly GDP are plotted in Figure 3. The figure also plots the 95% HFDI for the forecast window starting in the first quarter 2020. Released GDP figures from first quarter 2020 to third quarter 2021 lie within this interval. Interestingly, except for the forecasts starting in the third quarter 2020 (the quarter following the through), all mean projections end within this interval. All projections starting in a quarter of 2020 are highly volatile, whereby first-period forecasts inherit previous periods' direction before mean-reverting to the growth pattern implied by the autoregressive process. The absence of new substantial shocks after 2020, renders projections smoother, reflecting mainly the autoregressive process estimated for the pre-crisis period.

The third panel in Table 1 displays mean yearly GDP growth rates (95% HFDI) implied by these quarterly projections. For comparison, the table includes in the first and second panel forecasts released in real-time by, respectively, SECO and KOF.[6] Against the background of the unprecedented restrictions imposed in the first half of 2020, the forecasted negative GDP growth rates in the first half year were much larger than updates published in the second half year. The pandemic expected to be a one-year transitory event, GDP was predicted to strongly recover in 2021. Based on real-time data, forecasts published in KA20 implied a decrease (increase) in yearly GDP growth of 4.1% (2.7%) for 2020 (2021). The HFDI included all published forecasts of SECO and KOF, except for -6.7% published by SECO in April 2020.

In retrospect, the effective number of short-time workers turned out to be lower than pre-registered in April 2020, namely 1.4 versus 1.9 million, respectively. The pseudo real-time projections starting in the first quarter of 2020, forecasts a mean decrease in GDP by 2.9% and a rebound by 2.3% in, respectively, 2020 and 2021. The mean forecast for 2020 happens to be close to the decline of 2.4% released by the Federal Statistical Office in August 2021.[7] Although the mean forecast for 2021 is lower than forecasts published during 2020 by SECO and KOF, the upper tail of the HFDI (0.6,3.8) includes GDP growth rates published by SECO (3.5%) and KOF (3.6%) in December 2021.

The volatile projections starting in the third and fourth quarter 2020 translate into volatile forecasts for yearly GDP growth. The growth rates predicted in September imply the

[6] State Secretariat for Economic Affairs (2020a-2020e, 2021a-2021d), KOF Swiss Economic Institute (2020a-2020e, 2021a-2021d). Figures correspond to forecasts including large sports events.

[7] Federal Statistical Office (2021).

Covid outbreak to have a permanent negative level effect on GDP, while in December growth rates forecast a rapid recovery to pre-crisis GDP levels in 2021 (see also Figure 3). The December mean forecast for 2020 (-1.4%) is less pessimistic than figures published by SECO (-3.3%) and KOF (-3.5%), while the mean forecast for 2021 aligns with figures published by SECO and KOF.

The renewed increase in short-time workers in the fourth quarter 2020 translates into uncertain prospects for GDP growth at the beginning of 2021.[8] Finally, forecasts for 2021 implied by projections starting in the second half of 2021 are aligned with those released by SECO and KOF. Looking ahead, the model forecasts a moderate increase of GDP for 2022 (2.3%), roughly 1% lower than forecasted by SECO and KOF. Nevertheless, the HFDI again encompasses these figures.

4 Conclusion

We document how a simple, univariate model fares during the two past years of the pandemic in predicting quarterly GDP growth. The model includes shocks or news to the number of short-time workers as timely available indicator. Although less pessimistic, forecasts of yearly GDP growth implied by quarterly projections are in line with forecasts published by SECO and KOF at the outbreak of the crisis. In retrospect, conditional on effective numbers of short-time workers GDP growth would have been predicted to decline by 2.9% in 2020, and the 95% HFDI encompasses the decline of 2.4% released by the Federal Statistical Office in August 2021. Subsequent projections starting in 2020 turn out to be more if not too volatile. The projection starting in September imply the Covid outbreak to have a permanent negative level effect on GDP, while the one starting in December predicts a quick recovery to pre-crisis GDP level. Forecasts for 2021 improve and align to figures published by SECO and KOF in the second half year of 2021.

Obviously, an univariate model fitting quarterly GDP growth is too simple to deliver fully reliable projections. Nevertheless, results document that shocks in (log) short-time workers include valuable information to forecast GDP growth at the beginning of a crisis period like the pandemic outbreak in the first quarter 2020. Highly volatile, i.e. oscillating production rebounds call for dynamic model adjustments, for example in autoregressive dynamics, to obtain more stable forecasts as the crisis persists. However, as the effect of major shocks vanishes, projections imply forecasts of yearly GDP growth rates that are aligned with forecasts published by SECO and KOF. Overall, we conclude that the

[8] Likewise, the decreasing trend in the daily fever curve of Burri and Kaufmann (2020) came temporarily to a halt around the turn of the year 2020 to 2021, see https://github.com/dankaufmann/f-curve/ (Accessed on January 31 2021).

number of short-time workers contains valuable information to now- and forecast quarterly GDP growth. Yearly GDP growth forecasts implied by these quarterly forecasts may serve cross-checking other forecasts.

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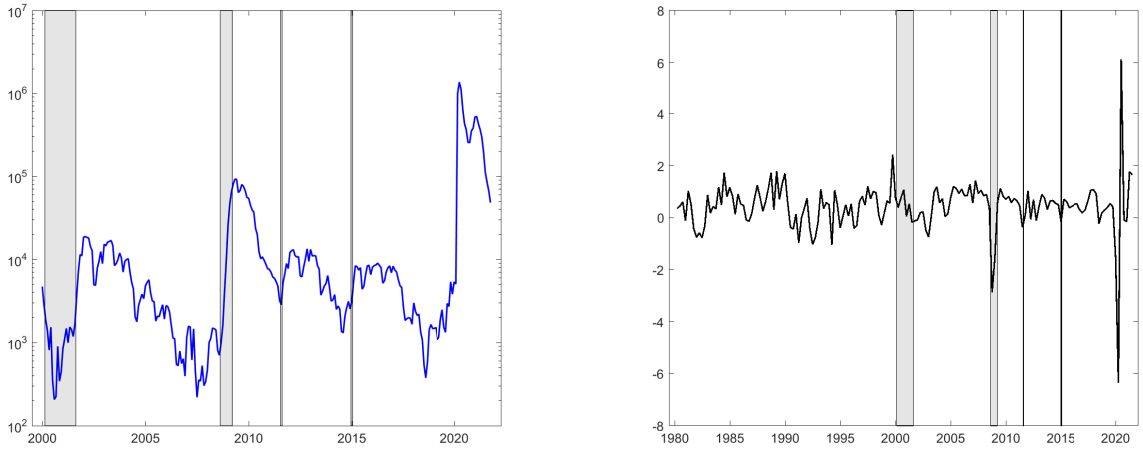
Table

Table 1: Yearly GDP growth forecasts and releases.

	Date	2020	2021	2022	Date	2021	2022	2023
State Secretariat of Economic Affairs (2020a-2020e, 2021a-2021d), real-time								
	19/03/20	-1.3	3.3		11/03/21	3.2	3.5	
	23/04/20	-6.7	5.2					
	16/06/20	-6.2	5.3		15/06/21	3.8	3.5	
	12/10/20	-3.8	4.2		16/09/21	3.4	3.2	
	15/12/20	-3.3	3.2	3.3	09/12/21	3.5	3.2	1.7
KOF Economic Institute (2020a-2020e, 2021a-2021d), real-time								
	17/03/20	0.3	1.4		25/03/21	3.0	2.8	
	15/05/20	-5.5	5.4					
	16/06/20	-5.1	4.3		22/06/21	4.0	2.8	
	22/10/20	-3.6	3.2	2.4	06/10/21	3.2	3.6	1.5
	15/12/20	-3.5	3.2	2.6	16/12/21	3.6	3.0	2.1
KA20, real-time								
	30/04/20	-4.1	2.7					
		(-6.5,-1.5)	(-0.1,5.4)					
Short time workers model, Equation (3), pseudo real-time								
	31/03/20	-2.9	2.3		31/03/21	-1.1	1.5	
		(-4.7,-1.0)	(0.6,3.8)			(-4.0,1.7)	(-0.4,3.8)	
	30/06/20	-1.7	1.7		30/06/21	1.3	1.2	
		(-2.8,-0.4)	(-0.1,3.6)			(0.1,2.6)	(-0.8,3.4)	
	30/09/20	-6.5	0.9		30/09/21	3.1	2.0	
		(-7.7,-5.3)	(-1.9,3.5)			(2.3,4.0)	(-0.3,4.4)	
	31/12/20	-1.4	3.9	1.4	31/12/21	3.5	2.3	1.8
		(-2.1,-0.7)	(0.4,7.4)	(-0.6,3.4)		(3.1,3.8)	(-0.3,4.5)	(-0.3,3.9)
SECO (see notes to Figure 1)								
Download	06/01/22	-2.5						
Federal Statistical Office (2021)								
Release	26/08/21	-2.4						

Figures

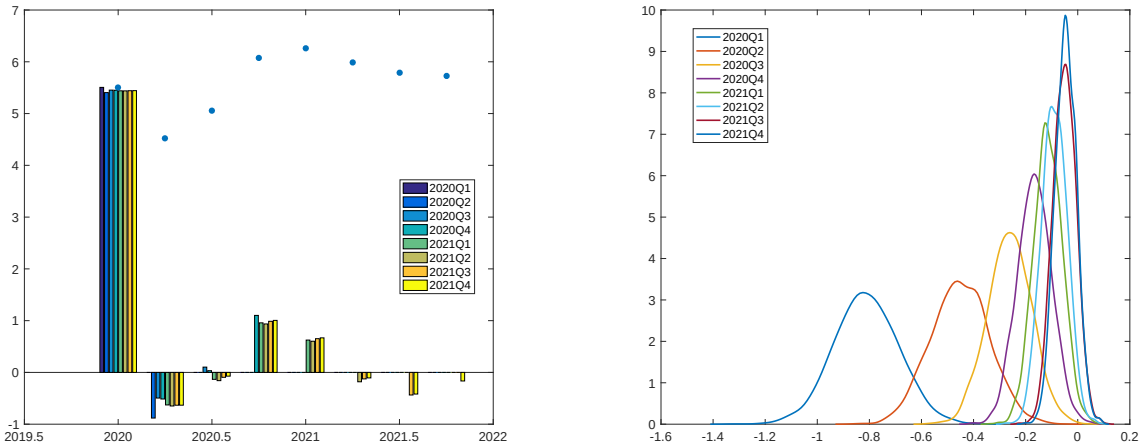
Figure 1: Time series. (a) Short-time workers. Monthly frequency, logarithmic scale. (b) Real GDP growth, quarterly frequency, percentage scale. Gray bars highlight the dotcom and financial crises, the introduction and discontinuation of the euro-Swiss franc floor.



(a) (b)

Short-time workers, concatenated data: Published pdf-file (https://www.seco.admin.ch/seco/de/home/Arbeit/Arbeitslosenversicherung/leistungen/kurzarbeitsentschaedigung.html) as of May 1, 2020, January 2000 – December 2003; download (https://www.amstat.ch/v2/index.jsp) as of January 9, 2022, January 2004 – October 2021. GDP growth: Download (https://www.seco.admin.ch/seco/en/home/wirtschaftslage—wirtschaftspolitik/Wirtschaftslage/bip-quartalsschaetzungen-/daten.html) as of January 9, 2022.

Figure 2: Log short-time workers. (a) Mean in-sample one-step ahead forecast error. Expanding sample period: April 2000 – third (first) month of starting forecast quarter $F = 2020Q1, \ldots, 2021Q3$ ($F = 2021Q4$). The dots represent cumulated shocks up to starting forecast quarter. (b) Posterior distribution of θ. Sample period: First quarter $2000 + \max(p, m)$ – fourth quarter 2019.



(a) (b)

Figure 3: Out-of-sample implied quarterly GDP forecast. The shaded area is the 95% HFDI of the projection starting in 2020Q1.