The Macroeconomic Effects of COVID-19 in Montenegro: A Bayesian VAR Approach

Gordana Djurovic (gordana@t-com.me)
University of Montenegro https://orcid.org/0000-0002-4999-3010
Vasilije Djurovic
University of Montenegro
Martin M Bojaj
University of Montenegro https://orcid.org/0000-0003-1433-4821

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Abstract: The outbreak of COVID-19 has faced the globe with economic upheaval. The research problem of this paper focuses on examining, diagnosing, and assessing appropriate macroprudential policy response of the Montenegrin government to the evolution of the pandemic disease. We explore three economic scenarios – shocks – of how the pandemic disease might impact the economy of Montenegro in the dawn of entering the European Union. We forecast a sustainable GDP growth model from January 2006 until December 2017. Deterministic-static simulation solution model – the baseline – is employed, adding sensitivity scenarios – shocks – from January 2018 until Jun 2018, respectively, from -10% until -60%. Thus, we observe what happens to GDP, capital stock, human capital, and employment. The model measures econometrically the macroeconomic costs, using Bayesian VAR independent Normal-Wishart prior, of the pandemic disease in terms of demand and supply lost due to illness and closed activities in the GDP growth in various pandemic scenarios. The supply side is hit severely through employment and human capital, while the demand through the capital stock. The measures, focused on securing employment and keeping highly qualified staff in Montenegro's companies are justified public finance spending.The results show a toll on the GDP, employment, capital stock, and especially human capital for 2018. Still, most likely, fast recovery of GDP growth is predicted in 2019 in case macroprudential policymakers make an appropriate fiscal and monetary combination puzzle.

Keywords: Pandemics, risk, macroeconometrics, forecast.

JEL: H5, D8, C5, E17.

Introduction

In late December 2019, a cluster of unexplained pneumonia cases has been reported in Wuhan, China. A few days later, the causative agent of this mysterious pneumonia was identified as a novel coronavirus. This causative virus has been temporarily named as severe acute respiratory syndrome coronavirus 2 and the relevant infected disease has been named as coronavirus disease 2019 (COVID-19) by the World Health Organization, respectively (Feng He at al.,2020) With incredible speed, the health crisis has grown into a deep economic crisis that has spread accros the world.

The pandemic disease COVID-19, as we write, continues to spread into the integrated world, especially from human to human, having no vaccine to offset such an outbreak. No health system in the globe is capable of stopping the virus. The epidemic center initiated in China, and after four weeks, other epicenters have been identified, such as Japan, Iran, Italy, Spain, Germany, United Kingdom, United States, and throughout the globe. The uncertainty about

the emergence of new cases and locations is not silent. The World Health Organization (WHO) has announced an international health concern.

Each country is facing economic consequences. Policymakers are trying to identify concrete measures to counter such an outbreak. Stock markets are dropping drastically. At the time of writing, the Dow Jones Industrial Index fell by 36.4% from February 18, 2020, until March 23, 2020 (DJIA, 2020). The US Federal Reserve (FED) has taken important and extraordinary measures to support market functioning and economic resilience. Most countries went the same route, creating generous support measures for businesses and citizens.

The focus of this paper is the analysis of the effect of the health crisis COVID-19 on the economic crisis in the case of Montenegro. It is small, open, a euro-ised economy focused on tourism, located in southeast Europe. Montenegro creates its gross added value of 8.2% in agriculture, 12.5% in industry (including energy production), 7.2% in construction, and 72% in services, of which direct tourism is around 10%. Employment in the service sector is 82%, while the balance from the current account and capital account is 15% of GDP. At the same time, GDP/Public debt ratio is 77% in 2019, and maneuver for a new borrowing is limited since annual debt service obligations are 11% of GDP (Central Bank of Montenegro, 2020). The growth model is based on steady foreign direct investment inflow and services. The main foreign policy strategic priority of this Western Balkans country is the full-fledged membership to the European Union. The COVID-19 PANDEMIC creates a significant impact on Montenegro's economy and livelihoods and will likely create a recession in 2020 (instead of a 3.4% expected real growth rate).

The first projections go from -1.3% including contraction of the economic activities in April-May and gradual recovery in June-July (World Bank, February 2020), via 3% from the Central Bank of Montenegro (4 months scenario), up to -9% (IMF, April 2020) which includes a reduction in the second quarter and gradual recovery in the second half of the year. The full extent of the impact is difficult to quantify, given the evolving nature of the pandemic, but job losses and an increase in poverty are expected.

A limited number of studies have examined the potential consequences of such a pandemic on the economy of Montenegro. The objective of this paper is to fill this space by examining the macroeconomic effects of COVID-19, employing monthly data from January 2006 until 2017, and out-of-sample data from January 2018 until December 2018, predicting the movement of macro-model variables. The novelty of the research is that we measure and add the effects of demand and supply variables cumulatively. Thus, we measure the COVID-19 impact for the first time in the Montenegrin economy using a Bayesian vector autoregressive (VAR) and forecasting sensitivity deterministic-static scenario model. We apply alternative forecasting scenarios to all the macroeconomic variables. Since the pandemic disease is an exogenous shock, we change the assumptions of the exogenous variables by a certain amount, make a shock to it, and then work out how the forecast changes as a result of the change in the assumption. The employment, capital stock, and human capital drop hypothetically from -10%, -20%, -30%, -40%, -50, and -60%, respectively from January 2018 until Jun 2018. The assumption is that the direct pandemic disease lasts three months, from January 2018 until March 2018. Still, the side effects stretch for the upcoming three months as well, from April 2018 until June 2018. The assumption is based on the premise

that even though the pandemic disease disappears for three months, its economic impact continues to deepen the consequences. It is a once-off counter windfall since the pandemic time-horizon is predicted to last for 6 months, from the very start to the very end. Namely, we assume that the direct impact starts in January until March, and from April until the end of June (six month scenario, with two 3-month periods of strong pandemic crisis impact and 3-month period of gradual recovery). The question that comes is, then what impact would that have on the GDP_GAP of Montenegro potentially?

By adopting monthly data gives us a better suitability observation period than models using quarterly or annual data since the pandemic is occurring even on an hourly and daily bases. Thus, it will enable us to observe the transition from one month to the other in the short and long-run. Moreover, the assumptions made in the study include all stages of severity, starting from a low-middle-severe stage. We included all stages since significant uncertainties exist about the pandemic disease, and different severities help us observe a more comprehensive picture as long as the medical technology is unable to prevent it from sharing from one human to the other.

The paper is organized as follows. First, we refer to the literature which considers comprehensive studies on the economic effects of epidemics. Second, we apply the vector autoregression (VAR) and BVAR, focusing on the assumptions of demand and supply shocks and deterministic-static simulations to study pandemic scenarios. We start with the *baseline* scenario and then modifying the macro-model by introducing new premises. Third, we present results and compare them with different models.

Literature

The history of pandemic diseases has led to many macroeconomic pieces of research and methodologies used. The fearest of the massive outbreak was the Black Death in the 14th century and Spanish influenza in 1918-1919 (Jonung and Roeger, 2006). In the last century, three strong pandemic diseases influenced the globe (Kilbourne, 2006).

Many studies have linked health and growth (Pritchett and Summers, 1996; Bloom and Sachs, 1998; Bhargava and et al., 2001; Cuddington et al., 1994; Cuddington and Hancock, 1994; Robalino et al., 2002a; Robalino et al., 2002b; WHO Commission on Macroeconomics and Health, 2001; Haacker, 2004). Still, there is no unanimous consensus among macroeconomists about the methodology and consequently results (Bell and Lewis, 2004).

The conventional approach is not appropriate since it uses only mortality and morbidity as independent variables in estimating the loss on growth rate. The chain effect of pandemic disease is multidimensional through supply labor, foreign direct investments, and demand – increasing government expenditure on health care, but not only. Several macroeconomic models have been applied to study the impact of diseases such as the G-Cubed multi-country model, which are dynamic-stochastic general equilibrium models developed by McKibbin and Wilcoxen, 1999-2013, McKibbin and Triggers, 2018, and McKibbin and Fernando, 2020. Koegh-Brown et al., 2009 use COMPACT model to epidemiological data on previous UK influenza pandemics, and show three scenarios of loss: a) low severity, a loss of 0.58% and 3.35%, yearly and quarterly, respectively; b) mild severity, a decline of 4.5% and 21%, annual and quarterly, respectively, and; c) high severity, a loss of 6% and 29.5%, yearly and

quarterly, respectively. McKibbin and Fernando, 2020, conclude that the scale of costs could be avoided by investing in public health systems in less developed economies. A conventional influenza epidemic panel-regression analysis of 43 countries reveals an economic and consumption decline of 6% and 8%, respectively (Barro et al., 2020). Weng 2016 uses GDP and consumption growth rates as dependent variables, while flu death rates and their 1st and 2nd lags as independent variables, making an analogy of Spanish influenza with 2008-2009 global Great Recession, predicting an economic dislocation.

Brainerd and Siegler (2003) propose that the 1918-1919 pandemic increased economic growth a year later. A similar argument is provided for South Africa (Young, 2004). Nevertheless, some researchers assess the model used by the US Congressional Budget Office in 2005. All models have two assumptions in common: a) the consideration of pandemic from a health perspective and b) macroeconomic model.

Methodology

Even though making predictions ex-ante, based on forecasting rather than real results, has high macro-econometric uncertainty, but still, we, macroeconomists, think that such examinations can not be counterproductive. Since the effects of a pandemic engage the spillover of travel cancellations, meetings, and significant events, they will contribute to a depressed economy worldwide.

Since the Government of Montenegro nationalized 2030 Agenda on Sustainable Development by adopting the National Strategy for Sustainable Development (NSSD) in 2016, together with a corresponding Action Plan for its implementation, our econometric model, production function, is remodeled as follows (Djurovic et al., 2018):

$$GDP\_GAP_t = \beta_0 + \beta_1 CapitalStock_t + \beta_2 logHumanCapital_t + \beta_3 Emp_t + u_t \quad (1)$$

where GDP_GAP_t denoted the gross domestic growth HP filtered gap, $CapitalStock_t$ denotes the gross fixed capital formation (% of GDP), $logHumanCapital_t$ denotes the natural logarithm of human capital (in this case this series comprises of employed with higher education, critical for keeping smart and sustainable growth), emp_t denotes the employment to the labor force (important for inclusive and sustainable growth). The data are sourced from the World Bank, except for human capital time series from the Statistical Office of Montenegro. The time series have been interpolated and seasonally adjusted. Since the COVID-19 is with symmetric shock to the economy, the gross fixed capital formation summarized impacts on the demand side (linked to the FDI drive model of economic growth). In contrast, human capital and employment are related to effects on the supply side of Montenegro's economy. We employ a New Keynesian macro-model, where GDP growth is modeled with neoclassical production function using capital and labor as input (Roeger et al., 2004). We consider employment and human capital, on the supply side, since the impact of the disease incapacitates a lot of employment force and those who care for the incapacitated ones. On the other hand, we use capital stock to measure the demand side. Accordingly, the Government of Montenegro has taken an appropriate national strategy to respond to the pandemic disease COVID-19 (Government of Montenegro, 2020).

We reveal a significantly wider knowledge gap. First, conceptual specification, based on which empirical examinations of GDP_GAP pandemic influenza determinants are analyzed, is not prevailing, combining theory and empirical results. Second, we use Bayesian VAR, identifying a recursive structural model and summing up all the effects of each scenario to the corresponding variable. It has not been applied to Montenegrin data. Since the policymakers are interested to hypothetically see the reaction of GDP in different situations, such as a decrease in human capital or a decrease in capital stock. Hypothetically, we create three shocks, each simultaneously effecting each other and summing up the shocks to have a better view of the cumulative reaction of economic growth. The model has demand and supply variables, incorporating, in the meantime, prospective fiscal and monetary policy shocks, which would equilibrate the economy with conventional and nonconventional policy measures.

Empirical results

Based on unit root tests of ADF, PP, and KPSS stationary tests, the variables prove stationarity. Visual inspection, along with correlograms, confirms the stationarity. Structural breaks are identified using the stability diagnostics such as recursive estimates, Chow breakpoint test, Quandt-Andrews, and Bai-Perron. Thus, we added dichotomous variables.

Recursively, we identify a SVAR model of GDP. As seen in Table 1, all the criteria suggest a fitting length of 2 lag orders, as indicated by Clark and Ravazzolo, 2015.

Table 1: VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1928.002	NA	30609423	28.58826	28.93092	28.72751
1	-720.1632	2273.578	0.748458	11.06122	11.74655	11.33972
2	-437.3250	515.7638*	0.014809*	7.137133*	8.165129*	7.554884*
3	-430.0096	12.90967	0.016869	7.264847	8.635508	7.821848
4	-425.2042	8.197438	0.019972	7.429473	9.142800	8.125725
5	-421.6381	5.873454	0.024131	7.612326	9.668317	8.447828
6	-418.0332	5.725438	0.029217	7.794606	10.19326	8.769360
7	-414.4370	5.500183	0.035488	7.977014	10.71834	9.091018
8	-411.4118	4.448837	0.043629	8.167820	11.25181	9.421074

* indicates lag order selected by the criterion

Source: Authors' calculations

The stationarity of the VAR (2) is confirmed since all the inverse roots of the characteristic polynomial lie within the unit circle.

Table 2: VAR (2) residual serial correlation LM

Lags	LM-Stat	Prob
1	22.14723	0.1385
2	7.220576	0.9688
3	2.938432	0.9999
4	1.998823	1.0000
5	1.932459	1.0000
6	2.850541	0.9999
7	3.123212	0.9998

Probs from chi-square with 16 df.

Source: Authors' calculations

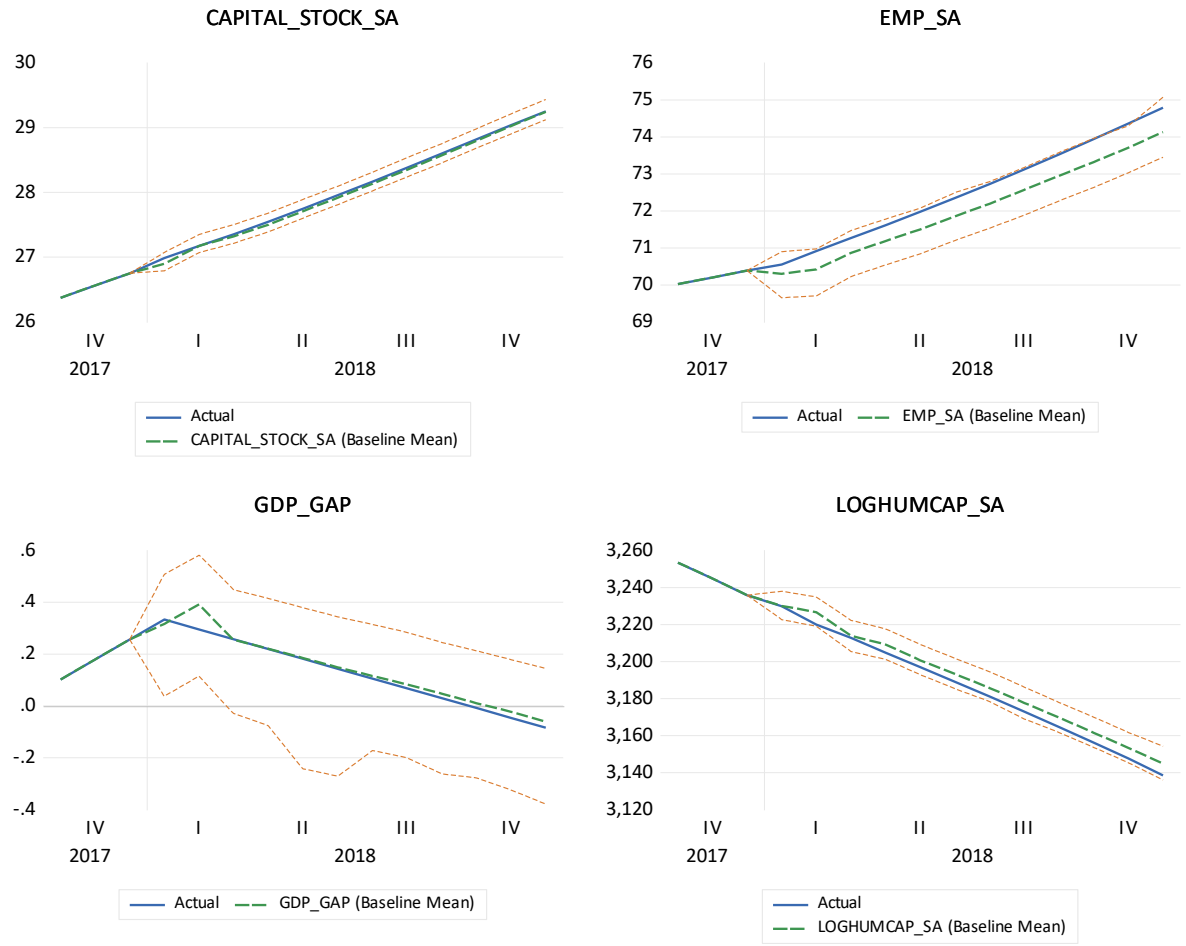
Table 2 shows the VAR (2), based on the autocorrelation LM test for serial correlation, accepts the null hypothesis of no serial autocorrelation up to order 7.

We are interested in forecasting the economic upheaval of COVID-19, which appears to be more severe than what the globe witnessed during the Financial Crisis of 2008-2009.

Before proceeding further, we need to mention that there two ways of doing forecasting. The first is within the sample, which cuts the sample into two parts. The first part of the sample is used to make an estimation, and the second part of the data that hasn't been included in the regression for forecasting. The other option is to use all of the data available and do out-of-sample forecasting. To generate a forecast, we can use known values or forecasted values. Using the known values for forecasting is *static* forecasting, where we go back to the original data and ignore the previous forecast and use actual value to generate the forecast. This technique ignores any forecasting errors. In case we proceed using the forecasted values from regression, then it is *dynamic* forecasting. Here, if we continue to keep using static forecasting, using the known values, since the Government is not interested in allowing forecasted errors to increment on themselves. Thus, the Government adjusts the operations and interventions as needed, and consequently, we use static forecasting. Moreover, we use *deterministic simulation*, where we get only one value for the solution, which does not respond to innovations (yielding a single forecast rather than a distribution of possible values). It calculates under the current set of assumptions or known facts without any shocks introduced, which is called the *baseline.*

As noticed in Figure 1, the GDP model fits best into a 4.5 - 9% confidence band throughout the year of the forecasting performance, confirming that the model is well fitted for prediction.

Figure 1: Stochastic-static simulator model forecasting performance of VAR (2)



Source: Authors' calculations

Let us see what a Bayesian VAR model tells us about the probability of the COVID-19 impact-shock in the Montenegrin economy. Using Bayes' theorem, we can calculate this probability. A regression model with unknown coefficients β, the variance-covariance matrix $\sum_e$, and $e_{t\sim} nid\ N(0, \sum_e)$, Bayes' theorem is employed to combine the prior distribution of the parameters with the likelihood function of the data to produce a posterior distribution of coefficients β, viz (Ouliaris et al., 2018; Chin and Li, 2018).

$$p(\beta \mid \sum_e, Y) = \frac{L(Y|\beta, \sum_e)\, p(\beta|\sum_e)}{p(Y)} \tag{2}$$

and consequently, we get that the posterior distribution is the likelihood function times the prior distribution:

$$p(\beta \mid \sum_e, Y) \propto L(Y \mid \beta, \sum_e)\, p(\beta \mid \sum_e) \tag{3}$$

In our case, the simplification would like $p(MNE \mid shock) = \frac{L(shock|MNE)\, p(MNE)}{p(shock)}$. The Bayes' theorem allows us to update our opinion based on new information. Yesterday's posterior beliefs (updated opinion) are today's prior (opinion to be updated). The idea about updating beliefs is core to Bayesian econometrics and can be used to test the hypothesis. We start with some idea or belief, based on econometric inference, about how something works. Simulation methods of different types of priors get us different posteriors. In the case of the

normal distribution of the prior β, normal distribution will have the posterior as well, and the matrix weighted average of the OLS estimates of the mode and mean of the prior β is:

$$\bar{b} = \left[\underline{V^{-1}} + \sum_e^{-1} \otimes (X'X)\right]^{-1}\left[\underline{V^{-1}}\,\underline{b} + (\sum_e^{-1} \otimes X')y\right] \quad (4)$$

As seen from the above expression (4), the Bayesian methods tend to shrink the VAR estimated coefficients towards the prior mean, distant from the OLS estimates. Forecasting gains are exactly the just mentioned characteristic: shrinking the VAR estimates towards the prior mean. VARs often end up with the over-fitting problem, which can result in imprecise forecasts. Since VARs have many parameters to estimate $n(np+1)$, often inaccurate because of limited data, and consequently response functions and forecasts not well determined, thus the number of coefficients easily proliferates. Standard error bands tend to not account for parameter uncertainty, making forecasts to look more prices than they are really. The Bayesian method introduces *prior* distributions, including, *inter alia,* parameter uncertainty. The idea is to have a parsimonious model, a restricted number of parameters being estimated. Literature has emerged with practical solutions to omit some lagged values p in some equations, which is usually referred to as "best sub-set VARs." In this section, we will apply Bayesian methods, which set *valuable prior distributions* on the whole structure of the VAR coefficients to get a parsimonious onset.

Relative to our previous VAR model, we estimate BVAR prior type of Litterman/Minnesota, Normal-Flat, Independent Normal-Wishart, Sims-Zha (normal-Wishart), and Giannone-Lenza-Primiceri to perform out-of-sample forecasting from January 2017 to December 2017. Our primary variable of interest is GDP_GAP. Table 3 shows the results. There is an improvement in the forecasts.

Compared to the standard VAR (2) estimate, the BVAR of prior independent normal-Wishart shows to have the lowest root mean square error (RMS) of 0.028869 and mean absolute error (MAE) 0.016830, given the setting $\mu_1 = 0$. Since we have proven that the VAR (2) is stationary, and $\lambda_1 = 0.1$, implying a strong prior for β. Standard deviations of the first variables, in each equation, are controlled through λ_1, shrinking the first-lag coefficients. Relative to the VAR parameter estimates, the lagged coefficients have shrunk.

Table 3: Forecasting using Bayesian estimation methods 2018:1-2018:12

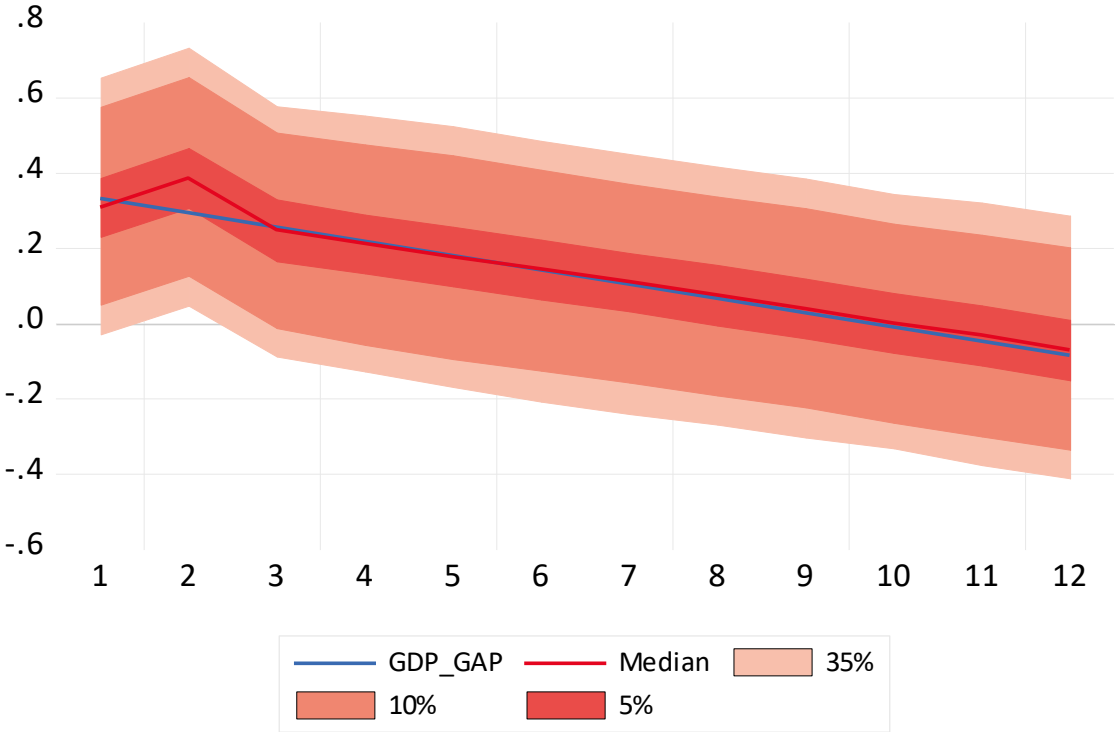
Prior		Variable	RMSE	MAE
Standard VAR	Model 1	GDP_GAP	0.031045	0.018866
Minnesota	Model 1	GDP_GAP	0.090412	0.085904
Normal-Flat	Model 1	GDP_GAP	0.034419	0.024212
Normal-Wishart	Model 1	GDP_GAP	0.034421	0.024216
Indep. N-W	Model 1	GDP_GAP	**0.028869**	**0.016830**
Sims-Zha (N-W)	Model 1	GDP_GAP	0.090923	0.086150
Giannone, L & P	Model 1	GDP_GAP	0.252499	0.250291

Source: Authors' calculations

The blue represents the actual values, and the red line the median value. Then, the rest represents the fans of quantiles. Visual inspection reveals that the Bayesian VAR (2) model, in Figure 2, fits the best into the median most of the time. It shows a sustainable forecasting performance.

So far, we have reached a critical point, identifying the most suitable model for forecasting GDP: Bayesian VAR of independent normal-Wishart prior.

Figure 2: Forecasting performance of GDP_GAP using Bayesian independent normal-Wishart prior, 2018:1 2018:12



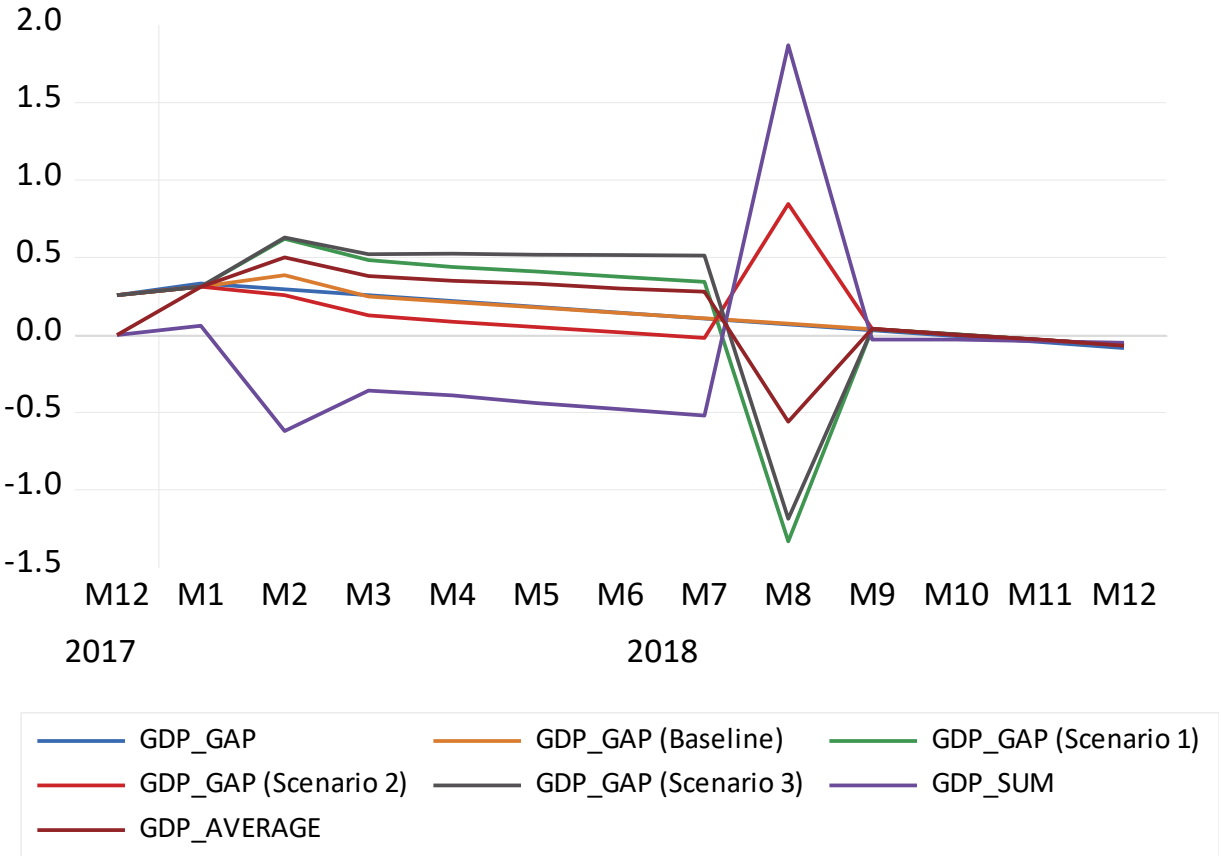
Source: Authors' calculations

Sensitivity Analysis

The macroprudential policymakers of Montenegro, especially the Ministry of Finance and the Central Bank of Montenegro, are interested in having a close prediction of GDP to the outbreak of COVID-19. We consider GDP as a leading indicator. The alternative scenarios start altering the data from January 2018 until July 2018. We assume that the employment, capital stock, and human capital decrease from -10%, -20%, -30%, -40%, -50%, and -60%, respectively from 2018:1-2018:6. We assume that the direct impact starts in January until March, and from April until the end of June, the economy keeps decreasing since the recovery of small and medium businesses dealt with a struggle in the first quarter. Consequently, we assume that the impact of the pandemic outbreak does end until the end of June.

Scenario 1 represents the employment decrease, scenario 2 represents the capital decrease, and scenario 3 represents the human capital decrease. The blue line denotes the real GDP_GAP, the orange line denotes the baseline, the green line denotes scenario 1 (decrease of employment), the red line denotes the scenario 2 (capital stock decrease), the dark gray denotes scenario 3 (human capital decrease), the purple line denotes the cumulative effect of the scenario 1-3 differences of real GDP_GAP, and the brown line denotes the average combination effect of the scenarios 1-3.

Figure 3: GDP_GAP BVAR independent normal-Wishart deterministic-static alternative scenarios.



Source: Authors' calculations

The static solution uses actual data instead of forecasted lagged values over the forecast period. We find it most suitable for the pandemic disease since the Government manages the situation in an hourly bases. The visual inspection of Figure 3 reveals that scenario 2 (the capital decrease) impacts the most GDP_GAP in Montenegro, forecasting a reduction in the GDP_GAP from 0.31166 to -0.019669, respectively from January 2018 until July 2018. Moreover, the recovery of the FDI inflow in Montenegro's economy could be expected soon after the end of the health crisis.

Furthermore, the sum of the differences between the real GDP_GAP and scenarios 1-3 predicts the GDP_GAP to decrease for the first seven months and afterward, an abrupt increase. Why would scenario 2 drag this increase? Since Montenegro is in the process of converging towards the European Union, investors (FDIs and their substantial impact on the gross fixed capital formation) would not drop their foreign direct investments. They will continue to invest in the Montenegrin economy, soon after the COVID-19 pandemic, and continue to powerfully increase the GDP. In this model, it is a very promising trend.

Interestingly, we notice that in the 3rd quarter that the GDP_GAP is predicted by scenarios 1 and 3 to drop sharply. In words: since the companies let their valuable employees go out of the doors in the 1st and 2nd quarter of 2018, the multiplicative effect would bring to a decrease in the GDP_GAP. The logical conclusion regarding priority Government measures is to be

focused on securing employment through different economic-social means during the COVID-19 pandemic. Soon after recovery, the economy will respond positively and that workers will be essential immediately to contribute to the economic recovery dynamic.

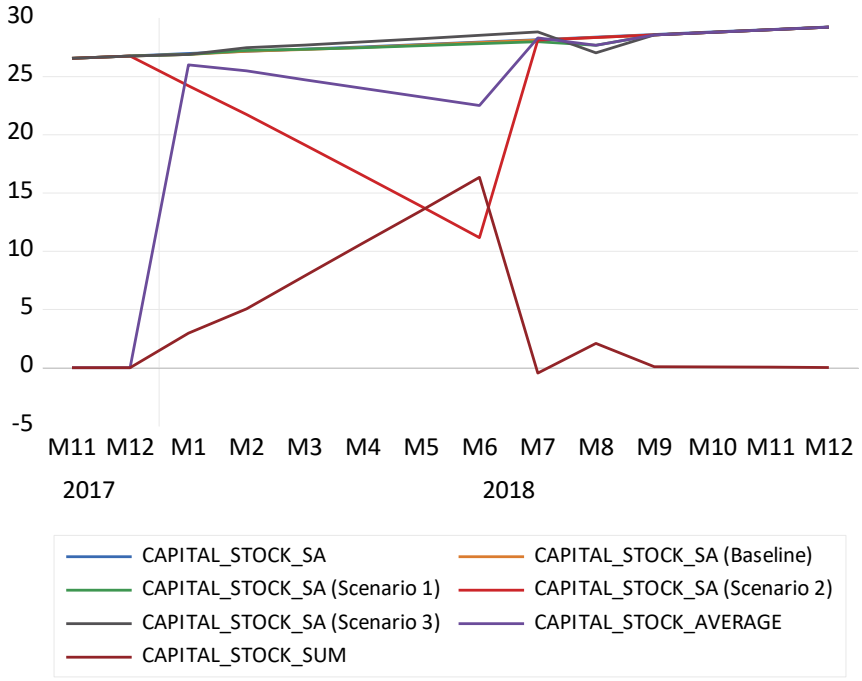
Table 4: Employment Bayesian VAR cumulative and combined alternative scenarios

	Emp	Baseline	S 1	E-S1	S 2	E-S2	S 3	E-S3	∑ of Δ	Average
Jan-18	70.55	70.31	63.28	7.27	70.31	0.24	70.31	0.24	7.74	67.97
Feb-18	70.92	70.43	56.34	14.58	71.58	-0.66	72.19	-1.27	12.65	66.70
Mar-18	71.27	70.88	49.61	21.65	71.97	-0.70	72.83	-1.56	19.39	64.80
Apr-18	71.62	71.19	42.71	28.90	72.34	-0.72	73.41	-1.79	26.39	62.82
May-18	71.98	71.52	35.76	36.21	72.67	-0.69	73.92	-1.95	33.57	60.79
Jun-18	72.35	71.87	28.75	43.60	73.02	-0.67	74.50	-2.15	40.78	58.75
Jul-18	72.73	72.22	72.22	0.51	73.39	-0.66	75.06	-2.33	-2.48	73.55
Aug-18	73.12	72.58	72.58	0.54	65.62	7.50	63.47	9.66	17.70	67.22
Sep-18	73.52	72.96	72.96	0.57	72.96	0.57	72.95	0.57	1.71	72.96
Oct-18	73.94	73.34	73.34	0.60	73.34	0.60	73.34	0.60	1.79	73.34
Nov-18	74.36	73.74	73.74	0.62	73.74	0.62	73.73	0.63	1.87	73.74
Dec-18	74.79	74.14	74.14	0.65	74.14	0.65	74.14	0.65	1.95	74.14

Source: Authors' calculations

Tables 4 shows the impact of shocks on employment, coming from scenarios 1-3. The just mentioned fact would recommend the Government of Montenegro that despite the upheaval caused by the coronavirus pandemic, their jobs should be secured. Since the supply shocks, through employment and human capital, trigger changes in aggregate demand much larger than the shocks themselves, the policymakers should take care of not allowing firms to exit and job destruction (Veronica et al, 2020). The chain effect would cause the recession, in case not intervened by the conventional and non-conventional policies. Unconventional because some sectors are shut down, and the traditional fiscal stimulus might not bring the multiplier effects as usual. Thus, considering the optimal policy, shutting-down direct human-to-human intensive sectors and giving full insurance payments to the touched workers can achieve the best allocation, even though the lower per-euro potency of fiscal policy. Arriving at blockbuster support and stimulus packages should be the primary focus, being confirmed by the brown prediction Bayesian VAR independent normal-Wishart performance.

Figure 4: Capital stock Bayesia VAR forecasting performance: scenarios 1-3



Source: Authors' calculations

As in the case of GDP_GAP, the same is visualized here: the innovation that comes from capital stock has the most substantial negative impact on employment in Montenegro. As a consequence of scenario 2 (decrease of capital stock) and scenario 3 (reduction of human capital), we see a decrease in the employment Bayesian VAR forecasting performance. Combined average performance shows and confirms the decline, as seen in the last column of Table 4.

As visually inspected by the purple prediction performance line in Figure 4, the average impact of the shocks decreases the combined average performance of the capital stock, even creating a chain effect on the 3 and most probably the 4th quarter of 2018. While in the case of human capital, we notice a drop of more than 20% for the first two quarters, comparing to the real data. The fact that human capital is predicted to drop from 3,189 in January to 2,547 in June is the fact that the policymakers should create such policies to keep jobs active during the COVID-19 pandemic. In words: the Government should act as aggressively as they can. Nowadays, governments all over the world are on the surge in unemployment and implementing measures in support of consumers, small businesses, and corporations.

The Government of Montenegro adopted on 23 March 2020 the first set of measures aimed at facilitating the living standard of citizens and assisting the economy during the coronavirus pandemic, urging citizens to abide by measures and to show solidarity. The focus of well-targeted economic and social measures waw to keep the current level of employment (data from February 2020) and to protect the most vulnerable categories of the population. The criteria consisted of the following: the three-month postponement of repayment of loans given by the commercial banks to companies and citizens (in total 3 billion euros), three-month postponement of payment of taxes and contributions on salaries for all companies and entrepreneurs, based on requests towards the Tax Directorate, the one-off financial assistance to the pensioners with the lowest pensions and beneficiaries of social assistance (1 million euros for 20.000 users) and numerous reduction in budget expenditure sides (restriction and

control of budget spending). The state-owned Investment Development Fund offered a new credit line intended to improve the liquidity of entrepreneurs, SMEs and large enterprises (120 million euros, up to a maximum amount of 3 million euros per beneficiary, by a simplified procedure, no approval fee and an interest rate of only 1.5%). These funds are intended for companies operating in the field of procurement of medicine, medical equipment, and vehicles; tourism and catering; traffic; services; food production and processing. The second package is presented on 20th April 2020 and consisted of the subventions to companies for two-months minimum gross salaries for registered workers in affected economic sectors and an additional packaging of the budget for agricultural support to farmers (Government of Montenegro, 2020).

Conclusion and Implications

Assessing the struggle policymakers are faced with, as we are writing, to define proper policy measures and diagnosing the onset of indicators, we felt compelled to identify an approach and methodology that the Government of Montenegro can use in developing the anti-pandemic and overall development strategy. Having seen the high increase in the interest of forecasting the cost of growth loss and the lack of any uniform methodology, we believe that the findings presented in our paper will appeal to macroprudential policymakers. Even though some research papers have identified a few methods that could be used in forecasting the pandemic effect on the economy, the methodologies developed from those findings have restrictions and difficult to administer on a national level. Therefore, our results will allow the policymakers to understand the variables involved in identifying the onset of COVID-19 outbreak dynamics and expected policies in Montenegro better and develop more efficient and effective policy measures that can be used nationally.

The Government's response to the current crisis was efficient, well-timed, prompt, and pretty much targeted toward both economy and socially marginalized categories. The support measures package was well targeted and in line with the current financial capacity of the Budget. The third package will be presented in May and will include the budget rebalance (raising of the public debt equally to defined additional support measures). The level of public debt could exceed 90% of GDP. However, these measures, focused on securing employment and keeping highly qualified staff in Montenegro's companies are justified public finance spending. It will strongly support a new wave of investment in the post-COVID-19 period.

This manuscript reveals a significantly wider knowledge gap: both theoretical and empirical. We identified a SVAR model recursively. The model aggregates critical macroeconomic variables to forecast the GDP growth rate. Bayesian VAR of independent normal-Wishart prior reveals to have the lowest RMSE and MAE, comparing to the standard VAR and other BVAR priors. We employ the BVAR model to predict all variables under three deterministic-static scenarios simultaneously. Besides, we combine and average the forecasts under different scenarios. The essential evidence shows that human capital is critical in keeping the sustainable growth. Keeping the human capital and letting it fly out of the country would be the blockbuster support and the vital stimulus package. Still, the policymakers have to be after the stock market since foreign investment will be very fragile after the pandemic disease has vanished.

In conclusion, a mixture of fiscal and unconventional monetary policies and their implementation in the upcoming months are crucial for sustainable development in Montenegro. The empirical findings of this manuscript provide macroprudential policymakers with an in-depth understanding of the pandemic effects on the Montenegrin economy.

The authors declare that they have no competing interests.

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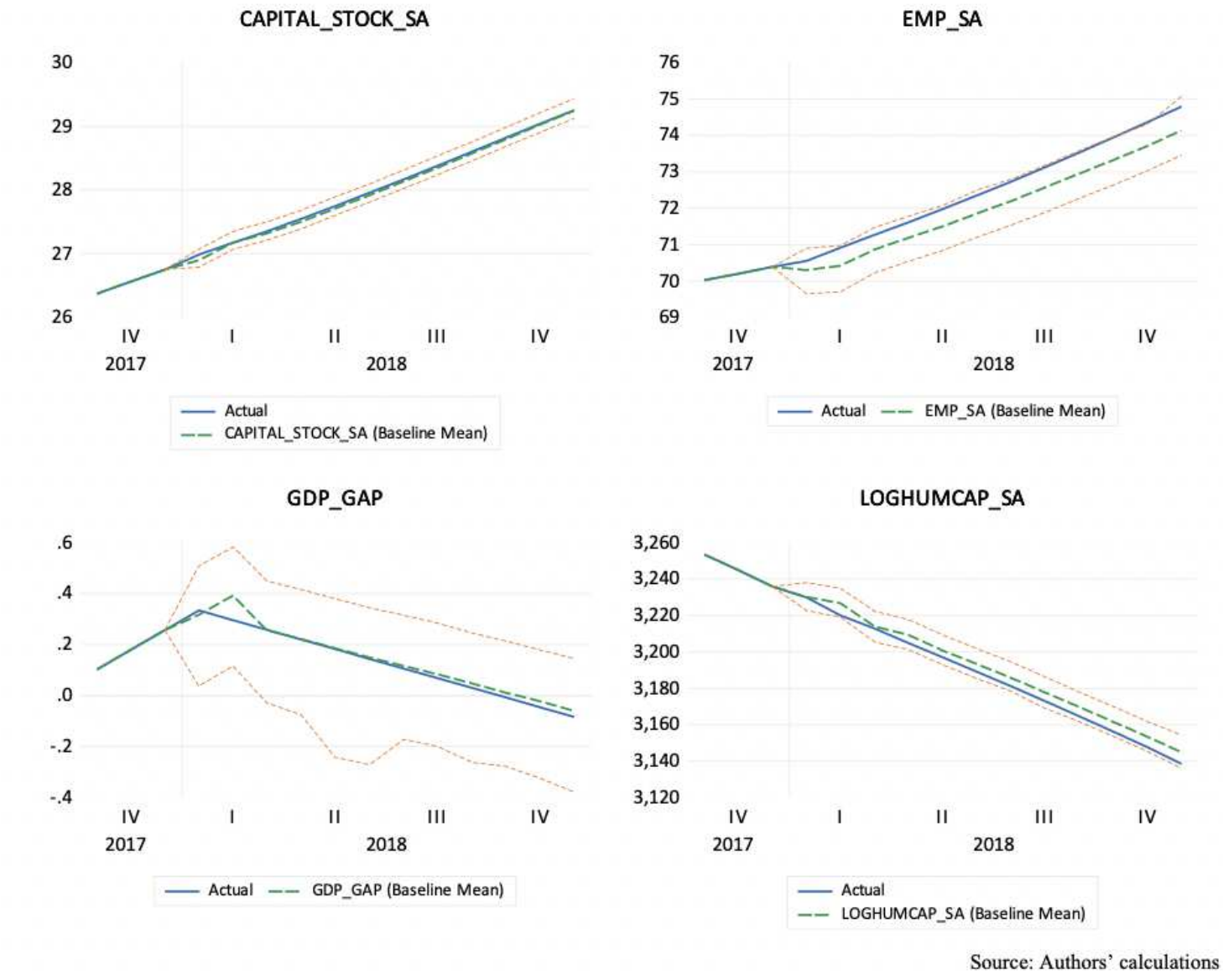
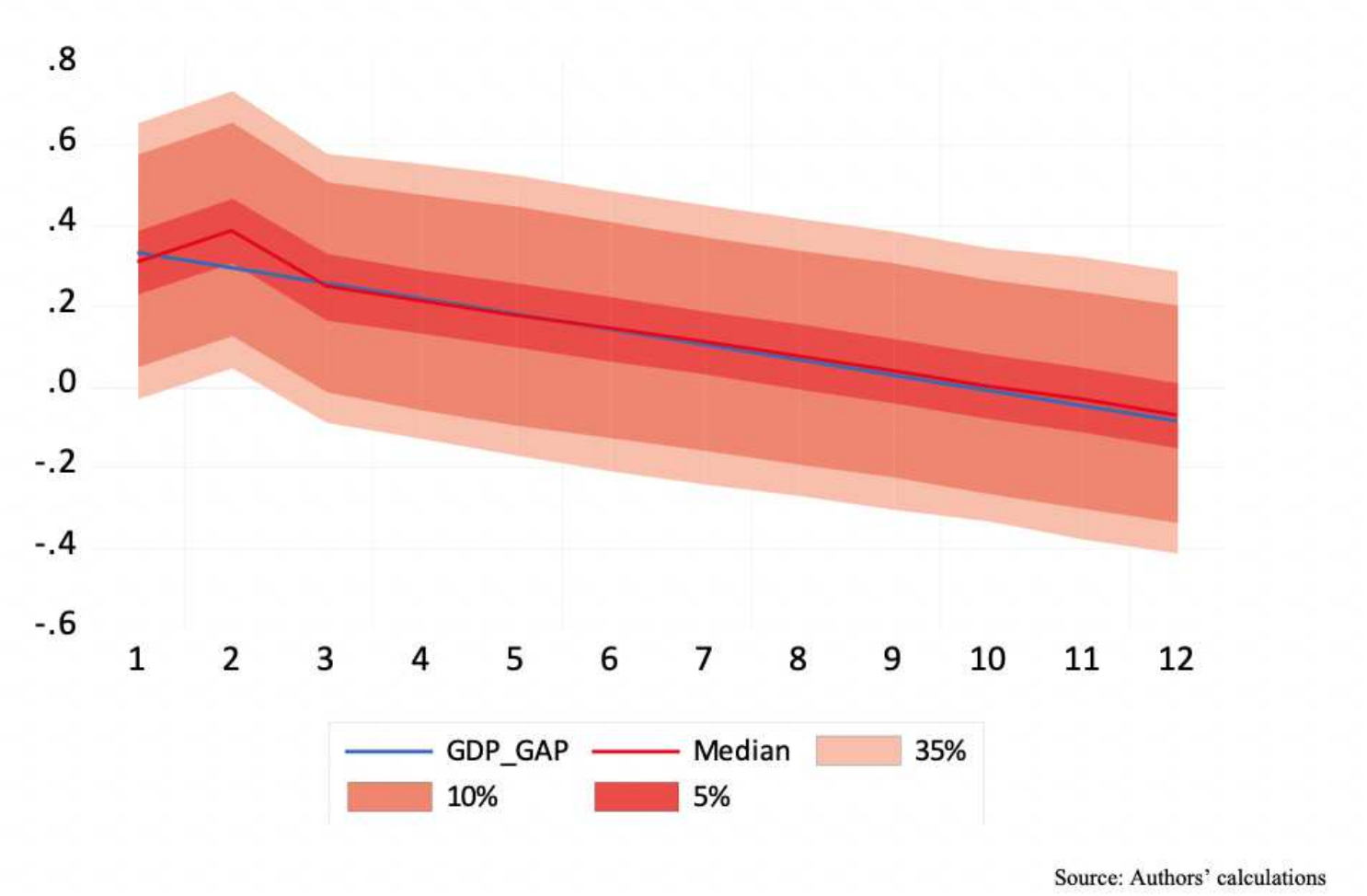
Figures



Source: Authors' calculations

Figure 1

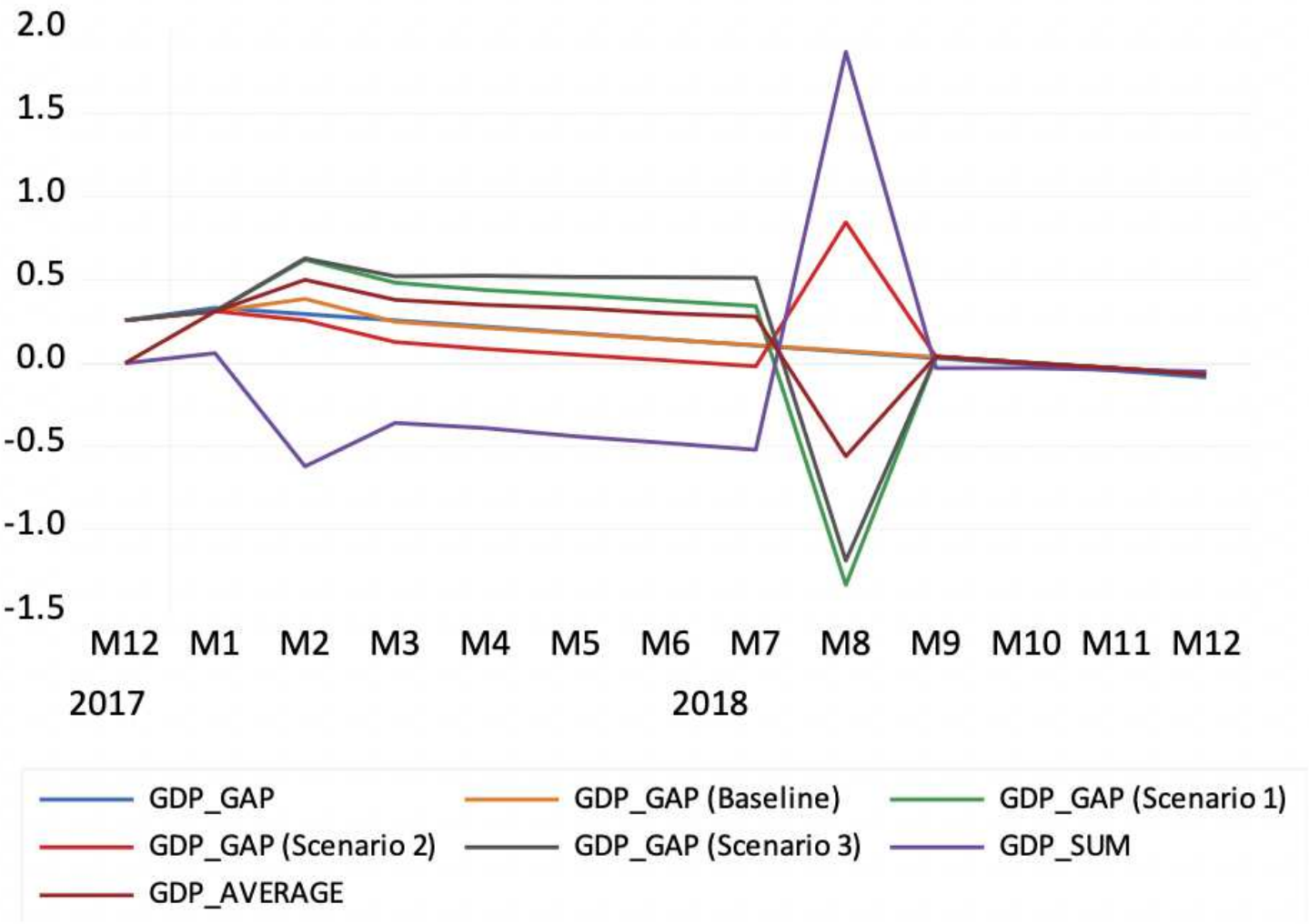
Stochastic-static simulator model forecasting performance of VAR (2)



Source: Authors' calculations

Figure 2

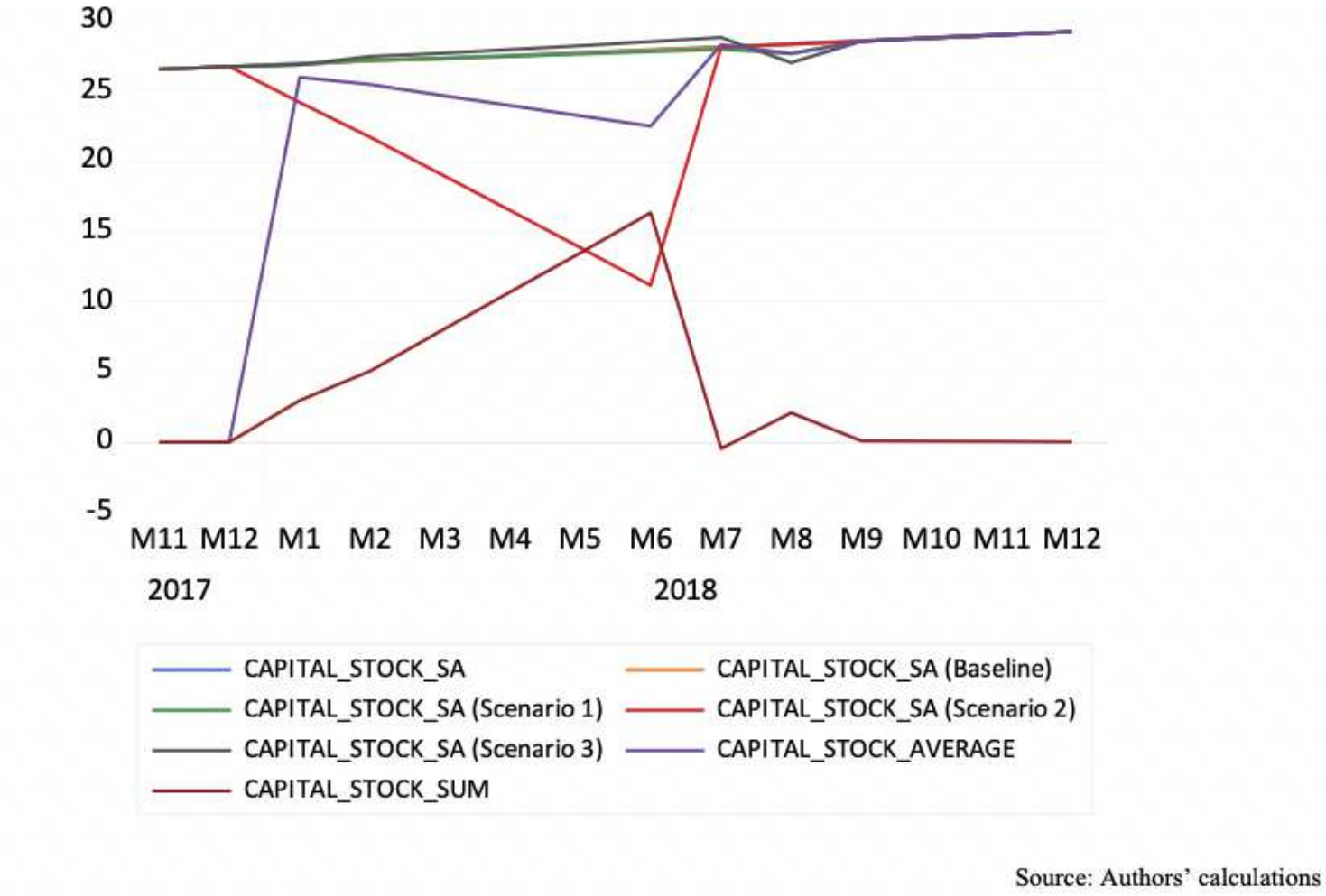
Forecasting performance of GDP_GAP using Bayesian independent normal-Wishart prior, 2018:1 2018:12



Source: Authors' calculations

Figure 3

GDP_GAP BVAR independent normal-Wishart deterministic-static alternative scenarios.



Source: Authors' calculations

Figure 4

Capital stock Bayesia VAR forecasting performance: scenarios 1-3

Supplementary Files

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- newmacromodel.wf1