



Munich Personal RePEc Archive

## **Impact of fiscal measures in response to the COVID-19 pandemic on small-open economies: lessons from Slovenia**

Arigoni, Filippo and Breznikar, Miha and Lenarčič, Črt and Maletič, Matjaž

2 December 2020

Online at <https://mpra.ub.uni-muenchen.de/104474/>  
MPRA Paper No. 104474, posted 04 Dec 2020 03:06 UTC

# Impact of fiscal measures in response to the COVID-19 pandemic on small-open economies: lessons from Slovenia <sup>\*</sup>

Filippo Arigoni<sup>†</sup>    Miha Breznikar<sup>‡</sup>    Črt Lenarčič<sup>§</sup>    Matjaž Maletič<sup>¶</sup>

Bank of Slovenia

October 5, 2020

## Abstract

We estimate the impact of the fiscal expansion due to the COVID-19 outbreak on the Slovene economy using two models. First, we simulate fiscal shocks in 3-scenarios in a calibrated large-scale DSGE model. Second, we employ a small-scale VAR model to check the robustness of the theoretical results. The findings suggest a significant response of GDP, private consumption, and imports to fiscal shocks. In particular, the outcomes highlight that compared to other unanticipated fiscal developments a government consumption shock explains the lion's share of domestic fluctuations. The main transmission channel is high complementarity between private and government consumption.

**Keywords:** Fiscal shocks; Fiscal multipliers; DSGE model; VAR model.

**JEL Classification:** C32, E32, E62.

---

<sup>\*</sup>The views presented herein are those of the authors and do not necessarily represent the official views of the Bank of Slovenia or of the Eurosystem.

<sup>†</sup>Author's e-mail account: [filippo.arigoni@bsi.si](mailto:filippo.arigoni@bsi.si)    <sup>‡</sup>Author's e-mail account: [miha.breznikar@bsi.si](mailto:miha.breznikar@bsi.si)

<sup>§</sup>Author's e-mail account: [crt.lenarcic@bsi.si](mailto:crt.lenarcic@bsi.si)    <sup>¶</sup>Author's e-mail account: [matjaz.maletic@bsi.si](mailto:matjaz.maletic@bsi.si)

# 1 Introduction

The outbreak of COVID-19 represents novel challenges for the economy and policymakers. Such an environment provides a textbook example of a large-scale countercyclical fiscal policy intervention.

We model the impact of fiscal measures on the Slovenian economy with the Euro Area and Global Economy model (henceforth, the EAGLE model, Gomes et al., 2012). The model, which was further extended with a big fiscal block by Clancy, Jacquinet and Lozej (2016) has some appealing features which are relevant for small open economy within a monetary union such as Slovenia. First, in the model, government spending consists partly of imported goods. This gives the feature that government spending has a lower multiplier as a result of higher import expenditures. Second, the model splits government spending between consumption and investment goods. Third, the model allows for the complementarities between private and government consumption. The last two features allow us to analyze the effects of such complementarities on the size of government consumption multipliers.

We analyze the effects of several fiscal shocks on the Slovenian economy. In particular, we disentangle the source of fiscal variation into (1) government investments, (2) government consumption, (3) direct taxes, (4) indirect taxes, and (5) social benefits. The focus on fiscal measures is motivated by the fact that these are the main instruments of Slovenian national authorities to monitor and shape the trajectory of the business cycle. Slovenian monetary policy is under the full control of the European Central Bank.

A short contextualization may justify why we focus on measures of the fiscal policy. Slovenia, after its independence, experienced two important fiscal interventions. First, following the Great Financial Crisis (henceforth, GFC); and second, during the sovereign crisis in 2012, when a recession hit the Euro Area. While the former event constituted a positive fiscal shock, it should not be interpreted as the intended *ad hoc* government response to the crisis. The fact is that the fiscal plan was already in place before the outbreak of the crisis.<sup>1</sup> In the second case, in 2012, fiscal policy responded to the domestic contraction by limiting the

---

<sup>1</sup>Especially the substantial wage increase of the public sector in the so-called Virant's wage reform in 2008.

public deficit by implementing restrictive reforms such as the acceptance of the Fiscal Balance Act (ZUJF) labour reform. Today, differently to the GFC and recession in 2012, the fiscal policy is intentionally reacting countercyclically by increasing the public debt and deficit to offset the negative shock of the COVID-19 on the Slovene economy.

We check the robustness of our theoretical results by estimating a small-scale VAR model à la Blanchard and Perotti (2002). We identify the shocks to fiscal policy and the response of taxes and spending to activity by using institutional information about the tax and transfer systems.

We provide two main contributions. First, we theoretically disentangle the impact of the latest fiscal stimulus packages on the Slovenian economy by simulating a 3-scenarios of the fiscal package in the calibrated EAGLE model.<sup>2</sup> Second, we present the empirical results of the small-scale VAR model.

Our results show that government consumption has a stronger and more persistent effect on the domestic business cycle than other fiscal variables. In particular, with a large scale DSGE model, we find that fiscal spending multiplier on impact equals 1.3. Cumulative spending multiplier increases to 1.4 in the first year, and levels-off at 1.3 after three years. In the model, the bigger proportion of the non-tradable sector is comprised of services that are provided by the government sector. Therefore, the effect of the fiscal stimulus on the non-tradable sector is larger than on the tradable sector. The fiscal stimulus positively affects private consumption and imports, and almost insignificantly investments and exports. The reason behind this result is that government consumption and investments stimulate aggregate demand and consist mostly of imported goods.

Our theoretical results are confirmed with a small-scale VAR model. The main transmission channel of the fiscal stimulus on the Slovenian output is high complementarity between private and government consumption. This result was first established by Clancy, Jacquinot and Lozej (2016) with the DSGE model, which was calibrated for Slovenian and Irish economy. Results of the SVAR model in Jemec, Strojjan Kastelec and Delakorda (2011) can be interpreted in a way that such complementarities are important in Slovenia.

---

<sup>2</sup>The basic EAGLE model was developed by Gomes, Jacquinot and Pisani (2012).

Finally, we find that the fiscal stimulus increases the nominal variables with a lower magnitude which is longer-lasting than for the real variables. The government subsidies to households and firms, and the direct fiscal stimulus, increase wages for several quarters.

The paper is structured as follows. Section 2 reviews the literature. Section 3 presents the fiscal packages in scenarios with different lengths of the COVID-19 lock-down. Section 4 calibrates the EAGLE model. Section 5 estimates the SVAR model. Section 6 compares fiscal multipliers implied by the models. Section 7 concludes.

## 2 Literature Review

In this section, we provide a short literature review. The strand of literature covering the effects of fiscal shocks on business cycles is wide. Caggiano et al. (2015) study the state-dependent fiscal multipliers of the US economy. They report that the median effects of fiscal shocks in periods of contraction are larger than in the periods of expansion. However, once we account for the standard errors, the confidence intervals imply the absence of non-linearities. This is the opposite of Auerbach and Gorodnichenko (2012, 2013). Results of Caggiano et al. (2015) differ because they impose stricter conditions on the transitional phase between the expansion and contraction periods.

Cugnasca and Rother (2015) investigate the impact of fiscal consolidation on economic growth in the European Union. They find that the size of the fiscal multiplier varies significantly under different states of the business cycle, the degree of openness to trade, the composition of the fiscal adjustment, and the presence of a stressed credit market. Only a few consolidation episodes yield multipliers above one. Kilponen et al. (2015) estimate output multipliers for alternative fiscal instruments by simulating fifteen structural models within the Euro Area. They find that country-specific short-run fiscal multipliers are smaller than one in absolute value. Temporary reductions in government consumption are typically associated with larger (short-run) effects on the GDP than temporary increases in tax rates. The difference becomes more pronounced when the economy is financially distressed.

Gornicka et al. (2018) set up a natural quasi-experiment to model the behavior of the fiscal multiplier during the GFC and European sovereign debt crisis (SDC) in the European Union. They find that fiscal multipliers increased over time, from about  $1/4$  to about  $2/3$ . They do not find evidence that ex-post fiscal multipliers have been substantially above 1. More recently, Alloza et al. (2020) assessed the spillovers of national fiscal policies to other countries within the Euro Area. They find (cumulative) domestic spending multipliers are slightly lower than one, while average cumulative output response in a Euro Area country to a trade-weighted increase in government spending in the other Euro Area countries roughly equals 0.4. However, domestic multipliers and cross-country spillovers are heterogeneous among Euro Area countries. Additionally, they find that the reaction of interest rates to fiscal expansions is an important determinant of the magnitude of the spillovers.

Turning to the Slovenian economy, Clancy, Jacquinot and Lozej (2016) develop a “fiscal” version of the EAGLE model to study the effects of fiscal shocks in Ireland and Slovenia as typical representatives of small open economies. Among several important contributions, they find that complementarities between private and government consumption play an important role in transmitting the stimulus to the economy. When such complementarities are high, government consumption expenditure reductions can lead to substantial output losses. When complementarities between private and government consumption are low, a reduction of government consumption may be a preferred option to minimize output loss during fiscal consolidation.

Jemec, Strojjan Kastelec and Delakorda (2011) follow Blanchard and Perotti (2002) and estimate a small-scale VAR model on Slovenian data. They find that positive government spending shocks have a positive immediate effect on output, private consumption, and investment. We can interpret their results in a way that high complementarity between private and government consumption seems to be important for the transmission of fiscal stimulus to the Slovenian economy.

### 3 Fiscal Packages

Fiscal policy measures are intended to directly – through increased government spending, investment, and tax relief – support the domestic demand and thereby temporarily moderate the decline in economic activity. In the longer term, however, the purpose of the measures is to primarily prevent corporate bankruptcies, redundancies, and preserve production capacity. Specifically to the COVID-19 situation, some measures are directly aimed to ensure the sustainability of the health care system and to redistribute government funding to support research to discover the cure for the virus.

Fiscal measures can be direct and indirect. Direct measures primarily consist of subsidies to companies, equity contributions to businesses, tax relieves, unemployment cash benefits to households, and self-employed, and are in the form of the direct help to safeguard the long-term sustainability of the healthcare system. These are the measures that are the main focus of this paper. The second part of the measures is indirect aid. These are mainly aimed to help companies obtain new loans and solve their liquidity problems. Mostly they are in the form of loan guarantees.

The Slovenian government introduced the set of measures worth around EUR 1 billion on the 9th of March. These measures were primarily aimed at providing liquidity to companies facing difficulties in settling their liabilities due to a lack of revenue. They consist mostly of the new SID Bank credit lines, assets of the Slovenian Enterprise Fund, and loan reschedules by the Regional Development Fund. State guarantees and the possibility of deferring taxes were also envisaged. Hence, the first set of measures primarily involved indirect measures.

With the worsening of the situation, the government prepared the "Act on Emergency Measures to Curb the COVID-19 Epidemic and Mitigate its Implications for Citizens and the Economy," which was approved by the National Assembly on the 2nd of April. The additional adopted measures were estimated at EUR 2 billion (4 % of GDP). The measures consisted primarily of *direct* financial aid to preserve jobs.

Among the measures to preserve jobs, the most important measure was the reimbursement of workers' compensation for temporary waiting for work and absenteeism, and exemption from

contributions, while maintaining the insurance rights and the benefits of social security funds. For employees who work, the contribution to the pension and disability insurance was paid by the Republic of Slovenia. Self-employed who were unable or able to carry out their activities on a substantially reduced basis due to the crisis were eligible for exceptional assistance in the form of a monthly basic income of EUR 350 for March and EUR 700 for April and May 2020. The compensation for the sick leave during the pandemic was covered by the Health Insurance Institute and not by the employer. Corporates were relieved of advance payment of personal income tax on income from the performance of business activities and advance payment of corporate income tax. Payment deadlines for payments to private suppliers from public funds were reduced to 8 days.

Additionally, the second package included 2) measures to improve corporate liquidity, 3) measures to assist agriculture, and 4) measures to improve people's social status and other measures.

Based on the publicly available information, and official Macroeconomic projections of the Bank of Slovenia 2020 we have prepared three possible scenarios on how big will the *actual* fiscal takeaway be given the length of the COVID-19 lock-down. We have rescaled the estimated amounts of the fiscal takeaway in three scenarios and merged the categories into (1) Government Subsidies, (2) Social Benefits, (3) Government Wages, (4) Holiday Vouchers, (5) Taxes, and (6) Expenditures for Protection Equipment. Only the shocks to government subsidies, social benefits, and government wages in scenario 3 last more than one quarter. Shocks to taxes and expenditures for protection equipment last only for one quarter in all scenarios. Table 1 presents the rescaled shocks.



Table 1: Normalized shocks to nominal GDP 48 billion EUR (in p.p.)

Category	Scenario 1	Scenario 2	Scenario 3	
	Q1	Q1	Q1	Q2
Government subsidies	1.9	2.6	2.6	0.9
Social benefits	0.7	0.8	0.8	0.1
Government wages	0.3	0.3	0.3	0.1
Holiday vouchers*	(0.5)	(0.5)	(0.6)	–
Taxes	0.2	0.2	0.2	–
Expenditures for protection equipment	0.2	0.3	0.4	–
<b>Sum**</b>	<b>3.3</b>	<b>4.4</b>	<b>4.5</b>	<b>1.1</b>

*Source:* Authors' calculations, Bank of Slovenia (2020), Agency of the Republic of Slovenia for Commodity Reserves. *Note:* \* For the holiday vouchers we assume that the takeaway will take place in Q2 and Q3 from the first fiscal shocks taking place. \*\* Without holiday vouchers.

## 4 The calibrated large-scale DSGE model

We estimate the effects of different fiscal measures on the Slovenian (domestic) economy by calibrating a large-scale DSGE model. The cumulative domestic spending multipliers can be calculated by checking the impulse response functions (IRFs) of a structural model.

### 4.1 The EAGLE model

To assess the effect of the fiscal package on the economy in a rich modeling environment we calibrate the EAGLE model on Slovenian data. The model was seminally developed by Gomes, Jacquinot and Pisani (2012), and extended with a larger fiscal block by Clancy,

---

<sup>3</sup>For the theoretical derivation of the model in detail see Gomes, Jacquinot and Pisani (2012) and Clancy,

Jacquinot and Lozej (2016).<sup>3</sup> The EAGLE model consists of four regions in the world economy, two of which constitute a monetary union (in our case Slovenia and the rest of the Euro Area). Apart from monetary policy regimes and some parameter values, each region covered in the EAGLE model is modelled symmetrically.

An important aspect of the model is that the regions are linked with each other through a bilateral trade relationship and their participation in international financial (bond) markets. The linkages between regions provide a wide range of macroeconomic interdependencies and spillovers present in the Euro Area. There are two types of households that are differentiated by their ability to participate in asset markets. Labour markets are monopolistically competitive allowing households to be the wage setters for differentiated labour services they supply to the firms. This implies nominal rigidities in the labour and goods market. Wage rigidities are modeled á la Calvo (1983).

On the production side, an intermediate sector produces tradable<sup>4</sup> and nontradable goods which are produced by monopolistically competitive firms. Prices of differentiated intermediate goods are also subject to the Calvo-type scheme with indexation. The final goods sector is subject to perfectly competitive firms that aggregate different varieties of domestic nontradable, tradable, and imported goods (Clancy, Jacquinot and Lozej, 2016).<sup>5</sup>

The reason why we use the EAGLE model with the fiscal extension is that the model allows for government spending to partly consist of imported goods. To simulate the reality of small open economies a significant proportion of goods consumed or invested by the government should be imported (Clancy, Jacquinot and Lozej, 2016).

Therefore, the fiscal multipliers of government spending are lower as a result of increasing import expenditure. Government spending is additionally divided into government consumption and government investment. In this respect, Clancy, Jacquinot and Lozej (2016) assume that the government consumption expenditure is wasteful, but they also impose additional assumptions.

---

Jacquinot and Lozej (2016).

<sup>4</sup>Tradable intermediate goods are subject to international trade, with export prices denominated in the importing country's currency (local currency pricing assumption).

<sup>5</sup>Aggregation of imports into a homogeneous import good is subject to adjustment costs whenever a country's trade structure changes.

The additional assumption, made by Coenen, Straub and Trabandt (2012), allows for complementarities between the private and government consumption. The latter feature of the model enables us to study the effects of such complementarities on both the size of government consumption multipliers and the spillovers of government spending shocks in their main trading partners.

The third assumption, made by Leeper, Walker and Yang (2010), allows government investment to contribute to public capital. This means that when public capital increases, the productivity of private capital also increases, and marginal costs of firms decrease. Consequently, the economy experiences an improvement in external competitiveness and attracts additional private investment. The current account improves and output increases.

On the other side, the government generates revenue by imposing proportional and lump-sum taxes.<sup>6</sup> Transfers and lump-sum taxes are not evenly distributed across the two modeled types of households. Those households that have full access to asset markets are receiving fewer transfers and pay more taxes in per-capita terms (Gomes, Jacquinot and Pisani, 2012; Clancy, Jacquinot and Lozej, 2016). Fiscal debt that is accrued by a particular government is held in the form of government bonds. The debt level of a region is subject to a long-term target debt level that is in line with the Maastricht Treaty. The target debt level is achieved through a smooth adjustment process in lump-sum taxes (Clancy, Jacquinot and Lozej, 2016).

## 4.2 Results of the EAGLE model

The main results of the paper are the estimated effects of the fiscal policy package on the key national economic variables depending on the three different scenarios of the actual takeaway. The latter is explained into the greater detail in Table 1 and mainly depends on the length of the economic lock-down.

The EAGLE model is calibrated to the case of Slovenia, which predominantly and economically operates within the Euro Area. This means that shocks that stem from the Euro Area

---

<sup>6</sup>The government generates revenue also through seigniorage that is earned on outstanding money holdings

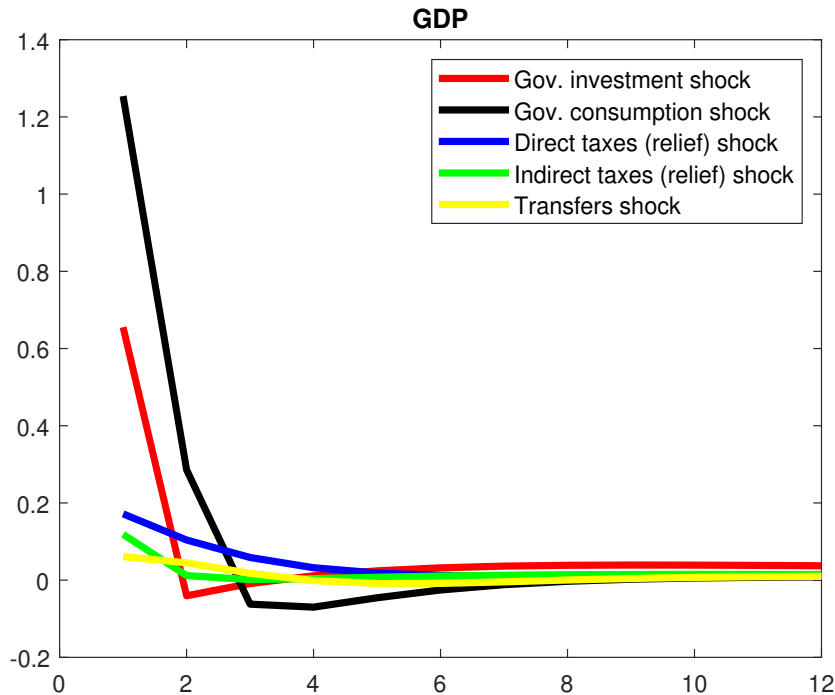
region have a larger impact on the Slovene economy than shocks originating from the US or the rest of the world. On the other hand, since Slovenia is a typical small open economy, shocks that originate from its economy have no significant effect on big regions. In comparison to the Clancy, Jacquinot and Lozej (2016), the major calibration difference involves the new parameter recalibration of the exogenous processes in the fiscal block of the model. First, we assume that fiscal packages are a strict one-off event that has no persistence in fiscal variables (investments, consumption, transfers/benefits, and taxes). Consequently, we set the persistence parameters in the fiscal exogenous processes to zero. Secondly, the size and the structure of the fiscal shocks are suited to the size and structure of the fiscal packages explained in Section 3.

The effects of different fiscal variables on the macroeconomic variables differ. Figure 1 shows the impulse responses of the GDP variable to shocks to different fiscal variables which are rescaled to 1% of GDP. The idea here is to show the differences in the effects of fiscal variables. Based on Figure 1, it is evident that government consumption and investments have the largest effect on the economy and thus have the largest multiplier. Direct tax relief has a significantly lower effect, while indirect taxes and social contributions have an even lower effect on the economy.

---

(Clancy, Jacquinot and Lozej, 2016), but this feature is not key in our paper.

Figure 1: The impulse response of GDP to shocks to different fiscal variables scaled to 1% of GDP



*Source:* Authors' calculations. *Note:* The chart in Figure 1 depicts a p.p. response of the GDP variable to different types of fiscal variable shocks scaled to 1% of GDP.

In Figure 2, we can see that the proposed fiscal stimulus (again, the size of the effects depends on the scenarios) has a positive effect on the Slovene economy. The immediate fiscal stimulus shock affects the GDP the most at the beginning (in period 1). The peak responses vary from 1.1 to 1.6 percentage points depending on the scenarios.<sup>7</sup> Since we assume the one-off type of shocks with zero persistence parameters the dynamics of most real variables quickly decrease back to the steady-state after 4 to 5 quarters.<sup>8</sup>

From Figure 2 it is also clear that the effect of the fiscal stimulus on the non-tradable sector is larger than on the tradable sector. The bigger proportion of the non-tradable sector is comprised of services that are provided by the government sector. Sectors such as

<sup>7</sup>The yearly effects of the fiscal stimulus packages depending on the scenario differ from 2.5 to 4.1% of GDP and also in-line with the projection done for the Slovene economy (Bank of Slovenia, 2020). In the second year, mostly due to the zero persistence assumption of the fiscal shocks, the effects of the fiscal stimulus packages disappear.

<sup>8</sup>For robustness check, we calculate the fiscal multiplier from the DSGE model. The size of the fiscal multiplier from the DSGE model (0.3 for government consumption shock, please refer to eq. 7) is in line with the multiplier obtained from the SVAR model above and with the literature, such as Bayer et al. (2020), who estimated the fiscal transfer multiplier.

manufacturing, storage, and transporting which comprise the tradable sector are affected less by the increase in government spending.

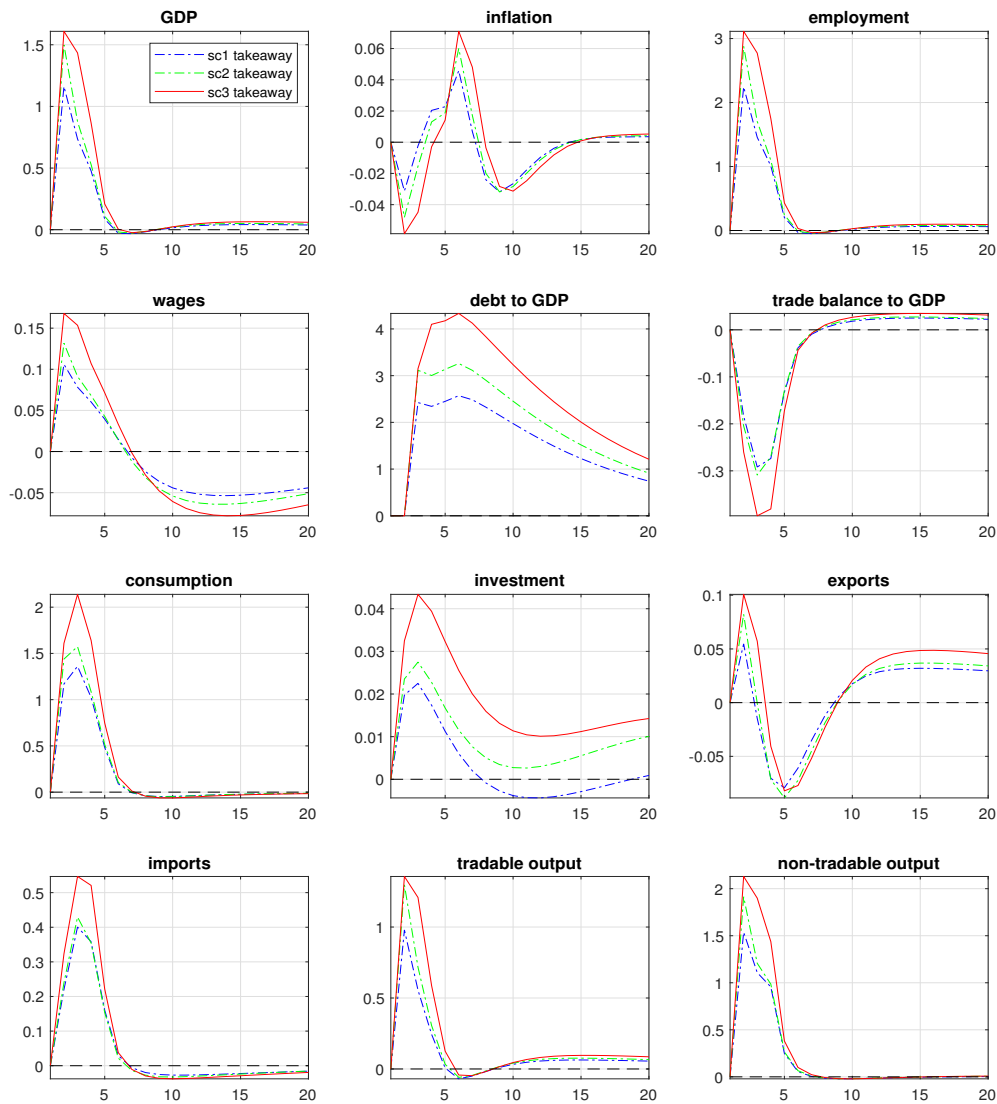
The fiscal stimulus positively affects private consumption and imports, and almost insignificantly investments and exports. The economic rationale is that government consumption and investments stimulate aggregate demand and consist mostly of imported goods. On the other hand, private investments and exports are less affected. Higher imports and lower exports worsen the Slovenian balance of trade.

Finally, in Figure 2 we plot the evolution of inflation and real wage variables. The fiscal stimulus increases wages through several quarters. The wages increase due to government subsidies to households and firms and as a result of the direct stimulus. On the other hand, the effect of fiscal stimulus on inflation is negligible. What is noteworthy to mention is that the fiscal stimulus affects the nominal variables with a lower magnitude but with a longer-lasting effect than the real variables.<sup>9</sup> However, everything comes at a cost, as indebtedness, and hence the debt to GDP increases significantly.

---

<sup>9</sup>Caggiano, Castelnuovo and Figueres (2020), for instance, find similar differences between the effects on nominal and real variables in the case of uncertainty shocks.

Figure 2: The impulse response of the main macroeconomic variables to fiscal packages in three scenarios



*Source:* Authors' calculations. *Note:* The charts in Figure 2 depict a p.p. response of the main macroeconomic variables to fiscal packages shocks..

## 5 The SVAR model

We estimated the small-scale VAR model to assess the size of the fiscal multiplier in Slovenia. During the period of the COVID-19 pandemic, governments announced large fiscal policy measures to help the economy to recover after the long-lasting lockdown period. With the

SVAR model, we assess the size of the fiscal multiplier.

The model comprises the set of three variables, namely gross domestic product, government spending, and net taxes collected by the Slovenian government. It is worth noting that government spending is composed of government consumption and government investment. The series of taxes is composed of net social contributions, direct taxes, and indirect taxes. All variables are logarithmically transformed. The estimated VAR model has the following form:

$$Y_t = \alpha_1 Y_{t-1} + \dots + \alpha_4 Y_{t-4} + \beta X_t + \epsilon_t \quad (1)$$

Where  $Y_t$  is a vector of endogenous variables in period  $t$ ,  $X_t$  is a vector of exogenous variables in period  $t$  and  $\epsilon_t$  represent reduced-form residuals of the model. In the set of exogenous variables, we include the trend, the constant, and a dummy variable for a crisis period. To account for the whole year we set the lag order of the model to 4.

## 5.1 Identification scheme

For the identification of the model, we follow Blanchard and Perotti (2002). Reduced form residuals stacked in the vector  $\epsilon_t$  are generally cross-correlated. To identify the orthogonal shocks and recover the effect of orthogonal structural shocks in taxes and government spending ( $u_t^{tax}$  and  $u_t^{govc}$ ) on the gross domestic product, we can write the identification equations as:

$$\epsilon_t^{tax} = a_1 \epsilon_t^{gdp} + a_2 u_t^{govc} + u_t^{tax} \quad (2)$$

$$\epsilon_t^{govc} = b_1 \epsilon_t^{gdp} + b_2 u_t^{tax} + u_t^{govc} \quad (3)$$

$$\epsilon_t^{gdp} = c_1 \epsilon_t^{tax} + c_2 \epsilon_t^{govc} + u_t^{gdp} \quad (4)$$

where vector  $u_t$  represents orthogonal structural shocks. After rearranging, and imposing



that the identification scheme has the form

$$A\epsilon_t = Bu_t \quad (5)$$

we can write matrices  $A$  and  $B$  as

$$\mathbf{A} = \begin{pmatrix} 1 & 0 & -a_1 \\ 0 & 1 & -b_1 \\ -c_1 & -c_2 & 1 \end{pmatrix}, \quad \text{and} \quad \mathbf{B} = \begin{pmatrix} * & a_2 & 0 \\ b_2 & * & 0 \\ 0 & 0 & * \end{pmatrix}. \quad (6)$$

Following Jemec, Strojan Kastelec and Delakorda (2011), we fix parameter  $a_1$  to value 0.87. Following Blanchard and Perotti (2002), we impose  $b_1 = 0$ . In other words, we assume that government spending does not react contemporaneously to the increases in GDP. Since we have  $n = 3$  equations we can estimate 6 parameters in  $A$  and  $B$ . Again, we follow Blanchard and Perotti (2002) and set  $a_2 = 0$ . Namely, we assume that taxes are not contemporaneously adjusted because of changes in government spending.

After plugging in the coefficients  $a_1$  and  $b_1$  we can calculate cyclically adjusted residuals of taxes and government spending,  $\tilde{\epsilon}_t^{tax} = \epsilon_t^{tax} - a_1\epsilon_t^{gdp}$  and  $\tilde{\epsilon}_t^{govc} = \epsilon_t^{govc} - b_1\epsilon_t^{gdp}$ , which no longer dependent on the gross domestic product. We can use them as instrumental variables for  $\epsilon_t^{tax}$  and  $\epsilon_t^{govc}$  to estimate coefficients  $c_1$  and  $c_2$ .

## 5.2 Results of the SVAR model

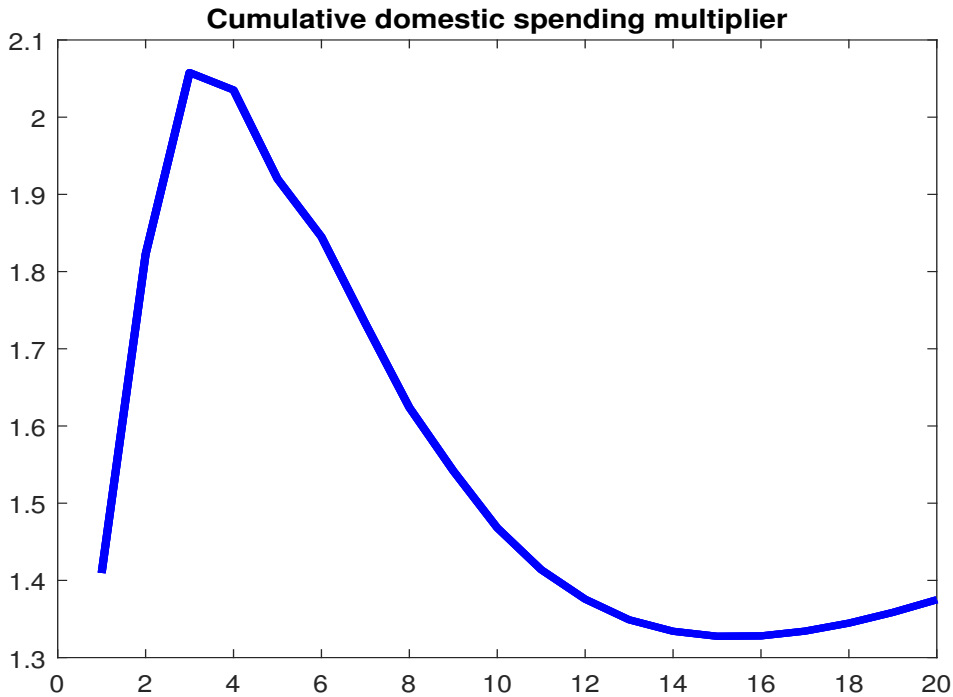
With the small-scale VAR model, we calculate impulse response functions and assess the size of fiscal multipliers for Slovenia. A 1 percentage point shock to government spending increases GDP by 0.32 percentages (on impact). However, we are interested in the effectiveness of government spending expressed as a percent of GDP. Therefore, we rescale the shock of government spending by a factor of 4.4, which is the inverse of a share of government spending (expressed as government consumption and government investment) in total GDP (1/0.23). The resulting impact of an increase in government spending (which is scaled to 1 % of GDP)

increases the GDP on impact by 1.4 percent ( $0.32 * 4.4 = 1.41$ ), which is also a definition of the fiscal multiplier. By another definition, and focusing on the nominal amount of fiscal stimulus, the shock to government spending of 1 € increases GDP by approximately 1.4 € on impact. The equations below summarize our calculations:

$$\frac{\Delta y}{\Delta g} = \frac{\% \Delta y}{\% \Delta g} \frac{Y}{G} = 1.41, \quad \text{where} \quad \frac{\% \Delta y}{\% \Delta g} = 0.32 \quad \text{and} \quad \frac{Y}{G} = 4.4. \quad (7)$$

We follow Alloza et al. (2020) and compute cumulative domestic spending multiplier. The (cumulative) elasticities are calculated by cumulating estimated responses of GDP over time and dividing them by the cumulated response of government spending. Again, we transform the elasticities into the multipliers by multiplying them with the sample average of the GDP-to-government spending ratio. For a € 1 increase in government spending, we find a cumulative domestic spending multiplier of € 1.9 after one year, decreasing to € 1.3 after three years. The results are presented in Table 2 and Figure 3.

Figure 3: Cumulative domestic spending multipliers over different quarters in the SVAR model



Source: Authors' calculations.

Table 2: Cumulative domestic spending multipliers in the small-scale VAR model

On impact	1.4
Peak effect (Q2)	2.1
First Year	1.9
Second Year	1.5
Third Year	1.3

*Source:* Authors' calculations.

## 6 Comparison of the fiscal multipliers

In the end, we check and compare the estimated cumulative domestic spending multipliers in the small-scale VAR model and the calibrated EAGLE model. Table 3 presents the multipliers. We can see that the multipliers align close to each other, and are, in economic magnitudes, close to Jemec, Strojan Kastelec, Delakorda (2011). The effect of the fiscal stimulus becomes insignificant and returns to the steady-state after 4 quarters. Consequently, we can see that in both models cumulative domestic spending multiplier decreases after the first year and levels off in the third year.

Table 3: Cumulative domestic spending multipliers in the small-scale VAR and EAGLE models

	<b>SVAR model</b>	<b>EAGLE model</b>
On impact	1.4	1.3
First Year	1.9	1.4
Second Year	1.5	1.3
Third Year	1.3	1.4

*Source:* Authors' calculations.

## 7 Conclusions

This paper lists the fiscal stimulus measures which were implemented by the Slovenian government and assesses the impact of the fiscal stimulus amid the COVID-19 outbreak on the Slovenian economy. To estimate the impact of the fiscal policy, in the paper, we use two models. We use the EAGLE model and the small-scale VAR model. We find strong evidence that the fiscal stimulus is affecting the GDP, private consumption, and import variables, while fiscal stimulus has a small effect on private investments and exports. The fiscal stimulus slightly increases inflation and real wages. The government subsidies to households and firms, and the direct fiscal stimulus, increase wages through several quarters. We find that the fiscal stimulus increases the nominal variables with a lower magnitude which is longer-lasting than for the real variables.

In the EAGLE model, we have three features that help us understand how the fiscal stimulus transmits to the Slovenian economy. First, the model allows government spending to partly consist of imported goods. Higher import expenditures lower the multiplier of government spending. Second, the model splits government spending between consumption and investment goods. Third, the model allows for the complementarities between private and government consumption.

We find that the main transmission channel of the fiscal stimulus on the Slovenian output is through high complementarities between private and government consumption which is in-line with Clancy, Jacquinot and Lozej (2016). We can reach the same conclusions based on the results of the SVAR model in Jemec, Strojjan Kastelec and Delakorda (2011).

## References

1. Alloza, M., Ferdinandusse, M., Jacquinet, P., and Schmidt, K. (2020). *Fiscal expenditure spillovers in the Euro Area: an empirical and model-based assessment*. ECB Occasional Paper Series No 240.
2. Auerbach, A., and Gorodnichenko, Y. (2012). Measuring the output responses to fiscal policy. *American Economic Journal: Economic Policy*, 4 (2), 1–27.
3. Auerbach, A., and Gorodnichenko, Y. (2013). Corrigendum: measuring the output responses to fiscal policy. *American Economic Journal: Economic Policy*, 5 (3), 320–322.
4. Bank of Slovenia. (2020). *Macroeconomic Projections for Slovenia, June 2020*. Bank of Slovenia.
5. Bayer, C., Born, B., Luetticke, R., and Müller, G.J. (2020). *The Coronavirus Stimulus Package: How large is the Transfer Multiplier?* CEPR DP 14600.
6. Blanchard, O., and Perotti, R. (2002). An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output. *Quarterly Journal of Economics*, 117(4), 1329-1368.
7. Caggiano, G., Castelnuovo, E., Colombo, V., and Nodari, G. (2015). Estimating Fiscal Multipliers: News from a Nonlinear World. *Economic Journal*, 125(854), 746-776.
8. Caggiano, G., Castelnuovo, E., and Figueres, J.M. (2020). Economic Policy Uncertainty Spillovers in Booms and Busts. *Oxford Bulletin of Economics and Statistics*, 82(1), 125-155.
9. Calvo, G. (1983). Staggered prices in a utility-maximizing framework. *Journal of Monetary Economics*, 12(3), 383-398.
10. Clancy, D., Jacquinet, P., and Lozej, M. (2016). Government Expenditure Composition and Fiscal Policy Spillovers in Small Open Economies within a Monetary Union. *Journal of Macroeconomics*, 48, 305-326.
11. Coenen, G., Straub, R., and Trabandt, M. (2012). Fiscal policy and the Great Recession

in the EA. *American Economic Review*, 102(3), 71 – 76.

12. Cugnasca, A., and Rother, P. (2015). *Fiscal Multipliers during Consolidation: Evidence from the European Union*. ECB Working Paper Series 1863.

13. Gomes, S., Jacquinet, P., and Pisani., M. (2012). The EAGLE. A model for policy analysis of macroeconomic interdependence in the Euro Area. *Economic Modelling*, 29(5), 1686-1714.

14. Gornicka, L., Kamps, C., Koester. G., and Leiner-Killinger, N. (2018). *Learning about Fiscal Multipliers during the European Sovereign Debt Crisis: Evidence from a Quasi-Natural Experiment*. ECB Working Paper Series 2154.

15. Jemec. N., Strojan Kastelec, A., and Delakorda, A. (2011). *How do Fiscal Shocks Affect the Macroeconomic Dynamics in the Slovenian Economy*. Bank of Slovenia Prikazi in Analize 2/2011.

16. Kilponen, J., Pisani, M., Schmidt, S., Corbo, V., Hledik, T., Hollmayr, J., Hurtado, S., Júlio, P., Kulikov, D., Lemoine, M., Lozej, M., Lundvall, H., Maria, J.R., Micallef, B., Papageorgiou, D., Rysanek, J., Sideris, D., Thomas, C., and De Walque, G. (2015). Comparing Fiscal Multipliers across Models and Countries in Europe. *International Journal of Central Banking*, 15(3), 285-320.

17. Leeper, E.M., Walker, T.B., and Yang, S-C.S. (2010). Government investment and fiscal stimulus. *Journal of Monetary Economics*, 57(8), 1000-1012.