The effects of fiscal policy during COVID-19 pandemic in Romania. The results of a DSGE model with financial frictions

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2024

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Abstract

This study investigates the effectiveness of fiscal policy in macroeconomic stabilization during the COVID-19 health crisis through a Dynamic Stochastic General Equilibrium (DSGE) model, incorporating financial frictions and using Romanian empirical data from 2007-2020. We analyse the impact of a consumption and labour demand shock similar to the ones occurring during the COVID-19 health crisis and explore how discretionary fiscal measures can modulate their effects. The findings suggest that increased government spending during the economic downturns of COVID-19 appears to mitigate some of the adverse effects, particularly on output and investment. While consumption does not seem to benefit significantly from fiscal stimulus, public spending helps to moderate declines in output and bolsters investment, especially in scenarios with a financial accelerator.

Keywords: fiscal policy, DSGE model, COVID-19, financial accelerator
JEL Classification: E2, E62, H12, H3

1 Introduction

The COVID-19 pandemic has triggered significant economic challenges, altering usual consumption habits and leading to unusual market behaviours, such as steep drops in stock values. In reaction to notable declines in demand, interruptions in the supply chain, and unpredictability over future cash flows, companies have reduced their investments. The real economy has been significantly influenced by these negative impacts, which had an impact on macroeconomic objectives and overall economic performance.

These shifts have had profound effects on economic performance indicators: the unemployment rate reached 7.5% in the European Union (EU27), surpassing the peak observed in 2008 during the Global Financial Crisis. Moreover, there was a significant drop in household real consumption per capita, which measures households' final consumption in nominal terms adjusted for the total population and price index. This plummeted by 12.3% in the EU, representing the steepest decline since 1999 (E*urostat: Newsrelease Euroindicators 2020*).

At the same time, real GDP growth in 2020 hit its lowest rate since 1980 at -7.2% (*International Monetary Fund Database*), further underscoring the severity of the downturn. This severe downturn was even lower by 2.4% than in the 2008 economic recession. The budget deficits followed a similar trend at the level of EU countries. Most of the countries encountered an increased deficit, with a 11 as percentage of the GDP in the second quarter, in value of 1185.5 billion EUR (*Eurostat: Newsrelease Euroindicators 2020*).

The economic landscape in Europe was severely disrupted by the COVID-19 pandemic, strongly affecting the consumer and corporate behaviour patterns and the supply and demand sides. Given the focus of this paper on the role of fiscal policy in shaping economic behaviour and performance, there will be examined the measures adopted by governments to mitigate the effects of the pandemic and to facilitate a return to equilibrium.

Governments worldwide have responded to these economic shocks with a range of fiscal measures aimed at mitigating the impacts and steering towards economic equilibrium. The predominant strategies have included expansive fiscal policies characterized by reduced taxation and increased public spending.

Most of the EU countries imposed short-term discretionary measures such as spending which amounted around to 6% of GDP and a tax postponement of around 1% of their national output. Some of the long-term measures used were capital investments and a decrease in the tax quotas. The largest beneficiaries from these measures were the SMEs, as they were granted a large number of liquidity measures such as tax relief, loans and credit guarantees.

The fiscal responses were largely characterized by their scale and immediacy, reflecting a shift towards Keynesian economic principles of countercyclical govern-

ment intervention. This approach, based on the idea that increased government spending during downturns can stimulate economic activity and stabilize the economy, has been central to the policy response during the pandemic. For example, the United States increased spending by allocating loans and grants to small businesses and enterprises, as well as additional funds to the healthcare system. China's fiscal policy relied also on increased spending on medical equipment, prevention and control schemes and transfers to unemployment aid, but also on decreased taxation such as tax relief and exemptions from paying social security contributions. The EU imposed three-pillar solidarity package by supporting the healthcare system, mitigating the unemployment risk, and offering financial support and grants to SMEs (*Boumans et. al 2020*).

It can be inferred that the majority of the governments relied on the economic theory as it concerns the recessionary cycle by increasing spending and decreasing or postponing taxation. According to the Independent Fiscal Institutions, the fiscal measures adopted by most of the governments within the EU Member States, along with the automatic stabilizers on the budgetary side, had an immediate effect, were well-oriented towards reducing the adverse impact of the economic shock.

This paper aims to analyse the impact of the COVID-19 pandemic on output and other macroeconomic variables through the DSGE simulation of two distinct shocks: one related to consumption preferences and the other concerning labour demand. Further, it examines the role of Romanian fiscal policy in mitigating these negative effects. The contribution of this paper to the existing body of literature is substantial, as it uniquely employs a DSGE model to analyse the economic effects of the COVID-19 pandemic across various macroeconomic variables, employing Romanian empirical data.

The paper is structured as follows: Section II provides a review of the relevant literature; Section III discusses the DSGE model and outlines its main economic agents; Section IV presents the empirical data and the calibration of parameters and Section V exhibits the results of the simulations. The final section summarizes the conclusions drawn from the findings.

2 Literature review

The question of how the fiscal policy can influence the economy by setting the levels of taxes and delivering the public goods with the most possible outcome of maximizing the society welfare lies in the centre of all macroeconomic debates. It has been observed that a DSGE model proved to be a powerful instrument in conducting the fiscal policy.

The benefit of using a dynamic model is that it takes into account the effects which the economic efficiency has on both current and future generations. There are many reasons why dynamic models are more preferred to the static ones. Moreover, a dynamic model allows governments to choose those fiscal policies that enhance economic efficiency and find a way to better solve the equilibrium transition of a national economy. By analysing the fiscal policy in a dynamic general equilibrium model, there are also taken into account the effects on other endogenous variables such as savings and interest rates. In this respect, a DSGE model can calculate the probability of an emerging crisis and design the optimal policies needed to deal faster and more efficiently with a financial shock.

One of the most influential pre-crisis DSGE models is the one introduced by *B. Bernanke et al. (1999)* in which the business fluctuations are taken into account through credit market frictions. This model, pivotal in macroeconomic research, examines how endogenous interactions within credit markets can amplify external economic shocks. It employs mainly three agents: households, entrepreneurs and retailers, who interact in a closed economy. As these types of models are concerned with how an economy can restore back to equilibrium, the authors conducted different types of shocks: a monetary policy shock, a technology shock, a shock induced by government expenditures which translates into a demand shock and an unexpected transfer of wealth between households and entrepreneurs.

Galí et al. (2007) explored the impact of increased government spending on output and consumption. Contrary to the predictions of standard Real Business Cycle (RBC) models, their findings suggested that public spending could bolster liquidity-constrained households and amplify the positive effects on output.

In the aftermath of the Great Recession of 2008, *J. Villaverde (2010)* proposed a new DSGE model that incorporated the fiscal policy and financial frictions to examine the output response to the fiscal shocks. The author concluded, based on the shocks conducted, that an increase in public expenditure tends to stimulate output more effectively in the short run compared to a reduction in tax levels, an insight supported by observations of the Fisher effect on real wealth and the finance premium during fiscal shocks.

The impact of fiscal policy is also examined in contexts where it interacts with monetary policy, especially under conditions like the zero-lower bound interest rates, some papers showing that fiscal expansion can have a magnified effect

on the economy *(Christiano et al. 2011*; *Erceg and Lindé 2014*; *Bhattarai and Trzeciakiewicz 2017)*.

Some authors *(Drygalla et. al 2017)* examined the effects of fiscal stimulus packages in the context of the Great Recession by using a DSGE model. Their findings, tailored to the German economic sector, suggest that fiscal interventions, such as public consumption, investments and adjustments in labour taxes played a role in mitigating the recession's impact. Other research, including the study of *Bhattarai and Trzeciakiewicz (2017)* which examined the impacts of fiscal policy on the economy, indicates a procyclical relationship between capital income taxes and government investment relative to GDP. The same study also finds that a public investment shock stimulates the labour demand more significantly than equivalent government spending shock. Other studies focused on fiscal policy stabilisation in the euro area, show that fiscal policy is effective in stabilising the GDP by employing countercyclical measures during economic downturns *(Ratto et. al 2007)*.

Research by *Gallegati et. al (2019)* delves into the significance of financial frictions across different sectors during business cycles. By comparing models with and without financial frictions, they demonstrate that such frictions can exacerbate or mitigate economic fluctuations, depending on their nature and the economic sector affected. This underscores the critical need to understand and incorporate financial dynamics in economic modeling and policy formulation.

3 The DSGE model

In building the DSGE model it was followed the approach introduced by *Bernanke et. al (1999)*. The model intends to examine how two different shocks: a preference shock on consumption and a shock on labour demand affect the output, which is similar to the situation during the COVID-19 lockdown. Similar to the case of *Bernanke et. al (1999)*, a financial accelerator was introduced to observe how the shocks on consumption and labour are amplified in a closed economy and how this has the potential to affect the rest of the macroeconomic variables included in the model.

The economic agents in the model are represented by households, entrepreneurs, capital producers, retailers, financial intermediaries, and the government.

In a frictionless business cycle model, firms acquire the necessary financing at a riskless interest rate. However, not all businesses have the same financial performance and some of them have an increased default probability. In this situation the financial intermediary, the bank, has to perform a "costly state verification" to reduce the asymmetry of information and the systematic risk. Therefore, the entrepreneurs have to pay, besides the loan and the riskless rate of return, also the

financing premium. However, unlike the BGG model, our model suggests including the government debt.

In order to recreate the same economic shocks that occurred during the COVID-19 lockdown, the emphasis lays on the consumption of households and the labour supplied. To observe how these shocks, amplified by the presence of a financial accelerator, affected the national output and what other effects they had on the rest of variables, we solved the optimization equations. After each equation, there were applied the dynamic first order conditions (FOCs), by deriving the Lagrange equation, and calculated the deterministic steady states (SS) for each of them. Eventually, the FOCs were log-linearised around the SS.

3.1 *Households*

In the model, households supply labour to entrepreneurs, receiving wages subject to income tax, consume goods and services from retailers, and invest in bank securities and retail activities, aiming to maximize their utility under budget constraints:

$$(1+\tau_{C,t})C_t + \frac{B_t}{P_t} + \frac{D_t}{P_t} = (1-\tau_{L,t})W_t H_t + \frac{R_{t-1}B_{t-1}}{P_t} + \frac{R_{d_{t-1}}D_{t-1}}{P_t} + P_{r_t} \quad (1)$$

Their utility function, incorporating consumption preferences and labour supply, is defined by a constant elasticity of substitution formula:

$$\max U_{\text{Intertemporal}} = E_t \sum_{s=0}^{\infty} \beta^s \left\{ \log\left(C_t - hC_{t-1}\right) \psi \frac{H^{1+v}}{1+v} \right\} \quad (2)$$

To analyse how an exogenous event on consumption preferences affects the other macro variables, the preference consumption shock is described by the equation below:

$$U = \sum_{s=0}^{\infty} \beta^s \left\{ \mathcal{E}_{C_t} \log\left(C_t - hC_{t-1}\right) \psi \frac{H^{1+v}}{1+v} \right\} \quad (3)$$

3.2 *Entrepreneurs*

Entrepreneurs, also referred to as wholesale firms, operate in a perfect competition market to maximize their real gross operating income over time, constrained by technological factors, capital accumulation, and investment adjustment costs. They face financing premiums from banks that impact their profit maximization efforts. Using a Cobb-Douglas production function: $Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$, entrepreneurs combine capital from previous periods and labour from households to produce output, influenced by exogenous labour shocks: $Y_t = A_t K_t^{\alpha} (\varepsilon_{L_t} L_t^{1-\alpha})$ that affect

productivity. Wholesale firms can increase their net wealth by two sources: by capital gains accumulated from capital investments made in the previous period, and by the income from labour supplied.

3.3 *Financial accelerator*

The DSGE model incorporates a financial accelerator mechanism, based on the "Costly State Verification" concept pioneered by *Townsend (1979)*, which intensifies the effects of consumption and labour preference shocks on the economy. This mechanism is crucial in markets with financial frictions, where the impacts are magnified compared to those in a perfect financial market. The "costly state verification" lays on the basis of the principal-agent relationship bearing in mind that the lender, the banks, have little information about the financial performance of the borrowers, the wholesale firms. The banks must pay a fixed monitoring cost in order to obtain all the possible information about the borrower's financial performance. The external finance premium depends on the financial leverage of the wholesale firm ((Total debt)/(Own capital)). The higher the leverage of the firm, the larger is the external finance premium. The introduction of the financial accelerator in the DSGE model is based on the following equation:

$$\mathrm{PFE}_t = \frac{E_t(R^k_{t+1})}{R_t} \tag{4}$$

3.4 *Retailers*

One of the fundamental characteristics of the RBC model is that of price flexibility. However, as opposed to it, in a DSGE model price inertia is introduced with the aid of retailers, factor which makes it more resembling to the real economy features. Price rigidities are introduced in our model through the monopoly power of retailers. The price rigidity equation, in a log-linearized manner, as presented by *Calvo (1983)*, is the following one:

$$\pi_t = \beta E_t(\pi_{t+1}) + \frac{(1-\varphi)(1-\varphi\beta)}{\varphi}\rho_t \tag{5}$$

Monetary policy influences through the Taylor rule are also introduced, adjusting the nominal interest rate based on output and inflation targets, demonstrating the interaction between monetary policy and economic variables under financial frictions.

3.5 *Banks*

In the model, the banks play a trivial role, as intermediaries between saving households and borrowing entrepreneurs. This triviality of the financial intermediation is explained by the fact that banks do not seek to obtain any profit, any extra funds owned are given back to households. Thus, it can be stated that banks operate in a pure and perfect competition market. As it has been shown also in reality, firms' and banks' balance sheet framework have acted as an amplifier to the transmission of shocks in the economy. The firms' financial structure is a key determinant in deciding upon the value of the external finance premium, as previously mentioned in the sub-sections above. When the financial position of a firm is deteriorating, then the probability of default is also increasing. Therefore, the banks have to increase also the amount of interest faced with a potential incapacity of the borrower to repay the loan. Having more costs incurred and with a deteriorating financial position, firms will diminish their investments, therefore reducing the levels of output. In this situation, the financial accelerator acts as an amplifier of the shocks to the rest of variables.

3.6 *The fiscal policy*

The exogenous public expenditures of the government are financed through lump-sum taxes collected from households. These are the taxes on consumption $(1 + \tau_{C,t})C_t$ and on labour $(1 - \tau_{C,t})W_t H_t$. What is also different to the baseline model is the fact that we introduced the nominal public debt as a variable. Thus, the governments are faced with a budget constraint and the equation looks as follows:

$$\frac{D_t^n}{P_t} = G_t + R_{t-1}\frac{D_{t-1}^n}{P_t} - \text{Tax}_t \tag{6}$$

In the event of a shock affecting the output or other variables such as, in our case, consumption and labour, the government tries to minimize the effects of this exogenous circumstance. It can either increase or decrease the level of public spending. This change is perceived as a government spending shock on the overall economy, and it is captured in the equation of the real public expenditures:

$$G_t = \rho_G G_{t-1} + \rho_{G_D} D_{Y_t} + \varepsilon_{G_t} \tag{7}$$

3.7 *Macroeconomic equilibrium conditions*

There are two conditions that need to be fulfilled to have equilibrium in our closed economy model. The first one is equilibrium on the labour market, in which the

demand of work coming from wholesale firms should equal the supply of labour coming from households.

$$\psi H_t^v = (1 - \tau_{L,t})\rho_t \Omega (1 - \alpha) \frac{Y_t}{H_t} \lambda_t \tag{8}$$

The second condition that needs to be fulfilled to have equilibrium in our model is to have equilibrium on the goods market. Since we have a closed economy as in the baseline model, we can neglect the influence of imports and exports on the output. The equation of the goods market equilibrium looks as follows:

$$Y_t = C_t + I_t + G_t + C_t^E + \text{Monitoring} \tag{9}$$

4 Data and calibration of the model

Before initiating simulations to analyse the impact of various shocks on economic variables, it's essential to establish a baseline calibration for the model parameters. While the original calibration of the baseline model is retained, adjustments have been made to tailor the model to reflect the fiscal conditions specific to Romania, accommodating the nuances of a closed economy within this localized context. The value of the capital used in the production process (α), the habits of consumption (h) and the inverse Frisch elasticity (v) were taken from one DSGE model conducted by *Copaciu et. al (2015)* for the case of the Romanian economy. As regards the fiscal conditions and other empirical data, the framework to establish the level of lump-taxes is the one as in the previous DSGE model. There was set a timeframe of 13 years, since 2007-2020 to have a more widespread vision of the parameters' value. The values for the implicit tax on labour and implicit tax on consumption were extracted from the *European Commission - Taxation Trends in the European Union: Data for the EU Member States, Iceland and Norway (2022 edition)*. After this, there was taken the average of the consumption and labour taxes. The average of the tax rate on consumption was at around 16%, so the calibration was set to 0.16. The mean of the implicit tax rate on labour was 31.72% and was calibrated at the value of 0.32. With respect to other empirical data, the level of public debt was also calibrated at 0.33. The last empirical value retrieved from the Ameco database was the government consumption to the output. There were taken the values for the total final consumption expenditure of general government and divided to the values of the gross domestic product (in national currency). After this, the average was computed and calibrated at 0.16. The calibration of the parameters can be found in the annex.

5 Simulation results

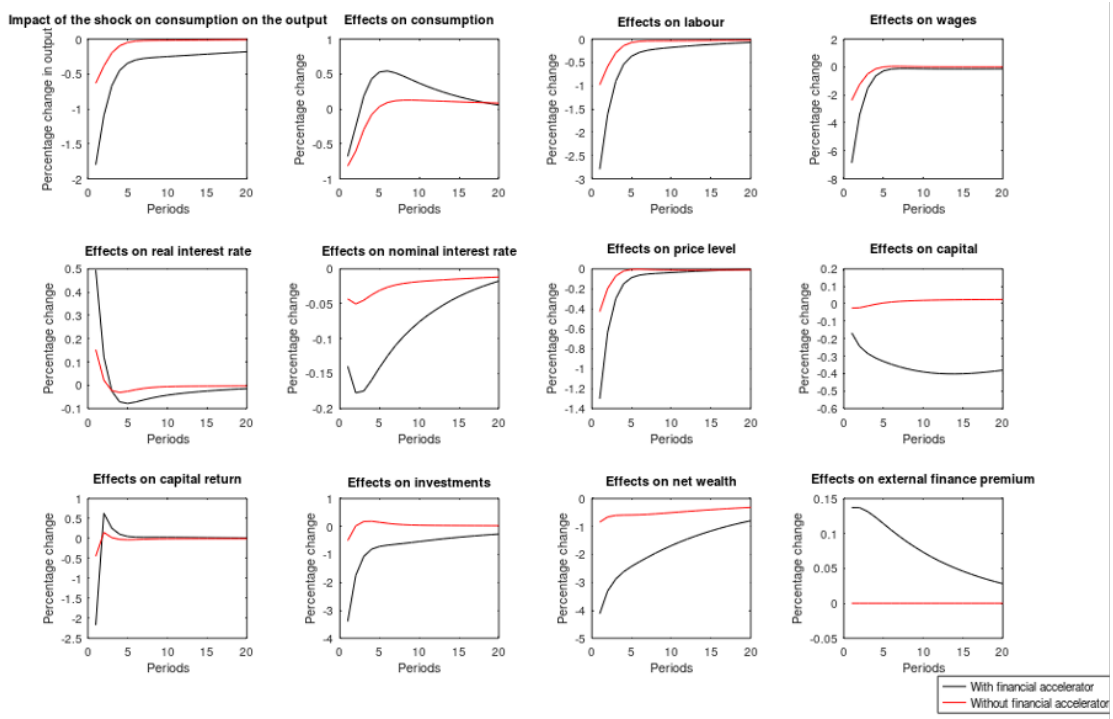
In order to recreate the same economic conditions as in the lockdown imposed due to the COVID-19 crisis, a demand shock which alters the consumption preferences of the households and a demand shock which strongly diminishes the labour force were introduced. The persistence of them was similar, that is 1% standard deviation from the steady state. Also, we will examine how these two shocks affects the variables having in regard the effects of the financial accelerator.

5.1 Effects of a consumption shock

If the level of household preference consumption decreases by one percent standard deviation from the steady state value this implies that the output is negatively affected by around 1.75% standard deviation from the steady state when the financial accelerator is present (*see Figure 1*). In an economy without it, the decrease in the output is around 0.6% standard deviation from the steady state. Based on the simulations, consumption is diminished, accounting for the fact that due to the imposed isolation, households refrained from consumption. Also, the demand shock was sustained by the consumers' perception such as the fear of contagion, reducing their willingness to acquire retail goods and services. As a consequence, firms produce less and reduce their productivity factors. Thus, there is less demand for labour relative to supply, and, as an effect, wages decrease (by more than 6% from the steady state in the presence of a financial accelerator and by 2% in its absence). At the same time, prices decrease, followed by a decrease in profits, and leading to a net wealth diminish (by 4% in the presence of a financial accelerator and by 1% in its absence). Due to increased borrowing costs and diminished net wealth, investments are significantly curtailed to 3.5% of the equilibrium state, a contraction far more severe than the 0.5% decrease that would occur in the absence of a financial accelerator. This reduction in investments further suppresses economic activity, demonstrating the financial accelerator's role in deepening the impact of shocks. This rise in real interest rates is another detrimental factor contributing to the severe decline in investments. Without a financial accelerator, the impact on investments is only temporary; however, with asymmetry of information, restoring investments to the steady state becomes more challenging due to the presence of the external finance premium. Finally, consumption patterns respond differently depending on the presence of a financial accelerator. With the accelerator, consumption initially decreases by 0.5%, quickly followed by a recovery. This pattern contrasts with a 0.8% decrease in consumption in its absence, commonly expected during an economic downturn. This resilience in consumption under the financial accelerator is partly due to reduced prices, which, alongside decreased investments, contributes to more severe demand-side effects than those on supply, leading to

overall price reductions and a moderated decrease in consumption initially.

Figure 1. Effects on the macro-variables due to a consumption preference shock

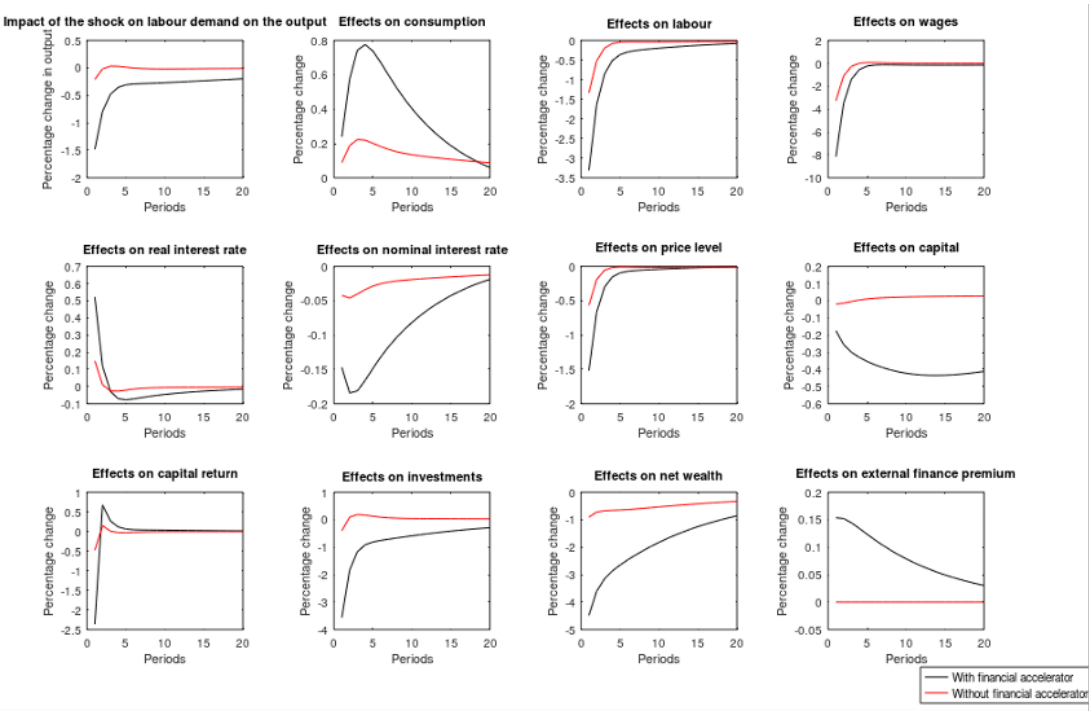


5.2 Effects of a labour shock

The other shock that occurred during the health crisis was the labour demand shock. By stimulating economic conditions analogous to those experienced during lockdown, characterized by restricted working conditions that diminished labour demand, the output is decreased by 1.5% in the presence of a financial accelerator (*see Figure 2*). When the markets are in perfect symmetry, that is when the lender has enough information about the position of the borrower, the output is decreased only by 0.1% standard deviation from the steady state. In the absence of a financial accelerator, the productivity of wholesale firms is affected, but they still manage receive funding at a riskless interest rate. Nevertheless, a reduced workforce led to a decrease in input levels, which subsequently contracted aggregate demand. The analysis extends to other macroeconomic variables where, in

the presence of a financial accelerator, the labour is decreased by more than 3% from its steady state (*see Figure 2*). Without the financial accelerator, the reduction in labour was limited to 1%, indicating that despite existing information asymmetries, the negative impact on labour remains considerable. The impact on wages is considerably higher. When a labour demand shock hits the economy and the labour is negatively affected, wages decrease by 8% standard deviation from its steady state value, given the presence of a financial accelerator and to 3% when it is absent. As a consequence of the fact that wholesale firms have less working capability and possibility to produce goods and services, their capital is reduced. When the financial accelerator is present, the decrease in capital follows a downward trend, from 0.2% in the first period to 0.5% in the twentieth period. When market asymmetries are absent, the effects on capital are not substantial, restoring to the steady state much faster.

Figure 2. Effects on the macro-variables due to a labour demand shock



The diminished production capabilities and reduced access to capital adversely affected the net wealth of entrepreneurs, exacerbated by the financial accelerator. This reduction in net wealth increased borrowing costs, leading to higher financing expenses and elevated external finance premiums. The capability of wholesale firms

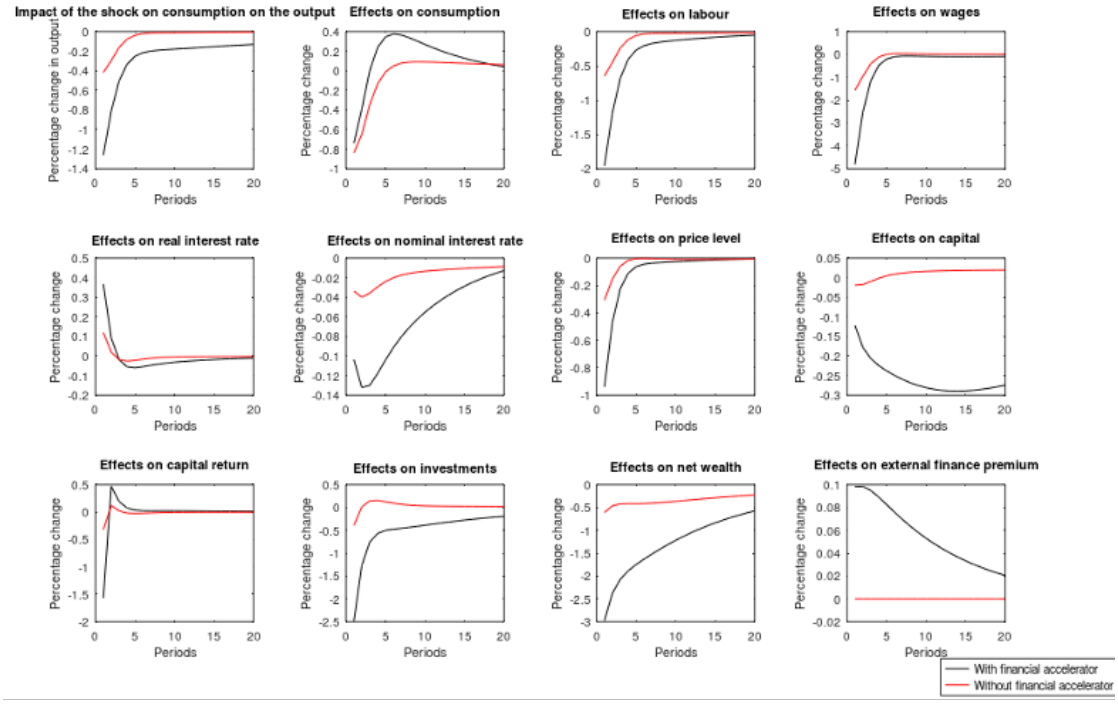
to secure financing deteriorated, necessitating higher payments to compensate for the reduced labour demand. Consequently, the net wealth of firms decreased by over 4% from the steady state. When the external finance premium is absent, so lenders and borrowers have enough information about the financial performance, the decrease in net wealth accounts to 1% from the steady state. Having the background of a financial accelerator, continuously decreased net wealth triggers an even more substantial reduction in wages. Having a continuous decrease in the capital, the entrepreneurs are discouraged from investing in new projects. This causes a reduction of almost 3.5% from the steady state value in the presence of the financial accelerator. These effects on investments are not so steep when the shock does not influence the costs of borrowing of the firms, decreasing by only 0.5% from the steady state and restoring much faster to equilibrium. Looking at the consumption side, we can notice that, similarly to the other shock applied, it increases. This is due to the fact that the nominal interest rates were reduced, and household could afford to buy the same goods and services at lower prices. Additionally, this may be related to the fact that people are less incentivized to save when the interest rate is low, leading them to consume more.

5.3 Government spending shock

In this sub-section we will examine how the government could have used fiscal policy to offset the effects of the health crisis by increasing government spending, in the attempt of restoring the economy to its previous equilibrium level. The Romanian government also relied on increased public spending to stimulate the aggregate demand. There were considerable high changes to the level of public goods supplied. For example, according to a Ministry of Finance report regarding the execution of the general consolidated budget for 2020, the public expenditure increased by 15.4% in nominal terms from the previous year, in amount of 27.9% of GDP (2020). To see the effects of a government spending shock and whether it managed to restore the output or incentivize the economy, we introduced a positive shock to the equation of public spending, calibrated at 1% standard deviation from the steady state. As far as it can be noticed from *Figure 3*, when the government adopts discretionary measures in the form of increased public spending aimed at restoring the economy after a negative consumer preference shock, the output is decreased to a lower degree, both in the presence and in the absence of financial frictions, than in the case where there was not given any fiscal stimulus. In an environment with a financial accelerator, closer to the real Romanian economy, the output is decreased by around 1.2% standard deviation from the steady state, compared to the baseline model where it was affected by 1.75%. When there is a frictionless economy, it is decreased by 0.4% compared to 0.6% from the baseline model, showing that the increase in the government spending proves to be more

efficient in the presence of a financial accelerator.

Figure 3. Effects on the macro-variables having a consumption preference shock with expansionary fiscal policy

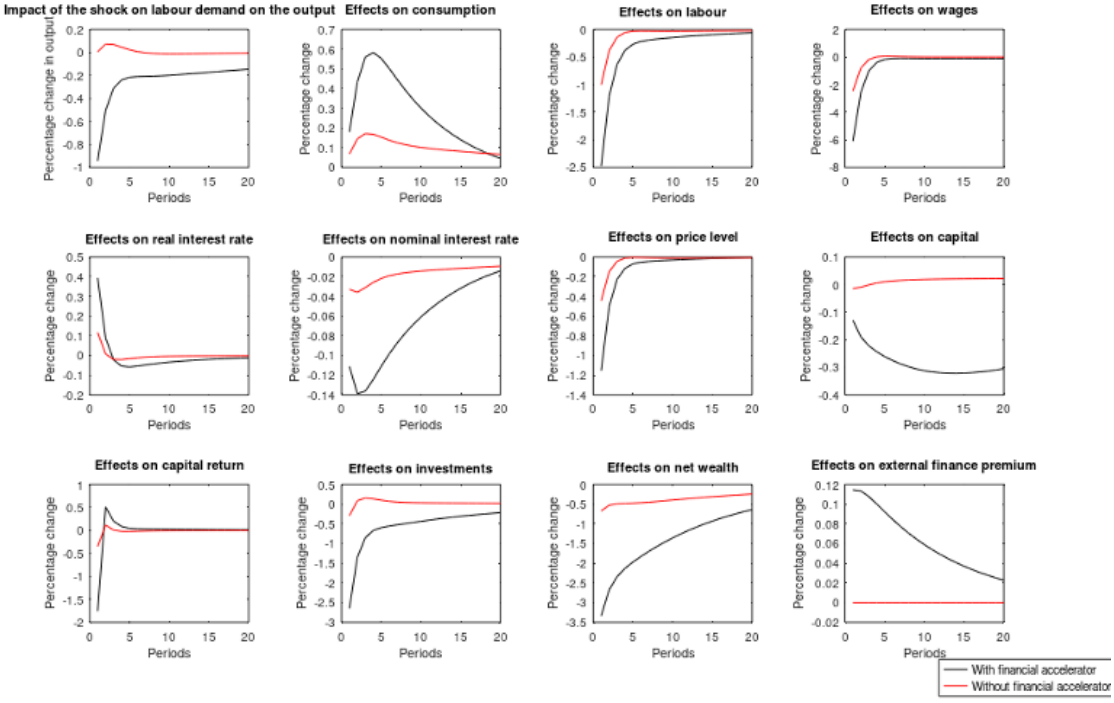


Even though the impact on the output is lessened, the government did not manage through its policy instruments to incentivize consumption (*see Figure 3*). It follows a similar trend as in the baseline model, decreasing in the first period, then it levels up in the fifth. However, the figures are different: in the presence of market frictions, consumption is decreased by 0.7% then it increases by 0.4% from its steady state. When the financial accelerator is absent, households' consumption decreases by more than 0.8% (it is to some extent similar to what happens in the baseline model) and as consumers are accommodated to the situation, it reverts to the equilibrium by the fifth period. On the other hand, there are some noticeable positive aspects on the rest on the macro-variables. Entrepreneurs' net wealth is diminished to a lower degree (by 3% compared to 4% in the first model). Investments are stimulated due to the public spending increase: there is a change of one percentage point from the baseline scenario when the financial accelerator is present (they decrease to 2.5% compared to 3.5%). These figures show how a fiscal stimulus makes consumption and investments move into opposite directions

after a consumer preference shock.

In the attempt of the government to revitalize the stance of the economy after the labour demand was severely restricted (*see Figure 4*), we observe positive responses on the output in the absence of a financial accelerator: it slightly increases above the steady state compared to the baseline model where we observe a decrease in the output by 0.1%. However, a frictionless economy is not so close to the real world, especially to the Romanian conditions. Therefore, we take a more detailed evaluation at what happens in the presence of a financial accelerator. The output decreases by 0.9% compared to the baseline model, where it downgrades by 1.5% from the steady state. One main factor contributing to this mitigation in the evolution of output is the stimulation of household consumption, which increases from 0.3% above the steady state in the original scenario to 0.6% above the steady state in the scenario with expansionary fiscal policy.

Figure 4. Effects on the macro-variables having a labour demand shock with expansionary fiscal policy



6 Conclusions

The aim of this paper was to examine the effects of COVID-19 health crisis when the governments worldwide imposed forced lockdown, and how the path to economic recovery looks like.

In the case of the consumption shock, the simulations suggest that even though the negative effects were quite substantial on private investments, labour and wages, consumption was not affected to the expected degree. By the fifth period, consumer spending is increased due to the fact that prices were decreased at the same time and the decline in investments as part of the demand side moves it in an opposite direction.

In terms of asymmetry between the two shocks, consumption and labour demand, the former had a more pronounced impact on output compared to the latter. This asymmetry can be attributed to the different channels through which these shocks affect the economy. The consumption shock directly reduces household spending, as component of the output, leading to a significant contraction in aggregate demand.

We also looked at what discretionary fiscal measures the government took in order to alleviate the negative economic impacts of the health crisis. Fiscal authorities worldwide relied on increased government spending as their main policy tool. Nonetheless, the downside is that these surges in government spending deteriorated the budget balance and indebted the economies, harming the fiscal sustainability and discipline. Romania faced a more financially difficult situation, as the government had on one side to sustain the support granted to the business environment due to the pandemic and on the other hand, to comply with the gradual reduction in the structural and budgetary deficit, as it has been subject to the Excessive Deficit Procedure due to the procyclical fiscal policies before the start of the health crisis.

The effects of government intervention in response to a consumption shock are slightly different from those in response to a labour shock. In the first situation, the increase in public spending seems to decrease household spending even further, while in the case of a labour demand shock, it is incentivized even more.

Based on the simulations, it was observed that increased government spending during economic downturns appears to mitigate some of the adverse effects, particularly on output and investment. While consumption does not seem to benefit significantly from fiscal stimulus, public spending helps to moderate declines in output and bolsters investment, especially in scenarios with a financial accelerator.

One of the shortcomings to this paper is that it was observed how the macrovariables interact in a closed economy, thus excluding the possible effects the balance of trade has on the aggregate demand. However, the parameters were calibrated to the Romanian economic conditions, so the DSGE model is intended to

show the trend of the macro-variables and their implications on the stance of the economy.

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7 Annexes

Parameter	Value	Description
ψ	0.06	Corrective coefficient applied to labour
v	2.5	Inverse Frisch elasticity
h	0.38	Consumption habits of households
$\tau_{C,t}$	0.16	Tax paid on consumption
$\tau_{L,t}$	0.32	Tax paid on labour
α	0.35	Percentage of capital used in the production process
Ω	0.99	Percentage of labour offered by households in the total amount of labour
δ	0.049	Depreciation rate applied to capital
θ	10	Probability of price change
β	0.99	Discount factor
γ_f	0.93	Probability of net wealth accumulation
ρ_G	0.5	Persistence to government expenditures shock
ρ_H	0.5	Persistence to labour shock due to lockdown restrictions
ρ_C	0.5	Persistence to consumption shock due to lockdown restrictions
ρ_{τ_C}	0.8	Autoregressive coefficient for consumption tax
ρ_{τ_L}	0.8	Autoregressive coefficient for labour tax
ρ_{G_D}	0.05	Autoregressive coefficient for public debt
β_0	0.8	Change in the monetary policy interest rate
β_1	1.1	Sensitivity of the monetary policy to changes in inflation
β_2	0	Change in output
ϕ	0.75	Probability of firms adjusting their prices
D_{Y_t}	0.33	Level of public debt
G/Y	0.16	Percentage of government spending to the output
N/K	0.5	Percentage of net wealth to capital

Table 1: Calibration of the parameters

Parameters	**Equation**	**Description**
Share of capital accumulation to the net wealth	$K/N = 1/(N/K)$	1 divided to the amount of net wealth in capital
Real interest rate	$1/\beta$	1 divided to the discount rate
Capital return	$1/\beta + 0.005$	1 divided to the discount rate + 0.005
ρ^*	$1/1.2$	The value at steady state
Output (Y) to capital (K)	$\left(\frac{1/\beta+0.005-(1-\delta)}{\alpha\rho^*}\right)$	(The capital return - (1 - the depreciation rate)) / the capital share in production
Share of capital accumulation to the output (in %)	$K/Y = 1/(Y/K)$	1 divided to the amount of output to capital
Share of entrepreneurial consumption to the output (in %)	$\frac{(1-\gamma_f)}{\gamma_f} \times N/K \times K/Y$	(1 - net wealth accumulation) / net wealth accumulation × net wealth as % in capital × capital as % in output
Share of investments to output (in %)	$\delta \times K/Y$	Depreciation rate × the amount of capital in % in output
Share of household consumption to output (in %)	$1-G/Y-(\delta\times K/Y)-\left(\frac{(1-\gamma_f)}{\gamma_f} \times N/K \times K/Y\right)$	1 - % of investments to output - % of government spending to the output - % of entrepreneurial consumption to the output
Share of taxes to the output (in %)	$G/Y - D_Y^* \times (r^* - 1)$	% of government spending to the output - the level of public debt at steady state × (interest rate at steady state - 1)
ϵ	$\frac{(1-\delta)}{(\rho^*\alpha\times Y/K+1-\delta)}$	(1 - the depreciation rate) / capital share in production × % of output to capital + 1 - the depreciation rate

Table 2: Steady State Ratios