The effectiveness of fiscal policy stimulus in the COVID-19 time: cross-country empirical evidence

Nazarii Pecher

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Editor: Christian Reiner, Christian.reiner@lbs.ac.at
Lauder Business School
Hofzeile 18-20, 1190, Vienna, Austria
www.lbs.ac.at

About the Author

Nazarii Pecher completed the “Strategic Finance and Business Analytics” Master Program at Lauder Business School. He graduated in 2021. This working paper corresponds to the excellent master thesis by Nazarii Pecher. The supervisor was Dr. Alexander Rabas, M.Sc..

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I declare in lieu of an oath that I have written this master thesis by myself, and that I did not use other sources or resources than stated for its preparation. I declare that I have clearly indicated all direct and indirect quotations, and that this thesis has not been submitted elsewhere for examination purposes.

I CONFIRM
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List of Abbreviations

ACME	Average Casual Mediation Effects
AD	Aggregate Demand
ADE	Average Direct Effects
ARRA	American Recovery and Reinvestment Act
CARES	Coronavirus Aid, Relief, and Economic Security Act
DSGE	Dynamic Stochastic General Equilibrium
EERP	European Economic Recovery Plan
EMU	European Monetary Union
EU	European Union
FDI	Foreign Direct Investments
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GSP	Gross State Product
IMF	International Monetary Fund
OECD	Organization for Economic Cooperation and Development
SAR	Special Administrative Region
VAR	Vector Autoregressive
WB	World Bank

Abstract

Governments worldwide have gone to great lengths in order to confront the economic ramifications of the crisis caused by the COVID-19 pandemics. The size of fiscal stimulus packages reached unprecedented highs, particularly given the low-interest environment and lack of policy space for monetary instruments. The overwhelming attention to fiscal policy dimension necessitates scrutinized view on the effectiveness of such measures. The current study attempts to provide this view by assessing whether a size of fiscal policy matters in terms of short-term economic recovery. The academic endeavor builds upon numerous theoretical and empirical tenets, that shape the hypotheses and its research construct. Essentially, empirical findings suggest higher fiscal multipliers in times of economic recessions. Zero interest rate environment is believed to increase output responsiveness as well. Numerous macroeconomic variables, notably trade openness, fiscal deficit, public debt, are expected to determine fiscal policy transmission as well. All these variables are incorporated into OLS model that is applied to find significant patterns and associations. While one basic specification yields negative relationship between fiscal measures and economic growth, two other enhanced specifications generally support the positive relationship. Mediation analysis corroborates the findings of one of the latter specification implying that fiscal policy decisions do have positive influence in times of the COVID-19 environment. These findings, however, denote rather low output response, which is close to zero. Among other control variables, the most robust effect appeared to be the one caused by the public debt negatively affecting the output response. Additionally, there is evidence that advanced countries have more efficient fiscal transmission mechanism which corroborates academic findings. The rejection of null hypotheses is conducted with 5% significance level. Despite the novelty and high relevance of the research, these results should be considered thoughtfully since the potential of endogeneity and policy lag issue was also identified.

1. Introduction

1.1. Statement of the problem

According to Fatas & Mihov (2009, p. 59), the number of studies on fiscal policy topics is usually three-four times lower than on monetary policy. It provides a firm indication that the effects of fiscal measures are normally less comprehensible and more questionable, especially under the actual extraordinary conditions (Auerbach, Gorodnichenko, & Murphy, 2020, p.195). Nevertheless, the current study seeks to discern certain scientifically proven patterns in policy transmission mechanism, hence, to shed light on the effectiveness of countercyclical budgetary measures in terms of economic output within the COVID-19 environment. To present the practical relevance of the topic, it is reasonable to briefly check and confirm the nature of unprecedented developments in the current world.

The outbreak of the COVID-19 pandemics in March 2020 signalized the beginning of the prolonged severe socio-economic reality. The limitations globally imposed on the social activities with the aim to curb the spread of the virus seriously challenged the viability of firms and their business models, which, in turn, pulled national economies into the unprecedented recessionary state. The decade of steady growth is over: according to the most recent estimates, the global GDP growth in 2020 dropped by 3.5% (IMF, 2021b, p.4; WB, 2021a p.4), which represents the deepest recession since World War II. Moreover, advanced economies seemed to suffer the most due to a negative growth rate that amounted to 4.9%, whereas developing countries were hit to a lower extent by 2.4% (IMF, 2021b, p.4). Considering the world's biggest economies, the US GDP dropped already by 9.2% in the second quarter of 2020, while the EU and Japan observed the contraction equivalent to 11.1% and 8.1%, respectively (OECD, 2021b). Since it is difficult to find a country that withstood the virus spread at the onset, the ramifications of the pandemics are of global nature.

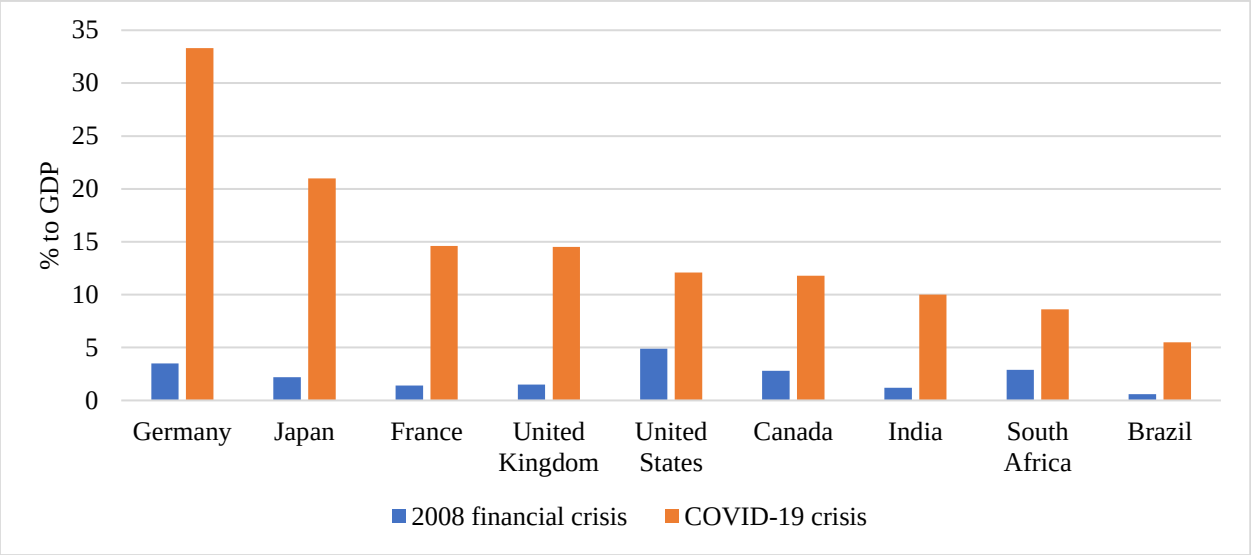
The severity of the ongoing crisis was reflected on other important socio-economic indicators. For instance, the unemployment rate hit unprecedented levels, particularly in the US, with 14.7% in April (US Department of Labor, 2020), whereas in the Euro area the unemployment reached around 9% in the second quarter of 2020 (Eurostat, 2020). On global average, the wage level in the first half of 2020 dropped by 5.4%, while the food prices were increasing at a noticeable pace across the world (WB, 2021a, pp. 135-136). In terms of poverty, the developing countries suffered the most: it was estimated that ca. 90 million people are in danger to fall below the poverty line (IMF, 2021b, p.6). It is evident that the COVID-19 crisis contributed to the aggravation of economic welfare of people worldwide.

Despite the recent remarkable progress in the pace of vaccination and effective lockdown measures, the significant uncertainty still remains due to the rather unpredictable nature of virus (OECD, 2021a, p.36). Moreover, the well-anticipated recovery is expected to unfold unevenly across different countries on the grounds that countries have implemented different strategies to confront the crisis, which might also further polarize the global wealth distribution (OECD, 2021a, p.22). Further concerns evolve around the households saving behavior and considerable debt accumulation, both private and public (OECD, 2021a, p.36). Nevertheless, there are number of reasons to predict the strong recovery in the second half of 2021, and one of this reason is considered to be the large-scale fiscal support strategy that was actively followed by the governments across the world (IMF, 2021b, p.5).

In order to reinforce economic conditions, policymakers are in the possession of two economic policy tools: monetary and fiscal. Due to the current low interest rate environment, which is particularly pertinent to high-income countries, countercyclical fiscal measures appeared to be the most applicable solution (Benmelech & Tzur-Ilan, 2020, p.2; Coenen et al., 2012, p.23). From the theoretical perspective, fiscal stimulus packages, as an element of IS curve, tend to increase the AD that, in turn, should lead to the amplified level of output (Mishkin, 2016, p.481). After the Great Recession, the pivotal importance of the fiscal expansion strategy during crisis was advocated in the studies of Batini, Eyraud, & Weber (2014, p.4) as well as Coenen et al. (2012, p.23). Hence, the up-to-date rhetoric in favor of the active policy support is practically uniform, from the leading economic institutions (IMF, 2021b, p.8; OECD, 2021a, p. 51; WB, 2021a, p.38) to the most recent academic studies that examined the effect of the pandemics (Gourinchas, 2020, p.39; Ma, Rogers, & Sili, 2020, p.3). There is also a special indicator, which assesses the direct effect of fiscal measures on the nation's GDP – "fiscal multiplier", which is considered to be sizeable in the pandemic environment based on the empirical findings of the last decade (Wilson, 2020, p.2).

That is, starting from March 2020, national governments worldwide have launched massive stimulus packages aimed at alleviating the global economic disruption caused by the COVID-19 outbreak. (IMF, 2020a, p.8). The following graph depicts the magnitudes of the fiscal support measures in the nowadays crisis in comparison with those policy actions implemented during the most recent global financial crisis in 2008. It is evident that the scale of current support packages are considerably higher, also when considering that the 2020 values are computed based on the data until June 2020 (see Figure 1).

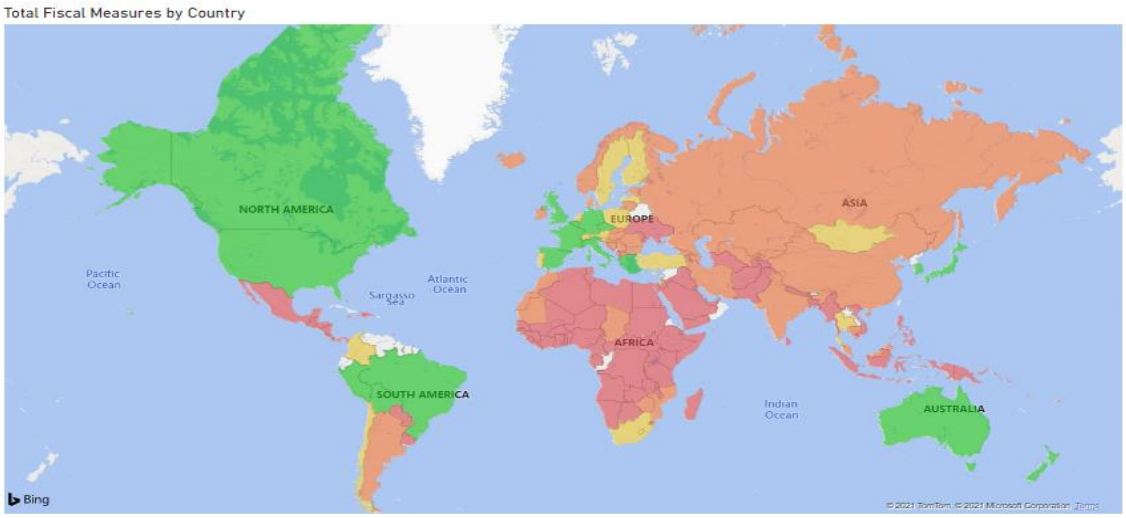
Figure 1 Comparison of fiscal stimulus for selected countries 2008 vs 2020, in % to GDP



Note: compiled by author based on data from Cassim, Handijski, Schubert, & Zouaoui (2020).

Another perspective on the complete dataset on fiscal measures can be obtained from the map below (see Figure 2). In this illustration, the size of total fiscal stimulus (in % to GDP) as of December 2020 varies according to the color shade with red being the lowest and green – the highest. Besides, fiscal measures size ranges from 0.017% of GDP (Lao) to 44% (Japan) (IMF, 2021a). It is clear that OECD members (more advanced economies) on average spend much more to confront the economic downturn when compared to less developed countries. However, there is no clarity whether more stimuli implies faster economic recovery.

Figure 2 Total fiscal measures per country in 2020, in % to GDP



Note: compiled by author in Power BI tool based on December data from IMF (2021a). The colors representing the size of fiscal measures – from lowest to highest: red, orange, yellow, and green.

All things considered, the unprecedented aspect is twofold: first, the economic recession caused by the COVID-19 virus was remarkably deep; second, the fiscal policy actions were of enormous scale. This constitutes the practical relevance and topicality of the current study, additionally considering the fact that the pandemics is still ongoing, hence there is continuous emergence of novel data and trends, which is crucially important to identify in order to be well-prepared for the uncertain economic future. In essence, the research problem of the current research endeavor implies the unclear nature and undiscovered functioning of fiscal transmission mechanism in the context of COVID-19 crisis.

The statement of the problem can be properly justified by the academia interest in the topic. Ma et al. (2020, p.1) fairly indicated that there is rich base of literature that investigates previous economic and financial crisis, yet the topic of global health crisis was addressed only to a limited extent so far. Nevertheless, Derkacz (2020, p.1) asserted that there is an increasing attention to the economic and social topics in the context of COVID-19 crisis. For instance, Eichenbaum, Rebelo, & Trabandt (2020, p.1) and Jorda, Singh, & Taylor (2020, p.1) focused on the estimating of the economic costs of the pandemics. Barro, Ursua, & Weng (2020, p.8) as well as Correia, Luck, & Verner (2020, p.1) dedicated their research to finding similar patterns in COVID-19 and Influenza pandemic that shook the world in 1918.

The first studies that addressed the topic of fiscal policy effectiveness were conducted by Baker, Farokhina, Meyer, Pagel, & Yannelis (2020, p.2) as well as Chetty, Friedman, Hendren, & Stepner (2020, p.1) who capitalized on the high-frequency consumer data to disentangle spending patterns following the launch of stimulus payments. At the same time, further studies already attempted to estimate the size of fiscal multiplier (Arigoni, Breznikar, Lenarcic, & Maletic, 2020, p.1; Derkacz, 2020, p.1; Faria-e-Castro, 2021, p.2). In principle, the studies so far found a consensus that fiscal policy plays an important role in the economic recovery, yet the specific magnitude of this effect is yet to be discovered.

The relevant findings in the academic literature provide diverse views on the efficiency of countercyclical fiscal measures in terms of stabilizing GDP growth. For instance, ARRA, which was introduced as a comprehensive response to 2008 financial crisis, led to the shot-term increase of real GDP by 0.2% (COB, 2015, p.3). As for the euro area, the post-2008 fiscal incentives seemed to have significant positive effects on the region's GDP, yet these effects were not long-lived (Coenen, Straub, & Trabandt, 2013, p.367) Moreover, fiscal multipliers tend to differ from country to country: in 2009-2010, the GDP response was rather neutral in the US, the UK, and Germany, while in Italy, Spain, and Greece it was negative (Stockhammer, Qazizada, & Gechert, 2019, p.57). It was also concluded that the

effect from fiscal measures tend to vary depending on the state of the economy: in recessions, the multiplier is expected to be higher (1 to 1.5) compared to expansionary cycles (0 to 0.5) (Auerbach & Gorodnichenko, 2012, p.18). However, Taylor (2018, p.29) asserted that the positive effects can be hampered by the fact that government support dispensed to households and firms might backfire due to an individual behavior conditioned upon savings allocations. Furthermore, there is scientific evidence that the low-interest rate environment is likely to favor fiscal stimulus effects, which is particularly relevant to the present circumstances (Wilson, 2020, p.4). Drawing upon the relevant findings on the topic, it is apparent that fiscal effect on GDP is of heterogeneous and short-term nature, which requires cautious approach when analyzing the results of such policy.

The topic seeks to assess the fiscal policy in the context of the unprecedented state of global economy, hence entering the merely explored area in academia, which constitutes its main merit as well as deficiency. Despite the gradual emergence of studies aiming at evaluating current countercyclical expansionary policy in certain countries, there is a lack of analytical view on the global level (Di Pietro, Marattin, & Minetti, 2020, p.927; Wilkins, Gilchrist, & Phillimore, 2020, p. 12). In order to understand the processes of economic recovery it is important to find the patterns of GDP response through quantitative techniques. Additionally, there is a lack of critical view on the determinants of this response, mainly in terms of economy wealth or debt burden (IMF, 2021b, p.10; OECD, 2021a, p.14).

The value of the current research implies investigating the issue on an ongoing basis, analyzing the most actual short-term GDP response in different countries worldwide, at the same time constructing the academic baseline for further research. Nevertheless, readers should account for the deficiency of the study that can be unraveled in its methodology due to the rather unproven power of current theories in modern environment. Moreover, whilst the majority of relevant literature is aimed at estimating the value of specific Keynesian-based macroeconomic efficiency measure – fiscal multiplier (Auerbach & Gorodnichenko, 2012, p.9; Hory, 2016, p.81; Ilzetzki et al., 2013, p. 244) – the current research design does not follow the same goal. Primarily, its objective envisages providing empirical findings on the relationships between macroeconomic variables in the times of the pandemics. Despite of the relaxed basic assumptions, this research attempts to duly incorporate all predominant conceptions in the literature, especially in terms of defining variables.

Further deficiencies include the generalization of cross-country results, lack of the relevant time-series data and potential endogeneity issues in the causal relationships between macroeconomic variables. The current study generalizes the results for all countries in the

world, which is counterintuitive in the sense of crucial cross-country peculiarities (Combes, Minea, Mustea, & Sow, 2014, p.1016). With this regard, the additional analysis of different group of countries based on income and economic development is designed to overcome this shortcoming. Other key limitation of the research implies using cross-country data instead of the extensive panel-based analysis which is more typical to investigate this topic (Agnello, Furceri, & Sousa, 2013, p.17; Ilzetzki, et al., 2013, p. 239). In this case, key conclusions from these studies will be utilized in order to provide valuable insights on the ongoing COVID-19 crisis. Furthermore, the endogeneity or reverse causality problem (Hall, p. 193, 2009), which is quite typical consideration of the macroeconomic research papers, will be tackled by period-by-period research setting (Coenen, et al., 2012, p. 30). These and other further limitations encountered in this paper will be presented in the conclusion.

The study and its findings are mostly aimed at policymakers, that are prompted to take rapid, yet informative decisions in battling with the ramifications of global economic slowdown. Currently, economies are experiencing an extraordinary level of vulnerability to virus spread, yet this period could serve its purpose by gathering all necessary information that might prove to be helpful while counteracting against the possible reinforcement of the pandemic situation in the near future. In any case, fighting with the one of the world's worst economic downturn would provide resilience during any future economic shock. Thus, this topic should drag attention of the global economic community as well, in particular academia.

1.2. Purpose statement and research questions

The main purpose of the study is to measure the effect of fiscal stimuli on the economic recovery of countries worldwide amid the COVID-19 pandemic. The study and its research construct will focus on identifying patterns of short-term GDP developments in response to the vastly implemented fiscal-based actions aimed to alleviate negative implications of the ongoing crisis. With such an intention, the study will draw upon existing theoretical understanding of fiscal multipliers mechanisms (Auerbach & Gorodnichenko, 2012, p.18; Wilson, 2020, p.4) as well as current state of analytical material evaluating effectiveness of fiscal measures deployed during financial crisis 2008 both in the US and the euro area (Coenen et al., 2013, p.367; COB, 2015, p.3). Additionally, the study aims to seek the significance of other factors that might determine the pace and magnitude of economic recovery in response to the government expenditures shock (Agnello et al., 2013; Hory 2016; Ilzetski et al., 2013).

Therefore, the current study seeks to answer the following central research question: How does the size of anti-COVID-19 fiscal stimulus actions relates to the GDP growth, controlling for other variables, such as level of national debt, fiscal strength, type of monetary policy, and trade openness? Consequently, the null hypothesis is formed as follows: there is no relationship between the size of fiscal stimulus and GDP growth. Alternatively, the following statement is formed: the size of fiscal stimulus is positively related to the GDP growth.

Additional hypotheses are necessary to properly connect the key empirical findings in the recent literature to the research construct in the current study. Literature review section provides an overview on the key macroeconomic variables that play an important role in the fiscal transmission mechanism during the COVID-19 pandemic. Importantly, the associations between control variables and output response will be tested to crystallize short-term influence mechanism of different variables in the context of unprecedented fiscal measures. With this regard, further additional hypotheses can be formulated as follows:

- H_0: There is no relationship between the economic development of the country and the output response. H_1: Advanced countries benefit from the higher output response.
- H_0: There is no relationship between the stance of monetary policy and output response. H_1: Zero-lower bound situation increases the strength of the output response.
- H_0: There is no relationship between the severity of measures and the output response. H_1: Severity measures are negatively related to the GDP growth.
- H_0: Trade openness level of a country does not impact the output response. H_1: With the higher trade openness level, the output response becomes weaker.
- H_0: There is no relationship between the fiscal strength of a country and the output response. H_1: The fiscal deficit is negatively related to the output response.
- H_0: There is no association between the level of public debt and the output response. H_1: The higher public debt negatively affects the output response.

Another major hypothesis builds upon the mediation analysis incorporated into this paper. Under the null hypothesis, the fiscal stimulus does not mediate the relationship between the quarantine measures and real GDP growth. Alternative hypothesis states that the

fiscal stimulus measures positively mediate the association between the quarantine measures and real GDP growth, i.e., alleviate the economic consequences of the pandemic.

1.3. Research design

The measurement of the fiscal stimulus effect on the pace of economic recovery requires complex quantitative approach designed in accordance with the current state of relevant research methodology which predominantly evolves around the notion of fiscal multiplier (Chinn, 2018, pp. 4748-4750). Sophisticated research techniques based upon the principals of Neoclassical economic thought were deployed to provide the range of estimations for fiscal multiplier instrument during versatile spending shocks (Auerbach & Gorodnichenko, 2012, p.19; Coenen, et al., 2013, p.385). Since the current study aims to evaluate the effect of fiscal stimuli under the circumstances of the ongoing pandemic crisis, critical relationship patterns will be tested and described between the macroeconomic variables, in particular cross-country government spending, GDP growth, severity of COVID measures, debt-to-GDP ratio, population, etc. The findings will reflect the economy's short-term response mechanism to the COVID-driven government outlays which will then constitute a valuable empirical input for further related research.

The selected research design is based on the tenets of cross-sectional correlational analysis using various controlling variables. The afore-mentioned quantitative design aligns with the intent of research, particularly when it comes to evaluating the significance of relationship between the specific macroeconomic variables. Apparently, multivariate analysis is designed using several significant independent variables, namely fiscal stimuli amount, stringency index, government debt ratio, trade openness, fiscal strength, similarly to numerous relevant studies that investigated fiscal policy transmission (Alesina & Ardagna, 2010, p.40; Hory 2016, p. 59; Ilzetski et al., 2013, p.240). Important emphasis is laid on the segmentation of countries as per economic development in order to disentangle fiscal transmission mechanism of potentially different nature across the samples of advanced and developing countries (Agnello et al., 2013, p.19; Hory, 2016, p.66). That is, similar multivariate regressions are conducted for segregated samples of countries. With a view of increasing the fitness of the model, lagged variables as well as population- and GDP-based variables are duly incorporated into the models. Furthermore, dummy variable technique is utilized in order to factor in such important categorical variable as the monetary policy stance (Christiano, Eichenbaum, & Rebelo, 2011, p.118; Erceg & Linde, 2014, p.104). Hence, the

comprehensive correlational design serves as an important analytical point for understanding the nature of macroeconomic variables in the context of the unprecedented economic events.

A set of multivariate linear regression models is applied in order to find valuable and significant relationship patterns relevant to the purpose of the study. The effect of fiscal stimulus as dependent variable in the regression model will be purposefully isolated by the means of various control variables. Annual (and in some cases – quarterly) GDP growth, which serves as the dependent variable, will be the only variable that model will try to explain in accordance with the purpose statement. Relationships between variables will undergo numerous tests of significance, and the significance level will be equal to 5%. After the data segmentation based on economic development of countries, further rounds of modeling and OLS diagnostics techniques are applied. These statistical instruments will aim to test the hypotheses provided in the purpose statement.

In order to increase complexity of the current research design and validity of the key conclusions, the relationship between the key variables is tested via mediation analysis and is further validated via bootstrapping procedures with 1000 simulations (Tingley, Yamamoto, Hirose, Keele, & Imai, 2014, p.6). According to Celli (2019, p.2), mediation analysis is an appropriate technique when the research objective implies not only evaluating the strength of relationships between variables, but also comprehending the nature of these associations. Consequently, Celli (2019, p.2) advocates the application of this research technique in economics. The study conducted by Njagi, Nduati, & Nyabuto (2021, p.101) with the usage of macroeconomic variables serves as a basis of research methodology in the present paper. In principle, mediation analysis builds upon multivariate regression which caters for swift continuation of the linear regressions designed in the first stage of analysis. That is, significant relationships identified in the course of simple multivariate regressions will be further examined by calculating ACME and ADE. Based on this procedure, conclusions will be offered regarding the ability of fiscal measures to mediate the effect between the severity of measures and output response.

For the purposes of the current research, the mix of convenience and purposive sampling is used. The actual sample will strongly depend on the availability of quality data, especially in terms of the volumes of fiscal stimuli allocation per country, which are central in the current academic effort. Such availability issues can be frequently encountered in the relevant studies (Agnello, 2013, p.21; Ilzetzki et al., 2013, p. 239; Koh, 2014, p.578). Nevertheless, analysis is consistently conducted in terms of geographic and economic dispersion of countries in order to retain status quo when making conclusions regarding

global developments. For example, samples used in the study employ either consistently proportionate amount of advanced and developing countries (according to their quotas in world economy) or focuses on separate group of countries (e.g., advanced only). Along those lines, countries will be purposefully segregated into income-based groups according to the WB and IMF classification (IMF, 2021a; WB, 2019). Apart from data quality issue, the usage of such nonprobability sample is justified when testing macroeconomic relationships on cross-country basis due to the fact that global economy is a complex construct, hence requiring researcher's critical view and available expertise to select the most representative sample.

Considering the sample size, the methodological formula implies usage of around 130 countries with 5% margin of error when the total population amounts to around 200 countries (Taherdoost, 2016, p. 25). Based on the comprehensive dataset provided by IMF in their October 2020 and January 2021 reports (2021a), the sample size might contain around 170 observations, yet this amount can be corrected by removing outliers. In general, the minimum threshold of 130 countries is not compromised in terms of global economy. However, some datasets (e.g., IMF report June 2020) contain considerably less observations, hence the analysis of such samples are taken with special care. Nevertheless, the inclusion of such dataset could provide more comprehensive picture about the nature and the timing of fiscal transmission mechanism during the COVID-19 pandemics. Additionally, the aggregate dataset is segregated into separate country groups in order to elicit conclusions specifically regarding advanced or developing economies.

Since the current quantitative study is based on secondary data, specific attention will be given to the reliability of the information sources. In order to fulfil this, databases from highly renowned organizations (IMF, OECD, and WB) are used. (IMF, 2021a; OECD, 2021b; WB, 2021b). Some data on quarterly GDP and interest rates is based on the Bloomberg terminal functions. The severity of quarantine measures data (Stringency index) is extracted from the open access information repository administered by the University of Oxford (Our World in Data, 2020). With the aim to increase the validity of data, information was double-checked on different sources.

1.4. Overview of the key results

A series of multivariate OLS regressions with fiscal measures as the key explanatory variable and output growth as the response variable indicated that there is positive, yet close to zero association between the beforementioned variables, which provides rather

conservative empirical view on the effectiveness of fiscal stimulus during the COVID-19 pandemics. Some initial specifications showed even negative relationship – with the increase of fiscal measures by 1%, the GDP lowers by 0.138%. However, after configuring the research setting according to academia, positive response was crystallized and totaled to 0.013%. This effect is the most prominent in advanced countries. The casual mechanism between variables was additionally tested with mediation analysis that corroborated the key hypotheses: fiscal packages positively mediate the association between stringency index and GDP growth, albeit only partially. Considering the control variables, there is a mixed evidence that the zero-lower bound situation reinforces the fiscal transmission mechanism, while public debt seems to have a consistent negative influence on it. Despite this outcome, one should not disregard the set of limitations, which question the generalization feature of the findings, notably endogeneity issue and policy lag considerations. Nevertheless, certain empirical patterns were discerned which contributes to the research stream focused on the economic costs and recovery potential in the context of the ongoing COVID-19 crisis.

1.5. Structure

The paper's structure is organized as follows: the entire body is divided into two major parts: Theoretical and Empirical. Theoretical part consists of two sections, namely Literature review followed by Theoretical and Conceptual frameworks, that essentially align the research question and hypotheses with relevant literature and common academic conceptions. The core analysis is conducted in Empirical part: this part starts with Methodology and Sampling strategy and is immediately followed by Data section. These elements are important to understand the construct of the quantitative research. Subsequently, all results are presented in the respective section along with additional diagnostics section. Empirical part is completed by Discussion of key findings with a view to relate the results to the literature and prevalent concepts. The paper is concluded by summarizing key results, listing main limitations of the research, suggesting further direction to study the topic, and stating the overall importance of the findings.

2. Theoretical part

2.1. Literature review

The issue of fiscal policy effectiveness was addressed by the considerable number of studies. Despite the predominant conception that fiscal policy induces higher output response, meaning that the relationship is characterized by slightly more than one-to-one reaction (Fatas & Mihov, 2009, p. 58), particularly in times of recession Auerbach & Gorodnichenko (2012, p.19), the topic is exposed to different methodologies and views which generates the relative ambiguity with regards to estimations. Therefore, it is important to structure the relevant literature in chronological and categorical order to properly extract scientific value from research conclusions and findings. Appendix A shows the literature map which contains this structure accompanied by the most prominent studies in certain domain.

Apparently, the vast focus will be allocated to the literature that emerged after the GFC, that contains crucial insights both on the evaluation of fiscal programs and on the identification of key macroeconomic factors that influence the fiscal multiplier. At the same time, basic academic foundations are considered in a respective manner in the theoretical framework which comes next after the literature review section.

Starting from the conceptualization of fiscal policy by John Maynard Keynes in 1930s, the effectiveness of fiscal measures instruments constituted the contentious topic among macroeconomists worldwide, which implies versatile fiscal multiplier estimates (Cogan, Cwik, Taylor, & Wieland, 2010, p. 282; Hory, 2016, p.79; Taylor, 2018, p.3). Regardless of the acknowledged prevalence of fiscal mechanisms over the monetary approach until 1960s, in 1970s its virtues were undermined by the dogmas of monetarists who considered money supply as the decisive toolbox when confronting with the ongoing inflationary pressure (Vera, 2016, p. 28). The following decades were characterized by rather skeptical attitude towards the effectiveness of discretionary fiscal measures, the thinking of which was reimagined during the onset of recessions in the first decade of 2000s. (Auerbach, 2012, p.161). The legacy of 2008 financial crisis compounded high government debt and deficit levels, which forced European and US policymakers to promptly switch to fiscal consolidation (Whalen & Reichling, 2015, p.735). The last decade saw the emergence of unconventional monetary actions and zero-lower bound situation. Therefore, the varying economic settings contributed to the vague overall inference on the effectiveness of fiscal measures despite the numerous research endeavors from prominent macroeconomists.

With a view to assessing the effect of fiscal policy shocks on the economy, various old and new econometric models were applied, predominantly on the time series sample of one single country. Blanchard & Perotti (2002, p.1364) investigated US government fiscal shocks in the post-war period and corroborated basic wisdom that budgetary expansions positively influence output. The findings of Fatas & Mihov (2001, p. 18) confirmed that positive effect in the US economy for the identical sample period; however, both studies similarly identified the "crowding-out" feature of private investment that downsizes the value of fiscal multiplier. In numeric terms, both studies affirmed that the fiscal multiplier resides around unity. The further research supported the logic of positive effect from fiscal support, yet with some reservations: while Hall (2009, p. 208) reevaluated fiscal multiplier at a range from 0.5-1, Mountford & Uhlig (2009, p.986) analyzed various fiscal strategies and defined that tax cuts result in the higher size of fiscal effects when compared to government spending.

Several other studies were conducted using cross-country approach with specific focus on the European and US economies. Burriel et al. (2010, p. 279) reported that the behavior of fiscal mechanism is predominantly homogeneous across the countries under consideration which normally implies below-unity multiplier. Furthermore, whereas tax multipliers appeared to be uniformly lower than spending multipliers in the short-term, the crowding out of private investments seemed to be more pronounced in the US than in the EMU (Burriel et al. 2010, p.277). By the same token, other academic works analyzed the sample of 44 countries in order to find significant factors that influence the size of fiscal multiplier (Ilzetzki et al., 2013, p.251; Wierzbowska & Shibamoto, 2018, p.3497). The main conclusions included that the economy's average level of income and its international position are among the main contributors to the size of fiscal multiplier. In some further studies, the American states were selected as a sample in order to investigate the significance of fiscal shocks on a cross-state level. Both studies conducted by Chodorow-Reich, Feiveson, Liscow, & Woolston (2012, p.141), and by Klein & Staal (2017, p.403) provided a basis for researchers to testify the positive effect of the fiscal stimulus relief programs on the employment and GSP.

Interesting conclusions were derived by the proponents of the so-called narrative approach, who used historical military-related events in order to identify genuine fiscal shock, which is different approach compared to vector autoregressive models. Along those lines, the estimates of Barro & Redlick (2009, p.42) as well as Ramey (2011, p.43), who incorporated exogeneous shocks into the model through sudden changes in military spending, pointed at fiscal multiplier taking a value at the range between 0.6 and 1.2. Leeper, Walker, & Yang (2009, p.1115) supported these arguments that many econometric models are not able to

capture the fiscal shock due to the anticipation effect. Nonetheless, the predominant majority of relevant studies used econometric identification instead of narrative approach.

The 2008 financial crisis and its aftermath provided macroeconomists with informative sources for analysis that reflected in the growing body of literature investigating the effect of certain fiscal programs, predominantly in the EU (EERP) and in the USA (ARRA). While the substantial part of ARRA-related literature is determined to calculate the effect of fiscal stimulus on the employment (Chodorow-Reich et al., 2012, p.119; Romer & Bernstein, 2009, p.12), the peculiarity of EERP-focused research implies extensive application of DSGE models that are considered to be one of the strands of New Keynesian scientific stream (Coenen et al., 2013, p.368; Cwik & Wieland, 2011, p.497).

While governments were spending significant amount of budget funds, three critical questions were posed in the academia (Coenen et al., 2012, p.23). First, it was unclear which specific set of policy actions are the most appropriate in the context of prolonged monetary accommodation. Second, policymakers were debating about the most optimal combination of fiscal instruments. Last but not the least, there was uncertainty about the long-term effects of fiscal stimulus, particularly in the context of future tax rises due to debt servicing (Coenen et al., 2012, p.25). Based on interim findings in years 2009-2012, there was a consensus that discretionary fiscal measures will positively influence output in the short-term perspective, notably considering the low interest rate environment.

In terms of the ARRA evaluation, Romer & Bernstein (2009, p.12) were among the first macroeconomists who presented their fiscal multiplier computations. The results derived by the representatives of American administration demonstrated the government purchases multipliers in the range between 1 and 1.6, while tax cuts multiplier was just below 1. Subsequently, Feyrer & Sacerdote (2011, p.22) obtained similar results, with multiplier reaching 2 when considering separate support packages, like transfers to low-income households and infrastructure investment. Nonetheless, these results were highly questioned by other economists, particularly Cogan et al. (2010, p.292), who estimated fiscal multiplier of the ARRA based on New Keynesian approach. The revised methodology allowed to testify less sizeable effect of fiscal support packages, that in nominal terms are less than 1 and even turn negative as government purchases drop. Such differences in estimates are mainly attributed to the fact that New Keynesian approach considers negative wealth effect and crowding out of private consumption and investment (Cogan et al., 2010, p.285). Other researchers conducted cross-state analysis by using pre-recession Medicaid outlays in order to tackle the endogeneity problem (Chodorow-Reich et al., 2012, p.118; Klein & Staal, 2017,

p.403). They reported for positive multipliers that favorably influenced state-level employment and output response.

Similarly, scholars were investigating the effect of the fiscal program implemented in the euro area during the financial crisis. Ceonen et al. (2012, p. 75) estimated that the EERP contributed to the annualized quarterly real GDP growth of 1.6%. At the same time, the researchers highlighted the need for detailed analysis of the developments of debt and deficit levels during the crisis. In their subsequent study, Coenen et al., (2013, p. 385) reiterated that the EU fiscal program provided a positive effect on GDP in short-term perspective, yet the long-term implications were still unclear. As for the size of fiscal multiplier, the researchers estimated it at the below-unity level. Such conservative findings corroborated the results based on holistic study by Cwik & Wieland (2011, p.535), who used five different econometric models to estimate the multiplier. The majority of these models indicated that the EERP was unable to produce output response that is higher than one. Further research confirmed a rather neutral effect of the fiscal program on GDP within the euro area (Gadatsch, Hauzenberger, & Staehler, 2016, p.1011). Additionally, it was reported that the fiscal spillover in the euro area has a negligible effect (Cwik & Wieland, 2011, p.535; Gadatsch et al., 2016, p.1012) meaning that there is little evidence that the countries with less fiscal room were able to benefit from the larger-scale fiscal packages implemented in such countries, like Germany or France. Overall, according to the existing body of literature, the effect of the EERP on the output in the European countries on average was less than one for one.

While the majority of studies were assessing the effectiveness of the countercyclical fiscal policy during the 2008 financial crisis in short-term context, several others concentrated on the long-term considerations of these government spending effects. In particular, the discussion concerned the topic of the fiscal consolidation that came into place shortly after the financial crisis. For instance, Mueller (2013, p.243) highlighted the importance of revising fiscal multiplier estimations when deciding upon the fiscal consolidation measures. The researcher drew upon the recent findings that suggested the relatively high size of fiscal multipliers during crisis, which mitigates the arguments of fiscal consolidation proponents. However, some corrections should be taken when considering the high levels of public debt (Mueller, 2013, p.243). In principle, Blanchard & Leigh (2014, p.199) confirmed that the forecasts of fiscal multipliers were underestimated, hence the urgency of budgetary consolidation efforts were overemphasized. Furthermore, the authors highlighted the importance of considering the fiscal effects in the long term contrary to the overwhelming

focus put on short-term estimates in the academic literature. The key aim of other related studies was to reevaluate the impact of fiscal policy on the economies, notably in OECD countries (Pyun & Rhee, 2014, p.208) and in the eurozone (Combes et al., 2014, p.1015). Specifically, Pyun & Rhee (2014, p.219) reached the conclusion that fiscal multipliers in the OECD economies during the GFC were greater than 1. Additionally, researchers outlined the need for the balanced combination of fiscal and monetary policies in the long-term perspective. In the same manner, Combes et al. focused on the Eurozone countries, which allowed them to report about significant positive spending multipliers across the region during the GFC (2014, p.1030). Thus, the subsequent studies that reevaluated the effect of fiscal expansion in the long-term view uniformly highlighted more positive impact of such policy decisions during the 2008 financial crisis, hence the need for more careful consideration of the fiscal consolidation.

The aftermath of the GFC provided an effective impulse to extend the existing body of knowledge on the fiscal multiplier, particularly in terms of cross-country approach with the help of panel VAR and multivariate regression models. Both studies (Agnello et al., 2012, p.17; Koh, 2017, p.572) took a rather broad view on the topic by analyzing more than 100 countries in a sample. Agnello et al. (2012, p. 22) specified that the fiscal policy is noticeably effective in the short-term, while the crowding-out becomes more pronounced in the medium term. In the similar manner, Koh (2017, p.587) investigated the fiscal policy influence in the set of 120 countries over the period 1960-2014, and, therefore, pointed at the estimated range of multipliers 0.4-1.8 that vary depending on the economic conditions.

Particular attention of the academia was centered around the sample of OECD countries. Both relevant studies (Corsetti, Meier, Mueller, & Devereux, 2012, p.524; Pyun & Rhee, 2015, p.208) uniformly indicated relatively high multipliers during the crisis. Pyun & Rhee (2015, p.209) investigated the period of the Great Recession more in-depth, which allowed their study to outline the importance of the monetary expansion in mitigating of the crowding out effect. In addition, Corsetti et al. (2014, p.558) emphasized the need for building fiscal buffer during the normal times in order to be effectively responsive in the event of crisis. By analyzing the fiscal policy topic based on the sample of European countries, Combes et al. (2014, p.1030) found an interesting pattern that government spending multipliers are higher in the Eurozone economies when compared to non-Eurozone countries. Similarly, countries that historically were candidates to join the euro zone benefitted from higher government spending multipliers when compared to the non-candidates.

The estimations of fiscal policy multipliers are not limited to the developed economies, the studies concerning developing markets are well-documented as well. For instance, research by Kraay (2014, p.203) suggested that government spending multiplier is equal to 0.4 based on the analysis of 102 developing economies in the period from 1970 to 2010. The author justified such a relatively low estimation by the fact that only average short-term output response was taken into account. Furthermore, the real value of the indicator might be different when focusing on the economic conditions of one single country (Kraay, 2014, p.204). Hory (2016, p.60) compared the output response between the emerging and advanced economies in the sample of 48 countries over the time period 1990-2013 using VAR models. The results indicated the noticeable difference in the fiscal multiplier in a way that emerging economies experienced lower impact of government spending on GDP. Consequently, Hory (2016, p. 74) identified the number of factors that determine the nature of such relationship, summarizing that the similar approach to fiscal policy in all countries would not be effective. Combes, Minea, Mustea, & Yogo (2016, p.124) used the cross-country methodology to estimate fiscal multipliers in CEE countries based on the data during 1999-2013. First, the authors emphasized the significant positive multipliers for all countries in the region, yet the actual size varied depending on a certain country-specific characteristics. Such a conclusion was highlighted by another cross-country study by Minea & Mustea (2015, p.2742) who analyzed the sample of the economies in Mediterranean region. It is evident from the literature that in the last decade a remarkable focus was put on the analyzing the relationships between the fiscal support and output in the developing countries in studies with cross-country samples.

Due to the frequently reported country-specific factors that are believed to play a significant role in estimating the size of fiscal multiplier, several studies attempted to circumvent this by focusing on specific countries. Apart from the overwhelming majority of literature that considered the US economy (Auerbach & Gorodnichenko, 2012, p.2; Blanchard & Perotti, 2002, p.1336; Mountford & Uhlig, 2009, p.962), some other specific economies constituted the scope of macroeconomic research as well. For instance, Cimadomo & Benassy-Quere (2012, p.869) conducted comparative analysis of fiscal policy between three highly developed economies: Germany, the UK, and the US. One striking finding is that the short-term spending multiplier in the UK was significantly lower (0.30) versus the multiplier in the US (above 1) (Cimadomo & Benassy-Quere, 2012, p.869). In the long term, the effects of fiscal policy shocks appeared to wane, except for the tax shock in Germany. Furthermore, the study highlighted the sizeable fiscal policy effect during the 2008 financial crisis in both

of the European countries, while in the US the significance of such factor was not high (Cimadomo & Benassy-Quere, 2012, p. 869).

In parallel, countercyclical fiscal packages in specific emerging countries were of certain interest for macroeconomists. Such studies allowed to extend the granularity of analysis thereby addressing certain components of fiscal policy set. To begin with, Chen et al. (2017, p.12) estimated the fiscal multiplier in China at a rate of 0.8 based on 2001-2015 data, while in the most recent years it was increased to 1.4. More specifically, Chinese fiscal stimulus markedly favored manufacturing, while the transmission mechanism in service-related sectors remained more neutral. On example of Brazil and its fiscal measures during the crisis in 2008, Costa Junior, Garcia Cintado, & Sampaio (2017, p.122) identifed general positive GDP response of Brazilian economy up until 2013. In addition, revenue-based measures seemed to be more effective than government spending shock (Costa Junior et al., 2017, p.122). Based on the similar study concerning another emerging economy - Malaysia, Rafiq (2013, p.6) discovered positive, yet modest effect of the discretionary fiscal stimulus on the economy in the short run. Moreover, researcher stated that Asian financial crisis in 1997 decreased the overall magnitude of fiscal multiplier in the country: while the pre-recession value had been 1.28, the economic fallout deteriorated it down to 0.8. (Rafiq, 2013, p.6). Contrastingly, the examination of fiscal policy in Macedonia over the period 2000-2014 illustrated that this small-open economy was better off with restrictive fiscal policy, since the size of spending and revenue multipliers were close to zero or even negative (Petrevski, Trenovski, & Tashevska, 2019, p.815).

After reviewing the literature from the holistic perspective of the output responsiveness, the next logical step would imply investigating the key factors that influence this response, which in turn will play a pivotal role when constructing a working model in the frame of the current study. Throughout the decades of research, macroeconomists disintegrated several patterns affecting the fiscal multiplier, yet the last decade brought the lion's part of academic discourse regarding the topic.

One of the biggest discussions revolves around the state-dependency attribute of the fiscal multiplier. Auerbach & Gorodnichenko concluded that fiscal policy appears to be "considerably more effective in recessions than in expansions" (2012, p.3). Upon empirical assessment based on the US historical data, the estimates of fiscal multiplier amounted to 1-1.5 in recessions and 0-0.5 in expansions (Auerbach & Gorodnichenko, 2012, p.19). For some specific scenarios, the estimated multiplier reached the maximum value of around 2.5 (Auerbach & Gorodnichenko, 2012, p.9). These findings were supported by another research

conducted by Canzoneri, Collard, Dellas, & Diba (2015, p. 106), who considered the nature of countercyclical financial frictions as a possible explanation to the state-dependency of fiscal multipliers. Importantly, the results of this research also implied the negative relationship between the magnitude of fiscal support packages and the size of spending multipliers (Canzoneri et al., 2015, p.77). To elaborate on this topic, Bachmann & Sims affirmed that "the positive response of output and productivity to a fiscal stimulus during times of slack is mild on impact, gradual and prolonged" (2012, p.248). The most pronounced difference between the fiscal stimulus shocks in recessions and expansions is the ability of these government measures to boost the long-term productivity in case of the slack. The study by Riera-Crichton, Vegh, & Vuletin (2014, p.5) corroborated these conclusions on the set of OECD countries by specifying the fiscal multiplier for recessions at the level of 2.3 compared to the expansions-driven 1.3. However, it should be emphasized that the estimations relate mainly to long-term assessments (Riera-Crichton et al., 2014, p.20).

It is worth mentioning that the single-country estimations corroborated the afore-mentioned findings. Apart from the seminal paper by Auerbach & Gorodnichenko (2012, p.19) who investigated the US economy, the similar results were obtained by Shoag (2010. p.39). After examining the effect of state-based pensions plans, the researcher concluded that the multiplier was higher during the periods of labor market slack (Shoag, 2010, p.39). By the same token, Baum & Koester (2011, p.29) gauged the size of fiscal multiplier for Germany to be more sizeable in the cases of negative GDP gap. To understand the nature of such a phenomena, the macroeconomists appeal to the specifics of consumers behavior that under the pressure of financial constraints during recessions provided the main reason for positive wealth creation (Canzoneri et al., 2015, p.106).

On the contrary, Ramey & Zubairy examined the US spending historical data from 1889 to 2015 on a quarterly basis and deduced that fiscal multipliers did not increase during economic slack staying at the rate below unity (2018, p.852). Furthermore, the authors compared their research technique, called Jordà local projection method, to the VAR method used by Auerbach and Gorodnichenko, arguing that the latter exploits numerous simplifying assumptions that might distort the results (2018, p. 888). In addition to obtaining such polarized estimates, the aggregation of historical data applied by the researchers might overgeneralize the results ignoring specific attributes of certain historical events and timeframes, which complicates the accuracy of the estimated fiscal multiples. Nevertheless, the predominant number of academic studies support the important findings of Auerbach &

Gorodnichenko (2012, p.19) implying that the discretionary fiscal policy during recessions provides notably more pronounced support to the economy compared to the normal times.

Subsequently, the impact of monetary policy on fiscal multipliers is another point to consider. Pyun & Rhee (2015, p. 219) stated that monetary expansion strategy eliminates the crowding-out effects from the fiscal shock during economic downturns. Christiano et al. concluded that the multiplier becomes sizeable when the nominal interest rate is bound to zero rate (2011, p.118), the important findings that were confirmed by the similar study conducted by Woodford (2011, p.33). Based on such characteristic of fiscal multiplier, both studies defined policy recommendations for governments with the appropriate timing and mix of measures. Studies by Cwik & Wieland (2011, p.498), Coenen et al. (2013, p.379), and Canzoneri et al. (2015, p.101) similarly identifed the importance of the monetary accommodation during the crisis when contemplating about the effects fiscal measures. In essence, such a phenomena is attributed to the fact that in the zero-lower bound setting additional government spending does not contribute to the rise of interest rates, hence the crowding-out effect is weakened (Auerbach & Gorodnichenko, 2012, p.8). Erceg & Linde argued that policymakers might consider it reasonable to implement government spending programs during the periods of "prolonged liquidity trap" due to the substantial multiplier effect (2014, p.104). Nevertheless, the researchers indicated that the overly excessive magnitude of fiscal support measures might ultimately decrease its marginal benefit, hence the governments have to carefully evaluate the forthcoming budget strategy in such an environment.

Given the current prolonged zero-lower bound environment, several recent studies reevaluated the effect of monetary policy on the fiscal policy effectiveness. Chodorow-Reich (2019, p.2) estimated the "no-monetary-policy-response" multiplier to be at the level of 1.7, implying that constant interest rates positively influenced the fiscal transmission mechanism. Furthermore, Cloyne, Jorda, & Taylor (2020, p.32) determined that the output response to the fiscal policy actions might well exceed 2 in the event of monetary accommodation. These findings demonstrate the persistence of the conventional wisdom considering the favorable combination of inactive monetary and active fiscal policy actions during recessions.

As in the case of fiscal multipliers and state-dependency discussion, Ramey & Zubairy questioned the predominant conception that the zero-lower bound environment means higher output response (2018, p. 852). In essence, their results provided a mixed evidence on this strand of research highlighting that fiscal multipliers appeared to be below unity for all relevant samples and scenarios examined (Ramey & Zubairy, 2018, p.893). At the same time,

Hills & Nakata disseminated the nature of fiscal multiplier under the zero-lower bound condition by adding "inertia parameter" that potentially might decrease the actual value of the multiplier well below unity (2018, p. 169). Horvath, Kaszab, Marsal, & Rabitsch investigated the topic from the perspective of the slope of Philipps curve, and estimated that strategic complementarities are able to contribute to lower inflation and higher real interest rates, hindering the private spending, hence decreasing the size of multiplier (2020, p.13). Since the COVID-19 crisis is accompanied by the stance of zero-lower bound disarming the further effectiveness of monetary measures, its impact on fiscal multiplier is worth considering.

Importantly, the exact size of fiscal multiplier is different for various fiscal policy instruments. For instance, when evaluating the short-term impact of ARRA on the American economy, Romer & Bernstein (2009, p.12) calculated the multipliers separately for governments purchases and tax cuts in a way that the latter had on average smaller size for different time periods. Similar result was obtained by Burriel et al. (2009, p.279) who outlined the feature of tax measures to be less effective in boosting the country's economy. Simultaneously, researchers provided evidence that in the euro area as well as in the US, public investment multipliers were higher than public consumption multipliers, yet less persistent in time Burriel et al. (2009, p.275). Along those lines, Cimadomo & Benassy-Quere (2012, p.869) analyzed different components of aggregate fiscal multipliers in several countries economies and specified that in the UK and in the US spending multipliers were higher than tax multipliers for various time horizons, while in Germany both multipliers were practically equal with net tax effect being the most long-lasting macroeconomic instrument. Some other studies went deeper into discriminating the effect of different fiscal policy measures. While Kilponen et al. (2015, p.12) compared the multiplier effect across different tax measures, Abiad et al. (2015, p. 22) juxtaposed the effects from debt-financed and budget-neutral government investments. Importantly, Ilzetski et al. (2013, p. 240) identified government investment as the most effective fiscal instrument in the developing economies, whereas in high-income countries this dominance was not adequately significant. Overall, the academic literature supported the conception that expenditures-side fiscal measures have more pronounced impact on the economy in contrast with revenue-side policy actions, while the latter appeared to be more long-lasting.

There is also variation on another side of equation, i.e., in terms of response variable. For instance, Burriel et al. (2010, p.280) tested the fiscal transmission mechanism on other GDP components, like private consumption and private investment. While the former GDP component demonstrated the positive response pattern of similar nature to GDP, the latter was

responsible for negative relationship in times of fiscal expansion. The study by Corsetti et al. (2012, p. 525) provided evidence that consumption reacts neutrally to fiscal shock, while investment and exports component suffered from the crowding-out effects. In their extensive study on 132 countries, Agnello et al. (2013, p.22) considered private spending as the ultimate response variable, whereby its multiplier appeared to be positive in the short term. While some studies focused on GDP components as response variable in order to estimate the effectiveness of fiscal policy, the majority employed real GDP growth which is considered to be the most comprehensive assessment of an economy.

When comparing the fiscal policy effectiveness in a large-scale panel of countries worldwide, macroeconomists agreed that one of the most prominent discriminating factor is the country's income level and economic development. In this respect, the seminal paper by Ilzetski et al. (2013, p. 240) provided empirical evidence that the output response in advanced economies was significantly positive and much more persistent than in the case of developing countries. Additionally, researchers outlined that not only fiscal effectiveness was different for these set of countries, but also the size of fiscal support, implying that advanced economies spent more to boost economic activity Ilzetski et al. (2013, p. 240). These findings were in accordance with the initial estimations by Furceri & Sousa (2011, p.166) who noted a substantial difference in government spending effects on private consumption when comparing between OECD and non-OECD countries. Along those lines, Agnello et al. (2013, p.19) took a more granulated approach for the topic, thereby stating that lower-middle income and developing countries benefited from short-term positive effect from fiscal stimulus, whereas in middle-term this effect dwindled. Considering the higher-income economies, they appeared to experience the same phenomena, yet in larger-scale magnitude, which consequently provided aggregate positive effect from fiscal policy (Agnello et al., 2013, p.19). According to Kraay (2014, p.203), the fiscal multipliers for developing economies averaged out at approximately 0.4, while existing literature on advanced economies predominantly conformed to the estimates around unity.

Nonetheless, such empirical-based conclusions are vulnerable to some critics. For instance, Batini et al. (2014, p.8) argued that the difference in multipliers across economies might be primarily explained by other variables, particularly by the efficiency of national transmission mechanism, hence requiring a different econometric approach. Hory (2016, p. 66) agreed with such assessment and analyzed the potential impact of different macroeconomic variables on the size of multiplier across the sample of emerging and advanced economies. The results demonstrated that all potential sources for heterogeneous

effects influence both samples in a similar way, i.e., the tested macroeconomic variables (debt, unemployment, imports etc.) behaved similarly in all countries irrespective of their economic development (Hory, 2016, p.59). Still, Hory (2016, p.59) deduced that public debt played a crucial role in fiscal policy effectiveness in the case of emerging economies, whereas for advanced economies this pivotal role was played by another variable – trade openness. Despite such a sign of skepticism, recent studies (Baumann, Lodge, & Miescu, 2019, p.29; Wierzbowska, & Shibamoto, 2018, p.3494) have empirically proven that higher-income countries were characterized by the bigger size of fiscal multiplier.

Public debt is considered to be another crucial factor influencing the effectiveness of fiscal policy. Based on the sample of the euro area countries during 1980-2008, Kirchner, Cimadomo, & Hauptmeier (2010, p.32) estimated that credit constraints that are caused by high level of the country's indebtedness increases the amount of Ricardian agents, who are unwilling to spend money immediately, but prefer to save in order to cushion themselves from the potential tax burden. In such case, the decreased level of private spending has negative impact on the economy, which in turn diminishes the size of fiscal multiplier. These results were corroborated by further studies. Ilzetzki et al. (2013, p.240) provided empirical evidence that the fiscal multipliers in the countries with public debt exceeding 60% of GDP were not statistically different from 0 in the long-term. Another study of the euro zone states indicated that public debt acts as a critical endogenous factor that influences the level of domestic private consumption (Nickel & Tudyka, 2013, p.17). Additionally, the author highlighted that the crowding-out feature is particularly pronounced when the indebtedness level increases due to the substantial fiscal outlays (Nickel & Tudyka, 2013, p.17). Since the governments tend to pursue fiscal consolidation strategy on the high debt-to-GDP levels, all this erodes the long-term multiplier effect. Hory (2016, p.74) provided the similar conclusion with important finding that the debt effect is more pronounced in advanced economies. Therefore, it is evident that public debt plays an important role in different time horizons considering the fiscal policy effectiveness, hence it substantiates the need to include this variable into the model.

Trade openness is considered to be a further consideration when analyzing the fiscal policy effectiveness. Basic logic of Keynesian models support the idea that fiscal measures are responsible for the best results in closed domestic environment (Koh, 2014, p. 573). It is believed that in open economies the specific proportion of fiscal transmission mechanism is leaked abroad (Hory, 2016, p. 66). In general, the recent empirical studies on the matter corroborated this wisdom, yet not uniformly. The seminal paper by Ilzetski et al. (2013, p.

240) provided empirical-based arguments that the economies with relatively smaller trade-to-GDP ratios tend to produce fiscal multipliers around 1, particularly in the long-term perspective. As for relatively more trade-oriented countries, the multipliers seem to decline into negative territory (Ilzetski et al., 2013, p.240). Further representatives of this research stream (Agnello et al., 2013, p.20; Hory, 2016, p.72) reinforced the afore-mentioned traditional conception of the inverse relation between trade openness and fiscal policy effectiveness. Moreover, Hory (2016, p. 72) emphasized that this effect is particularly noticeable in the developing economies. In contrast with the previous studies, Wierzbowska, & Shibamoto (2018 p.3506) asserted that the investigation of the trade openness level alone in this context is inadequate. Instead, they explored the feature of the country's capital flows to affect the output response due to fiscal expansion. More specifically, the researchers specified that net capital inflows might deteriorate the fiscal transmission mechanism due to its positive impact on economic and credit conditions (Wierzbowska, & Shibamoto, 2018, p.3506). Furthermore, they estimated that FDI inflows is the most influential component that might decrease the fiscal multiplier. As opposed to the previous studies, Koh (2014, p.587) stated that higher degree of trade openness should not automatically mean the diminished fiscal policy power and explained it by the increase in private consumption due to the rising imports. Nevertheless, it is commonly established in the literature that the openness to trade might decrease the fiscal policy effectiveness, which serves as another key item in the current paper's model.

The following economic factor that worth considering in the frame of current topic is the exchange rate regime of a country. Born, Juessen, & Mueller (2013, p.446) dedicated their research to this subject and established that the spending multipliers in the economies with fixed exchange rate regime are usually higher. The study by Ilzetski et al. (2013, p. 240) also covered this aspect and corroborated the previous findings. In economic terms, this phenomena could be explained by an active monetary policy followed by central banks under the fixed rate conditions, which in turn prevents the fall in net exports (Ilzetski et al., 2013, p. 246). In such situations, the increase of money supply boosts the total output. On the flipside, Koh (2014, p. 573) questioned the validity of such findings by giving priority to real exchange rate fluctuations and domestic policy actions in determining the fiscal policy effectiveness.

The existing body of literature suggested that there are various other factors responsible for influencing the fiscal transmission mechanism. Apart from examining the impact of public debt, Huidrom et al. (p.13, 2016) addressed the aspect of fiscal deficit, which

appeared to be another key determinant in economic policy channel. That is, the data showed that the fiscal multipliers are higher in the cases of strong fiscal stance, i.e., relatively lower level of budget deficit (Huidrom et al., p.13, 2016). The state of public finance is considered to be one of the key influencing elements assessed in the study by Hory (2016, p. 67). In similar vein, Agnello et al. (2013, p.21) additionally accounted for the government size which is represented by the government consumption to GDP ratio. Thereby, authors divided the sample into two categories depending on the size of public spending which consequently led them to the conclusion that the crowding out is more apparent in the case of insignificant government size (Agnello et al., 2013, p.21). The same authors singled out another worthwhile variable which is country size represented as the country's population. Upon empirical assessment of the panel of 132 economies, Agnello et al. (2013, p.22) inferred that relatively bigger countries have statistically more significant effect from fiscal discretionary policy that is, however, limited to the first two years. At the same time, countries with lower populations are more likely to suffer from crowding out of private investment.

Other statistically significant determinants of fiscal policy effectiveness include the conditions of labor market (Batini et al., 2014, p. 9), the savings rate (Hory, 2016, p. 67), the automatic stabilizers (Dolls, Fuest, & Peichl, 2012, p.279), etc. Given such a broad range of potential influential factors indicated in the academia, the current research attempts to identify the most pronounced ones that play important role in shaping economic recovery within the context of the COVID-19 crisis.

In the light of the current topic, the literature review would not be complete without the examination of the research stream that has certain connection to the ongoing pandemics and its accompanying economic crisis. First, it is important to understand, where the literature positions itself with relation to the effectiveness of fiscal policy. Recent studies that are mainly focused on the ARRA and the US economy, have provided a mixed evidence. Auerbach et al. (2020, p.225), Chodorow-Reich (2019, p.1), and Faria-e-Castro (2018, p.40) reestablished the importance of discretionary fiscal measures during crisis by confirming the state-dependency feature of fiscal multipliers and suggesting distinct spillover effects of budgetary support measures. In parallel, Ramey & Zubairy, (2018, p. 850) remained skeptical about the increasing size of fiscal multipliers in zero-lower bound environment, whereas Taylor (2018, p. 27) questioned the overall effectiveness of fiscal support packages in the US during the Great Recession. That is, prior to COVID-19 pandemics, there was no clear-cut consensus among macroeconomists on the merits of discretionary fiscal responses in

economic downturns, yet the majority backed the conventional wisdom of Keynesian school of thought.

Despite the considerable body of literature on the economic crises, there is little research on the role of macroeconomic instruments during global health crises, mainly due to the uniqueness of the current situation. The analysis of the socio-economic risks and costs was conducted based on the previous outbreaks of diseases such as Influenza 1918 (Fan, Jamison, & Summers, 2016, p.3; Morens & Fauci, 2007, p.1018), SARS (Liu, Hammitt, Wang, & Tsou, 2005, p.83), 1968 Flu, 2016 Zika (Jamison et al., 2017, p.324) with one of the focal points being the importance of continued vigilance with regards to the global health system. After the COVID-19 outbreak, numerous studies were conducted as well, particularly comparing the nature of the ongoing pandemics with Influenza 1918 (Barro et al., 2020, p.18; Correia et al., 2020, p.1); summarizing main policy recommendations based on modelling techniques (Alvarez, Argente, & Lippi, 2020, p.4); identifying short-term and long-term economic costs (Eichenbaum et al., 2020, p.1; Jorda et al., 2020, p.1). With this respect, main messages that are related to the key idea of this paper include: the fact that the COVID-19 crisis is a unique global situation compared to other global health crisis (Barro et al., 2020, p.18); the compelled containment measures contribute significantly to the deepening of the recession (Eichenbaum et al., 2020, p.28), the crucial part in preventing a profound economic downturn should play "bold policy initiatives" (Gourinchas, 2020, p.39), notably fiscal measures (Ma et al., 2020, p..30) that, according to theoretical dogmas and practical experience, ought to provide "large potential impact on GDP" (Wilson, 2020, p.1).

Considering the topic of the fiscal policy effectiveness during COVID-19 crisis, the depth of literature is not vast so far. The available relevant studies concentrate mainly on the effectiveness of specific fiscal relief packages in one selected economy. Bayer, Born, Luetticke, & Mueller (2020, p.33) provided model-based evidence that supported the benefits of transfer payments enforced under the CARES act in the US as a response to the virus outbreak. Authors estimated that transfer multiplier could reach 1.5 if targeted at households with high propensity to consume (Bayer et al., 2020, p.33). Elenev, Landvoigt, & van Nieuwerburgh (2020, p.33) affirmed that the extensive fiscal relief program prevented the number of bankruptcies, which allowed the economy to avoid the 8.5% of output losses. Derkacz (2020, p.19) highlighted the potential benevolent impact of fiscal buffers caused by the increase of autonomous spending multipliers in specific EU countries. In the most recent study, Faria-e-Castro (2021, p.23) confirmed the importance of targeted support measures, particularly unemployment benefits, that appeared to provide the most significant boost to the

US economy so far. On the example of small open economy, like Slovenia, Arigoni et al. (2020, p.18) estimated the noticeable effect of fiscal stimulus on GDP and private consumption, while identifying high correlation between government and private consumption in fiscal transmission channels. It is evident that such preliminary findings are in line with Wilson's scientifically justified expectations (2020, p. 1). However, there is an obvious deficiency in large-scale cross-country studies that could help to identify specific features of fiscal multipliers in the COVID-19 environment according to the literature review.

2.2. Theoretical and conceptual frameworks

The origins of the fiscal policy in its conventional form are tied to the unfavorable economic events of the 1930-s and to its solution being the idea of boosting the aggregate demand first formulated by the British macroeconomist John Maynard Keynes (Vera, 2016, p.26). In practical terms, the idea implied increasing government expenditures via the actions that should have been transmitted the purchasing power to American residents, for instance via the launch of public works program. As a result, the key driver of the economy – the aggregate demand – would be magnified in the short run, which, in turn, should accelerate the output growth (Blanchard & Johnson, 2013, p. 542; Mishkin, 2016, p. 474). This method was well implemented in the policy decisions taken by different countries up until the 1970-s, at time when inflationary pressures questioned the dogmas of the classic Keynesian theory (Vera, 2016, p.28). Consequently, it induced the development of various branches of economic thoughts that offered new approaches to study the fiscal policy. The key tenets promoted by these branches will be defined further.

The formulization of the idea proposed by Keynes is usually embodied in the IS-LM model that occupies an important place in the modern macroeconomic textbooks. John Hicks and Alvin Hansen, the Keynes's followers, developed this model in the 1940-s by illustrating the equilibrium options across financial goods and financial markets growth (Blanchard & Johnson, 2013, p. 85). According to the Keynesian theory, the boost in government spending should shift the IS curve rightward at any given real interest rate (Mishkin, 2016, p. 474). Inherently, the demand for labor should rise along with real wages, that in turn should increase consumption and output. (Koh, 2014, p.571). In theory, the process should work well in the closed economy. However, the expanded IS-LM model that considers an open economy, namely Mundell-Fleming model, envisages that fiscal expansion might result in negative trade balance induced by the rise in real exchange rate regime (Koh, 2014, p.571). This economic transmission channel tends to diminish the benefits expected by the increased

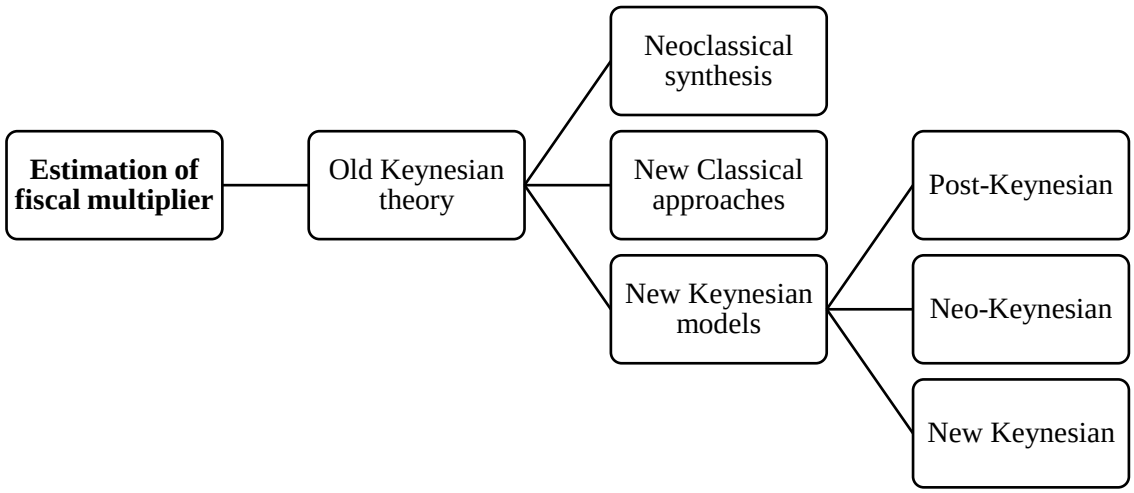
government spending. It provides us with only one example of how the forthcoming methodology might disprove some of the aspects of the previous thinking.

The assessment of the fiscal policy effectiveness is covered by the concept of fiscal multiplier, that was coined by Keynes in the 1930-s as an attempt to evaluate the effect of fiscal expansion during the Great Recession (Blanchard & Johnson, 2013, p.540). Essentially, the fiscal multiplier shows the magnitude of output reaction in response to fiscal measures implemented by a government (Chinn, 2018, p. 4748). The simplified calculation of the fiscal multiplier implies applying income-expenditure GDP model either by using national accounts data or marginal propensities to consume (Pusch & Rannenberg, 2011, p. 6). Macroeconomic models, however, usually follow another technique: the nominator includes the real GDP deviation from its baseline level in post-stimulus period, while the denominator is represented by fiscal stimulus size as the 1% of baseline GDP in initial period (Coenen et al., 2012, p.30). This algorithm allows to estimate the effect of temporary fiscal expansion, which will be used in current paper as well. Another option is to calculate the cumulative multiplier that is derived from fiscal measures implemented at different time horizons, up to 20 quarters (Coenen et al., 2012, p.31). The concept of cumulative multiplier is extensively used in various empirical studies (Auerbach & Gorodnichenko, 2012; Ilzetski et al., 2013; Mountford & Uhlig, 2009).

The concept of fiscal multiplier and key assumptions behind its calculation were constantly susceptible to modifications that constitutes its evolution. The traditional Keynesian model anticipates high positive output response mainly due to its simplistic assumptions (Cogan et al., 2010, p.282): firstly, it is presumed that prices are sticky hence firms have only one line of reaction which is the change of the quantity of produced goods; secondly, it is expected that households have high marginal propensity to consume, hence, strongly contributing to the economic growth (Hagedorn, Manovskii, & Mitman, 2019, p.1). Additionally, the disapproval of the old Keynesian thinking was induced by the impotency of their arguments during high inflation in 1970-s and subsequent critique by Robert Lucas (Vera, 2016, p.28). The main assertion of the American economist included inability of fiscal policy to withstand intrinsic inflationary expectations (Causevic, 2015, p.3). More specifically, Lucas criticized the absence of the mechanism that could account for the reaction of the main economic agents to policy actions. According to this logic, when evaluating the real effect of fiscal stimulus, the econometric models should include the forward-looking expectations of firms and households. (Causevic, 2015, p.4). Moreover, critics of the old Keynesian theory prioritized the monetary policy decisions and automatic stabilizers in

confronting the recession, while the discretionary fiscal policy was deemed to be ineffective (Auerbach, 2012, p.3).

Figure 3 Theoretical framework



Note: compiled by author according to Causevic (2015, p.2) and Chinn (2018, p.4748).

Consequently, the traditional old Keynesian school gave rise to other different academic strands that accommodated their thinking to the real environment (see Figure 3). The most common classification entails three separate streams: the Neoclassical synthesis, the New classical approaches, and the New Keynesian models (Chinn, 2018, p. 4748). The latter can be further disaggregated into post-Keynesian, neo-Keynesian, and new Keynesian itself (Causevic, 2015, p.2). According to the adherents to the neo-classical synthesis, the fiscal policy continues to influence the income as long as prices adjust to eliminate output gap; hence, in the long term the fiscal policy multiplier equals zero (Chinn, 2018, p. 4748). Moreover, Neoclassical synthesis supports the idea that fiscal multipliers are higher in the periods of monetary accommodation. In general, this stream of thought greatly resonates with the original concepts of old Keynesianism.

The main merit of the New classical approach is incorporating in its models the property called Ricardian equivalence (Hall, 2009, p.212). This feature is peculiar to the situation, when a government decides to increase spending in order to facilitate economic activity, yet the economic agents with forward-looking orientation expect that further government deficit will be financed by future tax rises. Consequently, private consumption remains intact or even decreases which is contrary to the initial policymakers intentions (Chinn, 2018, p. 4749). Such mechanism is alternatively referred to as negative wealth effect,

which is detrimental to the effectiveness of fiscal policy (Cogan et al., 2010, p.283). Due to the fact that the followers of New classical approach use this property, their estimations of multipliers are markedly lower compared to the findings of the conventionalists (Chinn, 2018, p. 4749).

New Keynesian models are characterized by the simultaneous inclusion of traditional Keynesian features, such as price rigidities, and state-of-the-art techniques of intertemporal analysis, hence incorporating the forward-looking element (Chinn, 2018, p. 4749). Similarly to neoclassical models, the long-run effects of fiscal policy tend to be minor, yet the policy mix of budget and monetary decisions well influence the GDP in the short run. In general, the notion of "New Keynesian" is associated with DSGE models (Hall, 2009, p. 218), yet it is frequently used to encompass all modern methodologies that attempt to estimate the fiscal multiplier. The range of these estimates is mostly in line with those derived by old Keynesian models, while being higher than in case of neoclassical synthesis (Hall, 2009, p. 183). One remarkable example of the study that used old Keynesian methodology is Romer & Bernstein (2009, p.12), while Smets & Wouters (2007, p.588) capitalized on the innovative DSGE approach and assumed that the current fiscal expansion is conducted at the cost of future tax increases. When comparing the results of these two seminal papers, it is evident that both offer short-run immediate estimate of around unity, yet over time, the Keynesian-based approach yields the fiscal multiplier that is three times higher than the one proposed by innovative framework (Cogan et al., 2010, p.283). This example clearly demonstrates that evolution of the topic allowed macroeconomists to expand the model by incorporating more scientifically proven variables, which in turn provided significantly more careful assessment.

After identifying the main academic branches that are dedicated to quantifying the effectiveness of fiscal policy, it is important to understand the methodology. The wide range of various estimates is mainly caused by the heterogeneity of the approaches. Based on the empirical literature, the following key methodologies threads could be discriminated: VAR-based models (time-series analysis), Dynamic stochastic general equilibrium models (DSGE), and other econometric approaches, like regression-based estimations.

One of the most widely used approaches is VAR-based approach that materializes in time-series models aimed to establishing relationships between macroeconomic variables (Whalen, 2015, p.2). The generic estimation method was used in the early studies by Blanchard & Perotti (2002, p.1330), who assumed the exogeneity of fiscal policy within the ordered quarterly datasets (Koh, 2014, p.576). In similar vein, yet with some technical adjustments, further studies were conducted by Auerbach & Gorodnichenko (2012, p.2),

Mountford & Uhlig (2009, p.962), etc. Panel VAR approaches occupy the important place in the empirical literature as well, with the numerous attempts to estimate the multipliers based on cross-country time series dataset (Hory, 2016, p.60; Ilzetski et al., 2013, p.239; Koh, 2014, p.570; Nickel & Tudyka, 2013, p.4; Wierzbowska, & Shibamoto, 2018, p.3496). In general, the estimations of fiscal multipliers rarely exceeded unity, especially in the case of cross-country analysis (Hall, 2009, p.194); nevertheless, certain studies yielded the results higher than 1, which was mainly attributed to accommodative monetary conditions or changes in business cycles (Auerbach & Gorodnichenko, 2012, p.19; Koh, 2014, p.587).

The main issue associated with VAR-models is the proper identification of fiscal shock (Whalen, 2015, p.2). In macroeconomic terms, it is reasonable to state that government expenditures affect the output; however, there is also a place the reverse causality, meaning that output might affect government spending as well (Hall, p. 193, 2009). Therefore, apart from the typical structural-based identification approach followed by the majority of related literature (Blanchard & Perotti, 2002, p.1330), a new idea was proposed by Ramey (2011, p.3) and Ramey & Zubairy (2018, p.857), which envisaged the introduction of military spending as a more justifiable exogeneous variable (Chinn, 2018, p. 4751). This narrative approach received the round of criticism as well, the main argument being the possibility of war outbreak due to poor economic conditions (Koh, 2014, p. 575). It is important to note, that the latter approach resulted in lower multipliers (Coenen et al., 2012, p.27).

Further methodological approach, that gained the popularity in the recent decades, especially within central banks, is DSGE (Hall, 2009, p.218). When comparing with VAR-based models, the crucial difference lies in the overwhelming focus on forward-looking agents that are assumed to make the informed decisions on current income usage given the potential negative wealth effect due to burdensome budget policy. In other words, the element of Ricardian equivalence is well incorporated into the model (Chinn, 2018, p. 4751). Therefore, the main merit of these models is represented by its strong connection to the economic theory and microfinance optimization, contrary to VAR approach, that attempts to find relationships between economic variables with deficient theoretical grounding (Whalen, 2015, p.3). Nevertheless, DSGE models are subject to constant criticism mainly due to its unrealistic assumptions: for instance, they normally assume the full utilization of resources or unrestricted access to the credit markets (Whalen, 2015, p.3). In response to this criticism, more recent DSGE models started to include “hand-to-month” or “rule-of-thumb” consumers with high marginal propensity to consume (Cogan et al., 2010, p.286). This modification increased the value of fiscal multipliers by 50% (Whalen, 2015, p.4). Further critique includes

the claims that DSGE models are quite similar to old Keynesian models due to the consideration of rigid prices (Cogan et al., 2010, p.286).

Despite these adjustments, DSGE tend to present the most conservative estimates, mainly due to the forward-looking element (Cwik & Wieland, 2011, p.534). In this stream, the seminal paper was written by Smets & Wouters (2007, p.588). The rapid emergence of academic literature capitalizing on this methodology is evident after the Great Recession, particularly through the works of Cogan et al. (2010, p.282), Cwik & Wieland (2011, p.498), Erceg & Linde (2014, p.77), Woodford (2011, p.1), etc. These studies focused mainly on one specific country or, as it is in the case of Coenen, Straub, & Trabandt (2012, p.72) and Coenen et al. (2013, p.368), on the Euro area, with specially designed model by the ECB - New Area-Wide Model. In modern academia related to the question of fiscal policy, DSGE models are often referred to as the most typical representatives of the New Keynesian stream (Cogan et al., 2010, p.282).

In terms of the current topic, the third methodological domain constitute other regression-based estimations, that do use neither VAR-based nor DSGE approach. This domain is characterized by lower degree of complexity and more relaxed assumptions, yet their results appear to be in line with more sophisticated studies (Nakamura & Steinsson, 2011, p.34; Chinn, 2018, p. 4751). The studies focus mainly on the regional cross-state or cross-province analysis, hence investigating local multiplier within one country (Brueckner & Tuladhar, 2010, p.9; Chodorow-Reich, 2019, p.1; Klein & Staal, 2014, p.396). The identification problem is resolved by introducing instrumental variable and running 2OLS regression (Gechert, 2017, p.19).

For instance, one considerable stream of literature attempts to estimate cross-state fiscal multiplier shortly after the implementation of ARRA package in the US. For these purposes, they include instrumental variable to the model which is pre-crisis Medicaid expenditures per state (Chodorow-Reich et al. 2012, p. 118; Klein & Staal, 2014 p. 395). Another state-based US study embeds military spending as an instrument to estimate relative fiscal multiplier (Nakamura & Steinsson, 2011, p.34). The study by Afonso, Gruener, & Kolerus (2010, p.17) introduced two instrumental variables, which are “distance to elections” and “lagged budget balance ratio”. In their research on Japan economy, Brueckner & Tuladhar (2010, p.10) attempt to circumvent the reverse causality by year fixed effects. In contrast, Alesina & Ardagna (2010, p. 52) employed simple OLS regressions to identify the relationship between the episodes of fiscal expansions and GDP on a sample of OECD countries from 1970 to 2007. Authors explicitly state that their intent did not imply estimating

the size of fiscal multiplier as it typically conducted in similar research (Alesina & Ardagna, 2010, p. 40). Instead, Alesina & Ardagna (2010, p. 62) provided a valuable empirical contribution on the effectiveness of various fiscal instruments; for instance, they ascertained that revenue-based measures tend to be much more effective than spending-related actions. As a result, some original thoughts were provided regarding the status of recovery from financial crisis in the US. Apparently, simple OLS techniques are also frequently used to evaluate the effectiveness of fiscal policy, yet with careful assumptions and thorough scientific justifications.

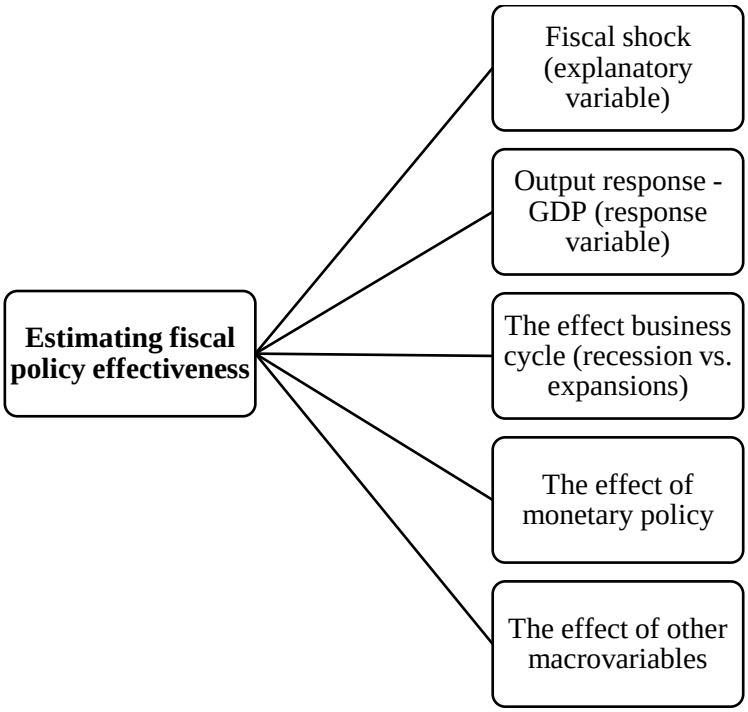
In addition to the plethora of various approaches and economic schools, the heterogeneity in the estimations of fiscal multipliers could be caused by certain technical aspects. For instance, the difference in timeframes used for panel VAR analysis might yield different estimates of fiscal multipliers. While the majority of key studies use quarterly statistics (Auerbach & Gorodnichenko, 2012, p. 2; Blanchard & Perotti, 2002; Ramey, 2011, p. 851), some others base their analysis on lower frequency data (Koh, 2014, p.570). Additionally, some models fail to input the element of fiscal anticipation attributable to households and firms that has impact on the size of a multiplier as well (Whalen, 2015, p.5). Similarly, the set of specific control variables might considerably affect the fiscal multiplier. The evidence for this is provided in the Literature review section.

Considering the current state of research, there is clearly a high propensity towards applying DSGE model on a single country in order to estimate the fiscal multiplier (Arigoni et al., 2020, p.2; Aursland, Frankovica, Kanika, & Saxegaard, 2020, p.321). At the same time, researchers tend to modify existing frameworks with a view to building original methodology to model the effect of fiscal stimulus (Derkacz, 2020, p.2; Faria-e-Castro, 2020, p.2). Some other recent studies by Baker et al. (2020, p.2) and Chetty et al. (2020, p.1) take advantage of high-frequency data to construct consumer behavior patterns. The bottom line is that there is no one common estimation technique of fiscal policy effectiveness during COVID-19 crisis, which gives some leeway in selecting the appropriate model.

With a view of summarizing the review of academic literature and examination of relevant theoretical framework, it is necessary to construct Conceptual Framework (see Figure 4) that would guide the methodological path of the current study. According to the Figure, the first task implies identifying the proper value of fiscal policy measures, which in literature is most frequently represented by the percentage of GDP or in absolute values per capita. The further step foresees identifying the proper response variable, that in predominant cases is represented by real GDP growth (absolute/per capita – depending on explanatory variable).

Other conceptual considerations relate to further macroeconomic variables that proved to be instrumental in explaining the relationships between fiscal policy and output. According to the literature reviewed, it is crucial to account for business cycle and monetary policy stance, while also including the inputs from other variables, like the country's income level, trade openness, debt-to-GDP, etc.

Figure 4 Conceptual framework



Note: compiled by author according to Literature review and Theoretical framework sections

The understanding of conceptual framework completes the theoretical part and organically leads to subsequent empirical part, that starts from presenting methodology and data in a way that is based on theoretical premises of the current study.

3. Empirical part

3.1. Methodology

The research design of the current paper is constructed in the following way: the careful examination of predominant methodological premises extracted from the literature review is combined with the author's original approach that reflects the understanding of the unprecedented COVID-19 environment. Despite of the proliferation of sophisticated VAR (Auerbach & Gorodnichenko, 2012, p.2; Hory, 2016, p.60; Koh, 2014, p.577) as well as DSGE techniques (Aursland et al., 2020, p.321; Coenen et al., 2013, p.368; Cwik & Wieland, 2011, p.498) to evaluate the fiscal policy effectiveness, some studies draw upon linear OLS regressions with or without instrumental variables (Afonso et al., 2010, p.13; Alesina & Ardagna, 2010, p.51; Klein & Staal, 2014, p.397). The justification for the application of linear methods can be found in the relevant literature, for example, in the study by Coenen et al. (2013, p. 372). Furthermore, the current research focuses solely on the COVID-19 crisis, hence, is built based on the cross-sectional data which significantly limits the choice of research method. With this regard, mediation analysis is offered as a reasonable tool to discern causal relationships between macroeconomic variables (Celli, 2019, p.3; Njagi, et al., 2021, p.101).

3.1.1. Multivariate OLS

OLS estimation techniques are frequently applied in the studies that attempt to evaluate the fiscal policy effectiveness (Gechert, 2017, p.19). In the case of fiscal multiplier, the fiscal expansion effect on the output is reflected in the relationships between fiscal measure in the initial period and real GDP growth in the following period (Coenen, et al., 2012, p. 30). At the same time, cross-country differences should be properly captured by control variables. Hence, the baseline estimation can be represented as follows:

$$GDP_t = \alpha + FM_{t-1} + \gamma_{t-1} + \varepsilon_t \quad (1)$$

where the response variable is normally denoted as real GDP growth GDP_t, while the explanatory variable is presented as the size of fiscal measures in % to GDP in the initial period FM_{t-1}. All other control variables are captured in γ_{t-1}.

Following the logic of studies by Chodorow-Reich et al. (2012, p. 130), Klein & Staal (2014, p. 397), Sacerdote (2011, p.8), who investigated the effectiveness of ARRA program, and Corsetti (2012, p. 533), who analyzed the fiscal transmission mechanism across OECD countries, the explanatory and response variables could be transformed in the following way:

$$LOG(GDP\ per\ capita_t) - LOG(GDP\ per\ capita_{t-1)}) = \alpha + LOG(FM\ per\ capita_t) - LOG(FM\ per\ capita_{t-1)}) + \gamma_t + \varepsilon_t \quad (2)$$

where both explanatory and response variables are presented as absolute change, normalized by population and logarithmic function.

After the following variable transformations are conducted:

$$LOG(GDP\ per\ capita_t) - LOG\big(GDP\ per\ capita_{t-1)}\big) = \Delta GDP_t \quad (3)$$

$$LOG(FM\ per\ capita_t) - LOG\big(FM\ per\ capita_{t-1)}\big) = \Delta FM_t, \quad (4)$$

the generalized form of the equation 2 can be presented as:

$$\Delta GDP_t = \alpha + \Delta FM_t + \gamma_t + \varepsilon_t \quad (5)$$

The control variables are introduced to the model based on the cross-country findings in studies by Agnello et al. (2013, p.22), Hory (2016, p.74), Ilzetski et al. (2013, p.240), Wierzbowska, & Shibamoto (2018, p. 3506). Ultimately, the equations (1) and (5) can be augmented by the following macroeconomic variables:

$$GDP_t = \alpha + FM_{t-1} + SI_t + ZLB_t + T_t + DEF_{t-1} + DEBT_{t-1} + LOG(POP)_{t-1} + \varepsilon_t \quad (6)$$

$$\Delta GDP_t = \alpha + \Delta FM_t + SI_t + ZLB_t + T_t + DEF_{t-1} + DEBT_{t-1} + \varepsilon_t \quad (7)$$

The selection of control variables is rationalized by the empirical findings in the relevant studies. SI_t represents Stringency Index that determines the severity of COVID-19 related measures in a country, which in turn is believed to play a pivotal role in curbing GDP growth (Barro et al., p.18). The stance of monetary policy is mirrored by the dummy variable ZLB_t, that shows if the country has zero or close to zero policy interest rates – until 0.25% (dummy variable – 1) or significantly higher than 0 – more than 0.25% (dummy variable – 0). In other words, zero-lower bound situation is presented by 1, while the opposite scenario is 0. The consideration of this input can be justified by numerous studies, in particular Erceg & Linde (2014, p. 104) and Canzoneri et al. (2015, p.101) that noticed the growing effectiveness of fiscal measures during zero-lower bound situations. The trade element T_t, denoted as a ratio of trade (exports and imports) to a country's GDP, is also presented and justified by the findings by Ilzetski et al. (2013, p. 240) and Hory (2016, p. 66). The idea implies that more open economies, i.e., with higher trade-to-GDP ratio, tend to experience lower effectiveness of fiscal policy due to the leakage of certain level of consumption abroad. Furthermore, DEF_{t-1} and $DEBT_{t-1}$ represent fiscal deficit and public debt, respectively, both measured in

percentage-to-GDP ratio and as of previous period. According to Ilzetzki et al. (2013, p.240) and Nickel & Tudyka (2013, p.17), the higher public debt tends to decrease the effectiveness of fiscal policy, notably due to the Ricardian equivalence considerations, while Huidrom et al. (2016, p.13) stated that fiscal strength can be considered as important factor for favorable output response. Moreover, in equation (3) the population variable is proxied by $LOG(POP)_{t-1}$, following the logic of the study by Agnello et al. (2013, p.21). The logarithmic functions are applied in order to normalize the absolute values.

In essence, the current research design builds upon methodology applied by Alesina & Ardagna (2010, p. 40), who used linear multivariate regression to explain the relationship between the episodes of fiscal shocks and real GDP growth. In similar vein, control variables are added in order to account for country-specific characteristics.

Importantly, it is evident from literature that the effect of fiscal stimulus on GDP can be investigated within both annual (Agnello et al., 2013, p. 17; Koh, 2014, p.570) and quarterly timeframes (Auerbach & Gorodnichenko, 2012; Hory, 2016). In the current paper, both timeframe strategies will be executed, yet the quarterly dataset is limited mostly to advanced countries due to the availability of national accounts. Regarding the policy lag, the basic logic of period-by-period temporary multiplier will be utilized (Coenen, et al., 2012, p. 30). According to Wierzbowska & Shibamoto (2017, p.3497), the full effect of fiscal stimulus can be realized two years after initial fiscal shock, yet studies by Baker et al. (2020, p.4) and Chetty et al. (2020, p.40) illustrated that some components of fiscal support packages are effective immediately, in particular unemployment benefits and transfers. The dataset used in the current study allows to break down the fiscal measures, hence, focus only on these measures that have short-term effect. Therefore, the aim of this research is to calculate immediate effect of fiscal stimulus by investigating temporary period-by-period relationship between macroeconomic variables.

The importance of using lagged variables can be justified in studies by Chodorow-Reich et al. (2012, p.127) and Wierzbowska & Shibamoto (2017, p.3496), who outlined the pre-existing economic conditions as important input to their model that evaluates the size of fiscal multiplier. In the current paper, these pre-existing economic conditions are dictated mainly by fiscal strength, and public indebtedness. Other control variables are used in the same timeframe as the response variable.

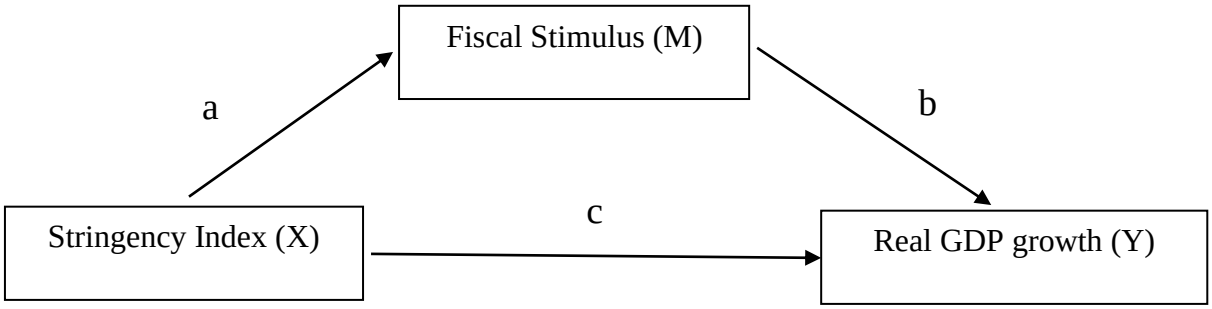
3.1.2. Mediation analysis

It stands to a reason that basing the research solely on multivariate OLS regression might be vague in terms of estimating causal relationships between macroeconomic variables. Therefore, mediation analysis is offered as a supplementary step in this quantitative analysis with the main purpose of identifying indirect effect of fiscal stimulus in the initial relationship between the severity of measures and real GDP growth.

According to Celli (2019, p.3), the application of mediation analysis is a useful tool to identify casual relationships in economics, in particular, it is sensible when analyzing policy options. Indeed, recent economic literature consists of the studies utilizing mediation techniques, notably the studies by Huber, Lechner, & Mellace (2017, p.180) and Njagi et al. (2021, p.101), despite of the fact that this technique is much more proliferated in educational and psychological domain. The afore-mentioned economic studies thoroughly employ macroeconomic variables, which resonates with the current topic.

In principle, the research design implying mediation analysis can be illustrated in line with Celli (2019, p.3):

Figure 5. Mediation analysis



Note: compiled by author

This research design is developed based on the study by Njagi et al. (2021, p.101) who considered the mediation effect of macroeconomic indicators when evaluating relationships between financial strength and performance of banks. Based on Figure 5, there are three OLS regressions that should be conducted in order to find mediation effect; yet the modern technique allows to consider only equations *a* and *b* (Njagi, 2021, p.102). The equation *c*, which is responsible for the total effect, is mainly used to establish the nature of mediation, whether it is partial mediation (M is significant, but X still affects Y) or complete mediation (M is significant, and X lost its influence over Y). The crucial prerequisite for the mediation is

the presence of significant association between X and M in equation 1, as well as X, M and Y in equation 2.

According to the hypotheses introduced in the introductory part, the mediation effect of fiscal stimulus should have positive sign, thus alleviating ramifications from the severe COVID-19-related measures and favorably influencing economy at the same time. Based on equation 5, the mediation analysis can be conducted by constructing the following 8 and 9 equations, similar to the study by Njagi et al. (2021, p.102):

$$\Delta FM_t = \alpha + SI_t + ZLB_t + T_t + DEF_{t-1} + DEBT_{t-1} + \varepsilon_t \quad (8)$$

$$\Delta GDP_t = \alpha + \Delta FM_t + SI_t + ZLB_t + T_t + DEF_{t-1} + DEBT_{t-1} + \varepsilon_t \quad (9)$$

Therefore, if the mediation exists, the causal indirect relationships in equations 8 and 9 should be significant and in aggregate should exceed the total direct effect between Stringency Index and GDP growth. In such a case, it will be evident, that with 95% significance, the fiscal measures variable mediates the initial relationship, hence, affects positively or negatively the afore-mentioned association. Technically, the analysis will be conducted in the statistical software R with the purpose of estimating ACME (Tingley et al., 2014, p.5). Subsequently, ACME will be compared to ADE, which will constitute the basis for the conclusion on the mediation effect. The estimations will be followed by number of simulations (by default, 1000) using bootstrapping methods.

3.1.3. Sampling strategy

The reporting of sampling methods is an important element of research design, that allows readers to assess the generalizability of the study (Turner, 2020, p.10). In a line with Taherdoost (2016, p.19), the formulation of sampling strategy should begin with identifying the population that specific research attempts to examine. In the current cross-sectional study, the population is represented by the total number of countries in the world. Despite of various estimations of the actual number of independent states, it is commonly acceptable to consider 195 countries in the world, 193 of which are members of the United Nations (Worldometer, n.d.). The next crucial step implies specifying the sampling frame (Taherdoost, 2016, p.20). Hereby, sampling strategy is heavily dependent on the availability of data – issue, that is frequently reported in relevant studies, notably by Ilzetzki et al. (2012, p. 239) and Minea & Mustea (2015, p.2732). It is therefore important to diligently collect reconciled data, preferably from the same reputable source. In this regard, the complete IMF Fiscal Monitor

dataset containing discretionary anti-crisis measures per each of 180 countries as of January 2021 will serve as a sampling frame (IMF, 2021).

The ultimate sample further varies based on the availability of other sets of data. For example, national GDP accounts are available for a broader range of countries, while quarterly data is mostly limited to the most advanced country group. Due to such complexities, both instances will be tested and presented yielding specific conclusions for the respective category of states. Drawing upon the common classification also outlined by Taherdoost (2016, p.22) and Turner (2020, p.10), current study will principally utilize non-probability convenience and purposive sampling, along with consistent stratification of countries according to their level of economic development. Such segmentation is frequently used in the relevant cross-country studies, in similar vein to Ilzetzki et al. (2012, p. 239), Agnello et al. (2013, p.21) or Koh (2014, p.578). Apart from the basic IMF methodology, the segregation will be conducted based on the World Bank's classification of the country's income level (WB, 2019).

Thus, the current sampling strategy is devoid of randomization element due to the author's attempt to capture fiscal transmission mechanism during COVID-19 pandemic in as many countries as possible with a view to data availability. However, this might represent one of the limitations of the current study due to high exposure to subjectivity, which will be duly reported in the respective section (Taherdoost, 2016, p.22). At the same time, when analyzing the total available sample, the proportions of different categories of countries (e.g., developed vs developing) will aim to represent how these proportions are set when considering the entire world. Furthermore, specific focus will be put on the country segmentation analysis due to the cross-country intricacies. The total list of countries (sampling frame) is presented in additional materials to this thesis, while the total number of countries and their share per each category (IMF- and WB-based) is reported below:

Table 1 *Categorization of sampling frame according to IMF methodology*

Category IMF	**Number of Countries**	**Share, %**
Advanced economies	36	20%
Emerging Markets	87	48%
Low-Income Developing Countries	57	32%
Total	**180**	**100%**

Note: compiled by author based on IMF (2021a).

Table 2. *Categorization of sampling frame according to WB methodology*

Category WB	**Number of Countries**	**Share, %**
High income	59	33%
Upper middle income	47	26%
Lower middle income	48	27%
Low income	26	14%
Total	**180**	**100%**

Note: compiled by author based on WB (2019) and IMF (2021a).

The calculation of the sample size based on the common approach summarized by Taherdoost (2016, p. 25) yields the result of around 130 countries, with population size of around 200 units, 95% confidence level and 5% margin error. When examining the fiscal transmission mechanism worldwide, the value of 130 will serve as a minimum threshold for the number of countries required for the current research. But, for instance, provided that analysis is concentrated on advanced economies, only around 50 countries will be considered. Moreover, the effects of outliers will be duly examined and removed. Therefore, the sample size for each set of estimations will vary and will be accordingly provided in the result section.

3.2. Data

In the frame of current study and research design, collecting macroeconomic variables in a consolidating manner appeared to be one of the most challenging tasks to achieve. The timing and the structure of publications of national accounts varies from country to country. Moreover, due to the analysis of the ongoing crisis, it was challenging to collect the appropriate recent historical data according to the predetermined methodology in order to find worthwhile connections between the pieces of information. Nevertheless, this potential information deficiency problem is tackled by using only reputable sources of information, like the most recent IMF, World Bank databases (IMF, 2021a; IMF, 2021b; WB, 2021b) which is combined with some relevant information from Bloomberg terminal. In some instances, the retrieved data was cross-checked across different sources.

3.2.1. Fiscal measures

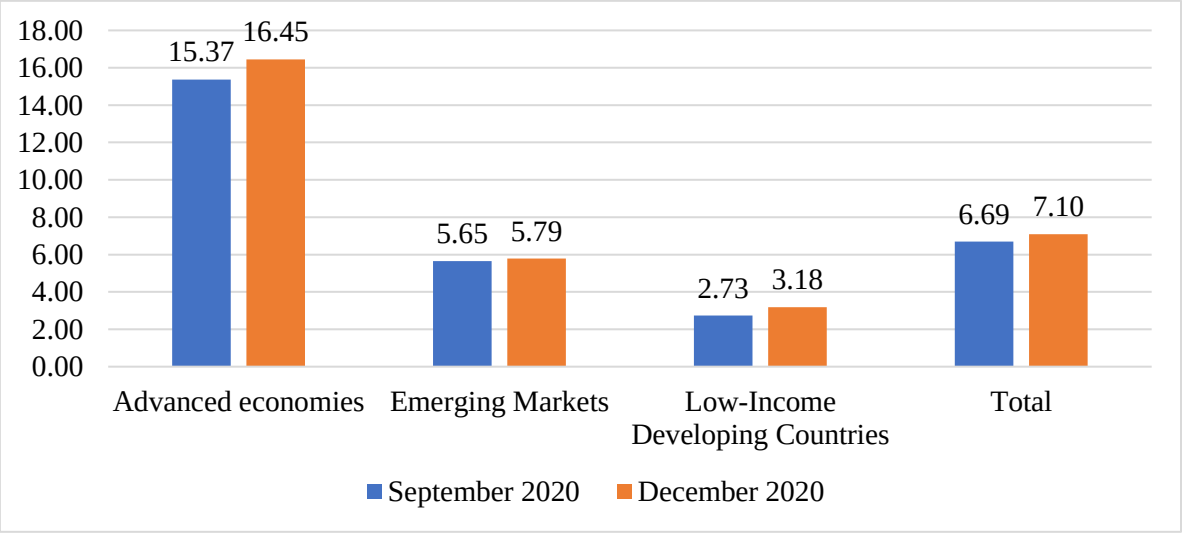
The proper quantitative definition of fiscal measures is instrumental for the current analysis, both for multivariate regression and mediation analysis. In relevant studies, researchers often use quarterly government consumption (public expenditure) as initial point to estimate the effectiveness of fiscal policy stimulus (Agnello et al., 2013, p.17; Ilzetzki et

al., 2013, p. 243). However, in the periods of crisis, predominant focus is normally on the countercyclical programs of fiscal stimulus, which can be embodied in the afore-mentioned programs ARRA or EERP implemented during the Great Recession in the US and Europe, respectively (Coenen et al., 2013, p.367; Sacerdote, 2011, p.3).

In order to follow the purpose of the current study, it is crucial to discern the level of discretionary fiscal stimulus directly induced by the COVID-19 pandemics, and the complete IMF dataset as of June 2020, September 2020, and December 2020 with cross-country absolute and relative data on fiscal measures perfectly fits this purpose (IMF, 2021a). While the September 2020 and December 2020 data features 179 and 180 countries, respectively, June 2020 contains information on 55 states. Moreover, the latter dataset predominantly consists of selected advanced and emerging markets. Hence, relatively bigger databases (September 2020 and December 2020) will be used more extensively, especially for mediation analysis, whereas the smallest dataset will provide some limited insight on longer-term quarter-on-quarter GDP response. All datasets can be found in file attachments, while their summary is presented in Appendix B.

The following graph (see Figure 6) shows how the magnitude of fiscal stimulus changed across different country groups between September 2020 and December 2020. It is evident that each country group expanded their fiscal packages during that time.

Figure 6 Comparison of fiscal stimulus in September 2020 and December 2020 across different country categories, in % to GDP



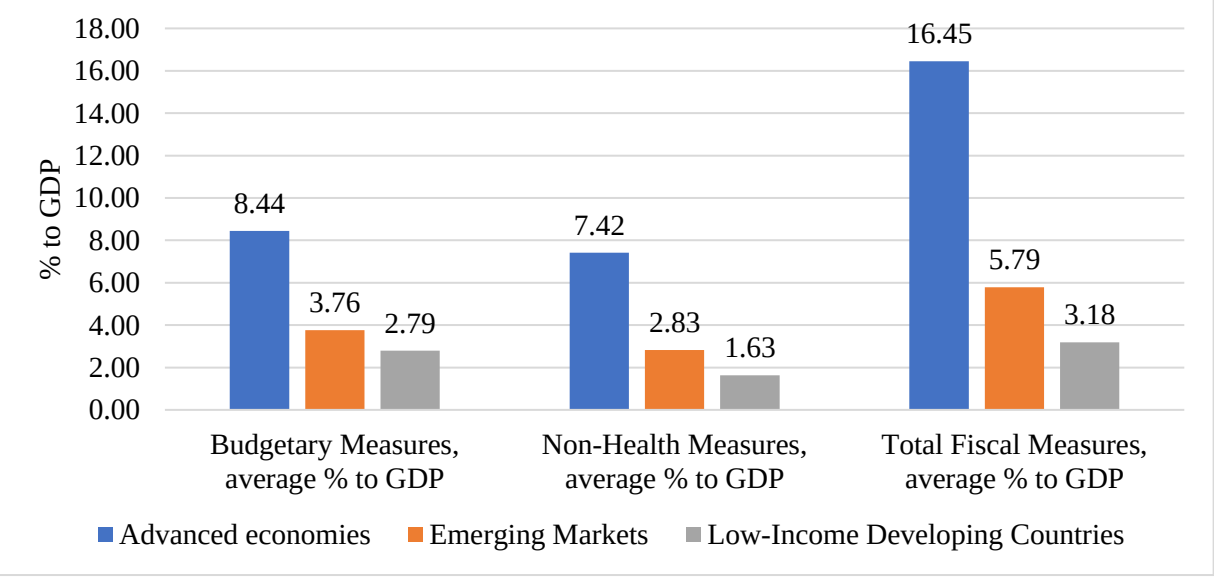
Note: compiled by author based on IMF (2021a).

Specific attention should be paid to the composition of countercyclical fiscal measures, which can be accessed within the IMF dataset. All fiscal packages are divided into

budgetary measures ("above-the-line") and debt-related measures ("below-the-line"). While the former include more common instruments that have immediate impact on the economy and fiscal deficit, like transfers, unemployment benefits, outlays into health sector, the latter consists of loan guarantee and equity injections predominantly to businesses that have more prolonged impact on the economy (IMF, 2020, p.22). Based on this composition, the dataset in the current study considers three key indicators: total fiscal measures (both "above-the-line" and "below-the-line"), total budgetary measures (only "above-the-line"), and total non-health budgetary measures (that accounts for "above-the-line" measures yet ignoring health-sector outlays) (IMF, 2020, p.22). The most distinguished value for the analysis is provided by non-health budgetary measures, since they include targeted government transfers and unemployment benefits with immediate effect on consumption and, hence, economic recovery (Wilson, 2020, p.3).

The Figure 7 illustrates how various fiscal components are allocated between different country groups. There is a striking prevalence of advanced economies in each of the component, in particular total fiscal measures, which includes loans and guarantees to firms as well. Another distinct aspect is that low-income countries spend relatively negligible amount on the non-health measures in comparison to advanced economies or even emerging markets. This fact further explains the need to categorize the analysis according to each country group.

Figure 7 Comparison of fiscal stimulus measures across different country groups as of December 2020, in % to GDP



Note: compiled by author based on IMF (2021a).

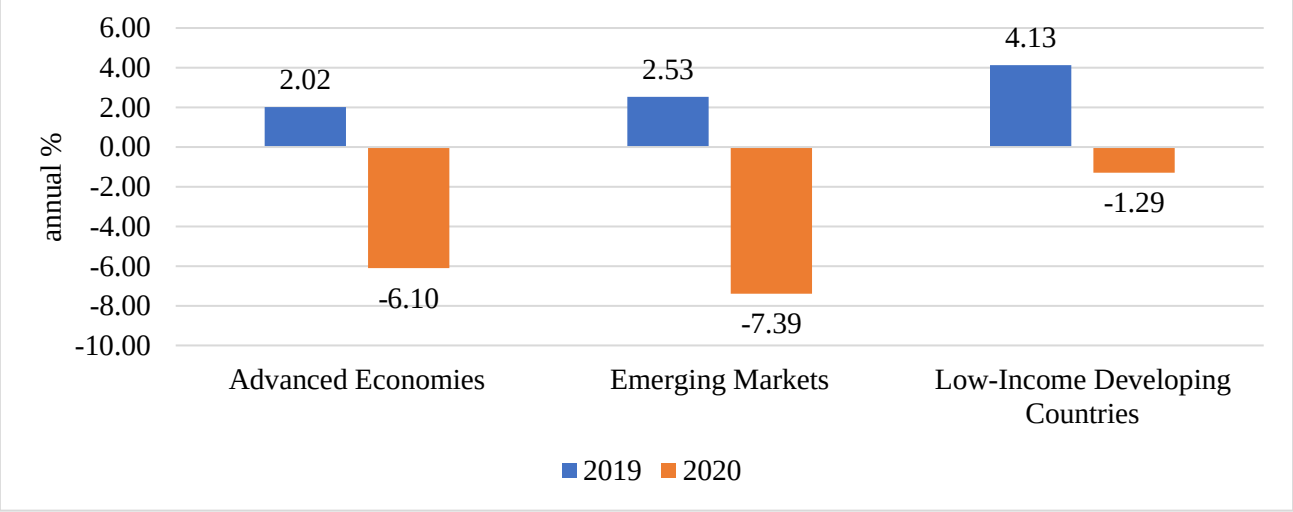
Regarding the variable transformation, in the multivariable OLS cross-country fiscal measures will be presented in the ratio to GDP, whereas mediation analysis will require to derive natural logarithm from per capita absolute value with a view to track the changes in fiscal measures across time.

3.2.2. Real GDP growth

In the current research setting, real GDP growth represents the output response in the fiscal transmission mechanism. Following the literature review, it is evident that response variable can be configured in the different way: while some studies include annual data (Agnello et al., 2013, p. 17; Koh, 2014, p.570), others investigate quarterly output (Auerbach & Gorodnichenko, 2012, p. 2; Ilzetzki et al., 2013, p. 243). Research design constructed by Sacerdote (2011, p.8) and Chodorow-Reich et al. (2012, p. 130) is predicated on the absolute amount of per capita GDP. Analogous to fiscal measures, the dataset provided by the IMF World Economic Outlook (2021b) fits well the objective of testing different scientifically proven models mentioned above, yet the data is published only on annual basis.

Based on the sample of 170 countries, Figure 8 illustrates that emerging markets suffered the most severely in 2020, while negative GDP growth low-income developing countries was the most negligible. Such difference should be accounted for by various control variables.

Figure 8. Annual real GDP growth per country category, in %

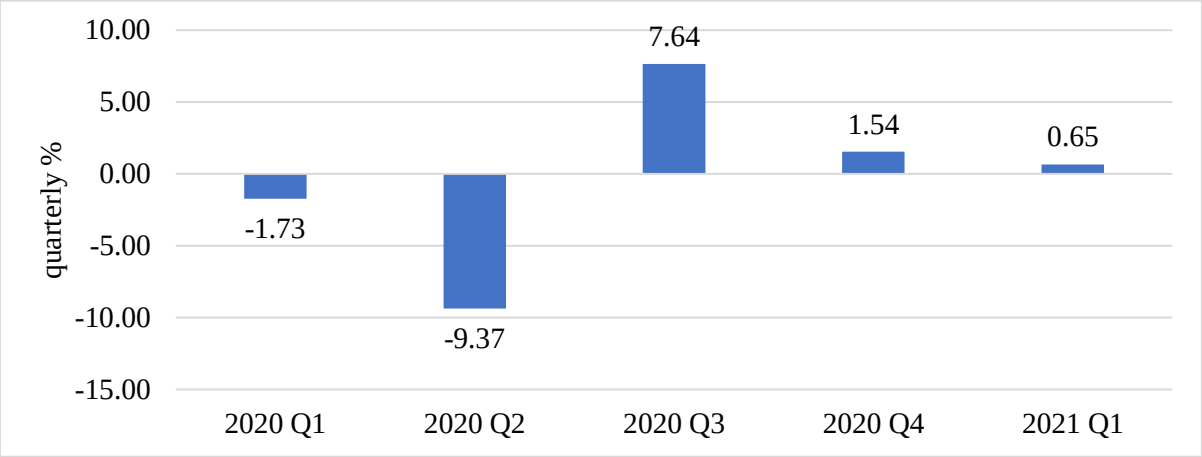


Note: compiled by author based on IMF (2021b).

In order to augment the breadth of response mechanism analysis, quarterly data was collected from Bloomberg terminal. The presence of quarterly data allows to find temporary

period-by-period fiscal-output relationship in accordance with the research design outlined by Coenen et al. (2012, p. 30). Nevertheless, this data is available only for advanced countries and is represented solely in the form of quarter-on-quarter percentage growth (Figure 9).

Figure 9 Quarterly real GDP growth per country category, in %, seasonally adjusted



Note: compiled by author based on data obtained from Bloomberg terminal (ECST, ECFC).

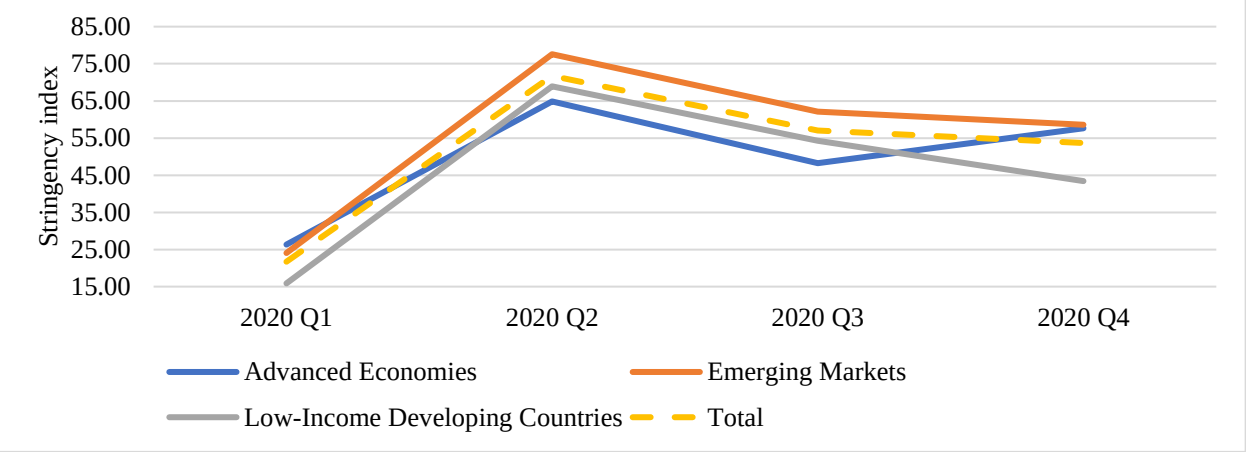
It is evident from the Figure 9 that the most severe hit to economies were experienced in the second quarter of 2020, which was followed by the quick recovery in the third quarter 2020. The available data on the fourth quarter 2020 and first quarter 2021 indicates the steady increase of GDP. Such results could be explained by unprecedented fiscal measures implemented throughout 2020 (Wilson, 2020, p.1), but gauging the specific extent to which this GDP growth can be attributed to fiscal measures constitutes the primary motivation of the current study.

3.2.3. Control variables

Among all other control variables, particular attention is brought to the indicator of the severity of quarantine measures – stringency index. It is believed that, along with fiscal measures, the lockdown actions will shape the economic landscape in each country, mainly due to the adverse effect on international trade and business activity (WB, 2020, p. 117; Vasiljeva, 2020, p. 2). The indicator has already been incorporated into the COVID-19 related studies that assessed the potential socio-economic costs of the quarantine measures (Cross, Ng, & Scuffham, 2020, p.2; Chisadza, Clance, & Gupta, 2020, p.3). Thus, given that stringency index will play a role of explanatory variable in the mediation setting, the role of this indicator for the current research cannot be underestimated.

Stringency index is presented by Hale et al. (2020, p.529) in the frame of Oxford policy tracker. It is a composite of 19 indicators that focuses on closure and containment strategies. The indicator can be in the range between 0 and 100, with 100 being the strictest level of measures (Cross et al., 2020, p.2). The database is available online and covers around 180 countries with daily data (Our World in Data, 2021). Depending on the timing of fiscal measures and real GDP growth, stringency index can be accordingly calculated as the average for the respective time period. For instance, when considering cross-country average of the index for each quarter in 2020 (see Figure 10), the strictest measures were launched in second quarter, while in fourth quarter only advanced economies were able to enforce some limitations. In this regard, they equaled to Emerging markets, who appear to be leaders in lockdown actions in 2020.

Figure 10 Quarter-on-quarter dynamics of stringency index, average



Note: compiled by author based on Our World in Data (2021).

The integration of other control variables into the model is dictated by the relevant literature findings. In the literature review section, several key macroeconomic variables were identified, which are expected to affect fiscal transmission mechanism, particularly during COVID-19 pandemic. First, the introduction of trade openness variable is motivated by Hory (2016, p. 66) and Ilzetski et al. (2013, p. 240), and is achieved by adding Trade as a share to country's GDP from the World Bank database (WB, 2021a). Trade variable represents the sum of exports and imports as of 2019 and serves as a structural economic indicator. The consideration of fiscal strength and indebtedness predetermined by Nickel & Tudyka (2013, p.17) and Huidrom et al. (p.13, 2016) could be realized by the inclusion of respective data from the IMF World Economic Outlook database (IMF, 2021b). Therefore, fiscal strength is mirrored in General government net lending/borrowing indicator, that ultimately measures the

total revenues minus total expenditures, whereas indebtedness is viewed as General government gross debt. Both are measured in % to GDP (IMF, 2021b). Furthermore, the interaction with monetary policy is captured by a dummy variable, where 1 signifies zero-lower bound situation (rates that are lower than 0.25% starting from March). This section of dataset is constructed based on information from Bloomberg terminal. The incorporation of a monetary policy element is motivated by numerous studies, particularly by Erceg & Linde (2014, p.104), Pyun & Rhee (2015, p. 219), and Canzoneri et al. (2015, p.101), who uniformly outline larger fiscal expansion effect in the periods of prolonged liquidity trap. Furthermore, population variable will be used when estimating the aggregate macroeconomic indicators. This data is supplied by IMF as well (IMF, 2021b). Importantly, the population variable will be transformed with natural logarithm in order to normalize the distribution. Last but not the least, lagged variable of real GDP growth will be used in order to explain the real GDP growth in current period, and IMF dataset (2021b) will be used to provide this information.

To summarize the data section, Appendix C provides explicit information about the sources of each variable and their function in current research setting. Appendix D supplies descriptive statistics summary on key explanatory, response and control variables considered in the current study.

3.3. Results

The analysis was conducted in the statistical software R using basic OLS regression functions and mediation package introduced by Tingley et al. (2014, p.2). The results are, therefore, presented in the tabular form including estimated coefficients for different variables and their significance. The relevant R code file is provided in the attachments to this paper.

3.3.1. Multivariate OLS

As already described in the methodology section, the analysis will start from simpler, yet comprehensive multivariate OLS models followed by the more complex mediation setting. In the first scenario, annual real GDP growth in 2020 will represent the dependent variable, while total fiscal measures implemented or announced at different point of time in 2020 will serve as an explanatory variable (in % to GDP). In principle, this logic corroborates the idea of the equation 1. The initial results are presented as follows:

Table 3 Multivariate OLS with annual real GDP growth

	Dependent variable:		
	Real GDP growth annual 2020		
	(1)	(2)	(3)
December total fiscal measures % to GDP	-0.138**		
	(0.058)		
September total fiscal measures % to GDP		-0.107*	
		(0.062)	
June total fiscal measures % to GDP			-0.026
			(0.074)
Lagged Real GDP growth annual 2019	-0.144***	-0.143***	-0.196***
	(0.028)	(0.028)	(0.051)
Stringency index 2020 average	0.478***	0.483***	0.956***
	(0.118)	(0.119)	(0.216)
Zero-lower bound dummy	0.569	0.224	-1.112
	(0.972)	(0.981)	(1.230)
Trade to GDP 2019	0.007	0.007	-0.007
	(0.005)	(0.005)	(0.010)
Debt to GDP 2019	-0.018*	-0.022**	-0.010
	(0.010)	(0.010)	(0.015)
Deficit to GDP 2019	-0.004	-0.011	-0.049
	(0.101)	(0.102)	(0.203)
Log Population	1.337***	1.304***	0.412
	(0.194)	(0.196)	(0.404)
Constant	0.113	0.175	4.781
	(1.612)	(1.632)	(3.306)
Observations	152	152	53
R^2	0.425	0.415	0.524
Adjusted R^2	0.393	0.382	0.437
Residual Std. Error	3.744 (df = 143)	3.778 (df = 143)	2.976 (df = 44)
F Statistic	13.207*** (df = 8; 143)	12.660*** (df = 8; 143)	6.047*** (df = 8; 44)

*p**p***p<0.01

The results show that models containing either September or December fiscal measures demonstrate significant negative relationship (with 10% and 5% significance level, respectively) between explanatory and response variable. In other words, with 1% increase of fiscal measures in 2020, the real annual GDP of that country decreases by 0.11% or 0.14%. This contradicts the alternative hypothesis implying that more fiscal measures induce weaker economy. Hence, the results presuppose that countercyclical fiscal expansion in specific year might undermine the economic strength. When plugging in either budgetary measures or non-

health measures as independent variable, no significant relationship is reported. Further examination in line with literature is required.

It is worth mentioning that in the first model above, stringency index is positively correlated with GDP, while debt-related association has negative sign. Other control variables, in particular dummy variables, do not show any type of significance.

Further scenario considers quarter-on-quarter setting with the attempt to find temporary fiscal effect according to the logic of Coenen, et al. (2012, p. 30). By this approach, the problem of endogeneity or reverse causality (Hall, p. 193, 2009) is duly tackled due to distributing variables into different time periods, hence allowing for policy lag. However, based on OLS regressions, there is no sign of significance for the association between fiscal measures and quarterly GDP growth, which was collected for some countries up to the first quarter of 2021. The possible reason for it could be the small sample size of nearly 50 countries that disables the comprehensive empirical-based research setting. Due to the absence of worthwhile results, these specifications are not reported in the main body of this work.

Certain branch of empirical studies, like for example Sacerdote (2011, p.8) and Corsetti (2012, p. 533), normalized the key variables in their models by population of a country. In similar vein, current study attempts to evaluate relationship between fiscal measures per capita as of different dates in 2020 and annual GDP per capita. Additionally, it stands to a reason to use more targeted fiscal component in the per capita scenario, which directly corresponds to government spending and foregone revenue, albeit not related to health sector (IMF, 2020, p.22).

Results in Table 4 (model 6) signify that with the increase of government aid equivalent to 1 USD, GDP per capita increases by 0.063 USD. According to the model, this result is correct 95% of the time. Importantly, the adjusted R-squared of this model (99%) indicates that this theoretical setting excels at explaining the variation of dependent variable. Furthermore, some highly influential outliers were identified and removed (e.g., Mauritius), which resulted in 46 countries left. However, such a small sample size constitutes a certain limitation to the conclusions.

Table 4 Multivariate OLS with annual real GDP growth per capita

	Dependent variable:		
	GDP per capita 2020 in USD		
	(4)	(5)	(6)
December non-health measures per capita in USD	0.041		
	(0.034)		
September non-health measures per capita in USD		0.162	
		(0.121)	
June non-health measures per capita in USD			0.063**
			(0.031)
Stringency index 2020 average	-9.858	-8.392	-42.620***
	(9.652)	(9.406)	(14.391)
Lagged GDP per capita 2019 in USD	0.959***	0.942***	0.969***
	(0.007)	(0.010)	(0.010)
Zero-lower bound dummy	317.247	617.702*	-818.719**
	(340.397)	(340.866)	(386.197)
Trade to GDP 2019	2.495	3.828*	1.997
	(2.196)	(2.138)	(3.125)
Debt to GDP 2019	-10.458***	-10.291***	-17.187***
	(3.584)	(3.398)	(5.032)
Deficit to GDP 2019	-23.747	-60.307*	-37.547
	(36.091)	(36.192)	(59.219)
Constant	621.555	530.585	3,098.082***
	(551.842)	(533.345)	(999.171)
Observations	140	138	46
R^2	0.997	0.997	0.999
Adjusted R^2	0.997	0.996	0.999
Residual Std. Error	1,314.700 (df = 132)	1,269.454 (df = 130)	744.837 (df = 38)
F Statistic	5,735.440*** (df = 7; 132)	5,542.135*** (df = 7; 130)	4,335.812*** (df = 7; 38)

*p**p***p<0.01

Subsequently, Table 4 supplies with interesting results in terms of control variables. It is evident from the model 6 that Stringency index considerably decreases the GDP per capita. The same relates to the public indebtedness. Nevertheless, the same model 6 provides evidence that the zero-lower bound situation negatively impacts the wealth of country's citizens.

The latest results indicate that for fiscal policy to be effective, certain period of time (policy lag) should separate the explanatory and response variable. Apparently, fiscal

measures implemented or announced later have little or no effect on economy in such short-term consideration. Due to its consistent results, model 6 will be tested further in mediation analysis.

Table 5 Multivariate OLS with annual real GDP growth per capita log difference

	Dependent variable:		
	GDP growth per capita 2020 Log		
	(7)	(8)	(9)
Growth in non-health measures per capita Log (December - September)	0.013***		
	(0.002)		
Growth in non-health measures per capita Log (December - June)		-0.007	
		(0.007)	
Growth in non-health measures per capita Log (September - June)			-0.005
			(0.004)
Stringency index 2020 average	-0.001***	-0.002***	-0.002***
	(0.0003)	(0.001)	(0.001)
GDP growth per capita 2019 Log	0.469***	0.843***	0.793***
	(0.140)	(0.200)	(0.203)
Zero-lower bound dummy	-0.005	-0.015	-0.014
	(0.009)	(0.011)	(0.011)
Trade to GDP 2019	0.0001*	-0.00002	0.00002
	(0.0001)	(0.0001)	(0.0001)
Debt to GDP 2019	-0.0003**	-0.0001	-0.0002
	(0.0001)	(0.0001)	(0.0001)
Deficit to GDP 2019	-0.0002	-0.003	-0.002
	(0.001)	(0.002)	(0.002)
Constant	0.032	0.055	0.069*
	(0.020)	(0.035)	(0.037)
Observations	133	49	49
R^2	0.346	0.511	0.523
Adjusted R^2	0.310	0.428	0.441
Residual Std. Error	0.042 (df = 125)	0.030 (df = 41)	0.029 (df = 41)
F Statistic	9.465*** (df = 7; 125)	6.124*** (df = 7; 41)	6.411*** (df = 7; 41)

*p**p***p<0.01

Moving one step further in the direction of methodological tenets outlined by Sacerdote (2011, p.8), Chodorow-Reich et al. (2012, p. 130), Corsetti (2012, p. 533) and Klein & Staal (2014, p. 397), the explanatory and response variables undergo the respective

transformations explicitly stated in the methodology section. As a result, Table 5 provides certain interesting insights into understanding fiscal transmission mechanism during COVID-19 pandemics.

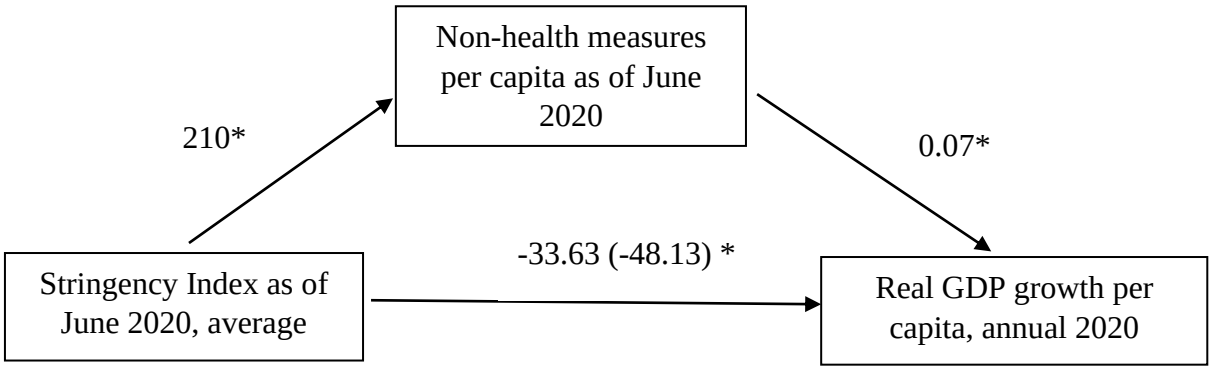
In model 7 the significant relationship can be interpreted in the following way: the 1% increase of targeted fiscal relief packages between September and December 2020 yields increase of annual per capita wealth growth by 0.013% in 2020. The sample size is considerable containing 133 observations, which is reasonable in terms of sample size calculations according to Taherdoost (2016, p. 25). This is recorded under the confidence level of 99%. At the same time, models 8 and 9 are insignificant in terms of independent variable.

The interpretation of control variables should be conducted carefully. Since both explanatory and response variable are transformed into logarithmic scale, it is therefore reasonable to state that, for example, stringency index negatively influences the per capita GDP growth. The similar nature of relationship is evident in case of public debt. Additionally, model 7 is the first model that realized certain influence from trade openness component: countries that are more opened to trade yield positive GDP growth. Nevertheless, the model has provided no evidence of the effect of monetary policy stance. Model 7 will be further tested in mediation analysis.

3.3.2. Mediation analysis

In accordance with Celli (2019, p.3), mediation analysis is useful to investigate causal relationships between different economic variables. In order to examine these associations more in-depth, current study applies mediation technique by using equations 8 and 9 outlined in methodology section for models 6 and 8 that previously presented promising results. Based on the results obtained with the help of "mediation" package in R (Tingley et al., 2014, p.2), the following conclusions can be communicated for model 6:

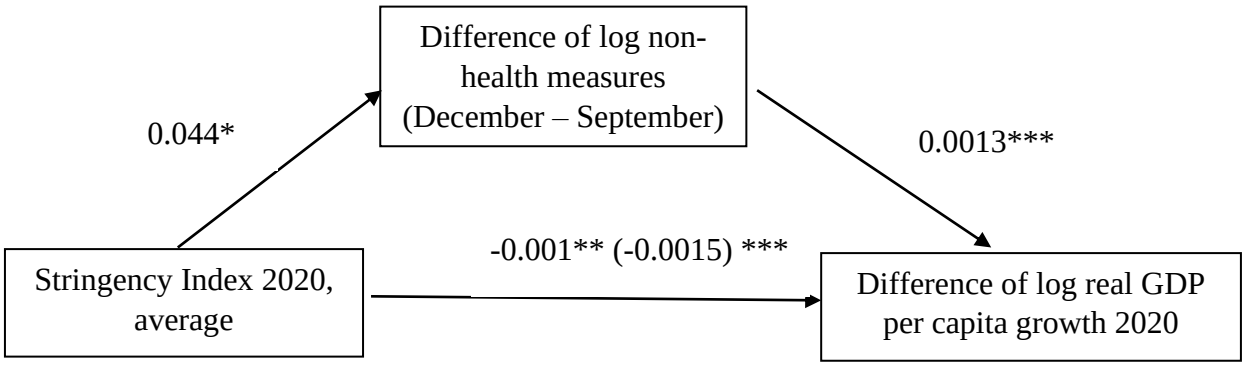
Figure 11 Mediation analysis for model 6



Running OLS regressions based on equations 8 and 9 yield the following results: there is no total effect of stringency index on real GDP growth, yet there is direct effect equivalent to -48.13 with 5% significance level when controlling for mediated variable. The indirect effect is computed by multiplying 210 with 0.07, which yields approximately 14.7. However, the bootstrapping procedures with 1000 simulations has not provided evidence that indirect effect is statistically significant. Thus, mediation in model 6 should be rejected, i.e., in this case, fiscal measures do not mediate the association between the severity of measures and GDP growth.

It is, therefore, reasonable to test mediation in model 8 that also has bigger sample size than model 6 (133 vs. 46). The result of this test is provided in the Figure 12 below:

Figure 12 Mediation analysis for model 7



It is evident that the direct effect of stringency index on real GDP growth is statistically significant with 99.9% confidence level, while indirect effect demonstrated the same degree of statistical significance based on bootstrapping procedures. The coefficient of the indirect effect can be found by multiplying 0.044 by 0.0013, which equals 0.00056. Since both the direct and indirect effects are statistically significant, fiscal measures variable, in this case, acts as a partial mediator in association between severity of measures and real GDP growth. In other words, part of the variation in real GDP growth per capita is explained by mediator (period-on-period change in non-health measures) in a way that integration of fiscal measures into the model increases the real GDP by 0.0013, while initial negative effect of stringency index on GDP still persists. Ultimately, these findings allow to accept the key alternative hypothesis of the current study using a sample size of 133 countries.

3.3.3. Advanced vs. Developing and low-income markets analysis

As identified by the relevant research findings, the degree of country's development is an important factor when considering how fiscal stimulus affects output in the short term (Agnello et al., 2013, p.19; Hory, 2016, p.66; Ilzetzki, 2013, p.240). Therefore, it is sensible to divide the aggregate dataset into country groups as per IMF and WB classifications (IMF, 2021b; WB, 2019) and conduct regression analysis on these separate samples of countries.

Table 6 Multivariate OLS with annual real GDP growth for different sets of countries as per income category

	Dependent variable:			
	Real GDP growth annual 2020			
	Advanced		Developing and low-income	
	(10)	(11)	(12)	(13)
December total fiscal measures % to GDP	-0.207***		-0.173	
	(0.075)		(0.118)	
September total fiscal measures % to GDP		-0.188**		-0.073
		(0.082)		(0.115)
Lagged Real GDP growth annual 2019	-0.162**	-0.150**	-0.117***	-0.121***
	(0.069)	(0.070)	(0.031)	(0.031)
Stringency index 2020 average	0.381	0.453	0.446***	0.461***
	(0.424)	(0.431)	(0.125)	(0.127)
Zero-lower bound dummy	2.456*	2.330	-4.176*	-4.675**
	(1.416)	(1.450)	(2.236)	(2.248)
Trade to GDP 2019	0.013*	0.012	0.0004	-0.001
	(0.008)	(0.008)	(0.010)	(0.010)
Debt to GDP 2019	-0.020	-0.029*	-0.012	-0.011
	(0.015)	(0.014)	(0.015)	(0.015)
Deficit to GDP 2019	-0.065	0.017	0.032	0.027
	(0.209)	(0.208)	(0.120)	(0.121)
Log Population	1.897***	1.814***	0.978***	0.975***
	(0.412)	(0.419)	(0.231)	(0.234)
Constant	-0.956	-1.141	0.393	0.124
	(3.984)	(4.122)	(1.796)	(1.811)
Observations	54	54	99	99
R^2	0.516	0.493	0.408	0.397
Adjusted R^2	0.429	0.403	0.356	0.343
Residual Std. Error	3.813 (df = 45)	3.899 (df = 45)	3.617 (df = 90)	3.652 (df = 90)
F Statistic	5.987*** (df = 8; 45)	5.479*** (df = 8; 45)	7.765*** (df = 8; 90)	7.400*** (df = 8; 90)

*p**p***p<0.01

The classification strategy is as follows: the category of advanced economies includes those identified by IMF as advanced economies or emerging markets and those allocated to high income bracket according to WB; the rest of the countries are referred to as developing and low-income category.

The OLS regression results in Table 6 show that the not rejecting of the central null hypothesis based on Table 3 results is primarily driven by the developments in advanced countries. In these countries, the higher fiscal measures in 2020 contributed to decrease of annual real GDP in 2020, with at least 1% significance level. At the same time, the analysis of developing and low-income countries sample did not provide enough evidence for the significance in aforementioned relationships, yet the contradictory findings regarding stringency index and zero-lower bound dummy are more prominent for this set of countries. Thus, similar to the results in Table 3, Table 6 does not provide enough support for the initial hypotheses, which necessitates further examination.

Per capita analysis conducted in a similar fashion as in Table 4 shows that, indeed, in advanced countries there is no evidence of significant relationships between targeted fiscal measures and output in 2020. However, Table 7 revealed that with 99% confidence level in the case of developing and low-income countries, one can state that the increase of non-health measures by 1 USD until December 2020 results in the increase of GDP per capita by 0.053 USD. Moreover, for the same set of countries, in 95% of all the time increase of stringency index by 1 unit will result in the decrease of per capita economic output by 8.4 USD, which constitutes the result more consistent to the acceptance of the alternative hypothesis.

At the same time, the advanced countries sample supports the hypothesis related to monetary policy: economies with the zero-lower bound situation benefit more from fiscal measures, significantly increasing the wealth of their citizens. This statement seems to be true in the 99% of the time. Additionally, in one of the regressions with advanced and non-advanced countries, it becomes evident that public debt deteriorates the GDP growth, with 90% confidence level. Such results provide with certain understanding of how the various control variables might practically affect the fiscal transmission mechanism. The size of adjusted R-squared is also worthwhile reporting: similarly to Table 4, the variation of the dependent variable is very well explained by these models (around 99%).

Table 7 Multivariate OLS with annual real GDP growth per capita for different sets of countries as per income category

	Dependent variable:			
	GDP per capita 2020 in USD			
	Advanced		Developing and low-income	
	(14)	(15)	(16)	(17)
December non-health measures per capita in USD	0.006		0.053***	
	(0.018)		(0.018)	
September non-health measures per capita in USD		0.016		-0.415
		(0.192)		(0.583)
Stringency index 2020 average	-13.564	-15.847	-8.404**	-6.886*
	(31.316)	(31.952)	(4.120)	(4.100)
Lagged GDP per capita 2019 in USD	1.001***	0.990***	0.961***	0.970***
	(0.017)	(0.025)	(0.008)	(0.010)
Zero-lower bound dummy	1,511.401**	1,817.602***	-369.060	-382.705
	(598.203)	(619.148)	(284.567)	(289.312)
Trade to GDP 2019	-1.054	2.021	1.212	0.834
	(4.115)	(4.665)	(1.325)	(1.332)
Debt to GDP 2019	-11.933*	-10.348	-2.741	-3.878*
	(6.735)	(6.694)	(2.022)	(2.091)
Deficit to GDP 2019	8.059	-94.659	-4.817	-17.198
	(109.742)	(119.608)	(15.398)	(15.911)
Constant	-1,857.019	-2,046.570	465.397**	425.906*
	(1,913.378)	(1,926.572)	(220.519)	(222.168)
Observations	50	48	92	92
R^2	0.993	0.992	0.995	0.995
Adjusted R^2	0.992	0.991	0.995	0.995
Residual Std. Error	1,880.378 (df = 42)	1,872.760 (df = 40)	471.961 (df = 84)	476.601 (df = 84)
F Statistic	829.919*** (df = 7; 42)	728.048*** (df = 7; 40)	2,573.934*** (df = 7; 84)	2,502.827*** (df = 7; 84)

*p**p***p<0.01

In accordance with Table 5, Table 8 demonstrates the presence of significant relationships (with 99% confidence level) between the log-transformed and population normalized growth values of targeted fiscal measures and real GDP. It is particularly evident that the increase of real GDP growth is higher by 0.007% in the case of advanced countries compared to non-advanced sample. This corroborates the key hypothesis regarding the effect of economic development on fiscal transmission mechanism.

Table 8 Multivariate OLS with annual real GDP growth per capita log difference for different sets of countries as per income category

	Dependent variable:	
	GDP growth per capita 2020 Log	
	Advanced	Developing and low-income
	(18)	(19)
Growth in non-health measures per capita Log (December - September)	0.015***	0.008***
	(0.004)	(0.003)
Stringency index 2020 average	-0.001	-0.001***
	(0.001)	(0.0003)
GDP growth per capita 2019 Log	0.693	0.411***
	(0.434)	(0.145)
Zero-lower bound dummy	0.031*	-0.055**
	(0.017)	(0.024)
Trade to GDP 2019	0.0001	0.0001
	(0.0001)	(0.0001)
Debt to GDP 2019	-0.0004**	-0.0001
	(0.0002)	(0.0002)
Deficit to GDP 2019	0.001	0.0004
	(0.003)	(0.001)
Constant	-0.040	0.019
	(0.056)	(0.020)
Observations	48	86
R^2	0.501	0.314
Adjusted R^2	0.414	0.253
Residual Std. Error	0.045 (df = 40)	0.039 (df = 78)
F Statistic	5.736*** (df = 7; 40)	5.112*** (df = 7; 78)

*p**p***p<0.01

Similar to the results in Table 6 and Table 7, developing and low-income countries suffer more with the increase of stringency index. Regarding the interaction with monetary policy, advanced economies sample provides evidence for the initial hypothesis, whereas non-advanced sample does not confirm this pattern. Furthermore, public debt seems to have negative effect on output analogously to the results in Table 5.

In general, the analysis of separate country groups (advanced vs. non-advanced) supports the idea that the fiscal transmission mechanism varies depending on the economic development. These and previous OLS settings as well as mediation analysis results will be further discussed in the Discussion section of this study.

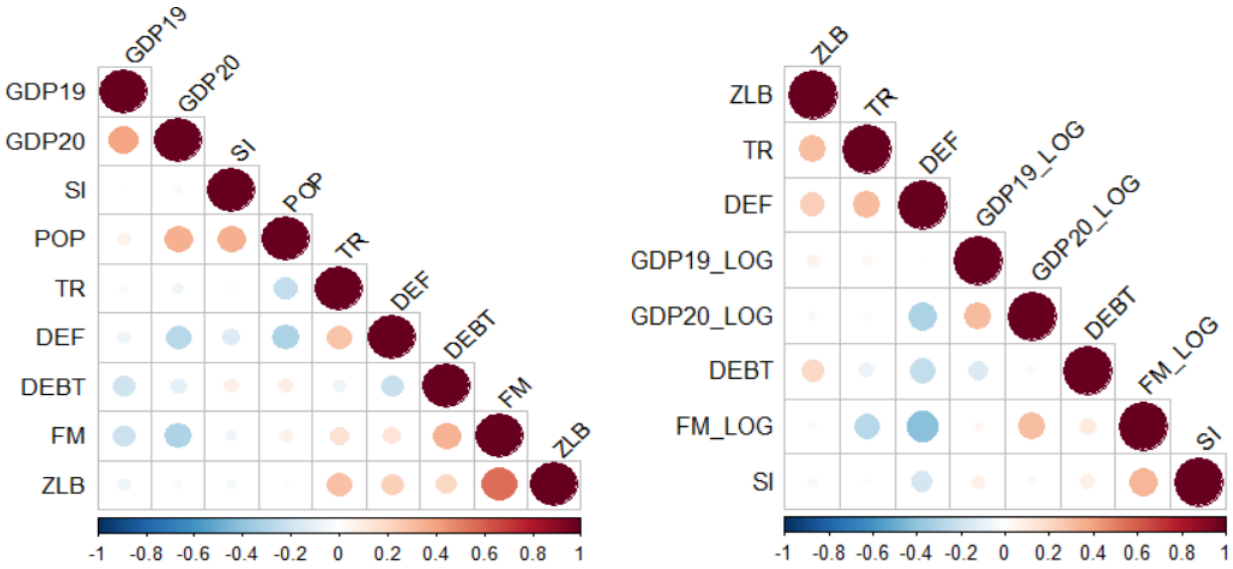
3.4. Variables and OLS diagnostics

Since the present research attempts to discern significant relationships and empirical patterns in the context of global economy during the COVID-19 pandemics, special attention should be allocated to the validation of the research construct. Apart from conducting numerous regressions and checking the persistence of outlined effects, it is important to examine the OLS setting to understand whether key relevant OLS assumptions are followed.

First and foremost, it is reasonable to check the extent of correlation between the macroeconomic variables employed in the models. The need for scrutiny is reinforced by the discussions about the potential of reverse causality problem, which might be the case in the studies that investigate the effectiveness of fiscal policy (Abiad, Furceri, & Topalova, 2015, p.17; Alesina & Ardagna, 2010, p.42; Hall, p. 193, 2009). That is, proper identification of fiscal measures plays important role in confronting the endogeneity issues.

Therefore, Figure 13 provides the visual representation of correlations between all sets of variables that correspond to OLS analysis in Table 3 and Table 5. In the case of Table 3 setting (left-side visual) fiscal measures variable (FM) has clear positive correlation with debt variable (DEBT) and Zero-lower bound dummy (ZLB). More importantly, the association between explanatory variable (FM) and response variable (GDP20) is noticeably high, with negative sign. Since it is a potential sign for endogeneity, further analysis is necessary. Pearson test for the variables FM and GDP20 conducted in R showed no evidence for correlation, with p-value of 0.26 under the null hypothesis of no correlation.

Figure 13 Correlation matrix for variables used in Table 3 and Table 5 (model specification 1 and 7)



Note: based on rquery.cormat function ("corrplot" package)

The right-handed matrix on the Figure X shows that log difference of fiscal measures (FM_LOG) has quite strong negative reciprocal relationship with deficit and trade variable (DEF and TR), whereas the positive one can be observed with the main explanatory variable (GDP20_LOG). Hence, Pearson correlation test was conducted with basic R function (cor.test) using 95% confidence interval, which yielded the p-value of 0.0002. Thus, the endogeneity issue might be present in the case of model 7, which necessitates a certain level of scrutiny when stating final conlusions.

Further OLS diagnostics are conducted to see if the key assumptions of linearity, homoskedasticity, independence, and normality are met. Appendix E and Appendix F presents diagnostics plots for the models 1 and 7, respectively. From the first graphs it is evident that there is no distinguishable non-linear pattern of residuals in the case of both equations. Second graphs (QQ-plot) provide evidence that the normality assumption is followed as well. Third graph allows to establish that there is no clear pattern for residuals, which supports homoskedasticity. Hence, the OLS regressions conducted both for relative values in equation 1 and log absolute values in model 7 are capable of summarizing patterns in the context of present study.

Finally, one should not disregard the power of outliers, especially when the limited number of observations of heteroskedastic nature are gathered as a base for the research. Based on the Cook's distance measure, influential outliers were identified for each sample size and subsequently removed. For instance, for the entire sample, it was estimated that observations 36 and 90 were the influential outliers, which corresponds to Macao SAR and Mauritius. Ultimately, the fourth graphs on the diagnostic plots in Appendix E and Appendix F demonsrate that none of the observations have the influence over the analysis.

3.5. Discussion of the key findings

Simple constatation of results adds little or no value to the stream of empirical research on the topic; instead, linking key findings of the present paper to the relevant literature conclusions allows to demonstrate certain value of the work and contribute to the academic debate on the ongoing topic. Hence, it is important to put the results section in the context of literature review section and juxtapose them to the initial hypotheses formulated in the introduction.

The major hypothesis serves as the most vital to the key purpose of the current study, which attempts to evaluate the fiscal policy effectiveness under the conditions of COVID-19 pandemics. In academia, it is commonly established that during recessions the fiscal

expansion is particularly efficient, with output response being higher than one in short-term or at least positive (Auerbach & Gorodnichenko, 2012, p.19, Batini et al., 2014, p.16; 2012, p.248; Canzoneri et al., 2015, p. 106). Based on these premises, Wilson (2020, p.1) anticipated considerable impact of anti-COVID 19 relief packages on the GDP. The initial results of the regression analysis (see Table 3) completely contradict such expectations – in that scenario, the increase of fiscal measures by 1% (in % to GDP) in 2020, decreases the real GDP growth by 0.14%. Such results appear to be more prominent in advanced countries (see Table 6).

It is fair to state that despite the ultimate prevalence of positive multipliers, negative output response are quite common as well. However, negative associations between fiscal measures and output are reported, for example, when studying specific countries (Batini et al., 2014, p.24; Petrevski et al., 2019, p.815; Stockhammer et al., 2019, p.57) or certain components of GDP components (Burriel et al., 2010, p.280). The negative wealth effect is reported to be one of the determinants of such negative relationship (Cogan et al., 2010, p.285). Nevertheless, the current study does not include the element of Ricardian households, hence does not control for consumers expectations. Moreover, the possible explanation for such contradictory result could be the timing consideration: Wierzbowska & Shibamoto (2017, p.3497) stated that policy lag for the fiscal transmission mechanism might amount to 2 years, while Batini et al. (2014, p.24) associated short-term response with the time period of 3-4 quarters. In this case, short-term analysis in Table 3 can showcase that countries that spent the most in the first year of pandemics will suffer the most due to the depleted economic resources and still non-realized effect from the stimulus.

In order to investigate the case more in-depth, the further step implied selection of more targeted measures (non-health budget measures) for the role of key independent variable, also normalized by the population variable and logarithmic function, in accordance with Chodorow-Reich et al. (2012, p. 130), Corsetti (2012, p. 533), Klein & Staal (2014, p. 397), and Sacerdote (2011, p.8). The results presented in Table 4 and Table 5 generally support the overwhelming conception that fiscal measures positively influence output, yet this response is near zero. The key advantage of the model specification 6 is its feature to allow for the most prolonged policy lag possible, since the explanatory variable contains data on fiscal measures announced until June 2020. This research setting well matches the logic of computing temporary fiscal multiplier, as provided by Coenen, et al. (2012, p. 30). On the flipside, the major deficiency of this specification is the lack of data (46 observations). This sample size corresponds to the ones encountered in relevant literature (Ilzetzki et al., 2013,

p.239; Wierzbowska & Shibamoto, 2017, p.3497); however, the before-mentioned studies employed panel-based data with long time-series, while the current study utilizes cross-sectional data on fiscal measures from IMF (2021b). Hence, the generalization of results for the whole global economy solely based on specification 6 is not reasonable, yet such empirical pattern should be considered.

The enhanced specifications in Table 5 with log transformation and change in levels yields the most promising results. Specific attention should be drawn to model 7: in this scenario, the bigger is the size of the increase in targeted fiscal measures between September and December 2020, the higher is the response in terms of increase of GDP 2020 compared to 2019. In other words, increase of fiscal measures positively influences the wealth of the population. However, this result itself can fall into the bracket of the most conservative estimations experienced in the relevant literature (Batini et al., 2014, p.16; Ramey & Zubairy, 2018, p.893). The coefficient is close to zero, which questions the ultimate effectiveness of the fiscal measures in the first year of COVID-19 pandemics. The key advantage of the model specification 7 is the possibility to cover as many countries as possible according to data availability. Both Agnello et al. (2013, p.22) and Koh (2014, p.587) employed the dataset of more than 130 countries, while the present model's sample size is 133, which also corresponds to the minimum threshold based on theoretical calculation of sample size (Taherdoost, 2016, p. 25). Nevertheless, the diagnostics of OLS setting indicated the presence of the endogeneity issue – common consideration for such type of analyses (Hall, p. 193, 2009). In order to devise a proper conclusion, a deeper investigation of causal mechanisms between selected variables is necessary.

Mediation analysis presents the opportunity to investigate these mechanisms, particularly with relation to economic variables (Celli, 2019, p.2). While specification 6 does not yield any specific result, the specification 7 provides some insight worth mentioning. First of all, two the most influential variables in current pandemic environment – severity of quarantine measures and fiscal stimulus – constitute the backbone of this research setting (Vasiljeva, 2020, p. 2; Wilson, 2020, p.1 WB, 2020, p. 117). In assessing their impact on GDP growth, it was estimated that the change in fiscal measures mediates the association between the severity of measures and output response in 2020. The result corroborates the second major hypothesis and provides evidence to the research question that fiscal stimulus measures have positive effect on the GDP in 2020, yet the magnitude of this effect is rather inconsiderable, i.e., close to zero. Additionally, the analysis proved only the partial mediation effect, which means that direct negative relationship between stringency index and output still

remains significant. That is, government attempts to stimulate the economy cannot fully limit the damage caused by the unprecedented quarantine actions.

Interesting results were obtained when dividing the dataset into two categories according to income- and economic development-related criteria. While Table 6 and Table 7 provide a mixed evidence, Table 8 with more enhanced research setting signifies that advanced countries have somewhat higher output response when compared to developing and low-income countries. In general, it corroborates the findings found in relevant literature, that uniformly advocated for the more efficient fiscal transmission mechanism in advanced economies (Agnello et al., 2013, p.19; Furceri & Sousa, 2011, p.166; Ilzetski et al., 2013, p. 240). The actual magnitude of the effect, however, is not comparable due to the various nature of research construct.

Furthermore, it is worthwhile discussing the results in the light of control variables and the respective additional hypotheses. The academia has strong consensus about the higher fiscal multipliers in the times of zero-lower bound situation (Christiano et al., 2011, p.118; Erceg & Linde, 2014, p.104, Woodford, 2011, p.33). The results for the full sample size indicate no significant pattern in this regard; however, after dividing the datasets, it becomes observable that advanced countries benefit more from the accommodative monetary policy. The afore-mentioned studies focused on the advanced economies (mainly – US), hence the results might be well justified. Additionally, it is evident from the dataset that predominant majority of advanced economies have zero or close to zero policy rates. In any case, the effect of monetary policy component on GDP across various economies might be a potential topic for further research, which could be organized similarly to the study by Hory (2016, p. 59).

Further hypothesis relates mainly to the nature of the current crisis, in such a way that stringency index represents the severity of quarantine measures implemented due to the immense COVID-19 transmission and acts as a key control variable in the models. According to the general logic and drawing upon relevant literature (Vasiljeva, 2020, p. 2; WB, 2020, p. 117), quarantine measures are expected to be the major determinant of negative GDP growth in 2020, thus, including this variable to the research setting is critically important. Initial models in Table 3 present contradictive results implying the positive relationship between stringency index and GDP growth. However, specifications 6 and 7, which received much more attention in the current study, support the anticipated negative effect from lockdown measures on the economy. The persistency of such effect was tested in mediation analysis, that yielded quite strong direct effect, also observable when accounting for mediation variable.

Regarding the remaining null hypotheses, only one that considered the effect of public debt can be rejected with at least 95% confidence level. The negative effect of public debt in 2019 on GDP growth in 2020 was robust across practically all specifications. Such pattern is in line with studies by Ilzetzki et al. (2013, p.240) and Kirchner et al. (2010, p.32), who concluded that the public indebtedness influences the fiscal transmission mechanism in an unfavorable way. Based on the models applied, no evidence for the significant effect of trade openness or deficit variables was found, which contrasts to the findings by Agnello et al (2013, p.20), Huidrom et al. (p.13, 2016), Hory (2016, p.72), and Wierzbowska, & Shibamoto (2018 p.3506). However, it does not mean that these variables do not play any role in the current pandemic environment, since their effect might be crystallized with more enhanced panel datasets. In any case, the inclusion of these variables into the present specifications is important to understand the key relationship between fiscal measures and output response.

4. Conclusions

Due to the unprecedented size of fiscal stimulus packages deployed worldwide during the COVID-19 pandemic, a logical question arises whether these measures are efficient for spurring economic recovery. In the frame of the present master thesis, the majority of OLS specifications and mediation analysis support the idea that there is a positive relationship between the fiscal stimulus and GDP growth under the conditions of the ongoing crisis. Such statement can be formulated with at least 95% confidence level. The effect, however, is close to zero and is rather small in numerical terms relative to the estimations in studies that constitute the academic reference point for the current thesis (Battini et al., 2014, p. 16; Fatas & Mihov, 2009, p.58; Ilzetzki, 2013, p.241). The most common reason for such inconsiderable effects could be negative wealth effect that was well explored and considered in the studies employing DSGE models (Coenen et al., 2012, p.51; Cogan et al., 2010, p.283). Moreover, empirical evidence shows that fiscal multipliers in the second year are higher than in the first year (Batini et al., 2014, p.12; Coenen et al., 2012, p.52). Nevertheless, the majority of such studies employed sophisticated models analyzing long time-series data in order to estimate fiscal multiplier – the research objective, that is not completely similar to the one in the current study, that primarily aims to crystallize empirical patterns within the newly emerged economic conditions. Therefore, it is fair to state that the present results indicate significant, yet small effect of fiscal stimulus measures on GDP growth, which constitutes the important empirical finding certainly of high interest to academic stream.

After the examination of various macroeconomic variables that potentially can have impact on fiscal transmission mechanism, it was found that the negative effect of public debt is the most robust. The monetary policy interaction appeared to be insignificant, apart from the sample of advanced countries, where the zero-lower situation seems to be significantly supportive for growth. In the enhanced specification, the severity of measures expectedly have negative impact on GDP growth. The current research setting provided no significant evidence of how the other variables, namely trade openness and fiscal strength, affect fiscal transmission mechanism in the short run. Interestingly, the advanced countries seems to benefit more from fiscal measures compared to the rest of the world, which represent the findings that are largely in line with relevant literature (Hory, 2016, p.74; Ilzetzki et al., 2013, p.240).

Nonetheless, when considering the results of this study, one should understand certain limitations. As stated by Hall (p. 193, 2009), the variables in such research setting are

exposed to endogeneity or reverse causality issue. The Pearson correlation tests signified the presence of such issue in one of the key model specifications. However, OLS diagnostics showed that the majority of the models' key assumptions are followed, and the effect of the outliers are duly controlled. Moreover, since the present thesis is concerned with the pandemic event only, the cross-sectional data was used instead of panel data. In such case, the generalization of results should be conducted carefully due to the presence of numerous country-specific peculiarities, the effects of which might dominate in the model. The incorporation of specific control variables according to the literature attempted to tackle this shortcoming. Furthermore, one should also factor in the potential effect of the policy lag: while some studies advocated for the calculation of temporary quarter-on-quarter effect (Burriel et al., 2010, p.265; Coenen, et al., 2012, p. 30), other studies established that it takes around 2 years to fully implement fiscal effects (Sacerdote, 2011, p.6; Wierzbowska & Shibamoto, 2017, p.3497). On this front, the thesis seeks to incorporate the more targeted fiscal measures as independent variable that have more immediate effect on the economy (IMF, 2020, p.22). Additionally, the results of the current study are not completely comparable with the findings in the relevant empirical research due to the difference in methodologies. Most importantly, current research setting does not include the element of Ricardian households, which is pertinent to the DSGE studies. Thus, this study is also limited in accounting for consumer behavior when estimating the effectiveness of fiscal policy. In general, the results of the current master thesis are highly dependent on the specific set of selected control variables, and the follow-up studies might capture different effects when, for instance, controlling for FDI (Wierzbowska, & Shibamoto, 2018, p.3506), exchange rate regimes (Born et al., 2013, p.446), labor market conditions (Batini et al., 2014, p. 9), or automatic stabilizers (Dolls et al., 2012, p.279). Finally, the consideration of exchange rate might come as a particularly relevant solution since all absolute amounts in the current study are based on one single currency (USD).

Despite the aforementioned limitations, the current thesis might be a good starting point for further research. First of all, it might be reasonable to investigate the fiscal transmission mechanism on continuing basis in line with the methodology presented in the thesis. Due to the policy lags, more noticeable output response might be discerned at the later stages of crisis or eventually in the post-pandemic period. The understanding of the relationship between fiscal stimulus and GDP growth under such extreme conditions can prove to be useful in battling future crises. Upon the availability of data, certain groups of countries can be analyzed more in-depth as well. It is interesting to see how certain

macroeconomic components influence advanced and non-advanced countries. For example, in the current thesis there is no evidence of the supportive effect of zero-lower bound in case of developing and low-income countries. It would be interesting to identify whether it is due to a specific reason or simply due to the prevalence of lower interest rates majorly in advanced countries. Such research can be conducted in similar logic to the one introduced by Hory (2016, p.74). Moreover, further research endeavors can account for other determinants, like FDI or exchange rate regimes, which are expected to have certain influence on the fiscal transmission mechanism (Born et al., 2013, p.446; Wierzbowska, & Shibamoto, 2018, p.3506). In similar vein, the application of DSGE setting would allow to include such important variable as anticipation effect, which might also be instrumental in the stimulus-output association. Finally, in contrast to the cross-country approach, analyzing the relevant fiscal processes in single economy (or economic region – e.g., the EU) will provide valuable contribution to the research stream.

The present master thesis attempts to capture the ongoing economic development, which comprises its main value-added feature. The rather conservative findings on the effectiveness of fiscal stimulus in the COVID-19 times might induce more attention to this topic in the academia. Ultimately, the consensus-based research conclusions could affect the practical application of fiscal measures in the future, that in turn would have a profound effect on the economy and the welfare of citizens. In this regards, the master thesis serves as a building block in the comprehension of the current economic events and the provision of evidence crucial for taking policy-related decisions in the near future.

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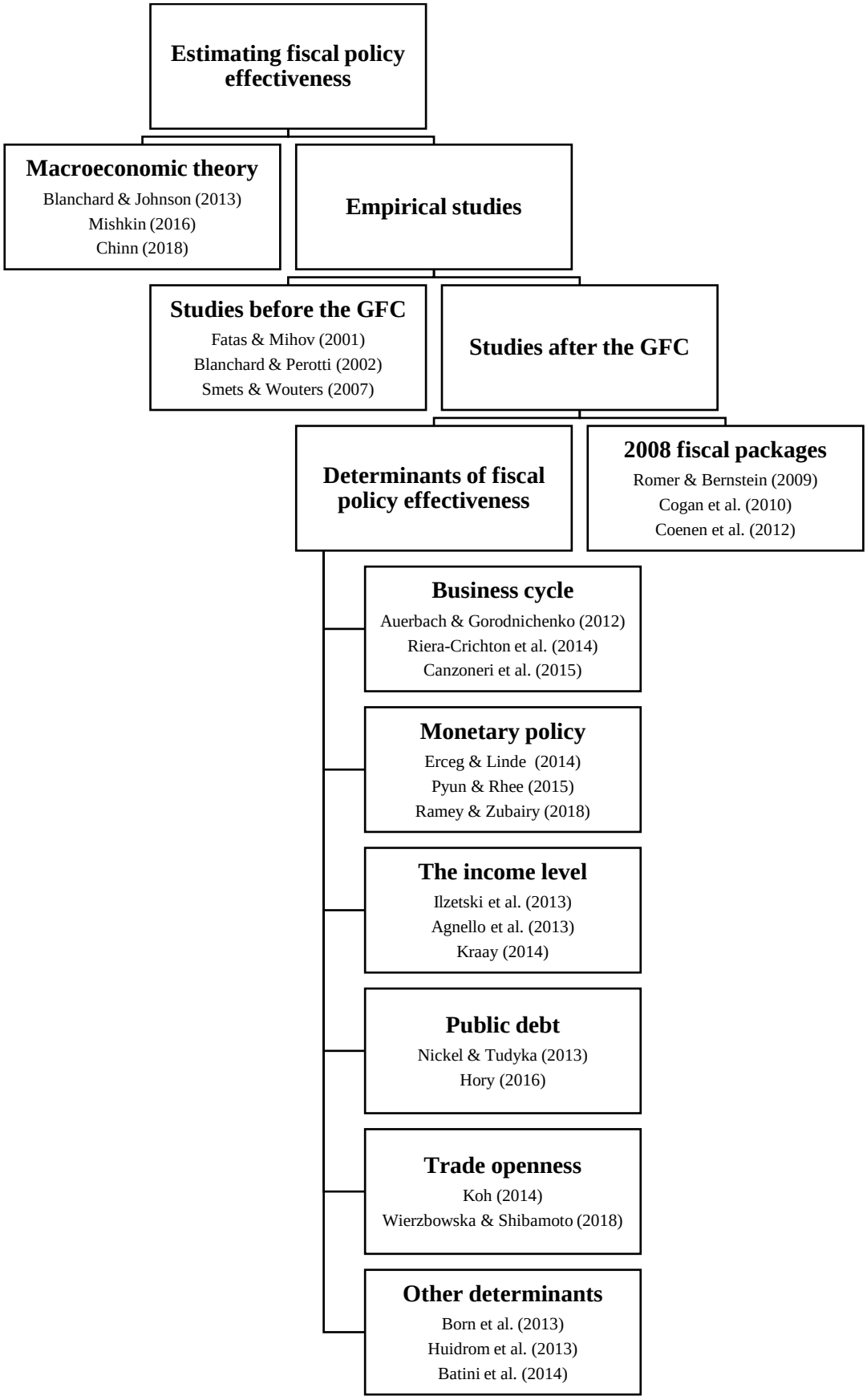
Appendix A Literature Map



Appendix B Different data sets based on IMF data

January 2021 Report (measures as of December 2020) a.k.a. Sampling frame		
Category IMF	**Number of Countries**	**Share, %**
Advanced economies	36	20%
Emerging Markets	87	48%
Low-Income Developing Countries	57	32%
Total	**180**	**100%**
Category WB	**Number of Countries**	**Share, %**
High income	59	33%
Upper middle income	47	26%
Lower middle income	48	27%
Low income	26	14%
Total	**180**	**100%**

October 2020 Report (measures as of September 2020)		
Category IMF	**Number of Countries**	**Share, %**
Advanced Economies	36	20%
Emerging Markets	87	49%
Low-Income Developing Countries	56	31%
Total	**179**	**100%**
Category WB	**Number of Countries**	**Share, %**
High income	59	33%
Upper middle income	47	26%
Lower middle income	48	27%
Low income	25	14%
Total	**179**	**100%**

June 2020 Report (measures as of June 2020)		
Category IMF	**Number of Countries**	**Share, %**
Advanced Economies	20	36%
Emerging Markets	26	47%
Low-Income Developing Countries	9	16%
Total	**55**	**100%**
Category WB	**Number of Countries**	**Share, %**
High income	26	47%
Upper middle income	15	27%
Lower middle income	12	22%
Low income	2	4%
Total	**55**	**100%**

Note: compiled by author according to IMF (2021a) and WB (2019).

Appendix C Summary of used data and sources

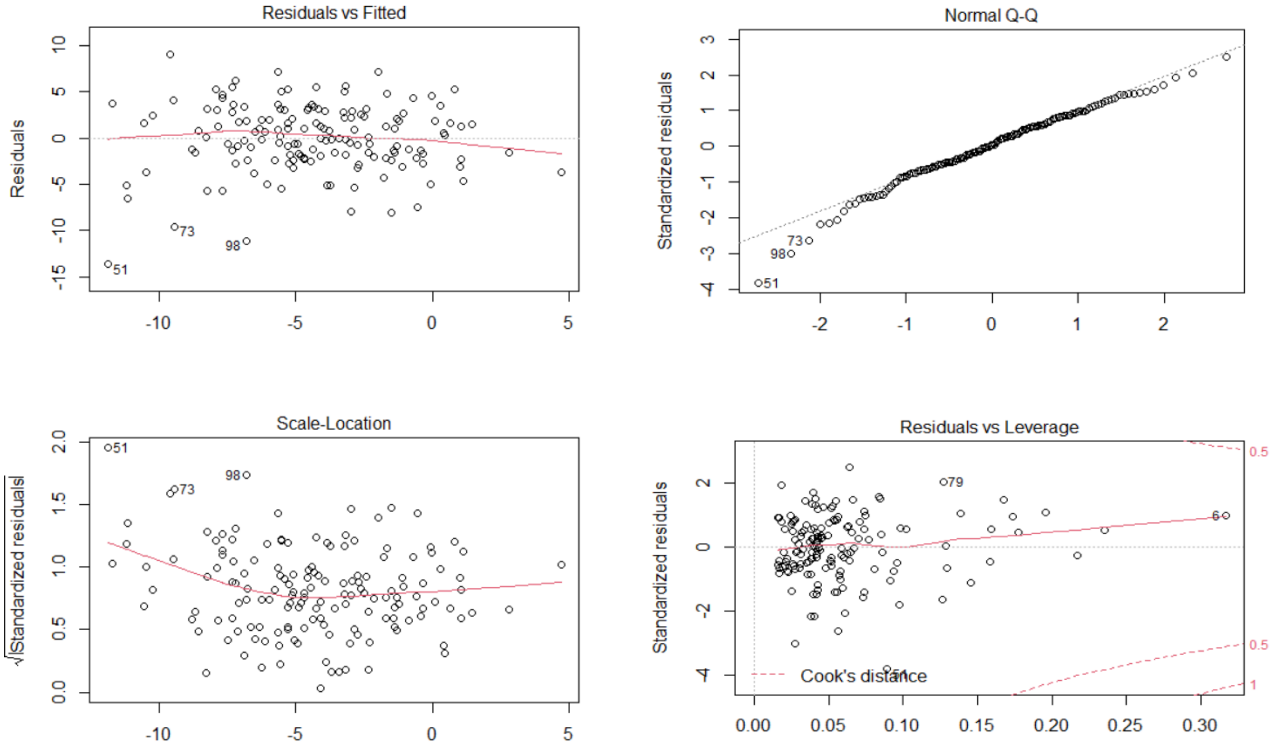
Variable	Unit of Measure	Role in a model	Source	Reference
Fiscal Measures (June, September, December 2020)	% to GDP, absolute amount (USD billions)	Key explanatory variable, mediated variable in mediation analysis	IMF Fiscal Monitor Database	IMF, 2021a https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19
Real GDP growth, annual (2019, 2020)	% annual growth, absolute amount, per capita (USD)	Key response variable in OLS and mediation	IMF World Economic Outlook April 2021	IMF, 2021c https://www.imf.org/external/datamapper/datasets/WEO
Real GDP growth, quarterly (each quarter 2020, 2021 Q1)	% quarter-on-quarter growth	Response variable	Bloomberg terminal	Functions: ECST, ECMX, ECFC
Stringency Index (average 2020, per quarter 2020)	Proprietary index (0-100)	Key control variable, explanatory variable in mediation	Our World in Data (Oxford government policy tracker)	Our World in Data, 2021 https://ourworldindata.org/grapher/covid-stringency-index
Trade openness (2019)	% to GDP	Control variable	The World Bank database	WB, 2021b https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?end=2014&start=1960
Fiscal balance (2019, 2020)	% to GDP	Control variable	IMF World Economic Outlook April 2021	IMF, 2021c https://www.imf.org/external/datamapper/datasets/WEO
Public debt (2019, 2020)	% to GDP	Control variable	IMF World Economic Outlook April 2021	IMF, 2021c https://www.imf.org/external/datamapper/datasets/WEO
Monetary policy dummy (2020)	Dummy variable (1 – ZLB; 0 – no ZLB)	Control variable	Bloomberg	Functions: ECST, ECMX, ECFC
Population (2020)	Million (log)	Control variable	IMF World Economic Outlook April 2021	IMF, 2021c https://www.imf.org/external/datamapper/datasets/WEO

Appendix D Descriptive statistics

Variables	n	mean	sd	median	min	max
Explanatory variables						
Budgetary Measures 2020, % to GDP	180	4.4	4.0	3.0	0.02	25.3
Non-Health Measures 2020, % to GDP	167	3.6	3.7	2.6	-0.1	25.1
Total Fiscal Measures 2020, % to GDP	180	7.1	7.7	4.9	0.02	44.0
Budgetary Measures 2020, USD per capita	179	1,712.9	10,829.5	27.4	0.1	137,115.5
Non-Health Measures 2020, USD per capita	166	1,588.8	9,726.8	22.7	-0.1	118,180.0
Total Fiscal Measures 2020, USD per capita	179	3,032.0	14,692.7	37.7	0.1	157,076.3
Response variables						
Real GDP per capita growth, 2019 (%)	170	3.4	3.0	3.5	-7.4	14.1
Real GDP per capita growth, 2020 (%)	170	-5.3	7.7	-3.8	-59.6	5.7
Real GDP growth, 2019 (%)	170	2.9	2.9	2.5	-7.4	13.2
Real GDP growth, 2020 (%)	170	-5.3	7.8	-3.9	-59.7	6.1
Real GDP growth, 2019 Q4 (%)	67	0.7	1.9	0.4	-4.5	7.0
Real GDP growth, 2020 Q1 (%)	67	-1.7	3.5	-1.4	-14.7	14.3
Real GDP growth, 2020 Q2 (%)	67	-9.4	7.4	-8.8	-32.8	13
Real GDP growth, 2020 Q3 (%)	66	7.6	6.2	7.6	-12.5	23.7
Real GDP growth, 2020 Q4 (%)	64	1.5	3.0	1.2	-10.9	9.7
Real GDP growth, 2021 Q1 (%)	53	0.7	3.0	1.0	-13.9	7.8
Control variables						
Stringency Index 2020	160	52.7	12.0	53.9	12.5	75.9
Stringency Index 2020 Q1	160	56.5	17.8	58.1	8.2	86.2
Stringency Index 2020 Q2	160	71.9	14.9	73.8	13.9	99.1
Stringency Index 2020 Q3	160	56.5	17.8	55.8	13.0	89.3
Stringency Index 2020 4Q	160	53.5	16.0	56.2	8.3	81.3
Trade, % to GDP	179	77.3	60.9	71.7	0	381.5
ZLB dummy	179	0.2	0.4	0	0	1
Budget 2019, % to GDP	169	-1.8	4.6	-1.8	-24	20.8
Budget 2020, % to GDP	169	-7.2	9.2	-6.5	-103	31.5
Debt 2019, % to GDP	167	56.2	33.8	48.9	0	234.9
Debt 2020, % to GDP	167	66.0	40.0	59.8	0	262.5
Population, million	170	43.1	154.5	9.5	0.01	1,400.0

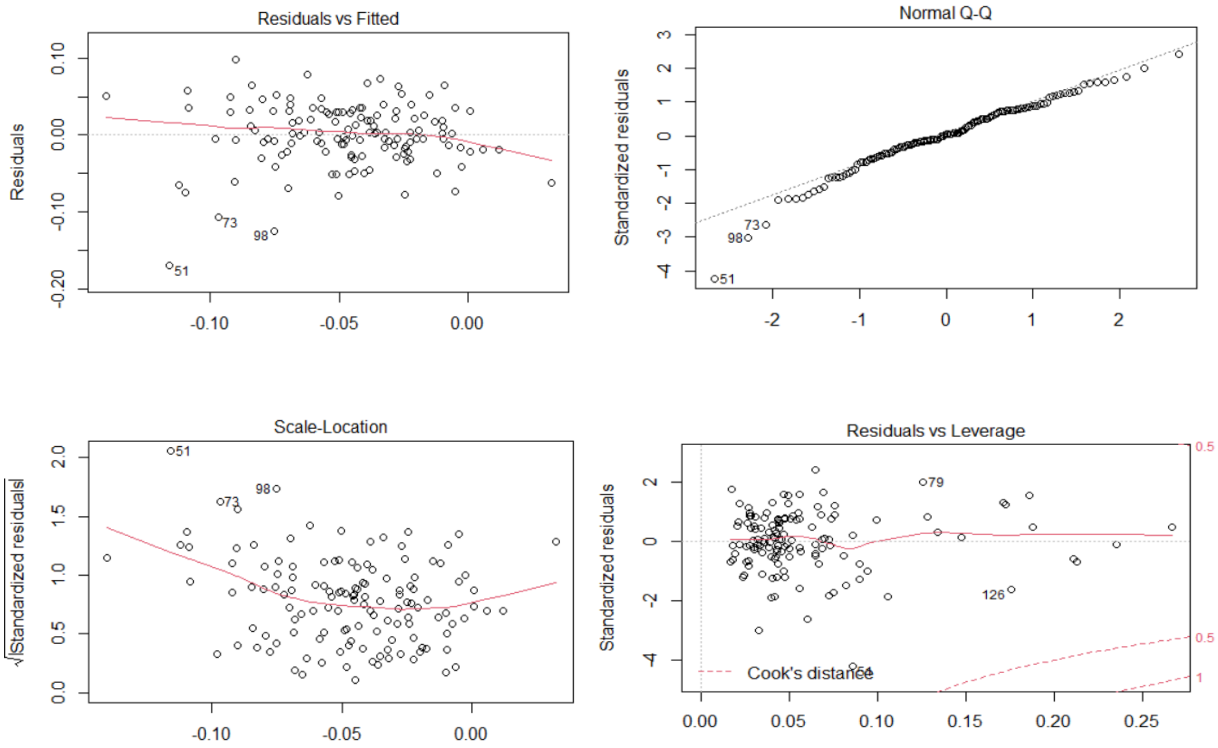
Note: compiled by author in R ("stargazer" function) based on data: IMF (2021a; 2021c), Our World in Data (2021), WB (2021b) as well as Bloomberg terminal.

Appendix E Diagnostics plots for Model 1



Note: compiled by author with basic R functions.

Appendix F Diagnostics plots for Model 7



Note: compiled by author with basic R functions.