

The impact of money supply on the real sector during the Covid-19 pandemic: Evidence from OECD countries

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Abstract

Declared as a pandemic on March 11, 2020, COVID-19 caused a “sudden stop” in the world economy, resulting in both supply and demand shock. Most of the countries responded by monetary expansion to tackle the global economic issue. In this study we aim to find the impacts of these economic policies during COVID 19 on global economy. Our sample includes 33 of OECD countries. We estimate the impact of monetary expansion on the real economy with a linear regression model. The results show that the monetary policy has positively and significantly impacted economic growth even after controlling for fiscal policies.

Keywords: Money Supply Shock, Health Crisis, Financial Markets, Real Economy, COVID-19, OECD countries

JEL codes: E44, I18, G01

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1. INTRODUCTION

The Pandemic COVID-19 has generated a health crisis while posing a global threat to economic activity. The impact of Covid-19 on the economy was experienced precisely as a “sudden stop”: a sudden stop in production and consumption and a rupture in supply chains. As a result, since the beginning of 2020, monetary expansion policies exceeding \$ 20 trillion have been implemented by the central banks of developed countries.

While the Pandemic is a common problem facing all humans, the level of economic devastation seems heterogeneous across countries. All nations have taken action to cope with the Pandemic and mitigate the financial risks on their economies. We see several measures, including containment policies, improving R&D in the health system, financial supports for all businesses, households, and actions to preserve employment (OECD, 2020^a). Globally, we have seen nationwide quarantine periods starting in developed countries (mainly EU countries) and extensions of the state of emergencies in many countries (IMF, 2020). The preliminary international reports highlight the fact that the impacts would not be the same across the economies. The potential impact of the Pandemic may be worse than an economic shock, and it can damage emerging economies and low-income countries more severely (World Bank, 2020). Even though the Pandemic spread had been slowing down in Summer 2020, we see a sharp increase in case number and deaths during the second wave. Starting from October 2020, many countries have restarted applying containment measures to control the spread of the virus. As the Pandemic spread, lockdowns have become mandatory to restore the health system. Thus, the COVID-19 outbreak alarmed OECD countries and force them to take emergency actions to support the economy due to temporarily frozen economic activities and income losses. Because of public health consideration, starting from December 2020, vaccination has started worldwide, mainly in developed countries.

On the economic front, several fiscal packages were adopted. We see similar financial supports for businesses such as tax payment deferrals

(OECD, 2020^a). In many countries, work schemes were designed for short-time in order to preserve employment. Different type of supports for households were implemented like direct cash transfers to low and middle-income households in US; expansion of the degree and the amount of income supports in EU; active monetary measures rather than fiscal packages in developing countries (OECD, 2020^a). As a fast response expansionary monetary policies were quickly adopted by several Central Banks (CBs) at the beginning of the Pandemic. Additionally, Elgin et al. (2021) found that more independent CBs adopt smaller cuts and larger fiscal and macro-financial packages.

As the Pandemic has dynamically been affecting the global economy, it is essential to work on efficient policy responses on the Covid-19 in the near future. OECD reports that fiscal action can aid in stimulating the economy where it is necessary. Furthermore, the report proposes “*specific support for developing countries, including international coordination, financial support, and adaptation of tax rules*”; it states that all options, including public finance and CB actions, will be necessary to restore the economy (OECD, 2020^a), not the way around.

Fewer number of studies focus on the monetary policies of OECD countries in COVID-19. On the other hand, OECD (2020^b) published several policy briefs reporting member countries’ new spending policies and immediate responses. Besides, studies are examining financial markets in specific countries, including OECD member countries. For instance, in Turkey, a limited number of studies analyze the impact of COVID-19 on the aggregate economy. We see Öztürk et al. (2020) conducting a sectoral analysis of the stock price index in the Pandemic. We see Çakmaklı et al. (2020) analyze sectoral supply shocks utilizing teleworking and physical job proximity and sectoral demand shocks with credit card purchases by conducting a SIR-multi-sector-macro model. Moreover, Kartal et al. (2020) discuss the main changes in the stock exchange index in Turkey during the Pandemic.

Given the immediate monetary actions of CBs to combat the Pandemic, our motivation, in this paper, is to provide an exploratory study that evaluates the effectiveness of money supply growth on the real economy. Our main reason for working with OECD data is the leading role of OECD countries in policy development. Furthermore, one of the OECD's main objectives includes "*establishing evidence-based international standards and finding solutions to a range of social, economic and environmental challenges*" (OECD). Therefore, OECD aims to provide an international standard for countries with different economic and geographical characteristics. Lastly, data availability can be problematic due to the dynamic nature of the Pandemic. For this reason, we chose OECD data sets as it offers researchers an opportunity to reach reliable data.

The structure of this study is as follows. The following section provides a literature review on monetary policies in a broad and wide range of studies focused on the economic impacts of COVID-19. Section 3 explains the data description, methodology, present econometric models, and discuss results. Lastly, in Section 4, we discuss our concluding remarks.

2. LITERATURE REVIEW

Monetary policies are commonly considered vital policy responses, especially in any downturn in the economy. In this regard, the monetary transmission mechanism showing the impact of monetary policies on the aggregate economy is worthy of attention. It can be in the form of different procedures, like monetary targeting of M3, inflation targeting, controlling interest rates (price control) (Juselius and Toro, 2005). As an unconditional monetary policy, quantitative easing (QE) is one of the standard tools that CBs apply to monetary expansion into the economy. It is noteworthy to mention that QE is not a newly discovered tool. We see that CBs used to apply it right after economic recessions like Fed in the 1930s, the Bank of Japan in 2001, the Bank of England, and the Fed after the recession in 2008 (Ricketts, 2011; Powell, 2002). As Haldane et al. (2016) denote, QE may have a significant macro-economic impact, and its effectiveness may vary over time. The vast literature on QE

and monetary expansion also states them as one of the crisis causes. Furthermore, Horwitz (2012) already concludes that expansionary monetary policies formed a basis for the Great Depression. On the other hand, Krugman et al. (1998) recommended a monetary expansion policy as a solution in Japan's case of the economic crisis.

In OECD countries, we see empirical evidence of monetary policy practices by adopting inflation targeting during the 1990s, as Divino (2009) states. Dedola and Lippi (2005) show evidence on heterogeneous effects of unexpected monetary policy shocks in 5 OECD countries' industries (France, Germany, Italy, UK, and the USA). From another point of view, Ahrend (2010) discusses monetary ease in OECD countries between 2002-2005 and finds accommodating monetary policy as one factor behind financial imbalances triggering the 2009 recession.

In emergency cases, monetary policies may constitute a fast government response mechanism to any financial and economic threat. In the pandemic COVID-19, IMF has categorized the policy responses as monetary, fiscal, macro-financial, and exchange rate and balance of payment (ICMA, 2020). Indeed, COVID-19 has brought concerns on an upcoming crisis, and it is seen that 21 CBs announced QE programs on their local 10-year government bond yields right after the COVID-19 outbreak (Hartley and Rebucci, 2020). As Bonatti et al. (2020) state, the Pandemic caused stress on ECB's conventional monetary policies, whereby we see exceptional policies to smooth the impacts of such an economic crisis aiming to prevent an economic collapse. Moreover, they argue possible scenarios that the ECB may face regarding the exceptional monetary policies. As they denote, QE may be weaker in case of a rapid economic recovery. However, if any stagflation occurs, QE policy may be justified, but in case of a prolonged recession, ECB could face a dilemma supporting the debt of countries or causing a crisis in the euro area. The uncertainty of a possible hit by an impending economic crisis put CBs to announce for unconventional QE, but the situation could be problematic in the world economy in the long run. Zhang et al. (2020) discuss the unlimited QE

policies in the US and its impacts on financial markets. Bhar and Malliaris (2020) tackle the modeling of monetary policy and QE in the US. Finally, Benigno et al. (2020) focus on QE and its potential to support health and welfare expenditures and fiscal stimulus in emerging markets from a different perspective.

Literature covers a broad range of studies on COVID-19 and its impact on the economies. One branch of the literature deals with the pandemic-related consequences on the financial variables. For instance, drawing on the efficient market hypothesis, Narayan (2020) argues that pandemic-related shocks have a transitional effect on the Yen-US dollar exchange rate, which is the most affected asset price during the Pandemic. On the other hand, the stock market and exchange rate nexus are investigated by Narayan et al. (2020) for the Japanese economy. The paper's main idea is that most firms in the Japanese economy benefit from the depreciation of YEN due to being more competitive and, therefore, stock market returns increase. Moreover, Haroon et al. (2020) suggest that under liquidity constraints, government interventions and flattening the curve seem to matter most for the emerging economies due to the aversion from uncertainty by investors. Finally, a refined analysis conducted by Pe et al. (2020) asserts that the impact of COVID-19 on the sectors such as transportation, mining, electricity & heating has been relatively more robust compared to manufacturing, information technology, education, and health care industries.

Due to the increased global risk, further studies investigate the impact of capital flows on the stock market prices in economies characterized by fragile financial markets (McKibbin and Fernando, 2020; Topçu and Güllal, 2020; Baker et al., 2020). For instance, Prabheesh (2020) points out the financial instability in Indian stock markets due to the reversal of portfolio records and provides evidence on the causality running from foreign portfolio investment to stock prices in the COVID-19 period. The situation seems alarming for financial markets, as indicated by Gil-Alana et al. (2020), who argues that shocks are long-lasting rather than temporary in

selected Asian countries. Furthermore, Ozili and Arun (2020) mention the impact of fast policy responses by several governments and states, and they highlight that these fast responses may deepen the global recession soon.

Several studies look into the impact of the Pandemic on energy markets. It is seen that uncertainty poses cause of volatility in the energy markets (Salisu and Adediran, 2020), above a certain level of oil price volatility, both oil price news and infection cases are essential predictors of oil prices (Narayan, 2020). Pandemic occurrence and the oil market are also studied by Qin et al. (2020), who concluded that oil prices had been negatively affected by the Pandemic. Devpura et al. (2020) also supported a similar argument who claim that the pandemic and oil prices are directly related. Huang & Zheng (2020) highlights the relationship between investor sentiment and crude oil futures price and found a structural change during the first quarter of 2020. Iyke (2020) found US oil and gas producers' heterogeneous responses to the Pandemic and stated that the Pandemic significantly triggered 28% of returns and 27% of return volatility. Similarly, Prabheesh et al. (2020) express that decreasing oil price is a negative signal for the stock market.

Moreover, Vidya et al. (2020) demonstrate to what extent the COVID-19 Pandemic deteriorates trade interconnectedness among the economies applying trade network analysis. From another perspective, studies are focusing on the impact of containment on economies and monetary transmission mechanisms –like supply and demand shocks, flight restrictions that limit the international mobility, social distancing, income per capita and consumption, emergency packages- (Baldwin and Tomiura; 2020; Thunström et al.; 2020; Ozili et al., 2020; Sumner et al., 2020; Bénassy-Quéré and Di Mauro, 2020).

3. DATA, METHODOLOGY, AND ECONOMETRIC MODELS

In this section, we firstly discuss data selection and methodology. Then econometric models and results are provided.

3.1. Data and Methodology

In this study, we used the pooled data of the OECD countries during the pandemic period. In the sample, we excluded Colombia, Iceland, Mexico, and Switzerland due to the lack of economic data for certain variables. Table A1 presents the list of sample countries. We exploited two databases to collect the data. First, we retrieved the selected macroeconomic variables from the leading economic indicators in the OECD database (OECD, 2020). We obtained Pandemic-related measures from Oxford COVID-19 Government Response Tracker (Oxford University, 2020). The economic variables that are used in the analysis are *quarterly growth rate (g)*, *industrial production index (IP)*, *the money supply in domestic currencies (MS)*, *interest rate (R)*, *the exchange rate (EXC)* And *fiscal stimulus package (FIS)*. To include the health-related policies, we constructed *containment index (C)* and *health index (H)*² They were using daily indicators from Oxford data. The selected indicators for containment index are school closing, workplace closing, cancel public events, restrictions on gathering, close public transport, stay at home requirements, restrictions on internal movement, international travel controls. For the health index, we exploited the indicators of public information campaigns, testing policy, contact tracing.

Fiscal stimulus package as a percentage of GDP entered into the equation with cumulative values. However, the rest of the variables are in quarterly frequencies for the 2020Q1-2020Q4 period. Except for economic growth and industrial production index, the remaining variables are available monthly and therefore converted to quarterly frequencies. As the growth rate and interest rates are in percentages and may take negative values, we use them in levels. For the rest of the variables, we used logarithmic transformations. In the Appendix, Table A2 shows the variable description and provides summary statistics.

The standard approach in empirical works to deal with the output effects of unanticipated monetary shocks is to apply Vector Autoregressive Regression (VAR) as the model allows for the endogeneity in macroeconomic variables.

However, due to the short period in this paper, we proceed with the simple linear regression and weighted linear regression models. Furthermore, to avoid the potential endogeneity of policy responses and gross domestic product (GDP), we use quarterly changes in economic growth rather than using GDP in level as the dependent variable.

Following earlier studies, we included two important financial market prices for monetary transmission; short-term interest rate and exchange rate, namely, into our model as independent variables (Taylor, 1995). However, later studies have focused on the inadequacy of traditional Keynesian perspective and interest rate channel due to zero lower bound problem (Fuhrer & Madigan, 1997; Krugman et al., 1998; Summers, 1991). Indeed, what we see during the global financial crisis (IMF, 2013) and the COVID-19 period (Dabrowski and Dominguez-Jimenez, 2020) as monetary responses are unconventional tools in the form of quantitative easing rather than the tools that the monetary transmission framework suggested. Therefore, we included financial stock as an explanatory variable and introduced a financial market quantity into our model. Furthermore, to control the fiscal responses and their potential impact on the real economy, we took the fiscal policy package indicator of COVID-19 Economic Stimulus Index (CESI) created by Elgin et al. (2020); fiscal packages of the governments are measured as a percentage of GDP.

Moreover, the industrial production index is taken as a proxy to represent the sectoral structure in each economy. Detailed sectoral analyses conducted by the International Labor Organization (ILO) (2021) state that the impact of COVID-19 on the sectors are uneven, and sectors such as construction and service have been affected to a greater extent. Therefore, we might expect a higher negative effect on real economies as long as they are more dependent on sectors outside the industry. Furthermore, to control for the various policy measures, we included containment and health indices using the indicators of Hale and Wester (2020). Lastly, country dummies are included to capture

unobserved heterogeneity, such as different institutional and social norms.

3.2. Econometric Model and Results

We estimate Equation 1 to investigate the effect of monetary shock on the economies' short-run economic performance with OLS and feasible GLS. Our model is a simplified version of New Keynesian models (Gali, 2009; Fornaro et al., 2020), where output and employment are determined by aggregate demand. Our primary aim is to test whether the countercyclical monetary policy impacts aggregate demand and output in turn. The results appear in Table 1. In Model 1, we estimated the main equation with OLS and performed diagnostic tests to check for any potential misspecification. Added variable plots in Figure A1 demonstrate that the interest rate variable suffers from collinearity. Added variable plots decompose the multivariate relationship into a set of two-dimensional plots where e_1 is residuals from the regression of particular X_i on all X_{-i} and e_2 is residuals from the regression of Y on all X_{-i} . The first residual, e_{1i} , represents the nonlinear part of X_i and the second residual, e_{2i} , represents the information on Y that X_i does not explain. Given this information, two extreme cases are essential. First, if the points are clustered through the e_2 axis, this implies perfect collinearity and the need to drop the variable, which is also the case for the interest rate variable in our model (Baum, 2006). Besides this technical explanation, we expect that the interest rate variable would not explain the variation in Y in our model as Eurozone countries have the same interest rate level.

Moreover, in the short run, due to the stickiness of prices, policy-induced change in money supply is closely linked to nominal interest rate, and the deterministic relationship implies that describing monetary policy actions through the monetary base or nominal interest rate is equivalent (Ireland, 2005) and therefore, endogeneity concerns might prevail. Thus, we proceeded with a model excluding interest rates. Variance inflation factors presented in Table A3 show that no multicollinearity problems exist among the remaining variables. For additional check for model specification, we apply Ramsey's

RESET test, whose results are reported in Table A4. According to the results, we fail to reject the null hypothesis of the absence of omitted variable in the model. However, OLS estimates suffer from heteroscedasticity, as is shown in the Breusch-Pagan test in Table A5 in the Appendix. Therefore, we estimated Equation 1 (excluding interest rate) with the Feasible Generalized Least Square (FGLS) estimator. FGLS implements transformation in original data and runs a regression to the transformed data to deal with deviations from non-i.i.d errors (Baum, 2006). The logic behind FGLS is to give much weight to the residuals with fewer variances. Although in Model 1 and 2, we estimated the equation with heteroscedasticity robust standard errors, we also show FGLS results.

$$g_{i,t} = \alpha + \beta_1 \log MS_{i,t} + \beta_2 R_{i,t} + \beta_3 \log EXC_{i,t} + \beta_4 \log FIS_{i,t} + \beta_5 \log IP_{i,t} + \beta_6 \log C_{i,t} + \beta_7 \log H_{i,t} + \sum_{i=8}^{41} \beta_i FE_i + \varepsilon_i \quad (1)$$

Our ex-ante predictions to have a statistically significant positive impact of money supply and fiscal stimulus package on the growth rate of real GDP suggested by countercyclical policy framework (Krugman and Wells, 2009). Considering the open-economy macroeconomic model of Fleming (1962) and Mundell (1963), we expect a significant negative relationship between exchange rate and output through the channel that exchange rate appreciation depresses net export and output in the short run. Additionally, a positive relationship between industrial production and growth rate is expected by economic insight. Lastly, we anticipate a significant negative relationship with containment measures in the short run and a significant positive relationship with health measures. For Model 1, we predict an insignificant effect of interest rate on output growth following the discussion above.

Regarding the regression results, monetary policy positively and significantly affects quarterly economic growth in all specifications. The positive and significant coefficient estimate of the logarithm of money supply asserts that in the COVID-19 period, monetary easing positively contributes to the growth rate of real GDP. FGLS coefficient estimates state that a 1%

money supply increase results in a 0.27% increase in economic growth. As expected, the interest rate variable is insignificant. Curdia (2020) stated that conventional monetary policy has a limited policy space because of the zero lower bound, most notably in the USA. Even though this is not the scope of this paper, COVID-19 measures also cover financial packages across many countries (IMF, 2020). When we control the cumulative value of the fiscal packages and several controls, significant monetary policy effect still prevails. Our result is in line with earlier empirical findings regarding monetary policy effectiveness even though it does not provide a specific mechanism due to the short period (Bernanke & Blinder, 1992; Taylor, 1995; Christiano et al., 1998; Camarero et al., 2002; Sun et al., 2010).

Additionally, FGLS estimates show that a 1% increase in fiscal stimulus package results in a 0.43% increase in economic growth. In US, Castro (2020) investigated the potential fiscal channels and argues that unemployment insurance benefits can be considered as a crucial way in the stabilization of the economy. In an earlier study, Drautzburg et al. (2015) also provided a positive fiscal multiplier in the short run, where they studied fiscal policy in response to the American Recovery and Reinvestment Act (ARRA) of 2009. A statistically significant and positive result of the fiscal policy variable supports these studies.

The coefficient estimate of the exchange rate variable, on the other hand, stands negative and significant, which is also in line with our expectations and theory. In open economy macroeconomic models, a negative relationship

Table 1. Regression Results

	(Model 1)	(Model 2)	(Model 3)
Growth rate (quarterly)	OLS	OLS	FGLS
log (money supply)	57.21*** (20.48)	56.47*** (20.41)	62.94*** (15.86)
interest rate	-0.979 (1.300)		
log (exchange rate)	-58.98*** (18.59)	-63.12*** (17.72)	-63.00*** (15.59)
log (industrial production index)	28.07** (11.42)	26.03** (11.07)	27.84*** (9.990)
log (fiscal stimulus package)	89.53*** (29.72)	95.36*** (28.62)	101.5*** (25.23)
log (containment measure index)	-6.524*** (1.771)	-6.500*** (1.766)	-5.105*** (1.533)
log (health measure index)	3.461* (2.029)	3.556* (2.020)	1.520 (1.515)
Country fixed effects	YES	YES	YES
Observations	128	128	128
R-squared	0.53	0.53	0.53

Robust standard errors in parentheses.

Significance levels: *** p<0.01, ** p<0.05, * p<0.1

postulates between the value of a domestic currency and net export or output levels (Fleming, 1962; Mundell, 1963; Dornbusch, 1976). Additionally, it is straightforward to expect a positive impact of the industrial production index on economic growth, not particularly for a pandemic period but regularly. We have this result in our model. Lastly, we find a negative and significant effect of containment measures and a positive and significant effect of health-related measures (only in FGLS, it is insignificant but still positive) on short-run economic growth. Recent study of Carlsson-Szlezak *et al.* (2020) claim that direct impact of social distancing measures was seen as reduced consumption of good and services, consumer confidence, and deteriorated production capacities. Mulligan (2020) states the cost of lockdown days and documents the offsetting effect of vaccine development and contract tracing. Our results also support these claims.

4. CONCLUSION

Since the beginning of the Pandemic, most governments have started to implement lockdown measures which caused a sudden and sharp decline in global production and supply chains, disrupted business activities, and an enormous uncertainty for the global economy. Concurrently, the COVID-19 outbreak depressed the aggregate demand due to quarantines, social life restrictions, and economic activities. As an immediate move, CBs around the world have reacted with similar responses. These are, in fact, the similar tools that the CBs used in financial turmoil in 2007-2009, even though the causes and the scopes were quite different.

In this study, we analyze the impact of monetary policy to stimulate the economy in the short run. We see a significant and positive impact of monetary policy on quarterly economic growth in all specifications. Our results justify QE measures of many CBs as sudden and immediate policy responses to the Pandemic (Bonatti *et al.*, 2020) by documenting the positive contribution of money stock on the quarterly growth rate of real GDP. Even after controlling the fiscal stimulus, our results suggest that monetary policy served its purpose, but its magnitude is

relatively weak. The negative and significant impact of the exchange rate on economic growth is in line with existing literature (Fleming, 1962; Mundell, 1963; Dornbusch, 1976). The positive and significant coefficient of the industrial production index highlights the more substantial impact of the Pandemic on emerging economies that are primarily dependent on the service sector. These economies are expected to be exposed to a sharper slowdown in economic growth due to containment measures, shutdowns and restrictions. Additionally, we see a negative impact of containment measures and a positive impact of actions such as testing, vaccination, and contact tracing.

The current study provides empirical evidence of monetary and fiscal policies on the short-run economic growth in a pandemic context. However, our preliminary results should be interpreted with caution despite the data constraints and the dynamic nature of the Pandemic. Therefore, we evaluate our results to contribute to the emerging literature that deals with macroeconomic policy effectiveness in the Pandemic era. Future studies may develop this model by adding different variables and extend the time horizon as long as more data becomes available. The study shows how vital investment in industrial production and quick policy responses in monetary and financial packages are for economic growth. For this reason, such policies may be recommended for underdeveloped economies in the short term.

Notes

¹ In the OECD database, exchange rates are defined over the dollar value of the currencies, which means the exchange rate variable for the USA is 1.

² In the data of Oxford Coronavirus Tracker, the variables are recorded on an ordinal scale in which higher values indicate higher strictness of the measures. We follow the index methodology of Hale and Wester (2020) and calculate daily indices using the equation $I_j = (v_j, t - 0.5(F_j - f_j, t)) / N_j * 100$ to normalize the indicators with different scales. In the formula, I represents sub-index score for any given indicator at time t . v denotes the original score of the indicator and has a scale of 0-2, 0-3 or 0-4. N is the maximum value that the indicator can take. F is the binary flag variable that exists only for particular indicators and captures

the geographical scope of the measure. For example, when the variable has a flag, F_j , it takes the value of 1 and f_j, t takes the value of 1 or 0 depended on whether the policy has been implemented over the whole country or targeted to a limited geographical area. However, instead of daily indices, we transformed the daily data to quarterly by simple averaging and got unique values for each sub-index at the country level.

REFERENCES

- AHREND, R. (2010). Monetary ease: A factor behind financial crises? Some evidence from OECD countries. *Economics: The Open-Access, Open-Assessment E-Journal*, 4(2010-12), 1. doi:10.5018/economics-ejournal.ja.2010-12
- BAKER, S., BLOOM, N., DAVIS, S., & TERRY, S. (2020). COVID-induced economic uncertainty. *NBER Working Papers*. No:26983, doi:10.3386/w26983
- BALDWIN, R. E., & TOMIURA, E. (2020). Thinking ahead about the trade impact of COVID-19. In *Economics in the time of COVID-19*. Retrieved from <https://voxeu.org/content/economics-time-covid-19>
- BAUM, C. F. (2006). *An introduction to modern econometrics using Stata*. Stata Press
- BÉNASSY-QUÉRÉ, A., & DI MAURO, B. W. (2020). European pandemic recovery: An opportunity to reboot. *Intereconomics*, 55(4), 205-209. doi:10.1007/s10272-020-0903-3
- BENIGNO, G., HARTLEY, J., GARCIO-HERRERO A., REBUCCI A., & RIBAKOVA E. (2020). Credible emerging market central banks could embrace quantitative easing to fight COVID-19. *VOX, CEPR Policy Portal*. Retrieved from <https://voxeu.org/article/credible-emerging-market-central-banks-could-embrace-quantitative-easing-fight-covid-19>
- BERNANKE, B. S., & BLINDER, A. S. (1992). The Federal Funds Rate and the Channels of Monetary Transmission. *American Economic Review*, 82(4), 901-921.
- BERNANKE, B. S. AND GERTLER, M. (1995), Inside the Black Box: The Credit Channel of Monetary Policy Transmission, *Journal of Economic Perspectives*, 9(4), pp. 27-48
- BHAR, R., & MALLIARIS, A. G. (2020). Modeling US Monetary Policy during the Global Financial Crisis and Lessons for COVID-19. *Journal of Policy Modeling, Forthcoming*. Retrieved from <https://ssrn.com/abstract=3680138> or <http://dx.doi.org/10.2139/ssrn.3680138>
- BONATTI, L., FRACASSO, A., & TAMBORINI, R. (2020). *COVID-19 and the future of quantitative easing in the euro area: Three scenarios with a trilemma* (652740). Retrieved from European Parliament Thinktank website: https://www.europarl.europa.eu/cmsdata/211393/2_Tamborini%20final.pdf
- CAMARERO, M., ORDÓÑEZ, J., & TAMARIT, C. R. (2002). Monetary transmission in Spain: A structural cointegrated VAR approach. *Applied Economics*, 34(17), 2201-2212. <https://doi.org/10.1080/00036840210138419>
- CASTRO, M.F. (2020). Fiscal Policy During a Pandemic. Research Division Working Paper Series. <https://doi.org/10.20955/wp.2020.006>
- CARLSSON-SZLEZAK, P., REEVES, M., & SWARTZ, P. (2020, March 27). Understanding the Economic Shock of Coronavirus. *Harvard Business Review*. <https://hbr.org/2020/03/understanding-the-economic-shock-of-coronavirus>
- CHRISTIANO, L., EICHENBAUM, M., & EVANS, C. (1998). Monetary Policy Shocks: What Have We Learned and to What End? (NBER Working Paper No. 6400). National Bureau of Economic Research, Inc. <https://econpapers.repec.org/paper/nbrnberwo/6400.htm>
- CURDIA, V. (2020). *Mitigating COVID-19 Effects with Conventional Monetary Policy*. Economic Letter. Retrieved from: <https://www.frbsf.org/economic-research/publications/economic-letter/2020/april/mitigating-covid-19-effects-with-conventional-monetary-policy/>
- ÇAKMAKLI, C., DEMIRALP, S., KALEMLİ-ÖZCAN, Ş., YESILTAS, S., & YILDIRIM, M. (2020). COVID-19 and emerging markets: An epidemiological model with international production networks and capital flows. *NBER Working Papers*. No:27191, doi:10.3386/w27191
- DABROWSKI M., & DOMÍNGUEZ-JIMÉNEZ M. (2020, August 26). Emerging market central banks and quantitative easing: High-risk advice. *Bruegel | The Brussels-based economic think tank*. <https://www.bruegel.org/2020/08/emerging-market-central-banks-and-quantitative-easing-high-risk-advice/>

- DEDOLA, L., & LIPPI, F. (2005). The monetary transmission mechanism: Evidence from the industries of five OECD countries. *European Economic Review*, 49(6), 1543-1569. doi:10.1016/j.euroecorev.2003.11.006
- DEVPURA, N., & NARAYAN, P. K. (2020). Hourly oil price volatility: The role of COVID-19. *Energy RESEARCH LETTERS*. <https://doi.org/10.46557/001c.13683>
- DIVINO, J. A. (2009). Monetary policy rules across OECD countries. *Revista Brasileira de Economia*, 63(1). doi:10.1590/s0034-71402009000100005
- DORNBUSCH, R. (1976). Expectations and Exchange Rate Dynamics. *Journal of Political Economy*, 84, 1161-1176.
- DRAUTZBURG, T. AND H. UHLIG (2015): "Fiscal Stimulus and Distortionary Taxation," *Review of Economic Dynamics*, 18, 894-920.
- ELGİN C., BAŞBUĞ, G., & YALAMAN A. (2020). Economic policy responses to a pandemic: A COVID-19 economic stimulus index. *VOX, CEPR Policy Portal*. <https://voxeu.org/article/economic-policy-responses-pandemic-covid-19-economic-stimulus-index>
- ELGİN, C., YALAMAN, A., YAŞAR, S., & BAŞBUĞ, G. (2021). Economic policy responses to the COVID-19 Pandemic: The role of Central Bank independence. *Economics Letters*, 204, 109874. <https://doi.org/10.1016/j.econlet.2021.109874>
- FLEMING, J. M. (1962). Domestic Financial Policies under Fixed and under Floating Exchange Rates, Staff Papers (International Monetary Fund), 9(3), 369-380. <https://doi.org/10.2307/3866091>
- FORNARO, L. and Wolf, M. (2020). Covid-19 Coronavirus and Macroeconomic Policy: Some Analytical Notes. Retrieved from: <https://www.crei.cat/wp-content/uploads/2016/07/CMP.pdf>
- FUHRER, J., & MADIGAN, B. F. (1997). Monetary Policy When Interest Rates Are Bounded At Zero. *The Review of Economics and Statistics*, 79(4), 573-585.
- GALI, J. (2009) *Monetary Policy, Inflation, and the Business Cycle: An Introduction to the New Keynesian Framework*: Princeton University Press.
- GIL-ALANA, L. A., & CLAUDIO-QUIROGA, G. (2020). The COVID-19 IMPACT on the ASIAN STOCK MARKETS. *Asian Economics Letters*, 1(2). <https://doi.org/10.46557/001c.17656>
- HALDANE, A., ROBERTS-SKLAR, M., YOUNG, C., & WIELADEK, T. (2016). QE: The story so far. *SSRN Electronic Journal*. doi:10.2139/ssrn.2858204
- HALE, T. AND WEBSTER, S. (2020). Oxford COVID-19 Government Response Tracker. Retrieved from <https://covidtracker.bsg.ox.ac.uk/>
- HAROON, O., AND RIZVI, S.A.R., (2020) Flatten the curve and stock market liquidity—An Inquiry into emerging economies, *Emerging Markets Finance and Trade*, 56(10), 2151-2161; <https://doi.org/10.1080/1540496X.2020.1784716>
- HARTLEY, J., & REBUCCI, A. (2020). An event study of COVID-19 Central Bank quantitative easing in advanced and emerging economies. *SSRN Electronic Journal*. doi:10.2139/ssrn.3607645
- HE, P., SUN, Y., ZHANG, Y., AND LI, T., (2020) COVID-19's impact on stock prices across different sectors—An event study based on the Chinese stock market, *Emerging Markets Finance and Trade*, 56(10), 2198-2212; <https://doi.org/10.1080/1540496X.2020.1785865>
- HORWITZ, S. (2012). Causes and cures of the Great Recession. *Economic Affairs*, 32(3), 65-69. doi:10.1111/j.1468-0270.2012.02176.x
- ICMA. (2020). COVID-19 market updates: Monetary policy. Retrieved from <https://www.icmagroup.org/Regulatory-Policy-and-Market-Practice/covid-19-market-updates/monetary-policy/>
- ILO. (2021). *Sectoral impact, responses and recommendations (COVID-19 and the world of work)*. <https://www.ilo.org/global/topics/coronavirus/sectoral/lang--en/index.htm>
- IMF. (2013). *Unconventional monetary policies - Recent experiences and prospects - Background paper*. International Monetary Fund.
- IMF. (2020). Policy Responses to COVID-19. Retrieved from <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19>
- IRELAND, P. N. (2005). The Monetary Transmission Mechanism (SSRN Scholarly Paper ID 887524). Social Science Research Network. <https://doi.org/10.2139/ssrn.887524>
- IYKE, B. N. (2020). COVID-19: The reaction of US oil and gas producers to the Pandemic. *Energy RESEARCH LETTERS*. <https://doi.org/10.46557/001c.13912>
- JUSELIUS, K., & TORO, J. (2005). Monetary transmission mechanisms in Spain: The effect of monetization, financial deregulation, and the

- EMS. *Journal of International Money and Finance*, 24(3), 509-531. doi:10.1016/j.jimonfin.2005.01.002
- KARTAL, M. T., DEPREN, &, & DEPREN, S. K. (2020). The determinants of main stock exchange index changes in emerging countries: Evidence from Turkey in COVID-19 pandemic age. *SSRN Electronic Journal*. doi:10.2139/ssrn.3659154
- KRUGMAN, P. R., DOMINQUEZ, K. M., & ROGOFF, K. (1998). "It's Baaack: Japan's Slump and the Return of the Liquidity Trap.". *Brookings Papers on Economic Activity*. 10(2): 137-87.
- KRUGMAN, P. R., & WELLS, R. (2009). *Economics*. W.H. Freeman.
- MCKIBBIN, W. J., & FERNANDO, R. (2020). The global macroeconomic impacts of COVID-19: Seven scenarios. *SSRN Electronic Journal*. doi:10.2139/ssrn.3547729
- MULLIGAN, C. B. (2020). *Economic Activity and the Value of Medical Innovation during a Pandemic* (Working Paper No. 27060; Working Paper Series). National Bureau of Economic Research. <https://doi.org/10.3386/w27060>
- MUNDELL, R. A. (1963). Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates. *The Canadian Journal of Economics and Political Science / Revue Canadienne d'Economie et de Science Politique*, 29(4), 475-485. <https://doi.org/10.2307/139336>
- NARAYAN, P.K., DEVPURA, N., AND WANG, H. (2020). Japanese currency and stock market—What happened during the COVID-19 Pandemic? *Economic Analysis and Policy*. 68, 191-198.
- NARAYAN, P. K., 2020. Has COVID-19 Changed Exchange Rate Resistance to Shocks? *Asian Economics Letters*, 1(1). <https://doi.org/10.46557/001c.17>
- OECD. (n.d.). *About the OECD*. OECD.org - OECD. <https://www.oecd.org/about/>
- OECD. (2020^a). *Tax and fiscal policy in response to the coronavirus crisis : Strengthening confidence and resilience*.
- OECD. (2020^b). Key Short-Term Economic Indicators. Retrieved from <https://stats.oecd.org/>
- OUR WORLD IN DATA. (2020, October 31). Coronavirus (COVID-19) cases - Statistics and research. Retrieved from <https://ourworldindata.org/covid-cases>
- OZILL, P. K., & ARUN, T. (2020). Spillover of COVID-19: Impact on the global economy. *SSRN Electronic Journal*. doi:10.2139/ssrn.3562570
- ÖZTÜRK, Ö., ŞIŞMAN, M. Y., USLU, H., & ÇITAK, F. (2020). Effects of COVID-19 Outbreak on Turkish Stock Market : A Sectoral-level Analysis. *Hitit Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 13(1), 56-68.
- PRABHEESH, K. B. (2020). Dynamics of Foreign Portfolio Investment and Stock Market Returns During the COVID-19 Pandemic: Evidence From India. *Asian Economics Letters*, 1(2). <https://doi.org/10.46557/001c.17658>
- POWELL, B. (2002). Explaining Japan's recession. *The Quarterly Journal of Austrian Economics*, 5(2), 35-50. doi:10.1007/s12113-002-1011-x
- QİN, M., ZHANG, Y., & SU, C. (2020). The essential role of pandemics: A fresh insight into the oil market. *Energy RESEARCH LETTERS*. <https://doi.org/10.46557/001c.13166>
- RICKETTS, L. R. (2011). *Quantitative Easing Explained*. Retrieved from St. Louis Fed website: <https://files.stlouisfed.org/files/htdocs/pageone-economics/uploads/newsletter/2011/201104.pdf>
- SALİSU, A. A., & ADEDİRAN, I. (2020). Gold as a hedge against oil shocks: Evidence from new datasets for oil shocks. *Resources Policy*, 66, 101606. <https://doi.org/10.1016/j.resourpol.2020.101606>
- SUMMERS, L. (1991). How Should Long-Term Monetary Policy Be Determined? Panel Discussion. *Journal of Money, Credit and Banking*, 23(3), 625-631.
- SUMNER, A., HOY, C., & ORTIZ-JUAREZ, E. (2020). Estimates of the impact of COVID-19 on global poverty. *WIDER Working Paper*. doi:10.35188/unu-wider/2020/800-9
- SUN, L., FORD, J. L., & DICKINSON, D. G. (2010). Bank loans and the effects of monetary policy in China: VAR/VECM approach. *China Economic Review*, 21(1), 65-97.
- TAYLOR, J. B. (1995). The Monetary Transmission Mechanism: An Empirical Framework. *Journal of Economic Perspectives*, 9(4), 11-26. <https://doi.org/10.1257/jep.9.4.11>
- THUNSTRÖM, L., NEWBOLD, S. C., FINNOFF, D., ASHWORTH, M., & SHOGREN, J. F. (2020). The benefits and costs of using social distancing to flatten the curve for COVID-19. *Journal of Benefit-Cost Analysis*, 11(2), 179-195. doi:10.1017/bca.2020.12
- TOPÇU, M., & GULAL, O. S. (2020). The impact of COVID-19 on emerging stock markets. *Finance Research Letters*, 36, 101691. doi:10.1016/j.frl.2020.101691
- VIDYA, C. T., AND PRABHEESH, K.P., (2020)

Implications of COVID-19 Pandemic on the global trade networks, *Emerging Markets Finance and Trade*, 56(10), 2408-2421. <https://doi.org/10.1080/1540496X.2020.1785426>

WORLD BANK GROUP. (2020, June 8). COVID-19 to plunge global economy into worst recession since World War II. Retrieved from <https://www.worldbank.org/en/news/press-release/2020/06/08/covid-19-to-plunge-global-economy-into-worst-recession-since-world-war-ii>

ZHANG, Z., JI, Q., & HU, M. (2020). Financial markets under the global Pandemic of COVID-19. *Finance Research Letters*, 36(101528). doi:10.1016/j.frl.2020.101528

ZHANG, Z., JI, Q., & HU, M. (2020). Financial markets under the global Pandemic of COVID-19. *Finance Research Letters*, 36(101528). doi:10.1016/j.frl.2020.101528

Appendix

Table A1. List Of 33 OECD Countries in The Sample

Australia	Latvia	Denmark	Poland	Greece	Spain
Austria	Lithuania	Estonia	Portugal	Hungary	Sweden
Belgium	Luxembourg	Finland	Slovakia	Ireland	Turkey
Canada	Netherlands	France	Slovenia	Israel	United States
Chile	New Zealand	Germany	South Korea	Italy	United Kingdom
Czechia	Norway	Japan			

Table A2. Summary Statistics

VARIABLES	(1) N	(2) Mean	(3) SD	(4) Min	(5) Max
Quarterly growth rate	128	-0.560	7.405	-19	18.46
Money supply (billion currencies)	132	133,688	555,341	15.66	3184353
Exchange rate (USD=1)	132	74.89	243.7	0.757	1,220
Interest rate	132	0.205	1.938	-0.700	14.08
containment index	132	42.07	20.86	3.777	79.58
health index	132	69.10	22.83	8.791	100
Industrial production index (quarterly)	132	103.7	10.53	77.43	128.4
Fiscal stimulus (%of GDP) (cumulative)	132	14.16	6.897	3.780	42.20
Total number of cases per million (cumulative)	132	64,041	35,796	522	152,258
Country code	132	17	9.558179	1	33

Figure A1. Added Variable Plots

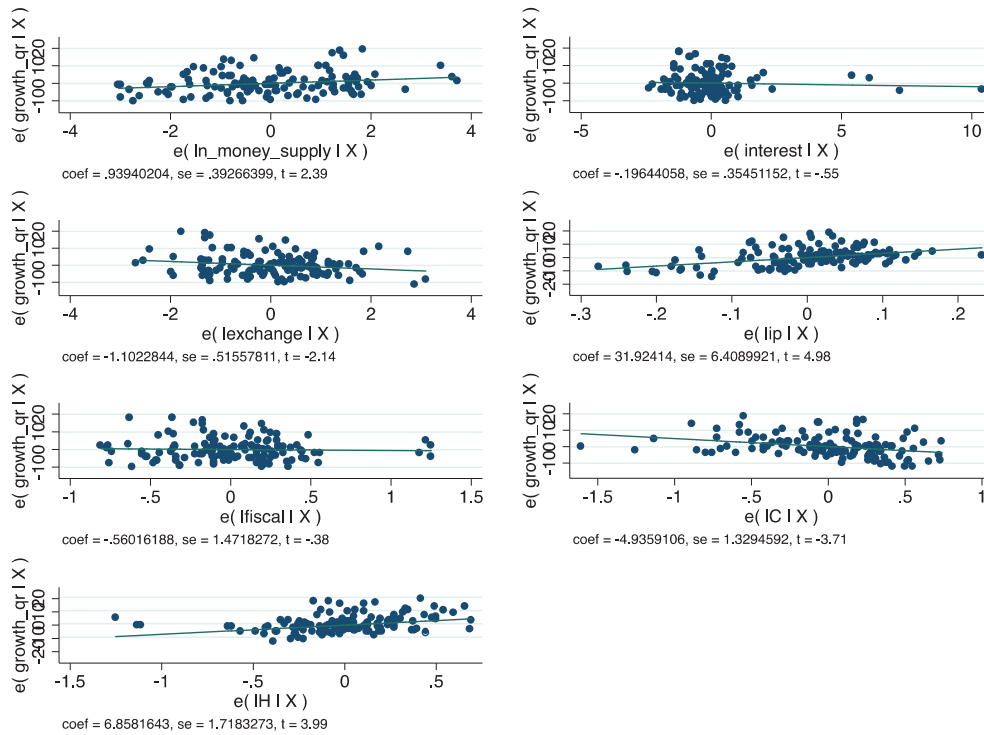


Table A3. Multicollinearity Test

Variable	VIF	1/VIF
log (money supply)	3.49	0.286716
log (exchange)	3.41	0.293609
log (containment measure index)	2.26	0.442170
log (health measure index)	2.16	0.462912
log (fiscal stimulus index)	1.16	0.861384
log (industrial production index)	1.35	0.861384

Table A4. Ramsey Reset Test Results For The Functional Form

Ho: model has no omitted variable	p-value
Model 1	0.2748
Model 2 (excluding interest rate)	0.2742

Figure A2. Residuals Normality

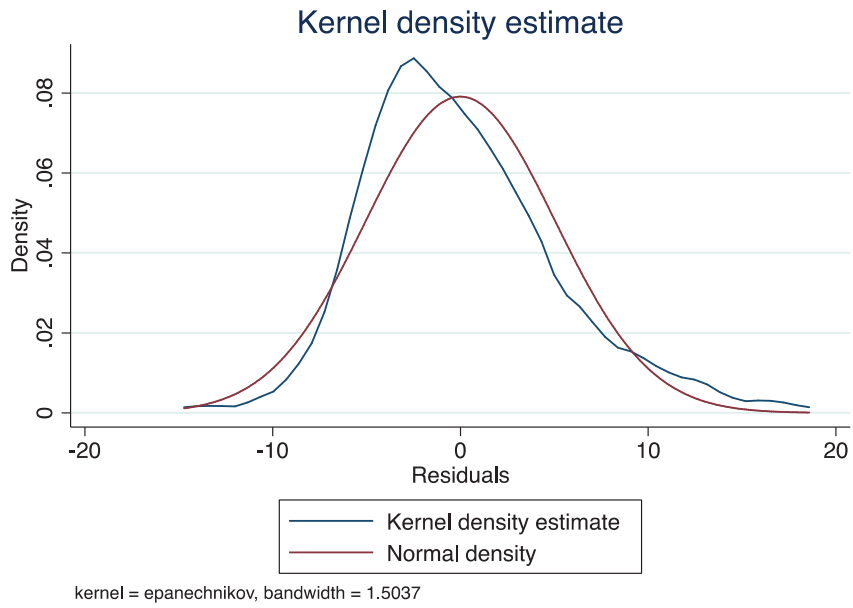


Figure A3. Residual Vs. Fitted Plot

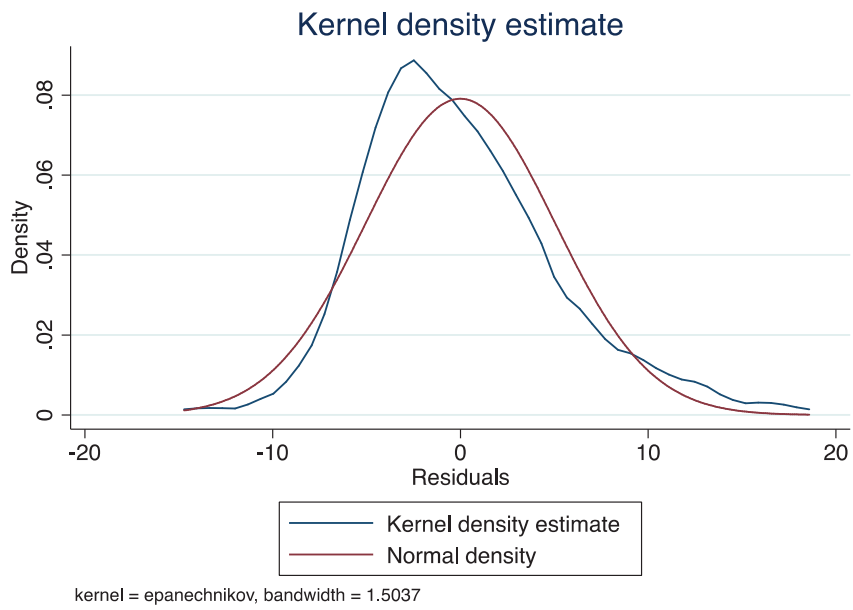


Table A5. Breusch-Pagan / Cook-Weisberg Test For Heteroskedasticity

Ho: Constant variance	p-value
Variables: fitted values of quarterly growth rate (model excludes interest rate)	0.0482