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THE ECONOMIC EFFECTS OF COVID-19 MITIGATION POLICIES ON UNEMPLOYMENT AND ECONOMIC POLICY UNCERTAINTY

Anasuya Haldar* and Narayan Sethi**

*Dept. of Humanities and Social Sciences, National Institute of Technology Rourkela, India.
Email: halder.anasuya@gmail.com
**Corresponding Author. Department of Humanities and Social Sciences, National Institute of Technology (NIT) Rourkela, India. Email: nsethinarayan@gmail.com

ABSTRACT

This paper examines the effects of COVID-19 mitigation strategies and Economic Policy Uncertainty (EPU) on unemployment-rate over the period November 2019 to April 2021 for the 16 most severely COVID-19 affected countries. Our specific objectives are threefold: first, to examine the dynamic relationship between EPU and unemployment-rate; second, to analyze the extent to which government's COVID-19 mitigation response affects the unemployment-rate; and third, to examine the effects of governments economic policies on the unemployment-rate through market indicators, such as the business and consumer confidence indices. We find that EPU increases fluctuations in unemployment for the COVID-19 affected countries, while governments' vaccination drive significantly reduces it. Increases in government stringency aggravate unemployment in the informal sectors and enhances labor inequality.

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I. INTRODUCTION

The COVID-19 pandemic poses serious concerns not only for health, but also for economic well-being (Guo *et al*., 2021; Fu and Chang, 2021; Narayan, 2021; Haldar and Sethi, 2020, 2021; Iyke 2020; Dash *et al*., 2021; Padhan and Prabheesh, 2021). The pandemic has severely affected the labor-market of most economies that were severely affected by the virus (Yu *et al*., 2020). The first wave of the pandemic which initially hit Europe, the USA and Southeast Asia, dented the labor- market completely due to partial or full lockdown measures and their repercussions are still evident in the soaring unemployment rates witnessed globally. Policy responses to COVID-19 are often handicapped by deficient and unclear political goals as well as dysfunctional institutional dynamics leading to rising policy uncertainty (Carter and May, 2020; Phan *et al*., 2018; Fasanya *et al*., 2021a; Morikawa, 2016; Shen *et al*., 2020; Haldar and Sethi, 2021; Dash *et al*., 2020).

During the period between January and March 2021, higher vaccination rates in many countries restored businesses and consumer confidence (Remes *et al*., 2021). Nonetheless, there was still much uncertainty regarding the economic policy as the 3rd wave of COVID-19 began. Given this background, in this paper, we examine whether the forces holding back labor supply, such as lack of aggregate demand and aggregate supply, continue to ebb in the face of government COVID-mitigation strategies and Economic Policy Uncertainty (EPU) in those economies where COVID cases are still high.

We analyze the effects of governments' pandemic mitigation strategies on the unemployment rates and EPUs for the affected countries which had the highest number of cumulative COVID-cases as of 31st May 2021. These countries are the USA, India, Brazil, France, Turkey, Russia, the UK, Italy, Colombia, Spain, Germany, Poland, Mexico, Indonesia, South-Africa and the Netherlands. It is readily known that the developing economies, unlike the developed ones, with a larger share of the youth working-age population and having a large informal sector, were the most adversely impacted by the pandemic. Moreover, in the developed countries like the USA and the UK, although unemployment soared in terms of inactivity and reduced working hours, workers were not technically unemployed due to job retention schemes and self-employment income support scheme grant (OECD Report, 2020). The benefit claimants more than doubled over the period December 2019 to May 2020 (Handwerker *et al*., 2020). But once emergency support schemes are removed, the unemployment escalated. Such support schemes were unheard of in the developing nations given lack of fiscal space. It goes without saying that EPU also differs across countries (Ozili, 2021) and between the developed and developing groups (Al-Thaqeb *et al*., 2020).

Lockdown measures are being relaxed as these nations achieve their targeted vaccination rates. Nonetheless there are differences in vaccine distribution policy in terms of affordability and coverage both within and across nations (Elgar *et al*., 2021). Unequal access to vaccination can lead to uneven effects on their economy and employment. Despite vaccination, a second wave has spread rapidly leading to partial lockdown in many countries. Under such circumstances the degree of government stringency, both between and within countries, depends on the access to vaccination. Overall, the vaccination and stringency policies are likely to have a direct impact on the unemployment rates. This study confirms that the unemployment rates in the most affected countries depend on the government policies related to vaccination and lockdown as well as on EPU. As more and more people are getting vaccinated, EPUs are reducing and businesses as well as consumer confidence levels bounce back leading to a rise in both consumption and production.

The fiscal and monetary policies adopted by governments to create job demand and revamp the labor market has differed from country-to-country, leading to changes in the labor market demand patterns over the COVID period. This has resulted in job losses, mostly in sectors such as tourism, hospitality and other informal sectors (ILO Monitor, 2020). Also due to lockdown, trade between countries was partly shut down leading to heavy economic losses (Nwokolo *et al*., 2020). The divergence between increases in skilled-labor and declines in semi-skilled or unskilled-labor will tend to increase inequality within countries (Park and Inocencio, 2020). Upper high-income countries lost greater working hours as compared to the less developed countries (ILO Monitor, 2020). Labor market policies play a critical role in limiting the social hardships and ensuring that employment rapidly rebounds once the shutdown of non-essential activities is eased.

Both the shifts in productivity resulting from uncertainty related to the pandemic and public mitigation policies exert a strong impact on unemployment (Andrews *et al*., 2021). Public mitigation policies affect both the demand and the supply sides of the economy (ILO Monitor, 2020; O'Reilly *et al*., 2020). Public remedies for unemployment depend on the type of unemployment. For example, cyclical unemployment requires either increased public investment or expansionary monetary policy as a cure, frictional unemployment requires labor reallocation to meet the gap between labor supply and labor demand, and structural unemployment is cured by training semi-skilled or unskilled labor to meet the labor demand. Government policy in the time of COVID-19 can affect the rate of unemployment by bridging the gap between the employers and the employees through job retention schemes to preserve the existing jobs. This prevents the loss of firm-specific skilled labor and promotes quicker labor market recovery. However, this is viable only if the COVID-19 shock on the economy is temporary, such measures may not be efficient or viable if the economic shock due to COVID-19 becomes persistent in the long run. As a result, some sectors like travel and recreational services may suffer more persistently than other sectors due to change in consumer preferences.

The government policies affect the information and incentives that employers and employees utilize to seek each other out and signals the market through the economic health indicators like share prices, consumer prices and the Business Confidence Index (Yang and Deng, 2021; Chang *et al*., 2021; Liu, 2021; Phan and Narayan, 2020). Similarly, increasing rate of unemployment signals the market about the gravity of the recession and further aggravates uncertainty (Bernstein *et al*., 2021). We can thus assume in the study that both unemployment and EPU are endogenously determined. Apart from policies that can indirectly signal about the health of the market, government policies in the times of recovery from COVID-19 can directly increase the household's labor supply and firm's labor demand through increased vaccination and reduced stringency.

In this study we examine the effects of government policy responses to COVID-19 and analyze the effects of EPU on the unemployment rates in countries which were severely affected by the COVID-19 pandemic. We have three objectives. First, to examine whether EPU affects the unemployment rate. Second, to analyze whether the government COVID-19 mitigation responses and economic policies directly or indirectly affect the unemployment rate through market indicators like business confidence index and consumer confidence index. It has been assumed in the study that EPU and the unemployment rate are endogenously determined during the COVID-19 study period from November 2019 to April 2021.

The study advances this literature in significant ways. First, in the earlier studies, the impact of government policy on unemployment rate has not been examined while considering the role of uncertainty during the COVID-19 period. The present study has several policy implications that might be useful for the governments of the highly COVID-affected economies to control the soaring unemployment rates in times of such unprecedented crisis. Second, most of these studies were based on either the developed (Bauer and Weber, 2020; Fasanya *et al.*, 2021a, 2021b; Freund and Rendahl, 2020) or developing (Ahmed *et al*., 2020; Yu *et al*., 2020; Kong and Prinz, 2020; Horvath and Zhong, 2019) countries. This study considers countries with the highest cumulative COVID-19 cases irrespective of the region because the incidence of COVID-19 equally affected countries from both the developing and the developed world. Finally, unlike the previous studies, which examined the effects of the pandemic on either unemployment or policy uncertainty, this study implements a dynamic simultaneous equation framework to analyze the co-movements of unemployment and uncertainty with government policy.

Foreshadowing our key findings, policy uncertainty significantly increases fluctuations in the unemployment rate for the COVID-19 affected countries, while governments' vaccination drive significantly reduces it. Increases in government stringency aggravates the unemployment rate in the informal sectors and enhances labor inequality. The rest of the paper is organized as follows. In Section II, a review of literature on unemployment and uncertainty during the pandemic period is provided. In Section III, a theoretical framework for the current analysis is explained. In Section IV, data and methodology used in the study are discussed while the empirical results are presented in Section V. Finally, in Section VI, we conclude the analysis with policy implications for the studied group of countries.

II. LITERATURE REVIEW

Several studies have discussed the evolving challenges of COVID-19 on the labor market (Mayhew and Anand, 2020; Fana *et al*., 2020; Periola-Fatunsin *et al*., 2021). Mayhew and Anand (2020) paid particular attention to the job retention scheme in the UK during COVID-19 period. They showed that the scheme although helpful in keeping workers connected with their employers is not sustainable due to slow economic recovery and changes in the structure of output and employment. A similar assessment for three European countries (Germany, Spain and Italy) by Fana *et al*. (2020) showed that the labor markets of the most affected and the least affected sectors will work differently until long term solutions like vaccination policy are implemented. They also found that the countries which are most affected by the pandemic like Spain, Italy and the UK are also the countries which have seen large labor market distortions.

A report on the effects of COVID-19 on the labor market (OECD Report, 2021) found that the pandemic as well as government stringency measures related to it had a large but uneven impact on the demand for skills. Individuals with different levels of education were affected differently by the pandemic and such effects differed from country-to-country. Larue (2020) discussed that, for Canada, rising food security concerns due to COVID-19 had made protectionist trade policies popular reducing the volume of trade. Firms may export less and increase FDI, thereby inducing trade in jobs.

Several studies concluded that the COVID-19 pandemic caused a global health crisis coupled with economic and labor market shocks that led to a global job market crisis of unprecedented magnitude (Lee *et al*., 2020; Couch *et al*., 2020; Ranchhod and Daniels, 2021; Bell and Blanchflour, 2020; Mamgain, 2021). The impact on individuals and countries have been dis-proportionate, making certain sections of the population more vulnerable like the women or the youth. Workers at the informal economy were at higher risk of job loss and vulnerable. As per the ILO Monitor Report (2020), out of 2 billion informal workers worldwide, 1.6 billion were significantly impacted by the crisis due to lockdown measures or due to work in high-risk sectors.

Using predictive linear and non-linear models, Ahmad *et al*. (2021) showed that the unemployment rates in selected European countries (France, Spain, Belgium, Turkey, Italy and Germany) will increase in the coming years and it will take 5 years to overcome the impact of the COVID-19. Al-Thaqeb *et al*. (2020) made an association between uncertainty due to the COVID- 19 pandemic and unemployment indirectly through the global economy. The negative impacts of EPU on individuals' businesses, governments and economics at the local and international levels was analyzed. It was found that high EPU, which is measured as a newspaper-based index of uncertainty, exerts adverse effects on households, government and corporations which delay financial decisions, reduces consumption, causes fewer debt issuance, fewer investments and higher unemployment.

COVID-19 affected different sections of the labor market differently. For example, Gezici and Ozay (2020) found that in the US labor market unemployment experiences were different for men and women. Women were likely to be more unemployed and these differences were exaggerated during COVID times based on race and ethnicity of the women. Goswami *et al*. (2021) examined the state level aggregate data from India. They found that states with higher spread of the infection, with adverse initial economic conditions and larger dependence on secondary and tertiary sectors have suffered larger economic losses. In contrast, states with greater containment strategy, greater healthcare capabilities and a larger share in the primary sector, experienced smaller economic losses. Spread of the virus interacts with these factors to significantly impact state economic performances. Almeida and Santos (2020) found that for Portugal, the impact of the COVID-19 on the labor market is very asymmetric across regions, sectors, age-groups and nature of labor ties. The youth and the women are more vulnerable to job loss.

Barbieri Góes and Gallo (2021) captured the dynamic interaction between epidemiological evolution of COVID-19 and its effect on macro-economy in the absence of vaccination using a stylized 2-equations dynamical system in the COVID-19 positivity rates and unemployment rates. They found that in the absence of widespread immunity through vaccination, unemployment rate increases and reaches equilibrium at a higher level than the pre-pandemic rate for a given level of infection rate. Pandemic driven shock on output may produce a L-shaped recession in the absence of adequate policy. Kozicki and Gornikiewicz (2020) argued that slowing down of passenger's transport and restrictions on global trade have led to lack of demand for energy resources leading to a fall in oil prices and strong exchange rate variability, all of which have contributed to high levels of unemployment globally.

Lai *et al*. (2021) investigated the impact of COVID-19 on the unemployment rates of selected developed and developing countries of Asia. Using intelligent-based prediction approaches that allow for diversity in the unemployment rate, the author found that in the developing countries of Asia, the unemployment rate will be three times higher than that in the advanced Asian countries, and it will take double the time to address the implications of COVID-19. The challenge is to preserve jobs in the medium term while resources are reallocated among firms and industries (Andrews *et al*., 2021). Job preservation needs to be adjusted with reallocation by adjusting parameters of the existing policies. Banerjee *et al*. (2020) remarked that bankruptcies in sectors hit by COVID-19 can exert a significant drag on the labor market. This underscores the need to reallocate resources quickly and efficiently to drive growth in the post pandemic period.

Su *et al*. (2021) scrutinized the influences of the COVID-19 pandemic on the unemployment in five European economies using Fourier causality tests. COVID-19 cases are seen to cause unemployment for Germany, Italy and the UK and COVID-deaths cause unemployment in Italy and UK. Butterick and Charlwood (2021) argued that COVID-19 pandemic had exposed deep labor market inequalities, changing demand patterns have led to changes in demand for inputs including labor.

Overall, our review shows that the impact of COVID-19 on unemployment rates has been uneven across different sections of the population in different countries and that government policy is seen as playing an important role in determining the fluctuations in the labor market. In what follows, we examine the implication of policy uncertainty on the labor market during the COVID-19 pandemic.

III. THEORETICAL FRAMEWORK

In New-Keynesian models, uncertainty shocks have mainly two effects: first, on aggregate demand and works through precautionary saving behavior of risk-averse households; and second, on aggregate supply which works through the precautionary behavior of firms (Auray and Eyquem, 2020; Gu *et al*., 2020). Hiring and investment decisions of the firms during such times are hard to grasp with standard macroeconomic models (Anderson, 2014). The effect of EPU on the unemployment rate during the current pandemic arises from uncertainty in consumption and investment decisions (McKibbin and Fernando, 2021). Based on newspaper-based information to measure uncertainty, Baker *et al*. (2020) claimed that COVID-19 has led to not only economic slowdown, but also political and regulatory uncertainty. Uncertainty in times of the pandemic has complicated the decision-making process of firms and consumers in all sectors (commodities, finance and housing) of the economy (Al Thaqeb *et al*., 2020).

From the experiences of the 2008-2009 Great Recession, it was found that economic and financial uncertainty leads to volatility in firm's production and a fall in output (Arellano *et al*., 2019). However, the severity of the effects of uncertainty on the economy depends on the domestic government policies and the spillovers effects of uncertainty from another economy. Leduc and Liu (2012) found that the adverse effects of uncertainty on the economy are like that of a fall in aggregate demand. The authors explain that private sector cuts back spending in response to increasing policy uncertainty, which leads to a rise in unemployment and a fall in output, inflation, and short-term interest rates. On the other hand, a reduction in aggregate supply by the firms reduces economic activity and raises inflation. In the face of a fall in aggregate supply as well as aggregate demand, policymakers face the trade-off between suppressing unemployment and ensuring price stability. Policy uncertainty also explains the inability of aggressive fiscal and monetary policies to lower unemployment rate during the crisis (O'Reilly *et al*., 2020). The government policies required to reduce unemployment during such times involve COVID-mitigation policies related to vaccination and social distancing norms which affect the economy by bringing back business and consumer confidence that reduces uncertainty.

A. Fall in Aggregate Demand due to Uncertainty in Consumption

Policy uncertainty affects the aggregate consumption which leads to changes in output and employment. As policy uncertainty rises, household precautionary savings also rises in a Rational Expectations/Permanent Income framework assuming that there is no perfect information available to households (Drakopoulos, 2021). Consumers having a convex marginal utility function will react to uncertainty by increasing savings. As the precautionary behavior of the households increase, there is a fall in both interest rates and aggregate demand at the same time. This fall in aggregate demand leads to deflationary pressures. It is therefore important to study the main variables affecting unemployment, in order to design policies for improving the labor market conditions. As argued by Basu and Bundick (2017), increase in uncertainty leads to increase in desired savings and can have expansionary effects on the economy unless the nominal rigidities lead to a decrease in goods demanded, which thereby causes a contraction in economic activity and increase in unemployment.

B. Fall in Aggregate Supply due to Uncertainty in Investment

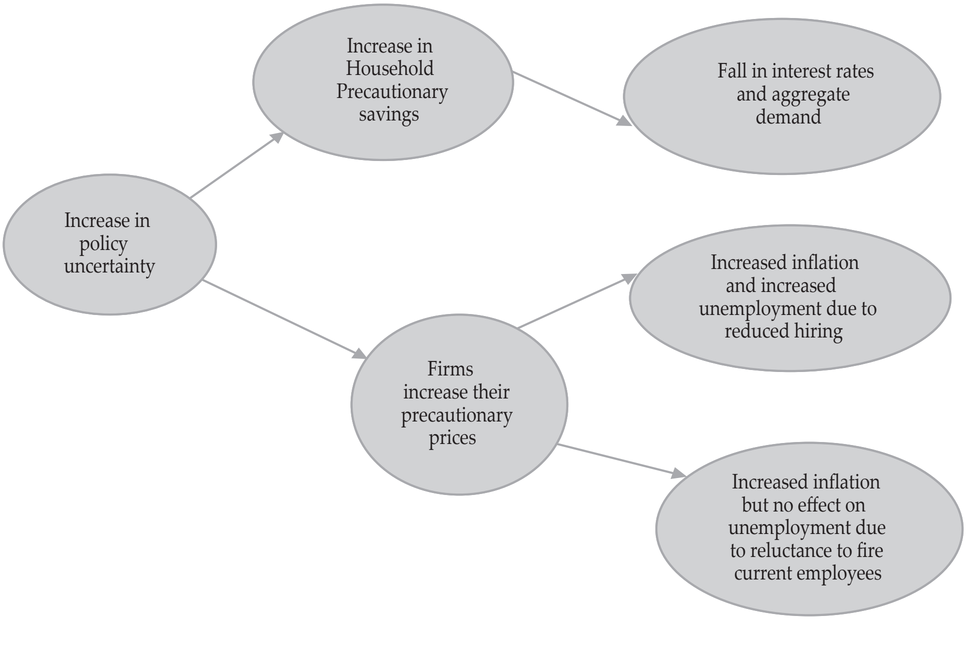
The uncertainty shocks affect a real economy when the employer's expected opportunity cost of hiring is greater than the opportunity cost of waiting in the presence of partial irreversibility (Bloom, 2009; Bernanke, 1983; Dixit and

Pindyck, 1994; Abel and Eberly, 1996; Caballero and Engel, 1999). Using a new Keynesian model with endogenous capital accumulation, Bloom (2009) showed that uncertainty about both short run and long run fiscal policy can cause a large contraction in the economy. In the times of uncertainty, firms postpone their investment decisions to avoid sunk costs. During such times the risk premia also rise, as a result the cost of external financing increases and firms are unable to undertake large investments. When uncertainty increases, firms increase their prices to ensure that in the future, they are not stuck with low prices. Whenever such increase in prices due to the precautionary pricing behavior of firms offsets the reduction in prices due to the precautionary saving behavior of the risk averse households, both inflation and unemployment increases after a policy uncertainty shock. Uncertainty thus exerts a depressing effect on current investment and employment level.

This, however, is only one side of the story; with higher uncertainty, firms might be more reluctant to separate from their employees, because searching for labor to match the required skill, is costly. Thus, the combined effect of reduced hiring by firms and reluctance to fire current employees has an ambiguous effect on unemployment rate. Anderson (2014) tested the hypothesis that firms may avoid hiring workers in times of uncertainty using a "value functional" or "recursive model of firm behavior", where firms tend to maximize the value of the businesses rather than maximizing profits. The author demonstrates that policy uncertainty affects the rational hiring decision of the US firms. It is therefore worthwhile to empirically analyze the effect of policy uncertainty on unemployment rate.

Figure 1.
Schematic Representation of Theoretical Framework

The Figure shows that the effect of increased policy uncertainty on macroeconomic outcomes is contingent upon household and firm decisions regarding consumption, savings and investment.



Based on the above theoretical framework, this study tests the following hypotheses:

1. That policy uncertainty increases the rate of unemployment
2. That policy uncertainty and unemployment are endogenously determined during the pandemic period
3. That government COVID-19 mitigation strategies and economic policies affect the unemployment rate in the presence of EPU.

IV. DATA AND METHODOLOGY

A. Empirical Model

The main variables of interest are unemployment rate and economic policy uncertainty. We examine the effects of government COVID-mitigation strategies and economic policies on unemployment rate in the presence of uncertainty. These relationships are explained within a simultaneous equations system. Simultaneous equations are appropriate when the endogenous variables appear in the equations as independent variables.

In this analysis, unemployment rate and policy uncertainty are assumed to be endogenous or jointly determined variables based on the previous theoretical justification that uncertainty in both investment and consumption increases unemployment and vice-versa. The exogenous variables of the system include government policy measures, namely, government stringency policy (GSI_{it}) and government vaccination policy (VAC_{it}), that were taken to control the spread of COVID. Exogenous variables and past values of the endogenous (or pre-determined) variables help in explaining the variations in the endogenous variables. The pre-determined variables are independent of the disturbance terms in the model and influence the endogenous variables of the model. Exogenous/pre-determined variables are themselves not influenced by the endogenous variables. In a simultaneous equation model, a necessary condition for estimating all the parameters is that the number of endogenous variables should be equal to the number of independent equations in the system. In this analysis, our model constitutes a system of two simultaneous equations (1) and (2):

$$UR_{it} = \propto_0 + \propto_1 . EPU_{it} + \propto_2 . GSI_{it} + \propto_3 . VAC_{it} + \propto_4 . INF_{it} + \propto_5 . ER_{it} + \propto_6 . IR_{it} + u_{1it} \quad (1)$$

$$EPU_{it} = \beta_0 + \beta_1 . UR_{it} + \beta_2 . GSI_{it} + \beta_3 . VAC_{it} + \beta_4 . BCI_{it} + \beta_5 . CCI_{it} + u_{2it} \quad (2)$$

Here, the endogenous variables are: the unemployment rate of the economy, UR_{it}; and Economic Uncertainty Index, EPU_{it} adopted from Baker *et al*. (2020). The exogenous variables in the system are GSI_{it} which the Government lockdown stringency index is in times of COVID-19 and VAC_{it} which denotes the average number of vaccinations given per month per hundred people. All other variables are the control variables, where INF_{it} is the rate of inflation; ER_{it} is the currency exchange rate; IR_{it} is the long-term interest rate; BCI_{it} is the monthly business confidence index; and CCI_{it} is the monthly Consumer Confidence Index.

$$UR_{it} = \propto_0 + \propto_1 . UR_{i(t-1)} + \propto_2 EPU_{it} + \propto_3 . GSI_{it} + \propto_4 . VAC_{it} + \propto_5 . INF_{it} + \propto_6 . ER_{it} + \propto_7 . IR_{it} + u_{1it} \quad (3)$$

$$EPU_{it} = \beta_0 + \beta_1 . UR_{it} + \beta_2 . UR_{i(t-1)} + \beta_2 . GSI_{it} + \beta_3 . VAC_{it} + \beta_4 . BCI_{it} + \beta_5 . CCI_{it} + u_{2it} \quad (4)$$

Equations (3) and (4) capture the dynamic effects of unemployment on economic policy uncertainty and vice-versa in the presence of government mitigation policies, and market signals indicated by the consumer confidence index and the business confidence index as well as other control variables.

B. Data

This study applies monthly economic data over the period November 2019 to April 2021. The data description and sources of all variables are summarized in Table 1. The abbreviations of all variables are also explained here.

Table 1.
Variable Description and Data Sources

The table shows the list of dependent and independent variables used in the analysis. The symbols of the variables, their measurement and data sources are presented. These symbols have been used throughout the analysis. OECD: Organization for Economic Cooperation and Development; JHU: John Hopkins University database (Dong *et al.*, 2020).

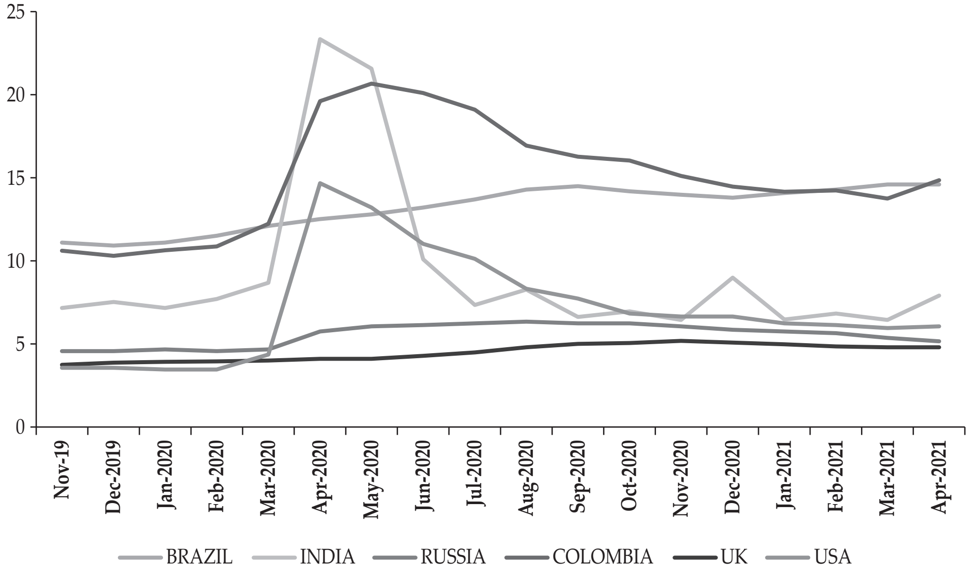
Variables	Symbols	Measurement	Data Sources
Panel A: Dependent Variables			
Unemployment Rate	*UR*	Monthly Proportion of working age population unemployed	OECD (2021)
Economic Policy Uncertainty	*EPU*	Economic Policy Uncertainty	Baker (2020)
Panel B: Independent Variables			
Inflation Rate	*INF*	Monthly rate of inflation (% GDP)	OECD (2021)
Long-term interest rate	*IR*	Rate of inflation (monthly average)	OECD (2021)
Currency exchange-rate	ER	Monthly rate of exchange	OECD (2021)
Business Confidence Index	*BCI*	Measure of manufacturing business environment	OECD (2021)
Consumer Confidence Index	*CCI*	Measure of demand side of the economy	OECD (2021)
Government-Stringency Index Consumption (Ktoe)	*GSI*	Strictness of lockdown policy	JHU data (2021)
Government Vaccination	*VAC*	Number of persons with at least 1-dose of vaccine (per 100)	JHU data (2021)

This study covers 16 countries with the largest number of COVID-19 cases as of April 2021.These include both developed countries like USA, France, Turkey, Italy, UK, Spain, Germany, South Africa and Netherlands and developing countries like

India, Brazil, Russia, Colombia, Poland, Mexico and Indonesia. It is evident that these countries are experiencing a 2nd wave of the virus and are also experiencing high rates of unemployment as is shown in Figure-2.

Figure 2.
Changes in Monthly Unemployment Rates in COVID-affected Countries

This figure shows the trends of unemployment rates from Nov ’19 to May ’21 for the countries which had the highest number of cumulative COVID cases during this time period. Source: John Hopkins University database (2021)



In Figure-2, we find that unemployment reached its peak between March’20 and August’20 for all the countries. For Brazil, unemployment shows an upward trend over the entire period. India, USA and Colombia experienced spikes in unemployment rate around March, but eventually returned to pre-pandemic levels around January 2021. In Russia, the rise in unemployment is weaker than that in the other countries. In the UK, however, the downward biased figures may be the result of Job Retention Schemes, the real figures may be higher once such schemes are withdrawn. Both India and Colombia show a rising trend in unemployment as of April 2021 due to pre-dominance of informal sectors in their economies. Descriptive statistics for all the studied countries and variables used in the analysis are presented in Table-2.

Table 2.
Descriptive Statistics

The Table shows the mean, standard-deviation, minima and maxima for each of the variables used in the analysis. Each of the variables has 288 total observations. The descriptive statistics give us an idea about the distribution of the variables across the observations.

Variables	Mean	Std. Deviation	Min.	Max.	Obs.
UN	25.33	10.09	2.00	54.25	288
EPU	10.45	1.23	4.63	20.45	288
INF	59.88	6.84	40.9	79.00	288
IR	20.37	2.16	18.27	33.58	288
ER	27.48	4.20	20.18	28.80	288
BCI	12.84	1.08	12.16	14.26	288
CCI	39.63	0.78	30.13	32.53	288
GSI	68.26	4.23	65.66	70.40	288
VAC	3.170	13.64	-8.59	41.81	288

In Table-2, the mean for key variables, *UR, EPU, GSI* and *VAC* are 25.33, 10.45, 68.26 and 3.17, respectively. It is observed that unemployment rate has a higher standard deviation as compared to other variables. This suggests that the distribution of the incidence on unemployment is highly disparate among the COVID-affected countries. The same is also suggested by the min-max values for *UR*. The rate of vaccination, *VAC* also exhibits high standard deviation. This might be owing to disparities in vaccine distribution among the developed and the developing countries. *GSI* for most of our developing countries is close to the average; however there are some outliers, with high and very low *GSI* index respectively.

Table 3.
Correlation Matrix

The correlation matrix shows the pairwise correlation coefficients between the variables used in the analysis. The sign of the correlation coefficients gives us an idea about the direction and strength of the relationship between the variables used in the analysis. *indicates $p<0.05$, i.e., statistical significance at 5% level.

Variables	*UN*	*EPU*	*INF*	*IR*	*ER*	*BCI*	*CCI*	*GSI*	*VAC*
UN	1								
EPU	0.66*	1							
INF	-0.31*	0.47*	1						
IR	-0.23*	-0.12*	-0.29*	1					
ER	-0.40*	0.02	-0.18*	0.84*	1				
BCI	-0.46*	0.14*	-0.16*	0.80*	0.93*	1			
CCI	-0.01	-0.04	0.09*	0.08*	0.08*	0.07*	1		
GSI	0.30*	0.07*	0.31*	-0.25*	-0.13*	-0.19*	-0.05	1	
VAC	-0.29*	0.09*	0.22*	-0.07*	-0.01	-0.05	-0.01	0.29*	1

In Table-3, the correlation matrix shows that *EPU* and *GSI* are positively correlated with the unemployment rate, whereas the other variables are negatively correlated at 5% level of significance. *EPU* is significantly correlated with *UR* and economic indicators like *CCI* and *BCI*. *UR* is negatively correlated with both *VAC* and *INF*, but positively related to each of the other economic indicators. Such high correlation among the variables calls for further investigation using panel estimation techniques, to check the direction of causality among the correlated variables.

C. Methodology

The simultaneous Equations (1) through (4) are estimated using OLS and 2SLS estimation techniques taking the common exogenous variables as the instruments. For robustness check, this paper uses a panel structural VAR (SVAR) model with two main variables of interest for the data of 16 countries - unemployment rate and policy uncertainty. Simultaneous equations can be estimated using Instrumental Variables (IV) and Two Stage Least Squares (2SLS) to correct for the simultaneity bias or endogeneity bias. In the first stage, the endogenous variables are regressed on the exogenous variables and instruments from the other equation. In the second stage, the independent variables are replaced by the predicted variables from the first stage and the reduced form equations are estimated by OLS. The exogenous variables in each equation can serve as the instruments in the other equation. The simultaneous equation model to be estimated is given as follows:

$$UR_{it} = \propto_0 + \propto_1 . UR_{i(t-1)} + \propto_2 EPU_{it} + \propto_3 . GSI_{it} + \propto_4 . VAC_{it} + \propto_5 . INF_{it} + \propto_6 . ER_{it} + \propto_7 . IR_{it} + u_{1it} \quad (5)$$

$$EPU_{it} = \beta_0 + \beta_1 . UR_{it} + \beta_2 . UR_{i(t-1)} + \beta_2 . GSI_{it} + \beta_3 . VAC_{it} + \beta_4 . BCI_{it} + \beta_5 . CCI_{it} + u_{2it} \quad (6)$$

In equation (6), BCI_{it} and CCI_{it} are good instruments for EPU_{it} since BCI_{it} and CCI_{it} are not in the equation (5) and these variables are not related to UR_{it}. In equation (5), INF_{it}, ER_{it} and IR_{it} are good instruments for UR_{it} given that they are not included in equation (6) and are related to UR_{it}.

In the first stage of 2SLS, both the endogenous variables are regressed on all exogenous variables in the model, to get the predicted values as follows:

$$\widehat{UR_{it}} = \pi_0 + \pi_1 . GSI_{it} + \pi_2 . VAC_{it} + \pi_3 . INF_{it} + \pi_4 . ER_{it} + \pi_5 . IR_{it} + \pi_6 . BCI_{it} + \pi_5 . CCI_{it} \quad (7)$$

$$\widehat{EPU}_{it} = \delta_0 + \delta_1 . GSI_{it} + \delta_4 . VAC_{it} + \delta_5 . INF_{it} + \delta_6 . ER_{it} + \delta_7 . IR_{it} + \delta_4 . BCI_i + \delta_5 . CCI_{it} \quad (8)$$

In the second stage, the Equations (5) and (6) are estimated by replacing the predicted variables from the first stage Equations (7) and (8). These predicted values are replaced in place of the endogenous variables in Equations (5) and (6) to get Equations (9) and (10).

$$UR_{it} = \propto_0 + \propto_1 . UR_{i(t-1)} + \propto_2 \widehat{EPU}_{it} + \propto_3 . GSI_{it} + \propto_4 . VAC_{it} + \propto_5 . INF_{it} + \propto_6 . ER_{it} + \propto_7 . IR_{it} + u_{1it} \quad (9)$$

$$EPU_{it} = \beta_0 + \beta_1 . \widehat{UR_{it}} + \beta_2 . \widehat{UR_{i(t-1)}} + \beta_2 . GSI_{it} + \beta_3 . VAC_{it} + \beta_4 . BCI_{it} + \beta_5 . CCI_{it} + u_{2it} \quad (10)$$

Equations (9) and (10) give the 2SLS estimates of the endogenous variables UR_{it} and EPU_{it} in the model. These estimates are unbiased and consistent, unlike the OLS estimates.

For robustness check, we also use a panel SVAR model with variables *EPU* and *UR*. Reduced form VAR models do not have a direct economic interpretation, while structural VAR models rely on economic theory to sort out the contemporaneous link in the model, also identifying some assumptions of the model. These models are used for government policy analysis. In SVAR models we can impose ad-hoc structures that prevent us from reaching the wrong conclusions. One such assumption for our model is that in the long run, the permanent changes in the unemployment rate do not have any long-run effect on policy uncertainty, we will decompose unemployment and policy uncertainty movements into components produced by uncertainty and unemployment shocks. We intend to explain deviations from the natural rate of unemployment under policy uncertainty. Natural rate of unemployment is the level of unemployment that exists in the absence of fluctuations in the cyclical unemployment. Policy uncertainty shocks can cause permanent effects in the unemployment rate and the economy might settle for a higher equilibrium natural rate of unemployment in the long run, on the other hand, shocks in the unemployment rate can only affect policy uncertainty in the short run. At first, unit root tests are reported to determine the order of stationarity of the variables. For structural VAR all the variables should be at least I (1) because with stationary or I (0) variables, the long run impacts of shocks to the level of the series will be always be zero. However, while estimating the model, the variables must be in stationary or difference form. Having tested the stationarity of the variables, we first estimate the VAR model using unemployment, policy uncertainty and vaccination in their difference forms. On imposing long run restrictions on the VAR model, assuming that unemployment rates do not affect policy uncertainty, and policy uncertainty or unemployment rate does not determine the vaccination drive, we obtain the estimation results for the SVAR model. The long run restrictions are given in equation (11) below.

$$\begin{bmatrix} \Delta UR_{it} \\ \Delta EPU_{it} \\ \Delta VAC_{it} \end{bmatrix} = \begin{bmatrix} B_{11} & B_{12} & B_{13} \\ B_{21} & B_{22} & B_{23} \\ B_{31} & B_{32} & B_{33} \end{bmatrix} \begin{bmatrix} \varepsilon_{ur} \\ \varepsilon_{epu} \\ \varepsilon_{vac} \end{bmatrix} \quad (11)$$

The first *(2 X 1)* vector is the matrix of our variables of interest, including unemployment rate, policy uncertainty and vaccination policy respectively. The last matrix is the vector of error terms uncorrelated with the shocks.

The B_{ij} coefficients determine the time-path of the effects of the shocks on the studied variables. The long run restrictions imply that the cumulative effect of unemployment on uncertainty is zero, similarly the effects of unemployment or uncertainty on vaccination is zero. Thus, we have $B_{12}=0$, $B_{13}=0$, $B_{23}=0$. After imposing these restrictions, we estimate the SVAR for our model.

V. EMPIRICAL RESULTS AND FINDINGS

The stationarity of the variables is, at first, tested using the Im-Pesaran-Shin (IPS) and Levin-Lin-Chu (LLC) unit root tests. These are first-generation unit root tests and assume cross-sectional independence among the variables. The LLC (2002) unit root test assumes the null hypothesis that under homogenous alternatives, the first-order serial correlation coefficients are identical for all the units of the observation. The IPS (2003) test is a group-mean panel unit root test; it is applicable only for balanced panel data. It is found that both unemployment rate and *EPU* are stationary at first difference.

Table 4.
Results of IPS and LLC Unit Root Tests

The Table shows the order of integration of the variables. It is observed that all the variables are stationary at the first order of integration. All the variables are integrated of order one. ***, ** and * are statistical significance at 1%, 5% and 10% levels, respectively.

Variables	IPS		LLC	
	I (0)	I (1)	I (0)	I (1)
UN	-1.886	-2.747*	-1.564	-4.281*
EPU	-1.359	-2.043***	-1.380	-3.387*
INF	-2.437	-2.643*	-1.711	-2.811*
IR	-1.360	-1.541*	-0.969	-2.128***
ER	-1.638	-2.417*	-1.731	-3.906*
BCI	-2.624*	-3.005*	-2.414*	-3.641*
CCI	-2.088***	-2.802*	-1.972	-3.876*
GSI	-1.698	-1.917*	-1.330	-3.037*
VAC	-1.527	-2.359*	-1.732	-3.138*

In Table-4 results of the first-generation unit-root test points out that all the variables are I (1). Given that these variables are non-stationary at level and stationery at the first difference, we consider lagged dependent variables and estimate the Equations (3) and (4) as specified in the previous section using OLS and 2SLS estimation techniques. The estimation results are given in Table-5 below.

Table 5.
Regression Estimation Results

The Table shows the OLS, Fixed effects Within Estimators (FE), Fixed Effects Between Estimators (FD) and 2SLS estimation results of the equations (1) to (4). The results show that *EPU* significantly increases the unemployment rate and vice versa. *VAC* significantly reduces the unemployment rate and policy uncertainty while *GSI* increases it. *BCI* and *CCI* significantly reduces policy uncertainty. ***, ** and * are statistical significance at 1%, 5% and 10 levels, respectively. *t*-statistics are reported in the parentheses.

Variables	Unemployment Rate (*UR*)				Policy-Uncertainty (*EPU*)			
	OLS (I)	FE (II)	FD (III)	2SLS (IV)	OLS (V)	FE (VI)	FD (VII)	2SLS (VIII)
UN					1.564	1.045	1.706	0.865**
					(0.164)	(0.176)	(0.154)	(1.001)
UN_{t-1}				8.547**				0.106**
				(1.107)				(1.013)
EPU	0.471***	2.215*	2.276*	5.432***				
	(1.658)	(2.534)	(2.356)	(1.045)				
INF	0.325***	0.453	1.324	-1.465				
	(1.832)	(0.523)	(0.634)	(-0.045)				
IR	0.546	0.764	0.753	0.785				
	(0.114)	(0.634)	(0.635)	(0.176)				
ER	0.012	0.014	0.012	0.156				
	(0.121)	(0.145)	(0.167)	(0.001)				
BCI					-2.167***	-2.234**	-2.287**	-3.159**
					(1.465)	(1.657)	(1.045)	(-1.053)
CCI					-1.156***	-1.164**	-1.178**	-2.645**
					(1.187)	(1.176)	(1.165)	(-1.052)
GSI	1.276***	-1.346	-1.389	-3.575***	0.354	0.634	-0.745	0.527
	(1.756)	(-1.367)	(-1.605)	(-1.034)	(-0.096)	(0.175)	(0.724)	(0.034)
VAC	-0.185**	-1.473	-1.453	-2.367***	-0.045***	-0.056**	-0.074**	-0.064**
	(-1.165)	(0.045)	(0.062)	(-1.068)	(-1.012)	(-1.056)	(-1.167)	(-1.073)
GSI X EPU	2.056*	0.078*	0.085*					
	(1.067)	(1.875)	(1.756)					
VAC X EPU	-0.076*	-0.056*	-0.045*					
	(1.056)	(1.078)	(1.067)					
GSI X UR					0.065	0.042	0.056	0.043
					(0.006)	(0.001)	(0.002)	(0.003)
VAC X UR					0.005	0.085	0.056	0.007
					(0.065)	(0.002)	(0.001)	(0.003)
Time-dummy		9.234**				8.765**		
		(2.546)				(2.354)		
Constant	1.158***	1.165**	1.174**	1.189**	1.156**	1.178**	1.108**	1.387*
	(1.236)	(1.124)	(1.105)	(1.487)	(1.786)	(1.768)	(1.167)	(1.438)
Partial R^2				0.7546				0.7865
F-statistic								
Sargan chi^2				0.1275				0.1345
p-values				(0.7214)				(0.7143)
Basmann chi^2				0.1267				0.1365
p-values				(0.7218)				(0.7634)
Countries	16	16	16	16	16	16	16	16

In Table 5, the OLS estimates of the structural equations (1) and (2) with *UR* and *EPU* as the respective dependent variables are presented under columns (I) and (V). For Equation (1) in Model-(I), the coefficients on *EPU* and *INF* are positive and hence increase the unemployment rate at 10% significance level. This supports the theory that under policy uncertainty, inflation and unemployment can both increase at the same time. Uncertainty renders monetary policies like interest rates and exchange rates ineffective in controlling the unemployment rates. Increase in the Government Stringency Index (*GSI*) increases the unemployment rate while increasing the rate of vaccination (*VAC*) reduces the unemployment rate; it is found that the moderating effects of *GSI* and *EPU* aggravates the *UR* while the moderation of *EPU* by *VAC* significantly reduces *UR* under such circumstances. The OLS estimates of Equation (2) in Model (V) show that Business confidence index (*BCI*), Consumer Confidence Index (*CCI*) and *VAC* significantly reduces policy uncertainty whereas the other coefficients are insignificant. The moderation effects of *GSI* and *VAC* respectively with *UR* do not affect the *EPU* significantly.

Considering country and time fixed effects we estimate the within- and between- estimators in Models (II) and (III) for the structural equation (1); under country fixed-effects we calculate the regression for within-estimators using the demeaned values of the variables in the regression in Model (II) and using time-lagged variables in Model-III; in Model-II, *EPU* is found to have a positive and significant impact on *UR*, the coefficient estimates are however found to be greater than that in Model (I) after the unobserved country fixed effects are accounted for. Similarly, in Model (III), the First Difference or between-estimations are reported considering the lag-differenced variables in the regression in order to take account for the changes in time; the coefficients of *EPU* are found to be greater than the OLS coefficients. By including time dummies the unobserved factors changing over time are accounted for. These effects are however fixed across cross-sections. The moderating effects of *GSI* and *VAC* respectively with *EPU* significantly increases and decreases the unemployment rate in all the models. All other coefficients that were previously significant under OLS are not significant anymore while the fixed effects are taken into account. The fixed effect estimates of equation (2) are reported under Models (VI) and (VII); like the OLS findings, in both these models *VAC*, *BCI* and *CCI* reduces *EPU*, but the absolute values of the coefficients show that the OLS estimates might have been an underestimation. The moderation effects in columns (VI) and (VII) are insignificant. The coefficients of the time-dummies are significant in both Models (II) and (VI).

We present the results of dynamic simultaneous Equations (3) and (4) discussed above in columns (IV) and (VIII) using 2SLS estimators. 2SLS corrects for the endogeneity or simultaneity bias. Since we might have endogenous variables, *UR* and *EPU* in the regression, instrumental variables are required to obtain unbiased and efficient estimates. Under Model (IV), *GSI* and *VAC* are the exogenous variables, *EPU* is the endogenous variables and *INF, IR* and *ER* are the control variables. Since *EPU* is the endogenous variable, *BCI* and *CCI* are taken as instrumental variables since they are correlated with *EPU*. The results reiterate our pooled OLS findings that *EPU* and *GSI* significantly increase unemployment and *VAC* significantly reduces it. The values of the coefficients are however greater as compared to those obtained under OLS and Fixed-Effects estimators.

This shows that without taking account for endogeneity, the coefficients tend to be underestimated. The coefficients of the lagged dependent variables are positive and significant under 2SLS. In equation (4) under Model (VIII), *UR* is the endogenous variable; *GSI* and *VAC* are the exogenous variables; *BCI* and *CCI* are the control variables and, *INF*, *IR* and *ER* are the instrumental variables. *UR* and its lagged value significantly increase *EPU* under 2SLS estimation while under the previous estimation techniques the impact of *UR* on *EPU* was insignificant. This is because under 2SLS, the endogeneity bias is corrected for using relevant instrumental variables. Consistent with the earlier results, *BCI*, *CCI* and *VAC* are also found to reduce *EPU* under 2SLS estimation.

However, if the endogenous variable is weakly correlated with the instrumental variable, then the instrumental variable estimation can be very imprecise and biased. For valid instrumental variables, they should be correlated with the endogenous variables but uncorrelated with the error terms. Weak instruments are detected by the partial R^2 values which show how much the instrumental variables explain the endogenous variable when we control for the exogenous variables. In Table 5, for models (IV) and (VIII), the partial R^2 values are 0.7546 and 0.7865 respectively, which indicate a high correlation. Besides the *F*-test statistics are also found to be large and highly significant for both models, indicating that the instrumental variables are not weakly correlated with the endogenous variables. In order to test for over-identifying restrictions, *p*-values for both Sargan and Basmann chi^2 are estimated, the probability values are found to be large indicating that the instruments are actually valid.

Next, we perform an independent sample *t*-test to compare the mean *UR* and *EPU* for the developed and developing countries assuming unequal variances. The results are given in Table 6.

Table 6.
Results of Independent Sample *t*-test

The Independent sample *t*-test is used to test the null hypothesis of difference in mean values between the developed and the developing countries. In this case, the mean-UR are significantly different while the mean-EPU are not significantly different.

	UR		***EPU***	
	Observations	**Mean**	**Observations**	**Mean**
Developed country	162	34.62	162	10.24
Developing country	126	28.24	126	10.82
t-test statistic	0.4042		0.8402	
p-value	0.6849		0.056	

In Table 6, we find that the mean *UR* differs significantly between the developed and the developing countries. The p-value for the *t*-statistic rejects the null hypothesis of equal mean. However, for *EPU*, we fail to reject the null hypothesis that mean-*EPU* for the developed and developing countries are equal. Therefore, the mean does not differ significantly between the developed and the developing indicating that uncertainty does not differ between the developed and the developing countries.

A. Robustness Check

We check the robustness by employing Structural VAR for the three main variables of interest, unemployment rate *UR*, policy uncertainty *EPU* and government vaccination policy *VAC*. Before conducting VAR, we require that there is no cointegration among the variables. The results of the panel cointegration tests are given in Table 7.

Table 7.
Panel Cointegration Test

The Table shows the results of the panel cointegration test. If all the variables are cointegrated, structural VAR cannot be performed. However, the cointegration test accepts the null hypothesis of no-cointegration. Since all the variables are not cointegrated, SVAR analysis can be conducted.

Types	*t*-statistic	*p*-value
Pedroni Residual Cointegration Test	4.02	0.01
Panel v-statistic	5.02	0.05
Panel rho-statistic	3.20	0.01
Panel PP-statistic(non-parametric)	1.12	0.05
Panel ADF-statistic(parametric)	0.15	0.02
Group rho-statistic	1.20	0.03
Group PP-statistic(non-parametric)	1.60	0.04
Group ADF-statistic(parametric)	2.03	0.01
Kao Residual Cointegration Test	1.02	0.02
Augmented Dickey Fuller	1.01	0.01

Since all the variables are not cointegrated we conduct SVAR analysis to determine the nature of endogeneity and causality.

Table 8.
Panel Structural Variance Decomposition

The Table shows the endogenous relationship among the variables *UR, VAC* and *EPU* with the help of Structural Variance Decomposition (SVAR) analysis. The endogenous relationship decreases with the increase in the percentage of vaccination.

Variable	*UR*			*VAC*			*EPU*		
Shocks	*RUR*	*RVAC*	*REPU*	*RUR*	*RVAC*	*REPU*	*RUR*	*RVAC*	*REPU*
1	95.36	2.10	3.67	96.54	2.30	2.34	94.30	2.67	3.45
2	92.31	3.45	2.87	96.10	2.24	2.25	94.24	2.75	3.30
3	95.67	2.30	3.23	96.45	2.34	1.67	94.34	2.24	3.24
4	98.75	1.24	1.36	96.30	1.25	2.87	94.25	2.20	3.34
5	93.24	2.34	5.31	96.24	1.67	2.23	94.67	2.54	3.25
6	93.20	1.25	7.67	96.34	1.87	2.36	94.87	2.21	3.67
7	93.54	1.67	5.75	96.25	1.23	2.31	94.23	2.56	3.87
8	93.21	1.87	5.24	96.67	1.36	2.67	94.20	2.25	3.67
9	93.56	1.23	5.20	96.87	1.31	2.75	94.54	2.67	3.75
10	93.10	1.36	5.54	96.67	1.67	2.67	94.21	2.87	3.24

In Table 8, based on the results from the countries'10th period, the impacts of the changes in *UR, VAC and EPU* on the determination of *UR* are 93.10%, 1.36%, and 5.54% respectively. In other words, *VAC* and *EPU* contribute 2.30% and 3.45% respectively to a 10% change in *UR*. The endogenous relationship among *EPU, VAC and GSI* is reduced considerably when the analysis is based on panel data in comparison with country specific studies. Another important result is that the impact of *EPU* changes on the determination of *UR* and vice-versa is bigger in developing countries compared to the effects of *VAC*. This implies that the endogenous relationship decreases with the increase in the percentage of vaccinations.

VI. CONCLUSION AND POLICY IMPLICATIONS

This study investigated the effects of economic policy uncertainty on unemployment rates during an unprecedented COVID-19 pandemic. Using a simultaneous equation model, we find that policy uncertainty significantly increases unemployment in the short run. The macroeconomic responses to uncertainty help to buffer the policy uncertainty during the crisis. Increase in vaccination as well as increase in business and consumer confidence indices reduces the adverse impact of uncertainty on the rate of unemployment. This study finds that the policy uncertainty and unemployment rates in the most affected countries depend on the government policies related to vaccination and lockdown. This is also confirmed by a structural VAR analysis which shows that policy uncertainty can also have long-term effects on the rate of unemployment.

As more and more people get vaccinated, economic policy uncertainty reduces and businesses as well as consumer confidence rises, leading to a rise in both consumption and production. This in turn reduces both the unemployment rate and economic policy uncertainty. Government must consider how its policies affect the information and incentives to employers and employees. How government policies signal the market through the economic health indicators like share prices, consumer prices and the business confidence also need to be considered. Economic policy uncertainty is in essence determined by these signals and will affect unemployment rate.

Similarly, the increasing rate of unemployment signals the market about the gravity of the recession and further increases uncertainty in the short-run. Further, in times of recovery from COVID-19, government policies that lead to increased vaccination and reduced stringency can directly increase the household's labor supply and firm's labor demand.

REFERENCES

Abel, A. B., & Eberly, J. C. (1996). Optimal Investment with Costly Reversibility. *The Review of Economic Studies*, 63, 581-593.

Ahmad, M., Khan, Y. A., Jiang, C., Kazmi, S. J. H., & Abbas, S. Z. (2021). The Impact of COVID-19 on Unemployment Rate: An Intelligent based Unemployment Rate Prediction in Selected Countries of Europe. *International Journal of Finance & Economics*, 1 - 16. https://doi.org/10.1002/ijfe.2434.

Ahmed, A., Granberg, M., Troster, V., & Uddin, G. S. (2020). Asymmetric Dynamics between Uncertainty and Unemployment Flows in the United States. *Studies in Nonlinear Dynamics & Econometrics*. https://doi.org/10.1515/snde-2019-0058

Al-Thaqeb, S. A., Algharabali, B. G., & Alabdulghafour, K. T. (2020). The Pandemic and Economic Policy Uncertainty. *International Journal of Finance & Economics*, 1 - 11. https://doi.org/10.1002/ijfe.2298.

Almeida, F., & Santos, J. D. (2020). The Effects of COVID-19 on Job Security and Unemployment in Portugal. *International Journal of Sociology and Social Policy*, 40, 995-1003.

Anderson, P. L. (2014). Persistent Unemployment and Policy Uncertainty: Numerical Evidence from a New Approach. *Business Economics*, 49, 2-20.

Andrews, D., Charlton, A., & Moore, A. (2021). COVID-19, Productivity and Reallocation: Timely Evidence from Three OECD Countries, *OECD Economics Department Working Papers*, No. 1676, OECD Publishing, Paris. https://doi.org/10.1787/d2c4b89c-en

Arellano, C., Bai, Y., & Kehoe, P. J. (2019). Financial Frictions and Fluctuations in Volatility. *Journal of Political Economy*, 127, 2049-2103.

Auray, S., & Eyquem, A. (2020). The Macroeconomic Effects of Lockdown Policies. *Journal of Public Economics*, 190, 104260.

Baker, S. R., Bloom, N., Davis, S. J., & Terry, S. J. (2020). *COVID-induced Economic Uncertainty* (No. w26983). National Bureau of Economic Research.

Banerjee, R.N., Kharroubi, E. & Lewrick, U. (2020). Bankruptcies, Unemployment and Reallocation from COVID-19, *BIS Bulletins 31*, Bank for International Settlements.

Barbieri Góes, M. C., & Gallo, E. (2021). Infection Is the Cycle: Unemployment, Output and Economic Policies in the COVID-19 Pandemic. *Review of Political Economy*, 33, 377-393.

Basu, S., & Bundick, B. (2017). Uncertainty Shocks in a Model of Effective Demand. *Econometrica*, 85, 937-958.

Bauer, A., & Weber, E. (2020). COVID-19: How Much Unemployment was Caused by the Shutdown in Germany? *Applied Economics Letters*, 28, 1053-1058. https://doi.org/10.1080/13504851.2020.1789544

Bell, D. N., & Blanchflower, D. G. (2020). US and UK Labour Markets before and during the COVID-19 Crash. *National Institute Economic Review*, 252, R52-R69.

Berg, J., Hilal, A., El, S., & Horne, R. (2021). World Employment and Social Outlook: Trends 2021. *International Labour Organization*.

Bernanke, B. S. (1983). Irreversibility, Uncertainty, and Cyclical Investment. *The Quarterly Journal of Economics*, 98, 85-106.

Bernstein, J., Plante, M., Richter, A. W., & Throckmorton, N. A. (2021). Countercyclical Fluctuations in Uncertainty are Endogenous. Dallas Working Paper No. 2109. Available at SSRN: https://ssrn.com/abstract=3888550

Bloom, N. (2009). The Impact of Uncertainty Shocks. *econometrica*, 77, 623-685.

Butterick, M., & Charlwood, A. (2021). HRM and the COVID-19 Pandemic: How Can We Stop Making a Bad Situation Worse? *Human Resource Management Journal*, 31, 847– 856. https://doi.org/10.1111/1748-8583.12344

Caballero, R. J., & Engel, E. M. (1999). Explaining Investment Dynamics in US Manufacturing: A Generalized (S, s) Approach. *Econometrica*, 67, 783-826.

Carter, D. P., & May, P. J. (2020) Making Sense of the U.S. COVID-19 Pandemic Response: A Policy Regime Perspective, Administrative Theory & Praxis, 42, 265-277.

Chang, C. P., Feng, G. F., & Zheng, M. (2021). Government Fighting Pandemic, Stock Market Return, and COVID-19 Virus Outbreak. *Emerging Markets Finance and Trade*, 1-18.

Couch, D. L., Robinson, P., & Komesaroff, P. A. (2020). COVID-19—Extending Surveillance and the Panopticon. *Journal of Bioethical Inquiry*, 17, 809-814.

Dash, D. P., Sethi, N., & Dash, A. K. (2021). Infectious Disease, Human Capital, and the BRICS Economy in the Time of COVID-19. *MethodsX*, 8, 101202.

Dong, E., Du, H., Gardner, L. (2020). An Interactive Web-based Dashboard to Track COVID-19 in Real Time. Lancet Infect Dis; Published Online Feb 19.
https://doi.org/10.1016/S1473-3099(20)30120-1

Dixit, A. K., & Pindyck, R. S. (1994). Investment under Uncertainty. *Princeton University Press*.

Drakopoulos, S. A. (2021). The Marginalization of Absolute and Relative Income Hypotheses of Consumption and the Role of Fiscal Policy. *The European Journal of the History of Economic Thought*, 28, 965-984.

Elgar, K., Lopert, L., Carey, E., & Wenzl, M. (2021). Coronavirus (COVID-19) Vaccines for Developing Countries: An Equal Shot at Recovery. *Tackling Coronavirus (COVID-19)-Browse OECD Contributions*, 1, 22.

Fana, M., Pérez, S. T., & Fernández-Macías, E. (2020). Employment Impact of Covid-19 Crisis: from Short Term Effects to Long Terms Prospects. *Journal of Industrial and Business Economics*, 47, 391-410.

Fasanya, I. O., Oyewole, O. J., & Agbatogun, T. (2021a). How Does Economic Policy Uncertainty Connect with the Volatility Spillovers in Asia-Pacific Markets? *Asian Economics Letters*, 2, 21437. https://doi.org/10.46557/001c.21437

Fasanya, I. O., Oyewole, O. J., & Oliyide, J. A. (2021b). Can Uncertainty due to Pandemic Predict Asia-Pacific Energy Stock Markets? *Asian Economics Letters*, 2, 21223. https://doi.org/10.46557/001c.21223

Freund, L. & Rendahl, P. (2020). Unexpected Effects: Uncertainty, Unemployment, and Inflation, *CEPR Discussion Papers* 14690.

Fu, Q., & Chang, C. P. (2021). How Do Pandemics Affect Government Expenditures? *Asian Economics Letters*, 2, 21147. https://doi.org/10.46557/001c.21147

Gezici, A., & Ozay, O. (2020). An Intersectional Analysis of COVID-19 Unemployment. *Journal of Economics, Race, and Policy*, 3, 270-281.

Goswami, B., Mandal, R., & Nath, H. K. (2021). Covid-19 Pandemic and Economic Performances of the States in India. *Economic Analysis and Policy*, 69, 461-479.

Gu, X., Ying, S., Zhang, W., and Tao, Y., (2020) How Do Firms Respond to COVID-19? First Evidence from Suzhou, China. *Emerging Markets Finance and Trade*. 56, 2181-2197. https://doi.org/10.1080/1540496X.2020.1789455

Guo, C., Bo, Y., Lin, C., Li, H. B., Zeng, Y., Zhang, Y., & Lao, X. Q. (2021). Meteorological Factors and COVID-19 Incidence in 190 Countries: An Observational Study. *Science of the Total Environment*, 757, 143783.

Haldar, A., & Sethi, N. (2020). The Effect of Country-level Factors and Government Intervention on the Incidence of COVID-19. *Asian Economics Letters*, 1, 17804. https://doi.org/10.46557/001c.17804

Haldar, A., & Sethi, N. (2021). The News Effect of COVID-19 on Global Financial Market Volatility. *Buletin Ekonomi Moneter dan Perbankan*, 24, 33-58.

Handwerker, E. W., Meyer, P. B., & Piacentini, J. (2020). Employment Recovery in the Wake of the COVID-19 Pandemic. *Monthly Lab. Rev.*, 143, 1.

Horvath, J., & Zhong, J. (2019). Unemployment Dynamics in Emerging Countries: Monetary Policy and External Shocks. *Economic Modelling*, 76, 31-49.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics*, 115, 53-74.

International Labour Organization. (2020). ILO Monitor: COVID-19 and the World of Work. *Updated Estimates and Analysis. Int Labour Organ*.

Iyke, B. N. (2020). Economic Policy Uncertainty in Times of COVID-19 Pandemic. *Asian Economics Letters*, 1, 17665. https://doi.org/10.46557/001c.17665

Kong, E., & Prinz, D. (2020). Disentangling Policy Effects Using Proxy Data: Which Shutdown Policies Affected Unemployment during the COVID-19 Pandemic? *Journal of Public Economics*, 189, 104257.

Kozicki, B., & Gornikiewicz, M. (2020). Unemployment Rate in Poland and USA during COVID-19 Pandemic: A Case Study. *European Research Studies*, 23, 187-201.

Lai, H., Khan, Y. A., Thaljaoui, A., Chammam, W., & Abbas, S. Z. (2021). COVID-19 Pandemic and Unemployment Rate: A Hybrid Unemployment Rate Prediction Approach for Developed and Developing Countries of Asia. *Soft Computing*, 1-16.

Larue, B. (2020). Labor Issues and COVID-19. *Canadian Journal of Agricultural Economics/Revue Canadienne D'agroeconomie*, 68, 231-237.

Leduc, S., & Liu, Z. (2012). Uncertainty, Unemployment, and Inflation. *FRBSF Economic Letter*, 28.

Lee, S., Schmidt-Klau, D., & Verick, S. (2020). The Labour Market Impacts of the COVID-19: a Global Perspective. *The Indian Journal of Labour Economics*, 63, 11-15.

Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit Root Tests in Panel Data: Asymptotic and Finite-sample Properties. *Journal of econometrics*, 108, 1-24.

Liu, C. (2021). COVID-19 and the Energy Stock Market: Evidence from China. *Energy Research Letters*, 2. https://doi.org/10.46557/001c.27024

Mamgain, R. P. (2021). Understanding Labour Market Disruptions and Job Losses Amidst COVID-19. *Journal of Social and Economic Development*, 1-19.

Mayhew, K., & Anand, P. (2020). COVID-19 and the UK Labour Market. *Oxford Review of Economic Policy*, 36(Supplement_1), S215-S224.

McKibbin, W., & Fernando, R. (2021). The Global Macroeconomic Impacts of COVID-19: Seven Scenarios. *Asian Economic Papers*, 20, 1-30.

Morikawa, M. (2016). How Uncertain are Economic Policies? New Evidence from a Firm Survey. *Economic Analysis and Policy*, 52, 114-122.

Narayan, P. K. (2021). COVID-19 Research Outcomes: An Agenda for Future Research. *Economic Analysis and Policy*. 71, 439-445.

Nwokolo, C. I., Ogbuagu, M. I. & Iwegbu, O. (2020). Impact of Coronavirus Pandemic on the Global Economy: Demand and Supply Shocks, *Ovidius University Annals, Economic Sciences Series*, 0, 50-60.

O'Reilly, P., Perret, S., & Van Dender, K. (2020). Tax and Fiscal Policy in Response to the Coronavirus Crisis: Strengthening Confidence and Resilience. *Intertax*, 736-742.

Organisation for Economic Co-operation and Development. (2020). *Job Retention Schemes during the COVID-19 Lockdown and Beyond*. OECD Publishing.

Ozili, P. K. (2021). Economic Policy Uncertainty: Are There Regional and Country Correlations? *International Review of Applied Economics*, 1-15.

Padhan, R., & Prabheesh, K. P., (2021) The Economics of COVID-19 Pandemic: A Survey. *Economic Analysis and Policy*, 70, 220-237.

Park, C. Y., & Inocencio, A. M. (2020). *COVID-19, Technology, and Polarizing Jobs* (No. 147). Asian Development Bank.

Periola-Fatunsin, O., Oliyide, J. A., & Fasanya, I. O. (2021). Uncertainty Due to Pandemic and the Volatility Connectedness among Asian REITs Market. *Asian Economics Letters*, 2, 22323. https://doi.org/10.46557/001c.22323

Phan, D. H. B., Sharma, S. S., & Tran, V. T. (2018). Can Economic Policy Uncertainty Predict Stock Returns? Global Evidence. *Journal of International Financial Markets, Institutions and Money*, 55, 134-150.

Phan, D. H. B., and Narayan, P. K., (2020) Country Responses and the Reaction of the Stock Market to COVID-19—A Preliminary Exposition, *Emerging Markets Finance and Trade*; 56, 2138-2150; https://doi.org/10.1080/1540496X.2020.1784719

Ranchhod, V., & Daniels, R. C. (2021). Labour Market Dynamics in South Africa at the Onset of the COVID-19 Pandemic. *South African Journal of Economics*, 89, 44-62.

Remes, J., Manyika, J., & Smit, S. (2021). The Consumer Demand Recovery and Lasting Effects of COVID-19. *McKinsey Global Institute*.

Shen, H., Fu, M., Pan, H., Yu, Z., and Chen, Y., (2020) The Impact of the COVID-19 Pandemic on Firm Performance. *Emerging Markets Finance and Trade*. 56, 2213-2230. https://doi.org/10.1080/1540496X.2020.1785863

Su, C. W., Dai, K., Ullah, S., & Andlib, Z. (2021). COVID-19 Pandemic and Unemployment Dynamics in European Economies. *Economic Research-Ekonomska Istraživanja*, 1-13.

Yang, H., & Deng, P. (2021). The Impact of COVID-19 and Government Intervention on Stock Markets of OECD Countries. *Asian Economics Letters*, 1. https://doi.org/10.46557/001c.18646

Yu, Z., Xiao, Y., & Li, Y. (2020). The Response of the Labour Force Participation Rate to an Epidemic: Evidence from a Cross-country Analysis. *Emerging Markets Finance and Trade*, 56, 2390-2407.