COVID-19: THE EFFECT OF COUNTRY SPECIFIC CHARACTERISTICS ON ITS ECONOMIC PERFORMANCE DURING THE PANDEMIC

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This paper uses data from global sources, such as IMF, OECD, IBRD, World Bank to explore the influence of countries' characteristics on their economic performance in 2020, during the COVID-19 pandemic. We principally find that high Covid mortality rates and strong dependency on tourism & travel have large and significant negative impacts on countries' economic growth in 2020 . On the other hand, control of corruption and high percentages of rural population appear to have positive causal effects on countries' economic performance. Female leaders seem to be significantly successful in decreasing the death rates, however their impact on economic performances is ambiguous. The variables that explain countries' performance the most, depend on the time horizon that we consider as a benchmark. In an attempt to eliminate endogeneity, the paper uses the stringency index as an alternative independent variable and uses Covid mortality as a plausible instrumental variable (IV) for the stringency index.

Introduction

In 2020, the media pointed out countries and their leaders, in order to assess the effectiveness of measures taken by the governments to fight the pandemic. Nonetheless, it is still ambiguous whether countries were only affected by actions taken by governments or if countries initially possessed characteristics that affected the economic severity of Covid. Those characteristics, for example, could be the level of corruption, rural population or foreign direct investment.

Our paper deals with economic performances and inherent characteristics of countries all around the world during the Covid-19 pandemic. This topic is complex to approach because not all countries were affected to the same extent. The precise questions we would like to answer are the

following: Which country specific characteristics relatively improved or worsened the economic outcome caused by the pandemic among all the countries ? Which structural characteristics bring a better management of this crisis ?

The objective of this paper is to bring some evidence-based explanations to this hot topic. To achieve that, we analyzed more than 25 variables which were mostly related to the structural characteristics of governments. To this end, we base our work on ordinary least squares (OLS) regressions. In order to tackle the potential problem of endogeneity associated with the stringency index, we instrument this variable using the number of Covid related deaths.

Model and Estimators

The first thing that comes to mind in linear regressions is y-variable. It is pivotal to define correctly the y-variable because this is the indicator that will define what is the "economic impact of coronavirus" for a given country. After the consideration of different possible variables, we have reached the conclusion that variables related with the gross domestic product (GDP) would best describe the economic impact of coronavirus. We have considered many other variables like unemployment, debt, budget deficit, poverty, real income, inflation, currency depreciation and different production indices. However, some of these variables were not clear indicators of the economic health of a country (e.g. budget deficit can increase in order to inject stimulus in the economy in order to cushion the economic blow of Covid-19) or cannot be measured today. Consequently, we chose GDP as the best indicator to reflect the economic impact of Covid-19. We selected two main forms of this y-variable, with two different time horizons. The first dependent variable that we constructed is the difference between the IMF's projected GDP growth in 2020 ("Covid year") and the average growth in the two previous years, 2018 and 2019 which we consider as "normal" years in comparison to 2020. By "normal" years we imply the years without the effect of the pandemic on economies. The short horizon is described by the following equation:

(0.1) $$growth\hat{G}DP_{2020,i} - mean(\ growthGDP_{2018/2019,i}\ ) = \alpha_1 + X'_i b_1 + \varepsilon_{1,i}$$

where $growth\hat{G}DP_{2020,i}$ is the projected GDP growth of countries in 2020, and $mean(\ growthGDP_{2018/2019,i}\ )$ is the mean of the GDP growth in 2018 and 2019 for those countries.

Our second y-variable is the difference between the same forecast of GDP growth in 2020 and the long-term average of GDP growth between the years 2010 and 2019. This dependent variable is more robust as this GDP growth benchmark is smoothed over 10 years. This is the long horizon, that we describe by the following regression:

(0.2) $$growth\hat{G}DP_{2020,i} - mean(growthGDP_{2010/2019,i}\ ) = \alpha_2 + X'_i b_2 + \varepsilon_{2,i}$$

where $mean(growthGDP_{2010/2019,i}\ )$is the mean of yearly GDP growth from 2010 to 2019.

In order to determine relations between a dependent and some explanatory variables, we based our search on economic intuition and empirical trials. The best and most effective solution to assess the direct impact of the Covid effect on our model is to use the number of Covid-19 related deaths per 1 million population as an explanatory variable. In this paper, we use the numbers as of November 14th 2020.

(1) $$y_i = \alpha_3 + b_3\ deathCOV_i + \varepsilon_{3,i}$$

where y_i can be defined as in (0.1) and (0.2) and $deathCOV_i$ is the number of Covid-19 related deaths per 1 million population. This estimator has shown that it has more explanatory power than any other Covid-related variables, such as the positive test rate, the total number of cases or the death rate of the disease.

To explore whether countries' characteristics might have a causal impact on the economic performance in 2020, we try to explain and control for multiple variables. The variables that hold our attention are the ones that make economic sense and have a strong explanatory power. However, the efficiency of independent variables vary slightly according to the time horizon that we consider as a benchmark.

One obvious explanatory candidate would be the exposition to a more economically touched sector. One of the most negatively affected sectors by Covid-19 pandemic is Travel & Tourism. To evaluate the dependency of countries on this sector, we use the share of the Travel & Tourism business in the GDP.

The other independent variables that we retained for our analysis are the following: a female dummy that takes the value 1 if a woman is the head of a country and 0 otherwise; current account balance, continental dummies, share of rural population, control of corruption, foreign direct investment, corruption perception index, voice and accountability percentile rank and share of exportation of goods and services in the GDP. We separate these explanatory variables in two different models. The first contains the variables that have been shown to be more effective in explaining variations with a short horizon. The model is described with the following equation:

$$(2)\ y_i = \alpha_4 + b_4\, deathCOV_i + c_4 T\&T_i + d_4 FEM_i + e_4 CAB_i + f_4 AFR_i + g_4 CPI_i + h_4 VA_i + \varepsilon_{4,i}$$

where $deathCOV_i$ is defined as in (1), $T\&T_i$ is the share of travel and tourism in the GDP, FEM_i is the dummy variable for female leader, CAB_i is the current account balance as a percentage of GDP, AFR_i is a dummy that takes 1 if the country is located in Africa, CPI_i is the corruption perception index score, and VA_i is the voice and accountability percentile rank[1].

The second model is constructed around x-variables that have more explanatory power in a long term horizon. The model is defined as following:

(3) $$y_i = \alpha_5 + b_5 deathCOV_i + c_5 T\&T_i + d_5 RUR_i + e_5 CC_i + f_5 FDI_i + \varepsilon_{5,i}$$

where $deathCOV_i$ and $T\&T_i$ are defined as in (2), RUR_i is the percentage of the population living in a rural area, CC_i is the control of corruption estimate, and FDI_i is the foreign direct investment net inflow as a percentage of GDP.

A valid OLS model requires full rank assumption which is the case with equations (2) and (3). However, we still have to control for multicollinearity in those regressions. Indeed, there is the possibility that the corruption variables and the number of Covid-related deaths are highly correlated. The intuition is that corrupt countries are more inclined to lie when reporting the number of deaths,

[1] This variable takes into account several aspects of the inhabitants' perception of their country. Countries are ranked on a scale from 0 to 100 (100 being the best score).This variable includes citizens' participation in the election of their governments, freedom of expression, freedom of association and free media

with the aim of giving a better picture of their epidemiological situation. Thus, we test for multicollinearity by checking the variance inflation factors (VIFs). The mean of the VIFs for model (2) is 1.82, with a VIF of 3.15 for the corruption variable. The mean of the VIFs for model (3) is 1.29, with a VIF of 1.48 for the corruption variable. Both results are below the benchmark of 10 and therefore the corruption variables in our models do not show the problematic signs of multicollinearity.

In the previous models, we assumed that the Covid-related deaths have a causal effect on a country's economic performance. However, this can be the source of an omitted variable and endogeneity bias. Indeed, we can hypothesize that the Covid-related deaths affect y-variable only through its effect on another variable. Therefore, we consider a stringency index variable as a new independent variable in order to explain the economic performance during the pandemic. The intuition is that the Covid-related deaths affect the dependent variable, not by itself, but via the stringency measures taken by governments. We considered many candidates as a stringency variable, for example the number of days over a threshold, or the mean of a stringency index, but the clearest indicator was the stringency continental ranking[2] , which we decided to implement in our model. Moreover, we have to instrument the stringency variable, as it is not clear whether the higher stringency index of one country is caused because of higher Covid deaths (governments increase stringency measures) or only by the stringency alone in one country. We want to isolate the effect of stringency only. Consequently, we use Covid-related deaths to instrument whether a country uses more severe stringency measures. By doing this, we purge the effects of Covid deaths out of the stringency variable and assume that the number of Covid-related deaths only affects the deviation of GDP growth via the change in the stringency index. This assumption is justified because the main element that causes the economic activity to decline when there are a lot of Covid-related deaths is

[2] Countries with higher stringency have small value (ranked 1,2,3 …) and country with low/no stringency have high value (higher ranking)

the lockdown measures on businesses. To implement the IV estimator, we proceed with the 2SLS method. First, we use the following regression (first stage):

(A) $$STR_i = \alpha_6 + X'_i b_6 + c_6 deathCOV_i + \varepsilon_{6,i}$$

where STR_i is the continental ranking of the stringency index from the beginning of the pandemic until 14th of November, 2020 and $deathCOV_i$ is defined as in (1). To implement STR_i in our model, we construct the second-stage equation:

(B) $$y_i = \alpha_7 + X'_i b_7 + c_7 \hat{S}TR_i + \varepsilon_{7,i}$$

where y_i can be defined as in (0.1) and (0.2) and $\hat{S}TR_i$ is a predicted variable from (A).

Results

The Table presents results from the short and long horizon dependent variables. Columns (1), (2) and (3) correspond respectively to regressions (1), (2) and (3). Columns (4) and (5) are constructed by replacing our independent variable $deathCOV_i$ from equations (2) and (3) by our unbiased estimator $\hat{S}TR_i$.

It is obvious from the table below, some variables showed good explanatory power. The one that seems to have the strongest and most significant power is the variable of Covid-related deaths.

	Short Horizon			short with instrumental variable		Long horizon			long with instrumental variable	
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
ſcovid	-0.00542***	-0.00300**	-0.00589***			-0.00517***	-0.00315*	-0.00433***		
	(0.00136)	(0.00133)	(0.00114)			(0.00174)	(0.00161)	(0.00162)		
ısm of GDP		-0.189***	-0.244***	-0.185***	-0.191***		-0.189***	-0.267***	-0.158***	-0.185***
		(0.0273)	(0.0240)	(0.0448)	(0.0551)		(0.0331)	(0.0340)	(0.0574)	(0.0676)
ummy)		1.080		1.524*			1.535		1.989*	
		(0.786)		(0.878)			(0.951)		(1.126)	
ntability, 0-100)		-0.0433***		-0.0546***			-0.0237		-0.0310	
		(0.0163)		(0.0192)			(0.0197)		(0.0247)	
		2.403***		2.381***			2.001**		1.723	
		(0.780)		(0.921)			(0.943)		(1.181)	
alance (% of		0.0852**		0.0696			0.0833*		0.0782	
		(0.0405)		(0.0505)			(0.0490)		(0.0648)	
ption Index		0.0504**		0.0396			0.0399		0.00909	
		(0.0244)		(0.0355)			(0.0295)		(0.0456)	
tion			0.00836		0.00727			0.0526***		0.0604**
			(0.0139)		(0.0211)			(0.0197)		(0.0259)
ption			0.244		-0.455			1.083**		0.655
			(0.309)		(0.535)			(0.439)		(0.657)
estment, net of GDP)			0.0219		0.0510			0.0993***		0.124***
			(0.0247)		(0.0333)			(0.0350)		(0.0409)
gency Ranking				0.139*	0.280***				0.176*	0.209**
				(0.0761)	(0.0774)				(0.0975)	(0.0949)
	-7.261***	-6.165***	-4.737***	-8.081***	-11.15***	-7.720***	-7.145***	-7.103***	-9.081***	-12.65***
	(0.399)	(0.876)	(0.747)	(1.096)	(1.363)	(0.510)	(1.059)	(1.059)	(1.405)	(1.672)
	0.097	0.522	0.500	0.307	.	0.056	0.406	0.373	0.102	0.106
	0.090	0.488	0.481	0.244	.	0.050	0.364	0.350	0.020	0.064
	150	108	143	85	111	150	108	143	85	111

rs in parentheses
< 0.05, *** $p < 0.01$

We can see that in all of our models, this variable shows a significance level of at least 10%, and 1% for the majority of them. It suits perfectly what we would have expected from the intuition and economical sense: higher death rate for a given country leads to a deteriorated economic condition. After controlling for many variables, we can roughly say (for detailed numbers, see the table) that ceteris paribus, if a country has 100 more deaths/million, on average, it reduces its growth rate by more than 0.5%.[3]

Another very important variable in our model is the share of tourism and travel (T&T) in GDP. It clearly occurs to be one of the most significant variables of our model. In all of our regressions, this variable is significant at a 1% level. From the table we can deduct that a country with 5% more of share of T&T in its GDP compared to another, on average, will suffer 1% more negative deviation in GDP than the other. For this variable also, the results follow the intuition: more economic dependency on the T & T sector leads to the drastic economic downturn during Covid -19 pandemic.

Without a surprise, we can conclude from the positive coefficients for the stringency ranks, that an increase in this index, on average, leads to a positive deviation in GDP. When there is tight stringency in a country this variable takes the positive value close to 0, whereas in absence of stringency this variable takes a value near or equal to 1. This result could be clearly justified with economic intuition that tighter the stringency on community and businesses, the more severe economic slowdown would a country experience during Covid-19 pandemic.

After controlling for many variables, it appears that African countries have been less affected economically by the pandemic than the other countries. The effect appears pretty big: the fact of being an African country increases on average the deviation of GDP by more than 2%[4] compared to other countries, depending on which regression we use. Although there is no clear justification for this result,

[3] to get an order of magnitude: until November 14th, Switzerland had 341 deaths/m; USA 738 and Japan 14

[4] 2.403 significative at 1% for short horizon regression (2)

it could be the fact that African countries rely on average more on non-oil commodities or maybe is it because they are less dependent on private consumption.

One of the interesting results appears with the variable of voice and accountability. It seems that a country with a high percentile on this ranking (associated with more democracy - see footnotes p.5) experiences a slowdown in its economic performance. This variable is strongly significant and it can seem, at first glance, astonishing. The reason for this could be because less democratic countries have more leeway to implement rapidly the necessary measures without resisting opposition that hinders it. What is the principal concern of the citizens ? Social welfare or economic growth? Our data suggest that the people will prioritize social welfare to economic growth, and the countries where the people's opinion has more strength are the democratic ones. Thus, the negative effect of Voice and Accountability appears on the GDP growth during the pandemic.

We captured the effects of other variables which are slightly less significant (but still significant) and which give us some more interesting explanatory results. It appears that countries with a higher current account balance cope better economically than those with a low level. It fits our economic sense that countries with a smaller deficit have more fiscal room to smooth the severe economic effects of Covid. We also observed that countries with a high share of the rural population tend to get less stressed economically during the pandemic. Since the virus affects principally big agglomerations, being more isolated in rural areas can decrease the magnitude of Covid impact. This result stays significant even after controlling for Covid-related deaths. Besides, it appears from our two corruption variables that a lesser degree of corruption yields positive economic effects. Indeed, we could imagine that less corrupt countries are more efficient in the economic measures they take: economic aid given to the population is less subject to stealing or wasting thanks to better decisions. We have also been able to capture a significant effect from the level of FDI inflows in 2019 GDP. The intuition behind this significant positive effect is possibly that the systematic risk is more diversified in countries with more FDI inflows. Indeed, the risk will be shared among various investors and thus, it will have a positive

effect on the economic output of a country. Concerning the female leader variable, we captured a positive effect in the IV models, confirming the idea that countries with female leaders have better dealt with the crisis. Nonetheless, these results have to be taken carefully as the results are significant at a 10% level and as the R-Squared in our IV models are quite low.

Conclusion

We encountered some challenges in the elaboration of this analysis. Because we are still in 2020, obviously it is not possible to use realized GDP to determine the deviation. Instead, we had to rely on IMF's forecasts. We could have used realized quarterly statistics, but we encountered a lack of exhaustive free data. Most of the useful data was either not free or not available in the global sources. In our IV regression, we made the assumption that Covid-related deaths only affect the deviation in GDP via the change it provokes on the stringency index. This assumption could be open to debate although we consider it as a strong hypothesis. Besides, we could carry out a more detailed analysis, if we had a behavioral variable that measures the "fear" within a community. This variable would explain how people change their private consumption during the pandemic.

To put in a nutshell, the main driver of a worsened economic performance, as it was expected, was the number of Covid-related deaths. This is also the case for countries with harsh Covid-induced restrictions. Countries imperatively ought to control the epidemic in order to limit the economic downturn. The second main driver of poor economic performance is the reliance on Travel and Tourism. Unfortunately, this dependency cannot change in a short period of time. Fiscal space before the start of the pandemic and control of corruption helped significantly, while astonishingly, a higher score in the variable of voice and accountability tends to hinder the growth. Our analysis has shown that a poor economic performance during the pandemic does not depend only on the measures taken by governments but also significantly depends on specific characteristics of countries during the Covid pandemic.

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