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IS EDUCATION OR REAL GDP PER CAPITA HELPED COUNTRIES STAYING AT HOME DURING COVID-19 PANDEMIC: CROSS-SECTION EVIDENCE?

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Abstract. This paper is evaluating whether education or the standard of living in a country helped citizens to stay at home during COVID-19 pandemic. The study implemented a cross-sectional regression on Google mobility trend reports as of 29th March, 2020 which include the mobility trends in retail and recreation, grocery and pharmacy, park, transit station, workplace and residential areas along with real GDP per capita as a proxy for standard of living and Education Index to approximate the level of education. The cross-sectional regression included 123 countries as a sample for the study. The study found that education index, park mobility trends and workplace mobility trends were significant variables in explaining the changes in residential area. However, real GDP per capita was not significant. The study concluded that standard of living is not a significant variable in changing the percentage of people who stayed at home. Moreover, education index has a negative impact on staying at home. Meaning, for each one-point increase in education index, the percentage change for citizens staying at home decreases by 0.087. Although, our result indicates that individual's education has a negative effect, this result can be explained by the decline of political trust in demarcate government were education index is high.

Keywords: COVID-19; Coronavirus; Education; Real GDP Per Capita; Cross-Sectional Regression; Standard of Living

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Introduction

According to the world health organization (WHO) coronavirus disease (COVID-19) was reported from Wuhan, China, on 31st December 2019 for the first time. COVID-19 is one of the large family of other coronavirus that cause sickness ranging from mild common cold to more severe diseases. For example, two coronavirus that have identified in humans are the Middle East respiratory syndrome (MERS-COV) and severe acute respiratory syndrome (SARS-COV). As we are writing this paper, COVID-19 is spreading in more than 185 countries affecting more than two million people all over the world. Because of the fear of sharp increase of cases of COVID-19, many countries implemented number of procedures and policies to slowdown the spreading of the

virus. Past studies have shown that epidemic infection had a negative impact on the economics activity such as H1N1 (Rassy and Smith 2013).

Beyond the tragic effect of coronavirus on the human lives, the pandemic has a direct economic effect. Families are losing their loved ones at the same time the economic climate are now becoming unbearable. The working population works from home and most workplaces are shutting down laying off their employees. According to the Department of Labor (DOL) in the US, 26 million people are filling for unemployment benefits. The stocks market around the world is trembling and this health crisis is now a world-wide global crisis. The economic impacts on various countries varies, countries such as Germany are having most of their cases absorbed by testing and good governance. However, low income economies like Bangladesh who do not have the needful resource are globe's most vulnerable populations (DOL, 2020).

Essential government measures like shutting down factories in China or closing retail shops in Italy might indicate that a recession is anticipated. According to General Administration of Custom in China, manufacturing and service sector in February has recorded a drop of 80% on automobile sales, a fall in exports by 17.2% between January and February. China is a crucial producer of inputs that are imported by most countries. The decline in exports is because of the shutdown of the factories. Also, most retail shops around the world experienced a drop in demand due to the movement restrictions required to curb the spread of coronavirus (GACC, 2020).

The spread of COVID-19 into the United State, Europe and other countries has led to legislative measures. Japan and Europe are already facing a recession because of their high dependence on international trade and weak fourth quarter performance. The Organization for Economic Co-operation and Development (OECD) has drawn a prediction that the outbreak of COVID-19 will reduce global economic from 2.9% to 2.4% (OECD, 2020).

The level of education or human development is an important factor in united nation development program (UNDP) framework to assess the readiness of pandemic crisis like COVID-19 (see Figure 1). In Figure 1, Asian-pacific countries are divided into different clusters ranging from 1 to 5. Cluster 1 includes China, South Korea, Hong Kong and Singapore where they have high human capital. On the other hand, cluster 5 have mostly medium level of human development which includes countries like Fiji, Bhutan, Tonga, Micronesia, Vanuatu, Nepal, Solomon Islands and Afghanistan.

By looking to the recent OECD forecasts, most worldwide countries are interconnected extremely with China. Countries like Japan, Australia and South Korea will face adverse downward in GDP growth. The spread rate of the disease in the European countries and the United States has led to the adoption of restrictive responses. These restrictive responses will have adverse effects on economic activities risking a loss of billions of dollars. The United Nation (UN) has projected that lowest levels of about -5%-15% in foreign direct investment (FDI) are anticipated in multinational cooperation around the world. Low income countries in Africa like Uganda and Nigeria are not immune from the economic losses from this outbreak. A quarter of Uganda's imports come from China and Nigeria depends on particular supplies, such as groceries from China. Even South Africa faces to lose over \$28 million that is spent by Chinese tourists.

Figure 1. Asia-pacific countries spread and responses of COVID-19 taking in consideration the level of human development and the degree of value chains integration

	CLUSTER 1	CLUSTER 2	CLUSTER 3	CLUSTER 4	CLUSTER 5
	Very high to high human development, advanced manufacturing value chains	Mostly high or medium human development, integration into value chains	Wide range of income and development levels, reliance on natural resource exports	Medium to high human development, relatively less trade integration	Wide range of human development levels, LDCs and SIDS
Spread of the pandemic and responses	Pandemic's early onset, focus on rapid containment, extensive stimulus packages, signs of early recovery	The "second wave" of the pandemic, stimulus packages and containment measures	Different degrees of the spread of the pandemic and wide variety of responses	Late wave of the pandemic, extensive containment measures, massive public health risks	Relatively isolated and potentially less affected by the pandemic, but public health risks due to low capacities
Level of human development	Very high or high human development	Ranges from very high to medium human development	Wide range from very high to low human development	High and medium human development	Wide range of human development levels, but mostly medium level
Degree of global value chains integration and trade	Highly integrated in advanced manufacturing value chains	Integrated in various manufacturing value chains	Forward linkages through supply of natural resources	Lower degree of trade openness	Small open economies, high degree of imports

Source: United nation development program - The Social and Economic Impact of Covid-19 in the Asia-Pacific Region

Countries around the world learned their lesson to be prepared for the next outbreak. Avoiding economic and health damage of similar outbreak can start by building the process and procedure to deal with infectious disease crisis. Sands, El Turabi, Saynisch, and Dzau (2016) found that the ignorance of infectious disease crisis has not been taken seriously, although infectious diseases have been threatening the global security for a long time. Infectious disease danger and threat have been underestimated among human lives and livelihoods, which led us to be unprepared for any outbreak caused by those diseases. Additionally, the authors urge countries to be prepared for such an outbreak and state that unity between nations is very important to face an upcoming outbreak.

Morin, Kinzig, Levin, and Perrings (2018) differentiate between the duration of infectious diseases into two categories. The first category is a short-term illness where imposing social distancing can be socially optimal by increasing the life cost of the illness. However, in the second category where a disease is extremely infectious, it may not be optimal to encourage social distancing by dropping the cost of disease. Additionally, they concluded that society would prefer less time with a stronger epidemic than longer time with an epidemic of lower intensity. So, it is important to understand why societies prefer short-term pandemics rather than long-term epidemics and to evaluate if it is because of the level of education in the society or real GDP per capita that led to this finding.

Many factors affected the public's reaction to the COVID-19 pandemic, but the roles of education and real GDP per capita cannot be ignored. In this study, we want to examine if education or real GDP per capita played a role in different countries in staying at home during COVID-19 Pandemic. This study contributes the first COVID-19 paper that investigates which of the two variables, education or real GDP per capita, were significant in implementing lockdown and isolation.

Literature Review

In the following sections we will review previous studies in ineffectual diseases and their economic ramification. Studies covered different area of the impact of the ineffectual disease on countries economics. Our study is the first study that examine stay home orders and link it to real GDP per capita and the level of education in different countries during COVID-19 Pandemic.

The importance of education and real GDP per capita was discussed in many public health studies investigating different approaches. For example, according to Nakamura (2016) people with higher income and higher education were to follow healthy diets and follow recommendation by health officials. This study indicates the behaviour of individuals depends on two important factors which are education and income. Thus, including education and real GDP per capita may explain any government policy that's related to individual decision.

Similarly, Davino et. at. (2016) investigated people's reaction in environmental policies in developed and developing countries, precisely, when governments impose new regulation that effect people to change their habit for public health emerge. The authors mainly include two variables that might affect people's reaction, GDP per capita and education. They concluded that developed countries are more likely to follow new regulations and people have more knowledge of the importance of environmental issues than developing countries.

In addition, Elmawazini el. at (2017) investigated the health gap between developed (OCED) countries and developing (SSA) countries, and globalization can shrink this gap. The authors concluded that globalization shows no significant effect on the health gap between the OECD and SSA countries. However, GDP per capita growth has a significant impact of the health gap between SSA and OECD countries.

Additionally, Abdelhafiz (2020) investigate the knowledge and attitude of people in Egypt in dependence on real GDP per capita, education, rural cities, and age. They found that people with low income, less education, and elderly have less knowledge and attitude to any government policies regarding the COVID-19 pandemic.

Moreover, Fernandes (2020) investigated the economics effect caused by COVID-19 outbreak across countries and industries. Additionally, the study shed light on the global economic costs of COVID-19, and 30 different countries' GDP. The author found that the effect of the current pandemic was underestimated in comprising with SARS in 2003 and financial crisis 2008/2009. Moreover, the study found that it is hard to forecast when the lockdown or stay at home order will end. Also, there is no guideline to follow during the length of a lock down for those countries in the study.

There are other Studies that recently focused in the pandemic outbreak that help to understand the COVID-19 pandemic impacts the countries economically. For example, Suborna (2020) examine the behaviour of macroeconomics activities in case of pandemic. The study includes all economic activities such as supply, demand, investment, trade, inflation (price level), supply chain, exchange rates, financial stability, economic growth, and international cooperation. The author concludes that it is important for every country to reform their economic policy and implementing of lockdown to prevent any difficulties in the future.

Moreover, Zhang et al. (2020) investigated the movement of population and its impact on the spread of COVID-19 in China. They found that population movements have statistically significant impact to the disease spread. Travel ban was effective to slow down the spread of the virus. However, the authors found that it would be much helpful if travel ban enforced earlier to prohibit the spread of the disease.

Also, Li, et al. (2020) examine people precaution of containing the disease or keep their normal economic activities during COVID-19 in China. In order to test people perception, they used an online survey with

randomized controlled trials during the COVID-19. The authors found lower number of confirmed cases has a positive impact on individual’s expectation on GDP growth rate. While this cannot be hold on the level of economic recovery, because there is no correlation with their expectations on GDP growth. The authors explained that individual expectations are not updated when new information provided in a randomized controlled trial.

Research objective and methodology

The cross-sectional data is collected for 123 countries. A descriptive statistic of all variables is shown in Table 1. Most of the variables are taken from Google mobility data reports. These reports show the percentage change in visits and length of stay at distinctive areas compared to the beginning of 2020 (between January 3rd and February 6th, 2020 - baseline). This baseline between January 3rd and February 6th is compared to March 29th in which most courtiers are on lockdown or advised to the stay at home during the COVID-19 outbreak. The places are categorized into 6 which are retail and recreation, grocery and pharmacy, parks, transit stations, workplaces and residential. China and Iran are not included in the data since Google services are not offered there. The other two variables are real GDP per capita adjusted to inflation and education index for each country. The data for those two variables are taken from the world economic outlook report (2019) and United Nations human development report (2019).

Table 1. Descriptive statistic of all data

	Retail & Recreation	Grocery & Pharmacy	Parks	Transit Station	Workplaces	Residential	Real GDP per Capita	Education Index
Mean	-59%	-38%	-39%	-59%	-34%	16%	17831	0.6888
Standard Error	0.0203	0.0204	0.0252	0.0182	0.018065	0.006331	2005	0.01511135
Median	-64%	-36%	-41%	-61%	-36%	15%	7223	0.706
Mode	-45%	-25%	-59%	-68%	-52%	15%	#N/A	0.923
Standard Deviation	0.22558	0.22729	0.2796	0.2026	0.20035	0.07022	22238	0.16759
Sample Variance	0.05088	0.05166	0.0782	0.0410	0.04014	0.00493	494561084	0.02809
Kurtosis	-0.6177	0.05367	0.65923	0.03902	-0.72454	0.10773	3.29715	-0.54370
Skewness	0.51590	-0.13449	0.52826	0.74724	0.28714	0.12014	1.80936	-0.49103
Range	0.92	1.18	1.38	0.86	0.87	0.38	115121	0.699
Minimum	-94%	-94%	-90%	-92%	-73%	-3%	\$414,328	0.247
Maximum	-2%	24%	48%	-6%	14%	35%	\$115,536	0.946
Sum	-72.45	-46.69	-47.82	-72.59	-41.73	19.92	2193331	84.726
Count	123	123	123	123	123	123	123	123

Source: Compiled by the authors

Retail and recreation category include the percentage change in visits in the beginning of the year compared to March 29th, 2020 for places like museums, cafes, movie theatres, shopping centers, libraries, restaurants and theme parks. All countries endured reduction in visits in this classification. However, Italy had the largest contraction in retail and recreation visits compared to the baseline reaching -94% in reduction.

Grocery and pharmacy category include drug stores, grocery markets, farmers markets, food warehouses, specialty food shops and pharmacies. The mobility trends for these places are mixed but mostly negative for most countries. Only 6 countries out of 123 had zero or positive percentage change in visits to grocery and pharmacy compared to baseline which are Belarus, Benin, Trinidad and Tobago, Ghana, Mongolia and Zimbabwe.

Parks mobility trends surprisingly jumped positively to 48% in Finland and 43% in Sweden and 41% in Belarus compared to the baseline. More people are visiting parks while they should stayed at home in those countries. Moreover, some other countries had a mild percentage change increase by 10%, 5%, 4% and 4%, in Benin, Mongolia, Estonia and Tajikistan respectively. The remaining countries had reduction in the percentage of visits compared to the beginning of the year. Google's classification for parks includes public gardens, public beaches, plazas, national parks, plazas, marinas and dog parks.

Transit station category includes subways, buses, train station and public transport is included under transit station category. The percentage change in mobility trends in these places were negative ranging from -6% to -92%. While all other sectors have at least one country that reached a percentage change in reduction reaching -90%, the maximum negative percentage change in workplace was in Jordan reaching -73% compared to the baseline.

Most countries had a positive percentage change in residential category reaching the maximum of 35% in Bolivia. Only Belarus and Tajikistan had a percentage change decrease by -2 and -3 respectively (see Figure 2). This variable will show the percentage change of all residential places compared to the baseline.

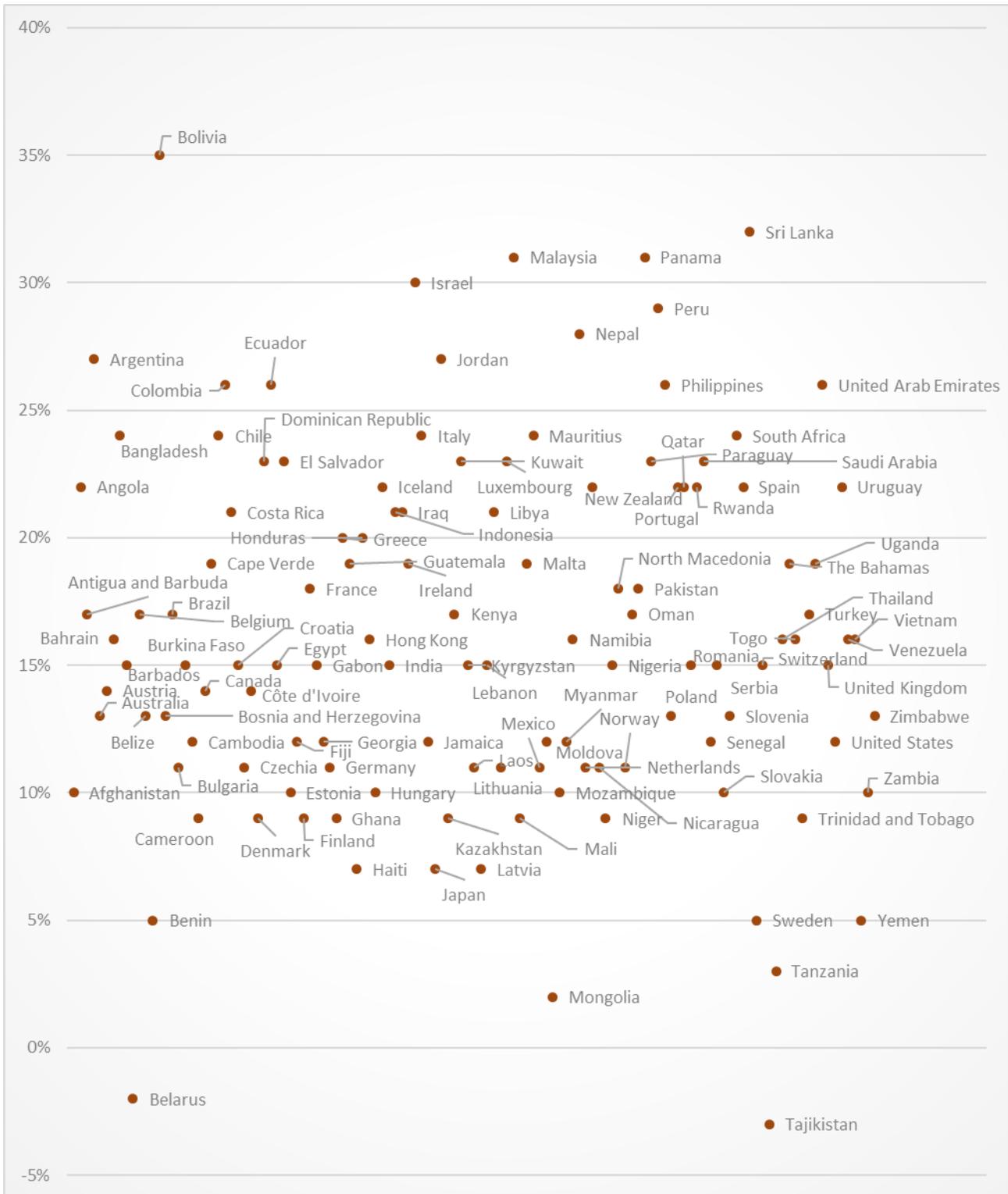
Real Gross domestic product per person adjusted to inflation (real GDP per capita) is a common variable used to measure the standard of living. The data is collected from the world economic outlook report (2019). It approximates each citizen benefit from overall economy of their country. Education index is collected from the Human Development Report (2018). The index is calculated by taking the average of mean years for adult schooling and expected years of children schooling.

The study is testing whether the standard of living or education were a significant contributor for people to stay at home during COVID-19 pandemic. The paper used real GDP per capita in 2018 as an estimator for the standard of living for the 123 countries. Also, the study used education index taken from the human development report (2019) as an approximation for education level for the 123 countries. To test for that, the study developed a cross sectional regression model for 123 countries as follows:

$$Y = \alpha + \beta_1 RR + \beta_2 GP + \beta_3 P + \beta_4 T + \beta_5 W + \beta_6 RGDP + \beta_7 E + \mu \quad (1)$$

Where Y represent the dependent variable which is the percentage change in residential areas compared to the baseline and, RR is the percentage change in retail and recreation mobility trend compared to the baseline, GP is the percentage change in grocery and pharmacy mobility trend compared to the baseline, P is the percentage change in parks mobility trend compared to the baseline, T is the percentage change in transit station mobility trend compared to the baseline, W is the percentage change in work place mobility trend compared to the baseline, RGDP the real GDP per capita in US dollar, E is the education index taken from the human development report (2018) and μ is an error term. RR, GP, P, T, W, RGDP and E are the independent variables.

Figure 2. Percentage change in residential areas compared to the baseline for 123 countries in March 29th, 2020



Source: Compiled by the authors

Results and discussion

After running the cross-sectional regression model using robust command in Stata application, the result is shown in Table 2. Table 2 shows that only parks, workplaces and education were statistically significant. Those variables can explain the percentage change in residential areas in different countries since COVID-19 pandemic. R² is 71.2%, which means that 71.2% of the variation in the residential area during COVID-19 pandemic is explained by the percentage changes in parks, workplaces and education mobility trends. The finding is interesting since it shows that living standard is not a significant factor in explaining the percentage change of people staying at home.

Another interesting finding is that education is a significant variable. However, the coefficient for education is negative which means for each one-point increase in education index, the percentage change for citizens staying at home decreases by 0.0872. Education is inversely affecting the percentage change in people staying at home during COVID-19 outbreak. The negative effect maybe because of the decline of political trust in demarcate government where education index is high. There is a significant evidence - especially in young people – showing that citizens display lower levels of political trust. Lower political trust can be the reason why citizens are ignoring stay at home orders (Chevalier, 2019). The OLS estimator equation is the following:

$$\hat{Y} = 0.1146 + -0.1019P - 0.1985112W - 0.0872E \tag{2}$$

Table 2. Cross-sectional regression model results

	Coefficients	Robust Standard Error	t-stat	P-value
Intercept	0.1145864	0.0201152	5.70	0.000***
RR	0.0692686	0.0593392	1.17	0.245
GP	-0.004733	0.0491194	-0.10	0.923
P	-0.1019377	0.0192068	-5.31	0.000***
T	-0.0654919	0.0414065	-1.58	0.116
W	-0.1985112	0.0442529	-4.49	0.000***
E	-0.0872348	0.0289625	-3.01	0.003***
RGDP	0.0000	0.00000	0.26	0.792
F(7.115)	44.24			
Prob>F	0.0000			
R ²	71.26%			
Root MSE	0.03877			
Observations	123			
Notes: *, **, and *** denotes statistical significance at 10%, 5% and 1% respectively.				

Source: Compiled by the authors

Moreover, workplaces and parks mobility trends have a negative sign which is expected since people who are in park and workplace will not be at home. The model shows that each one-point increase in workplace, the percentage change for citizens who are staying at home decreases by 0.1985. Also, for each one-point increase in parks, the percentage change for people who are staying at home decreases by 0.1019.

The model can help governments around the world to design more effective policy that target and limit going to workplaces and parks which ultimately increase the percentage of people staying at home. Not only those variables were significant in the regression model, they were also the highest correlated variables to the dependable variable (residential areas). Table 3 shows the correlation matrix of selected variables including parks

and workplaces relative to residential areas. The highest correction among selected variables relative to residential area is represented by workplace and parks variables which are 74% and 76% respectively. Taking in consideration those variable along with the level of education (education index of a country) since countries with relatively high education index would stay less at home compared with those countries with relatively lower level of education would have more effective government policy. For example, government should consider leaving grocery and pharmacy shops open since it will not have a significant impact for people to stay at home. However, legislatures should design policies that encourage working at home along with closure of parks. Having these steps in place would increase the percentage of people staying at home and eventually decrease the spread of COVID-19.

Table 3. Correlation matrix of selected variables

	Retail & Recreation	Grocery & Pharmacy	Parks	Transit station	Workplaces	Residential
Retail & Recreation	1.00					
Grocery & Pharmacy	0.89	1.00				
Parks	0.74	0.67	1.00			
Transit station	0.88	0.78	0.74	1.00		
Workplaces	0.89	0.78	0.70	0.86	1.00	
Residential	-0.68	-0.64	-0.76	-0.72	-0.74	1.00

Source: Compiled by the authors

Conclusions

During COVID-19 pandemic, policy makers across the world are trying to design the best policy to tackle and minimize the social-economic effect and to increase the percentage of people staying at home to limit the spread of the virus. Countries varies in the implementations depending on their evaluation of the situations and their economical status, that's motivate us to investigate which of the two variables education or real GDP per capita were significant in implementing lockdown and isolation. Many countries have different level of real GDP per capita and education. Using google mobility trends across 123 countries, the study showed that only the level of education can have a negative significant effect on the percentage of people staying at home. The inverse relation between staying at home and education might be related to the political trust in developed countries where less people trust their governments which is confirmed in other studies like (Chevalier, 2019). However, there are other factors that can increase the percentage of individuals staying at home. Limiting and closing parks would have a significant increase the percentage of people staying at home. Also, increasing the percentage of people working at home have a significant positive impact on the percentage of people stayed at home. Other sectors are tested in the study which includes retail, recreation, grocery, pharmacy and transit station but they were not a significant contributor in increasing the percentage of people staying at home.

This study can help policy makers around the world to tailor policies that target workplaces and parks to increase the percentage of people staying at home. Having more individuals works from home along with parks closure would significant increase the level of people staying at home. Also, countries with high level of education index should expect relatively less effective policy implementation compared to countries with lower education index. However, further research is needed as more data feeds in to construct a panel data when this pandemic is ended. Moreover, some countries such as China, Iran and Russia are not included since google services are not offered in them. In order to have a better understanding additional analysis is needed, understanding of economics impact of ineffectual diseases including COVID-19 is vital. Another area of research can be to check and see which business sectors are most affected -positively or negatively- from this pandemic.

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