Stay-at-Home Works to Fight Against COVID-19: International Evidence from Google Mobility Data

Hakan Yilmazkuday[1]

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Abstract

Daily Google mobility data covering 130 countries over the period between February 15th, 2020 and May 2nd, 2020 suggest that less mobility is associated with lower COVID-19 cases and deaths. This observation is formally tested by using a difference-in-difference design, where country-fixed effects, day-fixed effects as well as the country-specific timing of the 100th COVID-19 case are controlled for. The results suggest that 1% of a weekly increase in being at residential places leads into about 70 less weekly COVID-19 cases and about 7 less weekly COVID-19 deaths, whereas 1% of a weekly decrease in visits to transit stations leads into about 33 less weekly COVID-19 cases and about 4 less weekly COVID-19 deaths, on average across countries. Similarly, 1% of a weekly reduction in visits to retail & recreation results in about 25 less weekly COVID-19 cases and about 3 less weekly COVID-19 deaths, or 1% of a weekly reduction in visits to workplaces results in about 18 less weekly COVID-19 cases and about 2 less weekly COVID-19 deaths.

JEL Classification: I10; I18

Keywords: Coronavirus; Stay-at-Home; Google Mobility

[1] Department of Economics, Florida International University, Miami, FL 33199, USA. Phone: 305-348-2316. Fax: 305-348-1524. E-mail: hyilmazk@fiu.edu

1. Introduction

Coronavirus disease 2019 (COVID-19) has been declared as a pandemic on March 11th, 2020 by the World Health Organization. Due to the high number of COVID-19 cases and deaths, several countries reacted to this pandemic by issuing stay-at-home orders, because COVID-19 spreads mainly through person-to-person contact (e.g., see Chan et al., 2020). Nevertheless, as shown in Figure 1, countries have alternative changes in their mobility over time based on Google mobility data.[2] In particular, across countries, as of May 2nd, 2020, the reduction in visits to retail & recreation ranges between 21% and 95%, that of grocery & pharmacy ranges between 8% and 98%, that of parks ranges between 12% and 95%, that of transit stations ranges between 27% and 100%, and that of workplaces ranges between 14% and 92%, whereas the increase in being at residential places ranges between 8% and 55%, all with respect to the baseline determined by Google.[3]

This paper investigates the causal relation between country-specific changes in mobility and the corresponding COVID-19 cases/deaths. This is achieved by using daily data on COVID-19 cases and deaths as well as Google mobility data covering 130 countries around the world for the period between February 15th, 2020 and May 2nd, 2020. Descriptive statistics suggest that both COVID-19 cases and deaths are lower in countries with less mobility (to be discussed more in the Data section, below).

The formal investigation is achieved by using a difference-in-difference design to capture the causal relationship, where weekly changes in COVID-19 cases or deaths are regressed on weekly changes in mobility. After controlling

[2] These descriptive statistics are based on the data described in Section 2.

[3] The baseline is the median value, for the corresponding day of the week, during the 5-week period Jan 3–Feb 6, 2020.

for country-fixed effects, day-fixed effects, and country-specific timing of the 100th COVID-19 case, the results suggest that 1% of a weekly increase in being at residential places leads into about 70 less weekly COVID-19 cases and about 7 less weekly COVID-19 deaths, whereas 1% of a weekly decrease in visits to transit stations leads into about 33 less weekly COVID-19 cases and about 4 less weekly COVID-19 deaths, on average across countries. Similarly, 1% of a weekly reduction in visits to retail & recreation results in about 25 less weekly COVID-19 cases and about 3 less weekly COVID-19 deaths, or 1% of a weekly reduction in visits to workplaces results in about 18 less weekly COVID-19 cases and about 2 less weekly COVID-19 deaths. Finally, 1% of a weekly reduction in visits to grocery & pharmacy or parks results in about 1 less weekly COVID-19 death, although the effects on COVID-19 cases are statistically insignificant.

The empirical results of this paper are in line with other studies such as by Kraemer et al. (2020) who have shown that the control measures implemented in China have substantially mitigated the spread of COVID-19 or by Yilmazkuday (2020) who has shown that COVID-19 cases and deaths are lower in U.S. counties where a higher share of people have stayed in the same county or travelled less to other counties. However, different from these studies that focus on a single country, this paper achieves an international comparison using data from 130 countries around the world.

Other papers in the literature have also utilized Google mobility data to investigate alternative topics. Among these, Maloney and Taskin (2020) have shown that the reduction in mobility is mostly voluntary rather than due to following stay-at-home orders; Herren et al. (2020) have shown that the reduction in mobility across countries can be explained by country-specific outbreak trajectory, economic development, and the degree of democracy; Frey et al. (2020) have shown that collectivist and democratic countries have implemented relatively effective responses to Covid-19 in terms of reducing mobility; Bargain and Aminjonov (2020) have shown that regions with higher trust in policy makers decrease their mobility related to non-necessary activities significantly more than regions with lower trust in policy makers. However, none of these papers have investigated the causal relation between mobility measures and COVID-19 cases or deaths as in this paper. Moreover, due to the main question asked in this paper, the country-specific details investigated in the papers introduced so far are already controlled for by using country-fixed effects in this paper by construction.

The rest of the paper is organized as follows. The next section introduces the data set and descriptive statistics. Section 3 introduces the formal estimation methodology used. Section 4 depicts empirical results. Section 5 achieves several robustness analyses, while Section 6 concludes.

2. Data and Descriptive Statistics

Daily country-level data on COVID-19 cases and deaths have been obtained from the European Centre for Disease Prevention and Control.[4] Daily country-level Google mobility data have been obtained from Google.[5] The combination of the two data sets has determined the daily sample for 130 countries around the world covering the period between February 15th, 2020 and May 2nd, 2020.[6]

[4]The web page is https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide.
[5]The web page is https://www.google.com/covid19/mobility/.
[6]The list of countries is as follows: Afghanistan, Angola, Antigua and Barbuda, Argentina, Aruba, Australia, Austria, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Cambodia, Cameroon, Canada, Cape Verde, Chile, Colombia, Costa Rica, Côte d'Ivoire, Croatia, Czechia, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Fiji, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Guatemala, Guinea Bissau, Haiti, Honduras, Hungary, India, Indonesia, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan,

Google mobility data provide mobility information of people regarding their visits to retail & recreation, grocery & pharmacy, parks, transit stations, workplaces, and residential places. Google has constructed these data by comparing visits and lengths of stays at certain places compared to a baseline using information from Google Maps. Within this data set, retail & recreation data provide information on mobility trends for places like restaurants, cafes, shopping centers, theme parks, museums, libraries, and movie theaters. Grocery & pharmacy data provide information on mobility trends for places like grocery markets, food warehouses, farmers markets, specialty food shops, drug stores, and pharmacies. Parks data provide information on mobility trends for places like national parks, public beaches, marinas, dog parks, plazas, and public gardens. Transit stations data provide information on mobility trends for places like public transport hubs such as subway, bus, and train stations. Workplaces data provide information on mobility trends for places of work. Residential data provide information on mobility trends for places of residence that we consider as a stay-at-home measure.[7] Since location accuracy varies across countries (according to Google), we use these mobility measures after running their weekly changes on country-fixed effects and day-fixed effects, where we consider the corresponding residuals as the mobility measures below.

For motivational purposes (to provide visual evidence), the treatment group is constructed as countries that have experienced a certain degree of a

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Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Laos, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, Malaysia, Mali, Malta, Mauritius, Mexico, Moldova, Mongolia, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, North Macedonia, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Qatar, Romania, Rwanda, Saudi Arabia, Senegal, Serbia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Tajikistan, Thailand, Togo, Trinidad and Tobago, Turkey, Uganda, United Arab Emirates, United Kingdom, United Republic of Tanzania, United States of America, Uruguay, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

[7]More details can be found at https://www.google.com/covid19/mobility/.

decrease in mobility of people measured by Google mobility data, whereas the control group is constructed as the other countries. We proceed as follows: First, for each country, we calculate the weekly changes in mobility of people. Second, for each country, we consider the maximum weekly reduction during the sample period. If the maximum weekly reduction is above 50% for retail & recreation, grocery & pharmacy, parks, transit stations, workplaces or the maximum weekly increase is above 25% for residential, we consider this country as a part of the treatment group; other countries are considered as the control group.[8]

We first investigate how the treatment and control groups differ from each other visually in Figure 2. As is evident, COVID-19 cases increase as people are more mobile, except for the case when mobility is measured by visits to parks. Similarly, COVID-19 deaths increase as people are more mobile, except for the case when mobility is measured by visits to parks or grocery & pharmacy. Therefore, higher COVID-19 cases and deaths are associated with higher mobility across countries according to Google mobility data.

3. Estimation Methodology

The visual evidence provided in the previous section does not control for the beginning of COVID-19 cases at the country level or any other country-specific or day-specific characteristics. Moreover, using the maximum weekly changes in Google mobility or discrete thresholds to distinguish between control and treatment groups may not capture the data characteristics and thus one can easily end up with identification problems. We address these concerns by using Google mobility as a continuous treatment in our formal investigation.

[8]The threshold values of 50% and 25% roughly correspond to the half of the maximum (across countries) changes in mobility as of May 2nd, 2020.

In particular, we achieve a formal investigation by using the following difference-in-difference specification, where changes in Google mobility are considered as a continuous treatment:

$$\Delta D_{c,t} = \beta_0 + \beta_1 \Delta M_{c,t} + \phi_c \times 1(100thCase_{c,t}) + \theta_c + \gamma_t + \varepsilon_{c,t} \qquad (1)$$

where $\Delta D_{c,t}$ represents the weekly change in cumulative daily COVID-19 cases or deaths in country c at day t, and $\Delta M_{c,t}$ represents the weekly change in mobility measures (on retail & recreation, grocery & pharmacy, parks, transit stations, workplaces or residential) in country c at day t. It is important to emphasize that this specification already considers the time delay (of a week) by construction that is necessary for the effects of mobility to show up on COVID-19 cases or deaths. An alternative specification based on using a time delay of another week in mobility variables is also considered during the robustness analyses, below.

In Equation (1), $1(100thCase_{c,t})$ takes a value of zero (one) for country c at day t before (after) it experiences the $100th$ COVID-19 case, and ϕ_c is the corresponding country-specific coefficient for country c. The inclusion of this variable ensures that country-specific factors (such as health policies conducted by governments) that affect COVID-19 cases or deaths after the $100th$ COVID-19 case are controlled for during the investigation. It is important to emphasize that the results (to be depicted below) are robust to the exclusion of this control variable as we show during the robustness analyses, below.

In Equation (1), country-fixed effects are represented by θ_c's. In particular, θ_c's represent country-specific dummy variables that take a value of 1 for country c and a value of zero for other countries. The inclusion of these fixed effects ensures that country-specific factors that are constant over time (e.g., the development level of the country or its health system in general) are controlled for during the investigation.

In Equation (1), day-fixed effects are represented by γ_t's. In particular, γ_t's represent day-specific dummy variables that take a value of 1 for day t and a value of zero for other days. The inclusion of these fixed effects ensures that day-specific factors that are common across countries (e.g., declaration of COVID-19 as a pandemic on March 11th, 2020 by the World Health Organization) are controlled for during the investigation. Finally, $\varepsilon_{c,t}$ represents residuals.

Using Equation (1), we consider the following question: How does weekly changes in mobility affect weekly changes in COVID-19 cases or deaths across countries, after controlling for the beginning of COVID-19 cases at the country level as well as country-specific or day-specific characteristics? This question is answered as the country-specific mobility changes $\Delta M_{c,t}$ correspond to a continuous treatment in the difference-in-difference design of Equation (1).

4. Estimation Results

The estimation results based on Equation (1) are given in Table 1. As is evident, 1% of a weekly increase in being at residential places results in 70 fewer weekly COVID-19 cases, on average across countries. Similarly, 1% of a weekly decrease in visits to retail & recreation results in 25 fewer weekly COVID-19 cases, 1% of a weekly decrease in visits to transit stations results in 33 fewer weekly COVID-19 cases, 1% of a weekly decrease in visits to workplaces results in 18 fewer weekly COVID-19 cases, whereas the effects of visits to grocery & pharmacy or parks are insignificant.

Regarding the effects on COVID-19 deaths, 1% of a weekly increase in being at residential places results in 7 fewer weekly COVID-19 deaths. Similarly, 1% of a weekly decrease in visits to retail & recreation results in 3 fewer weekly COVID-19 deaths, 1% of a weekly decrease in visits to transit stations results in 4 fewer weekly COVID-19 deaths, 1% of a weekly decrease in visits to workplaces results in 2 fewer weekly COVID-19 deaths, whereas 1% of a weekly decrease in visits to grocery & pharmacy or parks results in 1 fewer weekly COVID-19 death.

In terms of fighting against both COVID-19 cases and deaths, it is implied that people have benefited from being in residential places or moving less in general. Across alternative mobility measures, being in residential places has the highest impact on reducing COVID-19 deaths, followed by visiting transit stations less, visiting retail & recreation less, visiting workplaces less, visiting parks less and visiting grocery & pharmacy less.

5. Robustness Analyses

This section achieves three robustness analyses. These include testing the contribution of considering the $100th$ COVID-19 case in Equation (1) as well as replacing the mobility variables with their lagged values.

For robustness analysis #1, $\phi_c \times 1(100thCase_{c,t})$ in Equation (1) is excluded from the regressions as follows:

$$\Delta D_{c,t} = \beta_0 + \beta_1 \Delta M_{c,t} + \theta_c + \gamma_t + \varepsilon_{c,t} \tag{2}$$

In this case, the results in Table 1 are replaced with those in Table 2. As is evident, the empirical results are qualitatively the same in this robustness analysis, although they are slightly lower quantitatively for both COVID-19 cases and deaths. Therefore, the results in Table 1 are robust to the consideration of $\phi_c \times 1(100thCase_{c,t})$.

For robustness analysis #2, mobility measures in Equation (1) are replaced with their lagged values to consider the amount of time that is necessary for mobility measures to show their effects. In this case, Equation (1) is revised as follows:

$$\varDelta D_{c,t} = \beta_0 + \beta_1 \varDelta M_{c,t-7} + \phi_c \times 1(100thCase_{c,t}) + \theta_c + \gamma_t + \varepsilon_{c,t} \tag{3}$$

where the only change with respect to Equation (1) is the lagged mobility variable of $M_{c,t-7}$ that represents the weekly change in mobility measures with a lag of seven days. The corresponding results based on Equation (3) are given in Table 3. As is evident, the effects of mobility on COVID-19 cases disappear in this robustness analysis, whereas the effects on COVID-19 cases remain the same qualitatively with respect to Table 1. It is implied that the effects of mobility are observed on COVID-19 cases only within a week (according to Table 1), whereas the effects on COVID-19 deaths are robust to the consideration of the timing of mobility measures.

For robustness analysis #3, $\phi_c \times 1(100thCase_{c,t})$ in Equation (3) is excluded from the regressions as follows:

$$\varDelta D_{c,t} = \beta_0 + \beta_1 \varDelta M_{c,t-7} + \theta_c + \gamma_t + \varepsilon_{c,t} \tag{4}$$

In this case, the results in Table 1 are replaced with those in Table 4. As is evident, the results are similar to those in Table 3, suggesting that the effects of mobility are observed on COVID-19 cases only within a week, whereas the effects on COVID-19 deaths are robust to the consideration of the timing of mobility measures.

Overall, the robustness analyses suggest that the results in Table 1 are robust to the consideration of the $100th$ COVID-19 case in Equation (1) as well as replacing the mobility variables with their lagged values.

6. Conclusion

This paper has investigated the effects of mobility (measured by Google) on COVID-19 cases and deaths by using international daily data across 130 countries covering the period between February 15th, 2020 and May 2nd, 2020. After controlling for country-fixed effects, day-fixed effects, and country-specific timing of the 100th COVID-19 case in a difference-in-difference design, the results suggest that 1% of a weekly increase in being at residential places leads into about 70 less weekly COVID-19 cases and about 7 less weekly COVID-19 deaths, whereas 1% of a weekly decrease in visits to transit stations leads into about 33 less weekly COVID-19 cases and about 4 less weekly COVID-19 deaths, on average across countries.

Similarly, 1% of a weekly reduction in visits to retail & recreation results in about 25 less weekly COVID-19 cases and about 3 less weekly COVID-19 deaths, or 1% of a weekly reduction in visits to workplaces results in about 18 less weekly COVID-19 cases and about 2 less weekly COVID-19 deaths. Finally, 1% of a weekly reduction in visits to grocery & pharmacy or parks results in about 1 less weekly COVID-19 death, although the corresponding effects on COVID-19 cases are statistically insignificant. Across alternative mobility measures, being at residential places has the highest impact on reducing COVID-19 deaths, followed by visiting transit stations less, visiting retail & recreation less, visiting workplaces less, visiting parks less and visiting grocery & pharmacy less.

References

Bargain, O., & Aminjonov, U. (2020). Trust and Compliance to Public Health Policies in Times of COVID-19. IZA Discussion Paper No. 13205.

Chan, J. F. W., Yuan, S., Kok, K. H., To, K. K. W., Chu, H., Yang, J., ... & Tsoi, H. W. (2020). A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. The Lancet, 395(10223), 514-523.

Frey, C. B., Chen, C., & Presidente, G. (2020). Democracy, Culture, and Contagion: Political Regimes and Countries Responsiveness to Covid-19. Covid Economics, 18, 1-20.

Herren, M. C., Brownwright, T. K., Liu, E. Y., El Amiri, N., & Majumder, M. S. (2020). Democracy and Mobility: A Preliminary Analysis of Global Adherence to Non-Pharmaceutical Interventions for COVID-19. Available at SSRN: https://ssrn.com/abstract=3570206.

Kraemer, M. U., Yang, C. H., Gutierrez, B., Wu, C. H., Klein, B., Pigott, D. M., ... & Brownstein, J. S. (2020). The effect of human mobility and control measures on the COVID-19 epidemic in China. Science, 368(6490), 493-497.

Maloney, W. F., & Taskin, T. (2020). Determinants of Social Distancing and Economic Activity During COVID-19: A Global View. World Bank Policy Research Working Paper, (9242).

Yilmazkuday, H. (2020). COVID-19 Spread and Inter-County Travel: Daily Evidence from the US. Transportation Research Interdisciplinary Perspectives. Forthcoming.

Table 1 - Mobility Effects on COVID-19 Cases and Deaths

	Dependent Variable: Changes in COVID-19 Cases					
	(1)	(2)	(3)	(4)	(5)	(6)
Retail & Recreation	25.23***					
	(6.699)					
Grocery & Pharmacy		4.586				
		(5.434)				
Parks			9.263*			
			(4.363)			
Transit Stations				33.10***		
				(7.442)		
Workplaces					17.97**	
					(6.229)	
Residential						-70.33***
						(18.30)
Adjusted R-Squared	0.630	0.630	0.630	0.631	0.630	0.631
	Dependent Variable: Changes in COVID-19 Deaths					
	(1)	(2)	(3)	(4)	(5)	(6)
Retail & Recreation	2.961***					
	(0.571)					
Grocery & Pharmacy		0.780+				
		(0.464)				
Parks			1.106**			
			(0.372)			
Transit Stations				3.573***		
				(0.635)		
Workplaces					1.992***	
					(0.531)	
Residential						-7.090***
						(1.561)
Adjusted R-Squared	0.541	0.540	0.540	0.541	0.540	0.542
Sample Size	9176	9140	9112	9153	9209	8989
Country Fixed Effects	YES	YES	YES	YES	YES	YES
Day Fixed Effects	YES	YES	YES	YES	YES	YES
Country-Specific 100th Case	YES	YES	YES	YES	YES	YES

Notes: +, *, ** and *** represent significance at 10%, 5%, 1% and 0.1% levels, respectively. The corresponding confidence intervals can be obtained by using the standard errors that are given in parentheses.

Table 2 – Robustness Analysis #1

	Dependent Variable: Changes in COVID-19 Cases					
	(1)	(2)	(3)	(4)	(5)	(6)
Retail & Recreation	17.28*					
	(7.399)					
Grocery & Pharmacy		1.877				
		(6.061)				
Parks			7.292			
			(4.861)			
Transit Stations				24.07**		
				(8.205)		
Workplaces					10.78	
					(6.908)	
Residential						-47.98*
						(20.24)
Adjusted R-Squared	0.532	0.532	0.532	0.532	0.532	0.532
	Dependent Variable: Changes in COVID-19 Deaths					
	(1)	(2)	(3)	(4)	(5)	(6)
Retail & Recreation	2.381***					
	(0.608)					
Grocery & Pharmacy		0.580				
		(0.498)				
Parks			0.981*			
			(0.399)			
Transit Stations				2.871***		
				(0.674)		
Workplaces					1.386*	
					(0.568)	
Residential						-5.300**
						(1.663)
Adjusted R-Squared	0.461	0.460	0.461	0.461	0.460	0.461
Sample Size	9176	9140	9112	9153	9209	8989
Country Fixed Effects	YES	YES	YES	YES	YES	YES
Day Fixed Effects	YES	YES	YES	YES	YES	YES
Country-Specific 100th Case	NO	NO	NO	NO	NO	NO

Notes: +, *, ** and *** represent significance at 10%, 5%, 1% and 0.1% levels, respectively. The corresponding confidence intervals can be obtained by using the standard errors that are given in parentheses.

Table 3 – Robustness Analysis #2

	Dependent Variable: Changes in COVID-19 Cases					
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Retail & Recreation	5.050					
	(7.209)					
Lagged Grocery & Pharmacy		-6.332				
		(6.006)				
Lagged Parks			-0.872			
			(4.947)			
Lagged Transit Stations				14.05+		
				(8.023)		
Lagged Workplaces					6.905	
					(6.748)	
Lagged Residential						-25.13
						(19.90)
Adjusted R-Squared	0.630	0.630	0.630	0.630	0.629	0.630
	Dependent Variable: Changes in COVID-19 Deaths					
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Retail & Recreation	1.840**					
	(0.613)					
Lagged Grocery & Pharmacy		0.0751				
		(0.511)				
Lagged Parks			0.495			
			(0.421)			
Lagged Transit Stations				2.781***		
				(0.682)		
Lagged Workplaces					1.426*	
					(0.574)	
Lagged Residential						-4.873**
						(1.691)
Adjusted R-Squared	0.543	0.542	0.543	0.543	0.542	0.544
Sample Size	8280	8245	8212	8250	8301	8108
Country Fixed Effects	YES	YES	YES	YES	YES	YES
Day Fixed Effects	YES	YES	YES	YES	YES	YES
Country-Specific 100th Case	YES	YES	YES	YES	YES	YES

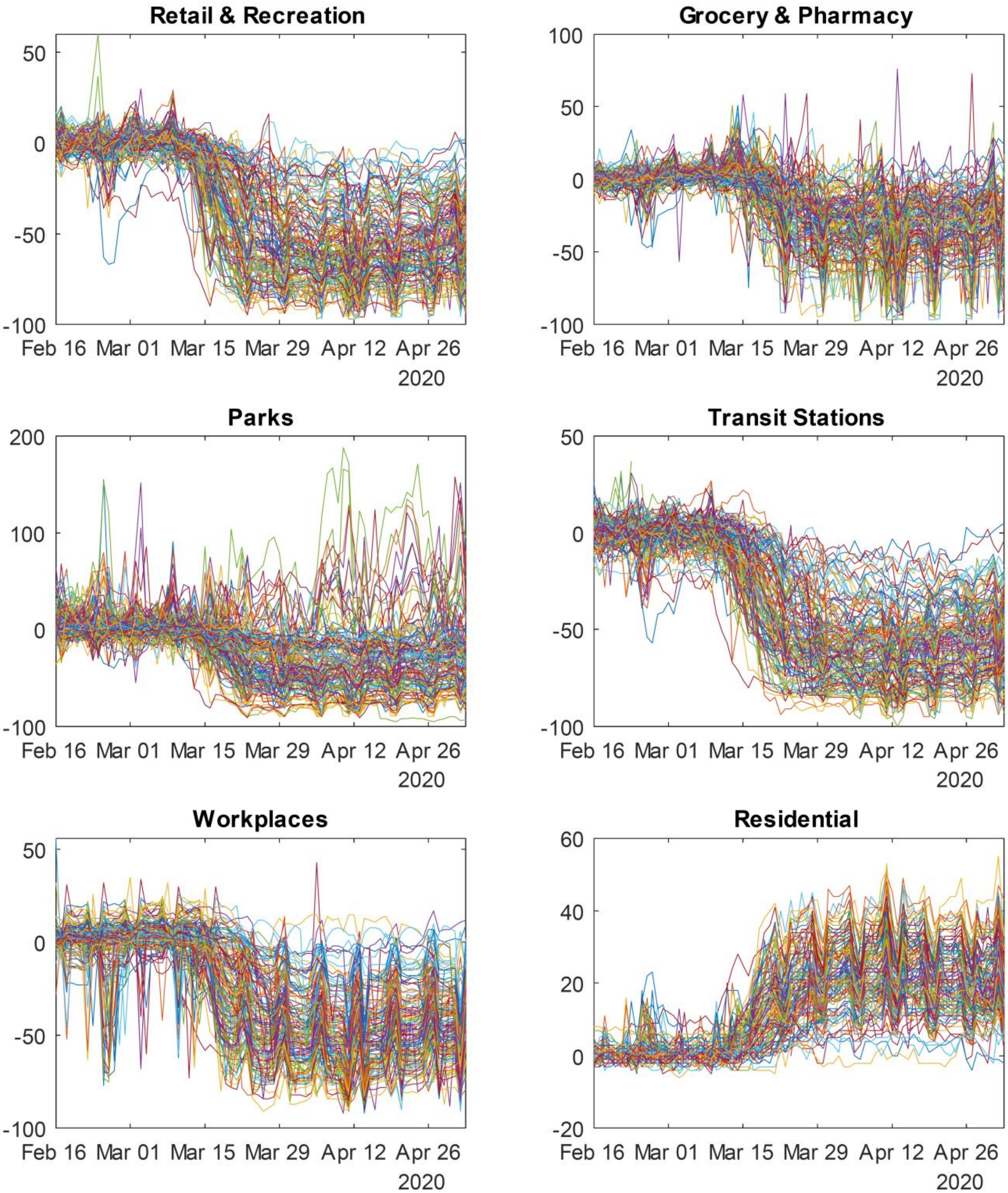
Notes: +, *, ** and *** represent significance at 10%, 5%, 1% and 0.1% levels, respectively. The corresponding confidence intervals can be obtained by using the standard errors that are given in parentheses.

Table 4 – Robustness Analysis #3

	Dependent Variable: Changes in COVID-19 Cases					
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Retail & Recreation	7.306					
	(7.493)					
Lagged Grocery & Pharmacy		-5.125				
		(6.295)				
Lagged Parks			-0.151			
			(5.158)			
Lagged Transit Stations				15.24+		
				(8.302)		
Lagged Workplaces					3.373	
					(7.031)	
Lagged Residential						-23.32
						(20.66)
Adjusted R-Squared	0.589	0.589	0.589	0.589	0.589	0.589
	Dependent Variable: Changes in COVID-19 Deaths					
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Retail & Recreation	2.197***					
	(0.627)					
Lagged Grocery & Pharmacy		0.262				
		(0.527)				
Lagged Parks			0.630			
			(0.432)			
Lagged Transit Stations				3.104***		
				(0.694)		
Lagged Workplaces					1.313*	
					(0.588)	
Lagged Residential						-5.228**
						(1.728)
Adjusted R-Squared	0.509	0.508	0.508	0.509	0.508	0.509
Sample Size	8280	8245	8212	8250	8301	8108
Country Fixed Effects	YES	YES	YES	YES	YES	YES
Day Fixed Effects	YES	YES	YES	YES	YES	YES
Country-Specific 100th Case	NO	NO	NO	NO	NO	NO

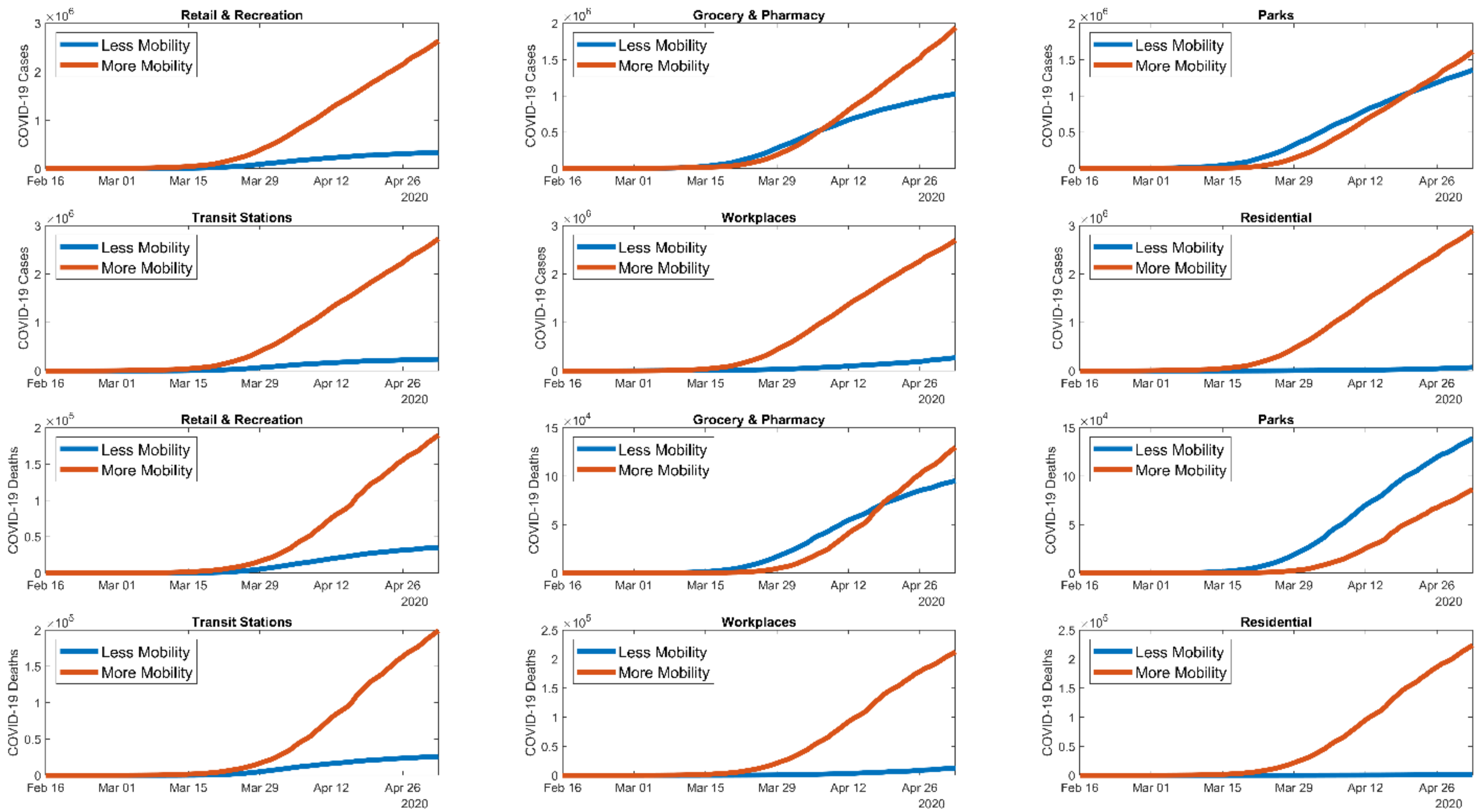
Notes: +, *, ** and *** represent significance at 10%, 5%, 1% and 0.1% levels, respectively. The corresponding confidence intervals can be obtained by using the standard errors that are given in parentheses.

Figure 1 - Google Mobility across Countries



Source: Google mobility data.

Figure 2 - Mobility versus COVID-19 Cases and Deaths



Notes: Less mobility is defined as more than 50% of a (maximum across days) reduction in visits to retail & recreation, grocery & pharmacy, parks, transit stations, workplaces or more than 25% of an increase in residential stays compared to Google baseline.