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Negative impact of democracy on GDP annual growth rate in 2001-2019 and 2020 and mortality rate due to COVID-19 in 2020

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Abstract

The study examines the negative impact of democracy on the GDP annual growth rate in 2001-2019 and 2020 and the morality rate due to COVID-19 in 2020. Whether democracy has deteriorated in the first 20 years of the 21st century in terms of annual gross domestic product (GDP) growth rate and the mortality rate due to COVID-19 was investigated. Using various statistical data and by applying instrumental variable analysis with three instrumental variables. The negative correlation between democratic maturity and GDP growth rate and positive one between democratic maturity and COVID-19 mortality rate in 2020 were found. The same relationships were observed even when the data of China and the United States or those of China and G7 countries were deleted and even when only G20 countries were considered, indicating that this is a common phenomenon in the world. We also proposed that these relationships were casual. The decline in the growth of capital formation, the accompanying decline in the growth of value added in all three sectors, and the decline in the growth of international trade were suggested as the causes of democracy's deterioration. Negative effects of democracy were also observed when GDP per capita growth rate was used, when democracy indicators proposed by different institutions were used, or when the Great Recession was considered. We confirmed the same negative effect of democracy by considering covariates and using the GDP growth rate in 2021, following the pandemic. This strengthened the conclusion that democracy in the first 20 years of the 21st century has deteriorated in terms of annual GDP growth rate and mortality rate due to COVID-19 in 2020.

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1. Introduction

Does democracy strengthen the economic growth of a country that adopts democracy? Does democracy protect the health of the public effectively? The answer for many people is considered "YES." However, this question has gradually become a subject of debate in the twenty-first century. In the past 20 years, we have seen astonishing economic growth in China, the setback of the Arab Spring, and the rise of populism in politics among the USA and EU countries, including the UK. These may raise the question of whether democracy in the twenty-first century will continue to be as resilient as it has been. This question may also be expressed in the books recently published; "How Democracies Die" (Levitsky & Ziblatt, 2018), "Twilight of Democracy: The Seductive Lure of Authoritarianism" (Applebaum, 2020), and "How Democracy Ends" (Runciman, 2018).

In addition, compared to China and other non-democratic countries, the USA and other democratic countries such as Canada, the UK, France, and Italy suffered higher numbers of deaths per capita during the COVID-19 pandemic, especially in the early stages of the pandemic.

In this paper, we investigated the impact of democracy on economic growth from 2001 to 2020 and the death of COVID-19 in 2020. We used the data on democracy, economic growth, and death by COVID-19 in most countries in the world, as well as the historical data on the mortality of European settlers, population density in the 1500s, and the fraction of the population who spoke English and other Western European languages. We analyzed these data with the instrumental variable method and the two-stage least squares method. We expected to show that the higher the level of democracy, the weaker economic growth, and the larger the number of deaths by COVID-19.

We first checked the cross-country correlations between the annual growth rate of gross domestic product (GDP) and the electoral democracy index, which has been widely used, and between the total deaths by COVID-19 and the democracy index by applying the ordinary least squares regression analysis. We confirmed the negative correlation of the democracy index with the annual growth rates in 2001-2019 and 2020 and the positive correlation of the democracy with the total deaths by COVID-19. Our purpose was to elucidate whether these results for democracy have a causal-effect relationship. Hence, secondarily, we applied the instrumental variable method and the two-stage least squares regression method. In the instrumental variable method, we used three variables; mortality of European settlers, population density in the 1500s, and fraction of the population who spoke English and other Western European languages. We obtained similar results about the impact of democracy through a two-stage least squares analysis using these three instrumental variables. This analysis suggested casual relationships between the democracy index and the economic growth rate, as well as between the democracy index and the total deaths caused by COVID-19. We found that democracy in the twenty-first century reduced the growth of capital formation in the countries, slowed down the growth of value-added in all three sectors (agriculture, forestry, and fishing; manufacturing; services), and reduced the global trade, especially the growth in exports. These were considered possible causes of the negative impact of democracy on the economic growth in the first 20 years of the twenty-first century.

We also found that our findings were robust. When we used the annual GDP growth rate per capita instead of the annual GDP growth rate, when we used the democracy index proposed by another institute, and when we considered the Great Recession, the negative impact of democracy was also confirmed. Furthermore, we observed the negative impact of democracy when we excluded data from China and the USA, the G7 countries, and only the G20 countries. In particular, the negative impact of democracy appeared to be a global phenomenon in the twenty-first century. We organized this paper as follows: Section 2 reviewed the previous papers. Section 3 described the data. Section 4 explains the analytical methods. Section 5 explored the analytical results on correlations, causal effect relationships, and possible causes of negative impacts of democracy on economic growth. Section 6 discussed the effect of other data sources on the impact of democracy, the influence of power countries., and the effect of democracy on economic growth in the twentieth century. Section 7 concludes.

2. Literature Review

In the twentieth century, researchers (Barro, 1997; Przeworski, Alvarez, Cheibub, & Limongi, 2000; Przeworski & Limongi, 1993) applied cross-country regression analysis and reported that the impact of democracy on economic growth seemed negligibly small. On the other hand, later research claimed that democracy was more stable and contributed to economic growth more than non-democracy. Acemoglu, Naidu, Restrepo, and Robinson (2019) concluded that democracy had a positive impact on GDP per capita. They found that a country that transitioned from nondemocracy to democracy achieved about 20% higher GDP per capita in the next 25 years than a country that remained a nondemocracy. In their analysis, economic growth was achieved by an increase in investment, the realization of economic reforms, improvements in the provision of schooling and health care, and the reduction of social unrest. Aghion, Aghion, Alesina, and Trebbi (2007) showed that democracy induced productivity growth in different sectors differently and provided the beneficial effects of democracy and political rights on the freedom of entry in markets, reducing the entry barriers more than autocracies. Madsen, Raschky, and Skali (2015) studied income (period: 1820-2000) and human capital (period: 1500-2000) in141 countries and found that democracy was a significant determinant of income and growth. Their results were robust to various estimation methods and covariates. Papaioannou and Siourounis (2008) showed, that,on average democratisations are associated with a 1% increase in annual per capita growth. Persson and Tabellini (2006) pose the question, "Does democracy promote economic development?". Their answer was positive but depended, in a subtle way, on the details of democratic reforms. Persson and Tabellini (2007) and Quinn and Woolley (2001) elucidated that democracies produced stable growth in national income and revealed highly favourable economic results. Rodrik and Wacziarg (2005) did not observe any evidence that supported the bad economic growth followed by democratization.

There have also been some studies on the large economic benefits of Western society. Acemoglu, Johnson, and Robinson (2001) elucidated that when countries in Africa or those closer to the equator installed Western social institutions, those countries did not have lower incomes. Acemoglu, Johnson, and obinson (2002)

suggested that the reversal in relative incomes occurred in the late eighteenth and early nineteenth centuries and resulted from societies with better institutions taking advantage of industrialization opportunities. Easterly and Levine (2003)compared the mutual views of endowments, institutions, and policies using cross-country evidence and found that tropics, germs, and crops influence development through institutions. Hall and Jones (1999) examined variation in capital accumulation and productivity, discovering that variations in institutions and government policies, commonly referred to as social infrastructure, drove output per worker.

The papers mentioned above studied the impact of democracy on economic growth in the twentieth century. About the impact of democracy in the twenty-first century, Kremer, Willis, and You (2022) studied the correlation between growth and human capital, institutions, policies, and culture. Although the growth-correlate slopes that controlled income seemed to be negative, they said those have remained stable since 2000. Acemoglu and Molina (2022) tried to provide causal explanations for the study by Kremer et al. (2022). Carothers and Press (2022) accepted the fact that democracy is in recession. By examining antidemocratic leaders' motivations and methods more closely, they discussed how international leaders should act and respond. There are many studies on the impact of populism on the threat to democracy, but few works have reported the negative effect of democracy on economic growth in the twenty-first century based on statistical data (for example, Burgess, Carrico, Gaines, Peri, and Vanderheiden (2021)).

Furthermore, some papers assert a significant health benefit of democracy. Besley and Kudamatsu (2006) studied the relationship between democracy and health using panel data from a cross-section of countries. Researchers identified a strongcorrelation between life expectancy and democracy. Gerring, Thacker, and Alfaro (2012) reviewed the link between democracy and human development and concluded that the stock of democracy during the last century affected the level of human development. Kudamatsu (2012) showed that infant mortality fell by 12% of the sample mean after democratization in the post-Cold War period. A relevant aspect of democracy was the combination of multiparty elections and leadership change.

Regarding COVID-19, especially in the beginning stage of the pandemic, in contrast to China and other autocratic countries, democratic countries also failed to take initial actions against COVID-19, leading to the deaths of many of their citizens. Since the onset of the COVID-19 pandemic, scholars have published several papers exploring the relationship between democracy and COVID-19. Allcott et al. (2020) presented survey results. There were significant gaps at the individual level between Republicans and Democrats about social distancing, the personal risk of COVID-19, and the future severity of the pandemic. Frey, Chen, and Presidente (2020) found that autocratic regimes imposed more stringent lockdowns and relied more on contact tracing, but there was no evidence that autocratic governments were more effective in reducing travel. Alsan et al. (2020) studied how willing citizens were to restrict the liberties of the public to protect public health conditions in the context of the COVID-19 pandemic. They found that one standard deviation increase in health security concerns increased the willingness to sacrifice the liberties of the public by approximately 68 – 83% of the difference between the average Chinese and the American citizen. Grossman, Kim, Rexer, and Thirumurthy (2020) assessed the role of political partisanship in individuals' compliance with physical distancing recommendations from political leaders using data on mobility from a sample of mobile phones in 3,100 counties in the USA in March 2020. They found that the effects of recommendation were greater in Democratic-leaning counties than in Republican-leaning counties, a pattern more pronounced under Republican governors. Schmelz (2020) surveyed 4,799 respondents toward the end of the first lockdown in Germany and suggested that a substantial share of the population would support measures more under voluntary than under enforced implementation. Recently, Ginzburg et al. (2023) compared mitigation policies against COVID-19 conducted by Israel and their timing in the first wave of the pandemic to those of the Organization for Economic Co-operation Development (OECD) countries, and studied whether country characteristics such as democracy, trust, education, economic strength, and healthcare reserve were associated with decision-making. They foundthat the trends of the countermeasures implemented in the country differed depending on whether its educational level and GDP per capita were lower or higher than the median of OECD countries. However, there is no previous paper to study the cause-and-effect relationship between democracy and the impact of COVID-19.

Repucci and Slipowitz (2021) explained how democracies responded to economic instability and the COVID-19 pandemic, as well as physical instability and violent conflict, through comparison with non-democratic countries. However, to our knowledge, there is no previous paper that showed an adverse effect of democracy on economic growth and public health protection in the twenty-first century with statistical data. This paper will provide some examples of the negative impact of democracy on economic growth and public health protection.

3. Data

3.1. Democracy, Economic Outcome and Death Due to COVID-19

We used the following data to study the impact of democracy on economic growth and death by COVID-19:

3.1.1. Democracy Index

The Varieties of Democracy (V-Dem) Project multidimensionally analyzes the complexity of democracy and provides the democracy index (Varieties of democracy, 2022). The V-Dem evaluates each of the five democratic principles at a high level: electoral, liberal, participatory, deliberative, and egalitarian, and gathers data to study these principles. The democracy index for electoral principles from the V-Dem considers multiple aspects of democracy, such as freedom of association and expression, and clean elections (Alesina, Tabellini, & Trebbi, 2017). This index is used in papers on economics and political science as a measure of democracy (e.g.,Coppedge, Lindberg, Skaaning, and Teorell (2016)). Therefore, the "electoral" index was used as the democracy index.

3.1.2. Economic Outcome

The economic outcome adopted in this study was the mean GDP annual growth rate from 2001 to 2019 and the GDP annual growth rate in 2020. The data were collected from the world development indicators of The World Bank (2022a).

3.1.3. Death Due to COVID-19

Our World in Data is an up-to-date source of COVID-19 data. The database (Our World in Data, 2022a) collected data on the total number of deaths due to COVID-19 per million (hereafter, morality rate) in 2020 for each country.

3.2. Instrumental Variables

In this study, three instrumental variables that were successfully used to study economic growth in previous studies were adopted, as explained below (Acemoglu & Johnson, 2005; Acemoglu et al., 2001; Hall & Jones, 1999).

3.2.1. European Settler Mortality between the 17th and 19th Centuries

The mortality rate of European settlers, such as soldiers, farmers, and members of the church, who settled in the colonies between the 17th and 19th centuries was considered. According to their morality rates, Europeans decided where to settle (Curtin, 1989). In colonies with low mortality rates, Europeans could settle and establish institutions that protected the liberty of people. Figure 1 demonstrates that the countries with higher European settler mortality showed a lower democracy index in 2019, supporting that European settler mortality can be used as an instrumental variable. Acemoglu et al. (2001) reported the data on European settler morality.

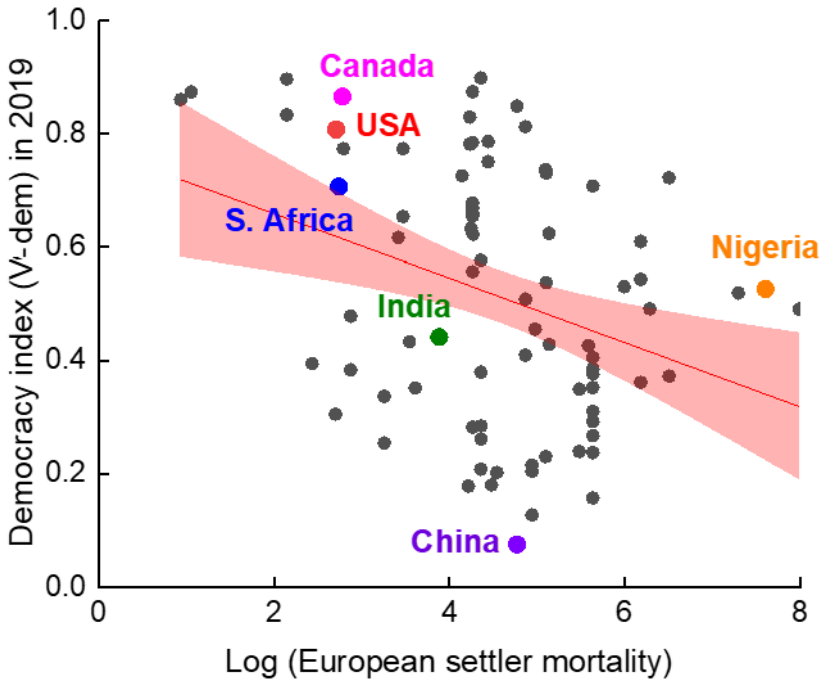

Figure 1. Relationship between logarithm value of European settler mortality and democracy index in 2019 for 87 countries. The red line represents the result of ordinary least squares regression analysis. The shaded area represents the 95% confidence interval.

3.2.2. Population Density in 1500s

Population density at the beginning of the colonial age determined institutions' inclusiveness in colonies (Acemoglu & Johnson, 2005). Hence, in the 16th century, European had the greater motivation to settle and introduce Western-style institutions to areas, countries, and regions with low population density. Hence, the number of inhabitants per km² in the 1500s was considered. Figure 2 shows that the countries with low population density in the 1500s correspond to those with high democracy in 2019.

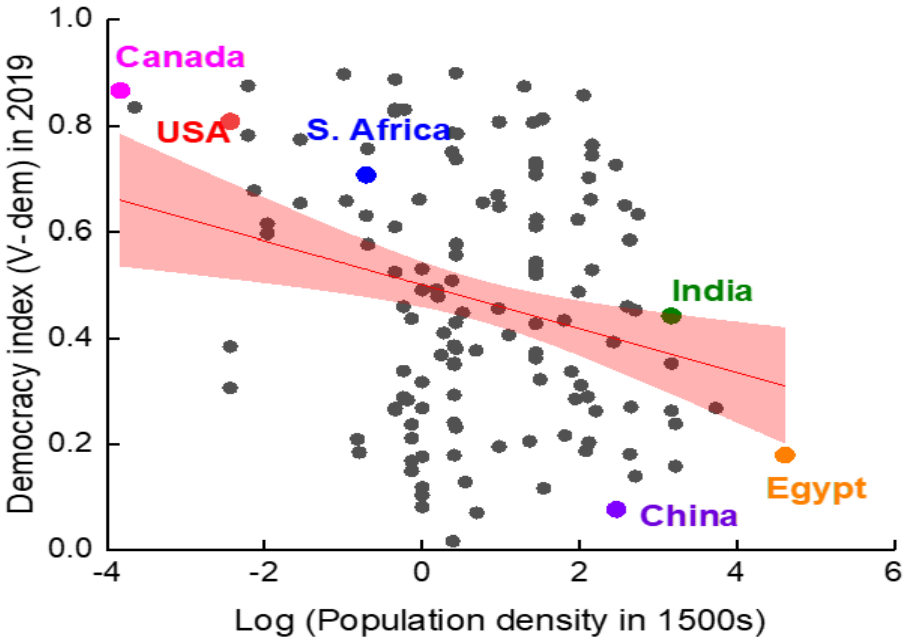

Figure 2. Relationship between logarithm value of population density in 1500s and democracy index in 2019 for 137 countries. The red line represents the result of ordinary least squares regression analysis. The shaded area represents the 95% confidence interval.

3.2.3. Fraction of English or European Language Speaking

Hall and Jones (1999) argued that an essential characteristic in world history was caused by the spread of influence in Western Europe, which determined the cultural, civilizational, and institutional frameworks of countries, and that the mother tongue most residents spoke could be considered a proxy of such impacts. We considered that the major European languages were English, French, German, Portuguese, and Spanish. In this study, according to the research by Hall and Jones (1999), the fraction of people who spoke English, French, German, Portuguese, or Spanish as a mother tongue in 1992 was used. Figure 3 illustrates a positive correlation between the fraction of major European languages spoken and the democracy index in 2019.

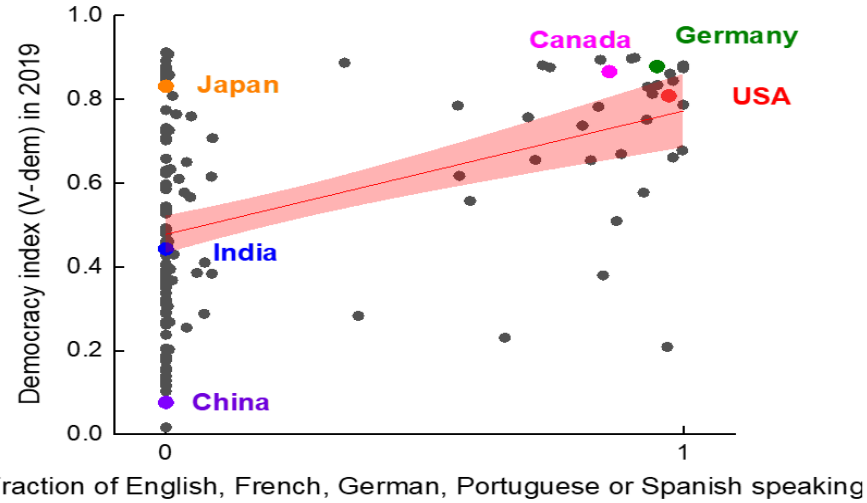

Figure 3. Relationship between fraction of major European language speaking people in 1992 and democracy index in 2019 for 136 countries. The red line represents the result of ordinary least squares regression analysis. The shaded area represents the 95% confidence interval.

3.3. Data of Cause Candidates

Considering the GDP growth and the deaths by COVID-19, and considering the research by Acemoglu et al. (2019) the following cause candidates were considered; (1) value-added in three sectors: agriculture/forestry/fishing, manufacturing and services, (2) capital formation, (3) labour force, (4) total factor productivity, (5) trade (import and export), (6) tax revenue in GDP, (7) school enrolment (primary and secondary schools), (8) mortality rate of infants, (9) R&D expenditure and researcher number, (10) new business density, and (11) suicide mortality rate.

The data on total factor productivity, R&D research number, and new business density were collected from Our World in Data (2022b); UNESCO (2022) and The World Bank (2022b) respectively. Other data were collected from The World Bank (2022a).

4. Analytical Methods

4.1. Correlations ofDemocracy with GDP Growth Rate in 2001 – 2019 and 2020 and Mortality Rate Due to COVID-19 in 2020

Before discussing whether the causal effect was observed between democracy and GDP growth and between democracy and death by COVID-19, the correlations of democracy with those in 2001-2020 were investigated. In this study, the period when there was no impact of the COVID-19 pandemic (2001-2019) and the period when the impact of the early stage of the COVID-19 pandemic was emphasized (2020) were separately studied.

The ordinary least squares regression analysis was applied to the plots of dependence of mean GDP annual growth rate in 2001-2019, GDP annual growth rate in 2020, and the mortality rate due to COVID-19 in 2020 on the democracy index,

$$Y_i = \alpha + \beta \cdot (DemocracyIndex)_i + \epsilon_i \qquad (1)$$

Where Y_i is the mean GDP annual growth rate in 2001-2019, GDP annual growth rate in 2020 or mortality rate due to COVID-19 in 2020,for country i, α the intercept, and ε_ia residual. The impact of democracy is expressed through the value of the coefficient, β. The ordinary least squares regression method has been used to discuss the correlation in the research fields related to econometrics (e.g. (Gonzalo, 1994; Gustafson, 2002; Tidwell, Dougherty, Chrabaszcz, & Thomas, 2017)).

4.2. Causal Effect Relationships of Democracy with GDP Growth Rate in 2001 – 2019 and 2020 and Mortality Rate Due to COVID-19 in 2020

Observing A and B simultaneously indicates a correlation between them, but it does not imply that A causes B or vice versa. On the other hand, causation implies that A and B have a causal effect relationship with one another. To investigate the causal, the application of instrumental variable analysis is useful for investigating the casual effect. To elucidate whether the lower GDP growth rate and higher mortality rate due to COVID-19 were caused by the higher democracy index, instrumental variable analysis was applied using historical determinants of democracy.

It was confirmed that the correlations among the three instrumental variables used were small compared to each other. To study how much democracy harmed the GDP growth rate and mortality rate by COVID-19, the two-stage least squares regression analysis was applied,

$$Y_i = \alpha_2 + \beta_2 \cdot (DemocracyIndex)_i + \epsilon_{2i}$$
$$(DemocracyIndex)_i = \alpha_1 + \beta_1 Z_i + \epsilon_{1i} \qquad (2)$$

Where Z_i represents the instrumental variable of country i. $(Democracy\ Index)_i$ was instrumented by each instrumental variable Z_i. The value of β_2 expresses the effect of democracy on Y_i. The instrumental variable method and the two-stage least squares regression method have been used to study the causal effect relationship (e.g.,(Angrist & Imbens, 1995; John, Abrams, Brightling, & Sheehan, 2019; Mogstad, Torgovitsky, & Walters, 2020)).

4.3. Possible Causes of Negative Impact of Democracy on GDP Growth Rate in 2001 – 2019

Using the data of cause candidates (2001-2019) and the democracy index in 2000, the possible causes were studied by two-stage least squares regression with Equation 2.

5. Results

5.1. Correlations ofDemocracy with GDP Growth Rate in 2001 – 2019 and 2020 and Mortality Rate Due to COVID-19 in 2020

Figure 4 shows the relationship between the democracy index in 2000 and the mean GDP annual growth rate in 2001-2019 for 171 countries. The value of β in Equation 1 estimated by regression analysis was 3.2 ± 0.50 (Table 1), indicating that the countries with highly qualified democracies struggled with lower GDP growth rates in 2001-2019, compared to the countries with less qualified democracies. Figure 5 shows the relationship between the democracy index in 2019 and the GDP annual growth rate in 2020 for 168 countries. The value of β was estimated at 3.9 ± 2.1 (Table 1), suggesting that the countries with higher democracy

index suffered greater economic damage than the countries with lower democracy index in 2020 alone. Figure 6 illustrates the relationship between the democracy index in 2019 and the mortality rate due to COVID-19 in 2020 for 173 countries. The value of β was 730 ± 110 (Table 1). More people per million died due to COVID-19 in the countries with higher democracy index than in the countries with lower democracy index. Specifically, countries with a higher democracy index failed to take appropriate actions to protect their public in the early stages of the COVID-19 pandemic.

Figures 1 – 3 illustrate there are correlations between democracy and GDP annual growth rate and between democracy and death due to COVID-19 but do not indicate causal effect relationships.

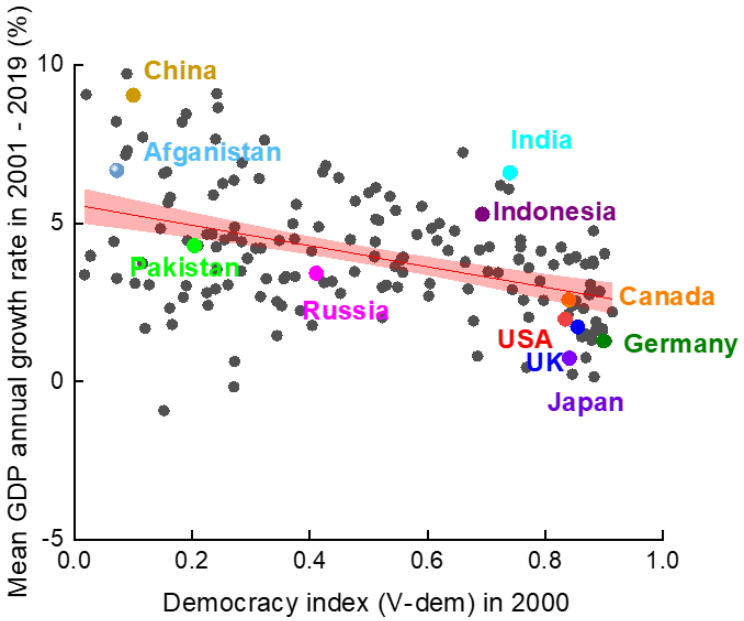

Figure 4. Correlation between democracy index in 2000 and mean GDP annual growth rate in 2001 – 2019 for 171 countries. The red line represents the result of ordinary least squares regression analysis. The shaded area represents the 95 % confidence interval.

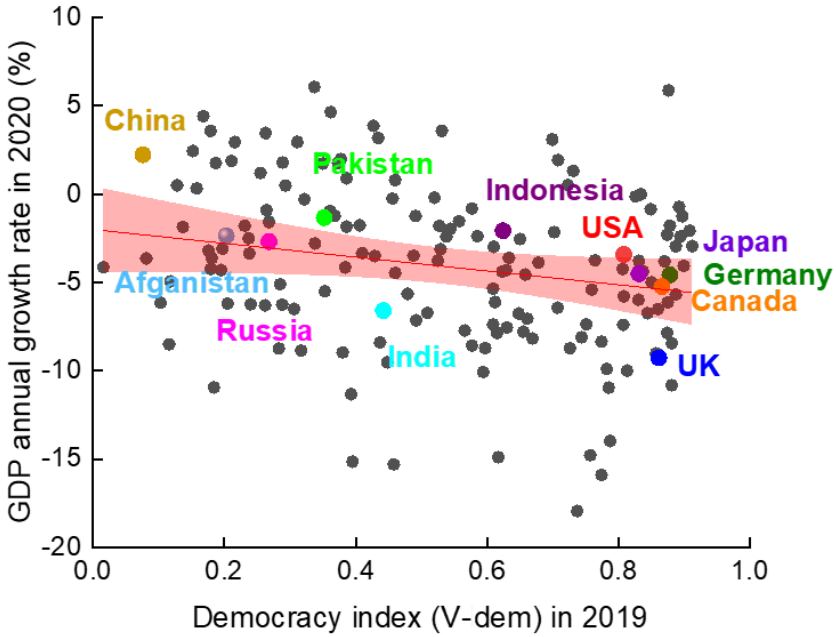

Figure 5. Correlation between democracy index in 2019 and GDP annual growth rate in 2020 for 168 countries. The red line represents the result of ordinary least squares regression analysis. The shaded area represents the 95 % confidence interval.

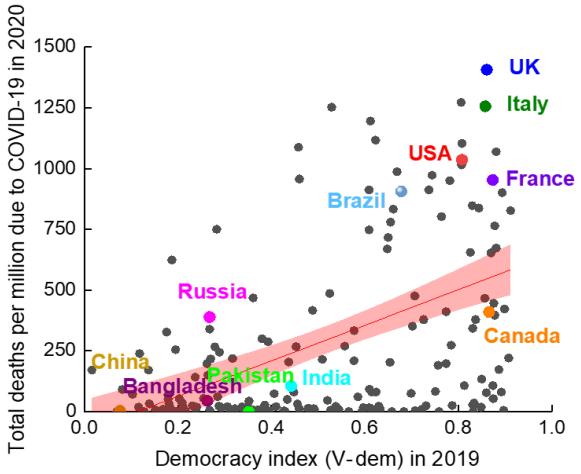

Figure 6. Correlation between democracy index in 2019 and total deaths per million due to COVID-19 in 2020 for 173 countries. The red line represents the result of ordinary least squares regression analysis. The shaded area represents the 95 % confidence interval.

Table 1. Slopes of ordinary least square regression analysis results.

	Democracy vs GDP annual growth rate in 2001 - 2019	Democracy vs GDP annual growth rate in 2020	Death due to COVID-19 in 2020
All available data	-3.2 ± 0.50	-3.9 ± 2.1	730 ± 110

5.2. Causal Effect Relationships of Democracy with GDP Growth Rate in 2001 – 2019 and 2020 and Mortality Rate Due to COVID-19 in 2020

5.2.1. Relationship between Instrumental Variable and GDP Growth Rate and Mortality Rate Due to COVID-19

Figures 7 – 9 show the relationships between European settler mortality and mean GDP annual growth rate in 2001-2019, between that and the GDP annual growth rate in 2020 and between that and the mortality rate due to COVID-19 in 2020, respectively. The similar relationships between population density in the 1500s and GDP growth rate/mortality rate due to COVID-19, and between the fraction of European language speakers and GDP growth rate/mortality rate due to COVID-19 were also confirmed.

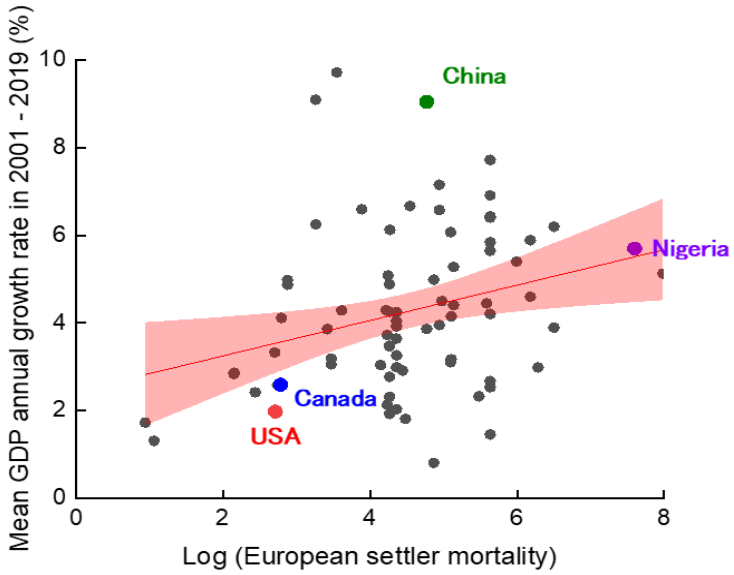

Figure 7. Relationships between European settler mortality and mean GDP annual growth rate in 2001 – 2019 for 78 countries. The red line represents the result of ordinary least squares regression analysis. The shaded area represents the 95 % confidence interval.

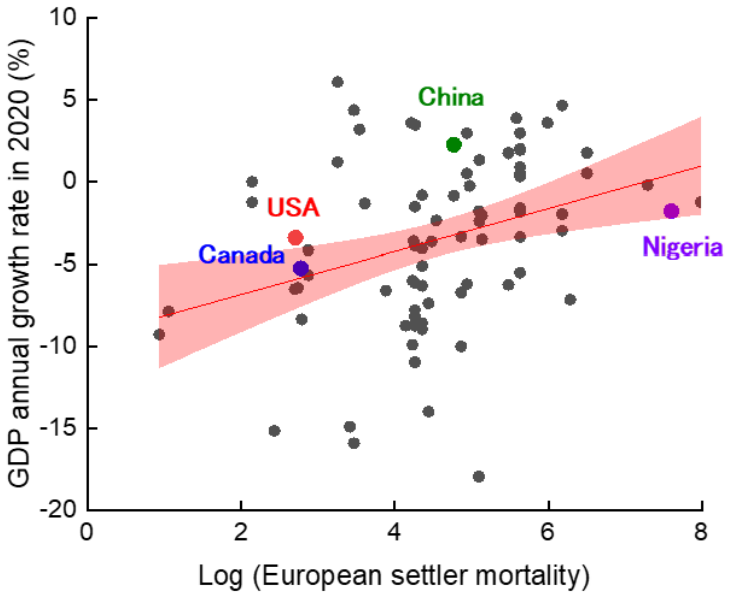

Figure 8. Relationships between European settler mortality and GDP annual growth rate in 2020 for 82 countries. The red line represents the result of ordinary least squares regression analysis. The shaded area represents the 95 % confidence interval.

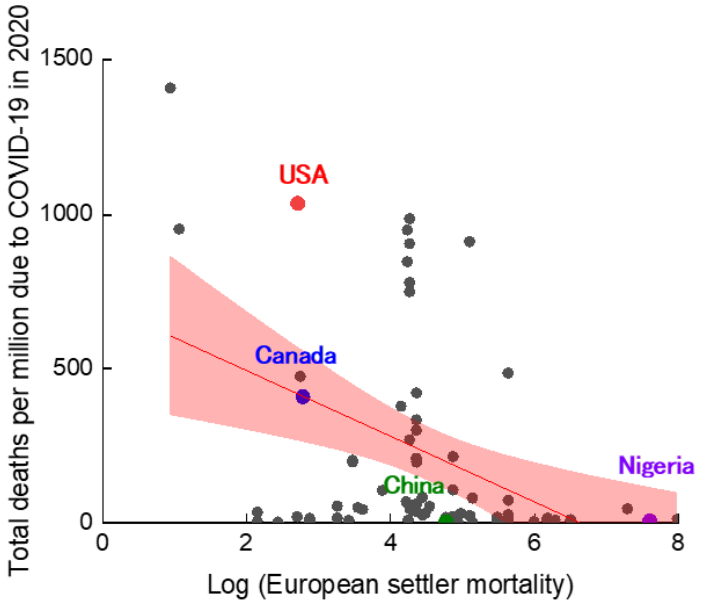

Figure 9. Relationships between European settler mortality and total number of deaths per million due to COVID-19 in 2020 for 83 countries. The red line represents the result of ordinary least squares regression analysis. The shaded area represents the 95 % confidence interval.

It was found that the countries with low European settler mortality, with low popular density in the 1500s, or with a large fraction of European language speakers (namely, countries with large democracy index) struggled through low economic growth in 2001-2019, experienced large economic damage in 2020, and had to accept a higher mortality rate due to COVID-19.

5.2.2. Two-Stage Least Squares Regression Analysis

The values of β_2 in Equation 2 evaluated by the two-stage least squares regression analysis is summarized in Table 2. From the p-values and the F-statistic, all values of β_2 were considered to be meaningful statistically. All values of β_2 demonstrate the negative effects of democracy on the GDP annual growth rate in the 21st century and the mortality rate due to COVID-19 in 2020. From these results, the causal effect relationships between democracy maturity and mean GDP annual growth rate in 2001-2019, between that and the GDP annual growth rate in 2020, and between that and the number of deaths due to COVID-19 were suggested.

Table 2. Values of β_2 evaluated by two-stage least squares regression analysis using European settler mortality rate (Mortality), population density in 1500s (Population) and fraction of European language speaking (Language) as instrumental variables for mean GDP annual growth rate in 2001 – 2019, GDP annual growth rate in 2020 and number of death per millions due to COVID-19. *n* is number of countries considered.

Instrumental variable	Mortality	Population	Language
GDP in 2001-2019	−5.0±2.3	−3.9±2.1	−4.8±1.1
p-value	0.03	0.0017	0.00
F-statistic	4.9	5.9	18
N	82	133	131
GDP in 2020	−23±8.6	−9.4±6.8	−9.0±4.6
p-value	0.008	0.017	0.050
F-statistic	7.3	12	3.9
N	82	130	131
Death by COVID-19	1900±690	2000±490	1500±310
p-value	0.007	0.007	0.00
F-statistic	7.8	16	22
N	83	133	131

5.3. Possible Causes of Negative Impact of Democracy on GDP Growth Rate in 2001 – 2019

The values of β_2 are summarized in Table 3. We found that democracy in the 21st century reduced the growth of value-added in all three sectors. Value-added growth mainly consists of changes in three factors: capital input, labour input, and productivity. The values of β_2 suggested that democracy markedly reduced the gross capital formation, and hence the growth of value-added in all three sectors was slowed down. Another possible cause of democracy's deterioration was the decrease in global trade, especially the reduction of export growth.

Other causes of the negative impact of democracy in the twenty-first century could not be found among the candidates considered, although Acemoglu et al. (2019) claimed that improvements in the provision of schooling and health care and reducing social unrest led to the power of democracy for economic growth in 1960-2010.

Table 3. Values of β_2 evaluated by two-stage least squares regression analysis using European settler mortality rate (Mortality), population density in 1500s (Population) and fraction of European language speaking (Language) as instrumental variables for cause candidates considered. *n* is number of countries considered.

Instrumental variable	Mortality	Population	Language
Value-added in agriculture (Annual % growth)	−6.2 ± 3.2	−3.5 ± 3.1	−2.7 ± 1.4
n	82	132	129
Value-added in manufacturing (Annual % growth)	−6.4 ± 4.7	−7.1 ± 4.6	−8.2 ± 2.1
n	80	125	125
Value-added in services (Annual % growth)	−6.4 ± 2.5	−2.9 ± 3.1	−5.6 ± 1.2
n	81	131	128
Gross capital formation (Annual % growth)	−41 ± 27	−4.0 ± 8.8	−6.7 ± 11
n	71	115	114
Labour force (Annual % growth)	−4.9 ± 1.6	−0.14 ± 2.0	−2.5 ± 0.80
n	82	133	130
Total factor productivity (Annual % growth)	−2.5 ± 1.4	−1.7 ± 3.0	−1.4 ± 1.0
n	58	89	98
Import value index (2000 = 100)	−5.4 ± 1.8	−3.4 ± 1.9	−3.6 ± 0.74
n	82	133	130

Instrumental variable	Mortality	Population	Language
Export value index (2000 = 100)	−10 ± 6.1	−4.0 ± 4.9	−4.4 ± 2.5
n	82	133	130
Instrumental variable	Mortality	Population	Language
Tax revenue (% in GDP)	0.71 ± 0.27	0.13 ± 0.81	0.34 ± 0.81
n	63	103	116
School enrollment, primary (% gross)	0.066 ± 0.083	0.039 ± 0.10	0.090 ± 0.052
n	81	130	129
School enrollment, secondary (% gross)	1.6 ± 0.41	0.85 ± 0.34	0.65 ± 0.13
n	80	128	129
Mortality rate, infant (Per 1,000 live births)	−3.0 ± 0.72	−1.0 ± 0.48	−1.2 ± 0.25
n	81	132	129
R&D expenditure (% of GDP)	3.9 ± 1.4	1.7 ± 1.0	0.80 ± 0.63
n	64	107	104
R&D researcher (Number per million)	4.0 ± 1.6	1.1 ± 1.2	0.81 ± 0.78
n	60	99	100
New business density rate (Per 1,000 working-age (15–64))	3.1 ± 1.5	1.9 ± 5.1	−1.5 ± 0.45
n	108	123	115
Suicide mortality rate (Per 100,000 population)	0.83 ± 0.36	1.6 ± 0.59	0.01 ± 0.18
n	81	132	129

6. Discussion

6.1. Effects of use of Other Data Sources, Great Recession, Covariates and Post-Pandemic

The results obtained in this study might depend on the data used, such as the democracy index. We discuss each country's economic growth using not only the GDP growth rate, but also the GDP per capita growth rate. Therefore, to justify the findings about the negative impacts of democracy on the GDP growth rate and mortality rate by COVID-19, the effect of the use of other data sources was checked. In addition, the Great Recession began in December 2007 and ended in June 2009. In addition,the Great Recession was the driving force behind the outcome. In this section, the GDP per capita growth rate (The World Bank, 2022a) and the democracy index proposed by Freedom House (2023) were used. Regarding the Great Recession (2008-2009), the same analysis was applied to the GDP annual growth rate before, during, and after the Great Recession period.

We also considered the effect of covariates. As possible covariates for GDP annual growth rate and mortality rate due to COVID-19, mean temperature (The World Bank, 2023) mean precipitation (The World Bank, 2023) population (The World Bank, 2022a), median age (The World Bank, 2022a), population ages 65 and above (The World Bank, 2022a), and diabetes rate (% of population ages from 20 to 79) (The World Bank, 2022a) were considered.

We applied the two-stage least squares regression analysis (Equation 2) to study the effects of using other data sources and the Great Recession. The effect of covariates was examined by a multiple least squares regression analysis.

Table 4summarizes$\beta_{2's}$value. Although the GDP per capita growth rate was adopted, the negative impact of democracy could be observed. When the democracy index by Freedom House was used, a negative effect of democracy was also confirmed. We also found that the negative impact of democracy on the GDP annual growth rate began before the Great Recession and persisted during and even after the recession. Furthermore, the relationship between the GDP annual growth rate in 2021 (after the COVID-19 pandemic) and the V-Dem index in 2020 was also checked.Figure 10 illustrates the impact of democracy in 2020 on the GDP annual

growth rate in 2021. The slope evaluated by ordinary least squares regression analysis was 0.011±0.010. Despite the perception of economic recovery following the pandemic in many countries, research revealed a slight negative impact of democracy on GDP growth.

Table 4. Values of β_2 evaluated by two-stage least squares regression analysis using European settler mortality rate (Mortality), population density in 1500s (Population) and fraction of European language speaking (Language) as instrumental variables when the data of GDP per capita growth rate and democracy index by freedom house were used and when the period was separated before, during and after the great recession. *n* is number of countries considered.

GDP annual growth rate per capita			
Instrumental variable	**Mortality**	**Population**	**Language**
Mean GDP annual growth rate per capita in 2001 - 2019	−2.1 ± 1.5	−2.4 ± 0.40	−1.6 ± 0.15
n	83	134	131
GDP annual growth rate per capita in 2020	−11 ± 3.7	−1.3 ± 0.82	−7.0 ± 2.6
n	82	130	130
Democracy index by freedom house (0 - 100 scale)			
Mean GDP annual growth rate in 2001 - 2019	−0.044 ± 0.020	−0.026 ± 0.019	−0.052 ± 0.013
n	82	133	131
GDP annual growth rate in 2020	−0.16 ± 0.049	−0.077 ± 0.056	−0.083 ± 0.042
n	82	130	131
Number of death due to COVID-19 in 2020	13 ± 4.3	1.6 ± 4.0	14 ± 3.0
n	83	133	131
Before, during and after great recession			
Mean GDP annual growth rate in 2001 - 2007	−3.9 ± 2.7	−2.4 ± 3.6	−4.4 ± 1.6
n	82	133	129
Mean GDP annual growth rate in 2008 - 2009	−17 ± 5.8	−12 ± 4.6	−8.9 ± 2.2
n	82	133	129
Mean GDP annual growth rate in 2010 - 2019	−4.3 ± 2.7	−2.0 ± 3.2	−4.7 ± 1.4
n	83	134	131

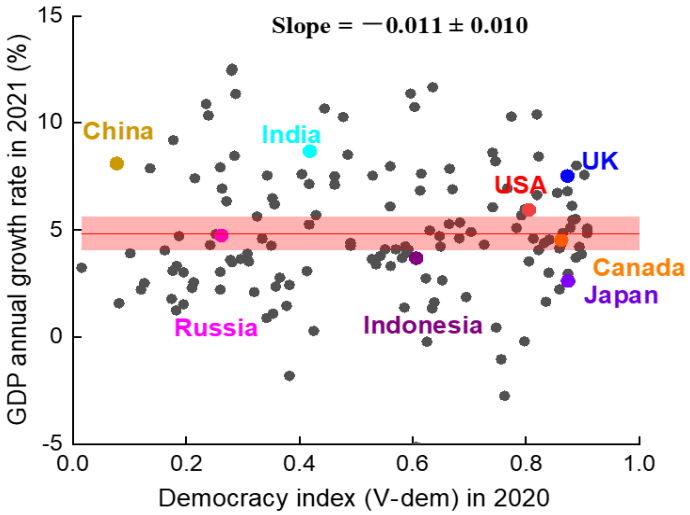

Figure 10. Relationships between democracy index in 2020 and GDP annual growth rate in 2021 for 167 countries. The red line represents the result of ordinary least squares regression analysis. The shaded area represents the 95 % confidence interval.

Regression coefficients for covariates considered are summarized in Table 5. The impact of democracy on the GDP annual growth rate and the mortality rate due to COVID-19 was greater than the impacts of covariates considered. This strengthened the study's conclusion.

Table 5. Regression coefficients for covariates evaluated by multiple least squares regression analysis.

GDP or COVID-19	Mean GDP annual growth rate in 2001-2019	GDP annual growth rate in 2020	Number of death due to COVID-19 in 2020
Democracy index	−1.7 ± 0.64	−3.7 ± 2.9	460 ± 150
Mean temperature	−0.052 ± 0.024	−0.058 ± 0.093	−3.9 ± 4.8
Mean precipitate	9.9E-5 ± 1.7E-4	3.5E-4 ± 7.6E-4	−0.029 ± 0.039
Population	0.14 ± 0.17	1.0 ± 0.74	79 ± 38
Median age	0.18 ± 0.046	−0.39 ± 0.18	16 ± 7.6
Population ages 65 and above (% of total population)	−0.49 ± 0.088	0.41 ± 0.28	−0.076 ± 12
Diabetes rate (% of population ages from 20 to 79)	−0.19 ± 0.038	−0.10 ± 0.17	−1.4 ± 7.9

6.2. Influence of Power Countries

To examine whether the results in this study are driven by power countries such as China and the USA, the same analysis as that used in Section 5.1 (ordinary least squares regression analysis (Equation 1) was performed for the cases in which the data excluding China and the USA were used, the case in which the data from China and the G7 countries were excluded, and the case in which only G20 countries were considered. The values of β estimated are also shown in Table 6, confirming that similar results were obtained in all three cases. The results of (1) and (2) suggest that one of the conclusions of this study, "Democracies in the 21st century had a negative impact on the GDP growth and the mortality rate by COVID-19," is robust. Therefore, the results shown in this study indicate that the negative impact of democracy on economic growth in the 21stcentury and public health protection in the early stages of the COVID-19 pandemic was a global phenomenon and was not influenced only by a small number of countries.

Table 6. Slopes of ordinary least square regression analysis results.

	Democracy vs GDP annual growth rate in 2001 - 2019	Democracy vs GDP annual growth rate in 2020	Death due to COVID-19 in 2020
Without the USA and China	−3.0 ± 0.51	−4.2 ± 1.8	720 ± 120
Without G7 countries and China	−2.8 ± 0.52	−4.0 ± 1.9	700 ± 120
G20 countries	−5.0 ± 1.6	−6.1 ± 2.7	710 ± 360

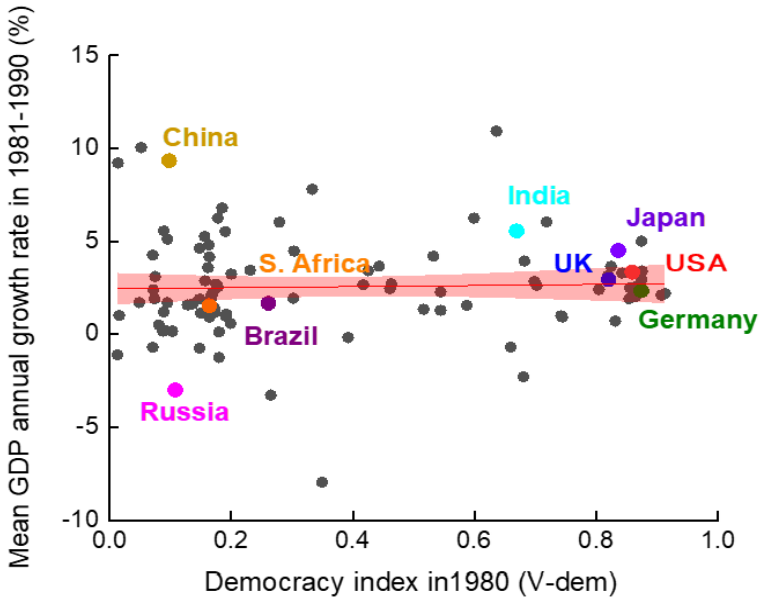

Figure 11. Relationship between democracy index in V-dem and GDP annual growth rate in 1981 – 1990 for 103 countries. The red solid line represents the result of ordinary least square regression analysis. The shaded area represents the 95 % confidence interval. The slope of red line is 0.30 ± 0.26 (Positive).

6.3. Relationship of Democracy Index with Economic Growth in the 20th Century

It is not surprising that we might be asked whether the findings of this study are unique to the twenty-first century. Figures 11 and 12 show the relationships between the V-Dem democracy index in 1980 and the mean GDP annual growth rate in 1981-1990 (103 countries) and between the V-Dem democracy index in 1990 and the mean GDP annual growth rate in 1991-2000 (153 countries), respectively. Democracy had a weak but certainly positive association with economic growth of 0.30 ± 0.26 from 1981 to 1990 and 0.12 ± 0.11 from 1991 to 2000. Furthermore, we could not see a negative causal effect of democracy in these periods.

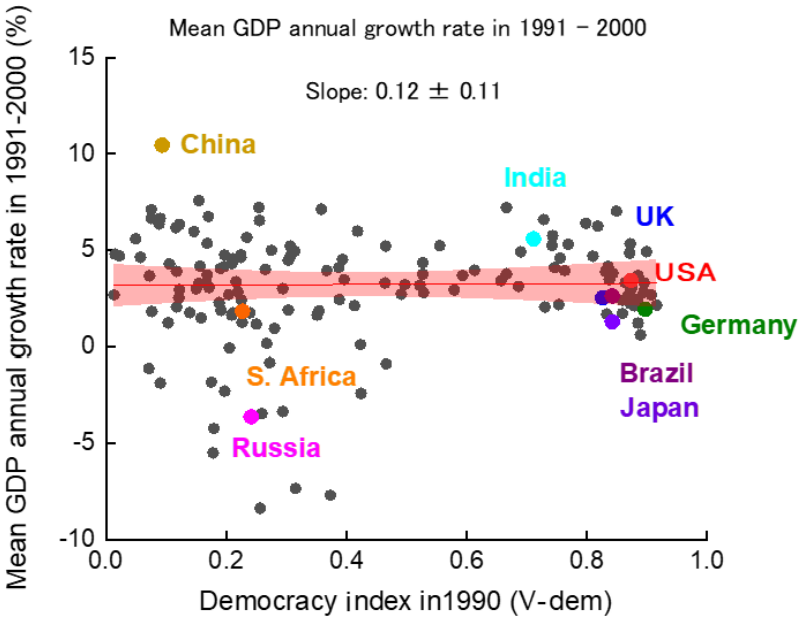

Figure 12. Relationship between democracy index in V-dem and GDP annual growth rate in 1991 – 2000 for 153 countries. The red solid line represents the result of ordinary least square regression analysis. The shaded area represents the 95 % confidence interval. The slope of red line is 0.12 ± 0.11 (Positive).

7. Conclusions

7.1. Implications

The analytical results using three instrumental variables, all leading to the same implications for the impact of democracy, suggest that the higher the democracy index, the worse the GDP growth rate (mean GDP annual growth rate in 2001-2019 and GDP annual growth rate in 2020). Possible causes behind the negative impact of democracy were the reduction of the growth of capital formation in the countries, hence slowing down the growth of value-added in all three sectors (agriculture, forestry, and fishing; manufacturing; services); and reduction of the global trade, especially the growth in exports. Furthermore, democracy also caused a higher mortality rate for COVID-19 in 2020, when it was in an early stage of the pandemic.

7.2. Limitations

This study may have a problem with the reliability of economic growth rates and the number of deaths due to COVID-19 announced by non-democratic countries. In addition, we have not yet been able to study the possible causes of the high mortality rate caused by COVID-19. Furthermore, our results do not imply a general conclusion about the role of democracy in the last twenty years. Although we found the negative impacts of democracy on economic growth and public health protection against COVID-19 at the early stage of the pandemic, democracy may be able to realize much better outcomes in other aspects for a long period of time. In other words, there is much room to improve and develop our society through democracy.

7.3. Future Research Suggestions

We will investigate the possible causes of the negative impact of democracy on the mortality rate in COVID-19, especially at the early stage of the pandemic. We will also study the impact of democracy on other outcomes that are difficult to quantify, such as *diversity, equity, and inclusion in political, economic, and societal sectors, happiness of the public, and movement of geopolitics.*

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