State of the World: Democracy's Impact on Social and Economic Development

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Abstract

There is an undisputed correlation between a country's form of government and its social and economic growth. Unfortunately, government is difficult to measure categorically (e.g. simply Democracy vs Autocracy), and the relationship of causality between these factors is complex. Using multi-dimensional political and social-economic data, along with statistics and machine learning, this study analyzes the democracy and development of 48 countries around the world over the past 40 years. Highly democratic countries were strongly correlated with robust and forward-thinking economies. Countries with weaker democracies were less predictable in terms of social-economic outlook. A stable autocracy like China can sustain high growth into 2030 while a country trending towards democracy can stagnate. The highest rates of social-economic growth were most likely to occur during periods of political stability rather than democratization. Democracies may have higher social-economic ceilings, but stability has a greater impact on growth.

Introduction

When we think about empires throughout history, government and wealth are two characteristics that we often associate with their rise and fall. In order to quantify these concepts, we can analyze a nation's democracy and social-economic development to better understand its past and future states. These analyses are important because they can potentially elucidate the state of the world on a macro scale. Unfortunately, the direction of causality between democracy and human development is not easily understood.

One prevailing idea is that stronger democracies are less prone to corruption, which allows technology and economies to develop fairly and without constraints (Rivera-Batiz, 2002). In theory, if nations have enough resources per capita, then fair governments should be able to improve the lives of the general population and unlock human potential. One can also argue that it is not the presence of democracy itself that spurs social-economic growth, but the effectiveness of government institutions (Pereira, 2017). Governments determine economic rules – the constraints and incentives that their people live by. These rules (investment regulations, property rights, etc.) in turn affect economic growth and determine the wealth of the overall population. For example, a free market economy combined with property rights are great incentives for individuals to innovate and contribute to the economy. This is a key reason why the US economy outpaced that of the USSR during the cold war to the present day (Maggs, 1961). Government institutions also make decisions on how to distribute resources and invest in human capital, technology, production, and so on. In theory, it is possible for an authoritarian government to maximize human potential under the right systems and laws. This also means that a young democracy with early institutions may not grow as fast as older democracies with more established systems.

On the other hand, it is possible that social-economic growth creates the preconditions that allow democracy to take hold and prosper. For example, education, public safety, and a strong middle class are strong indicators of the social and economic health of a nation and may be factors that lead to democracy (Lipset, 1959). Many argue that only citizens in wealthy nations with fair standards of living can effectively participate in democratic processes, and that a society composed of a small elite and impoverished masses would likely result in oligarchy or tyranny (Lipset, 1959). The general population must be intelligent enough to vote and participate in public discourse. As well, history shows that political regimes are more likely to change during periods of slow

economic growth (Geddes, 1999). People may become dissatisfied with the economic and social environment and demand change from government through voting or protesting.

Clearly, the causal relationship between social-economic growth and democracy is multifaceted, and these forces may impact each other in a positive feedback system. For each nation or case study that supports one theory, a counterexample exists in history. Almost identical political regimes can have vastly different economic outcomes and vice versa. While we can go back in time and interpret historical events using sociological and behavioral explanations, we can never determine causality because we do not know the counterfactual – the opposite of what happened. To be certain, we would need to set up double-blind experiments on entire countries, which is impossible. The next best thing is data and statistics.

Government and human development are tricky to measure. Any political system is too complex to be simply categorized as a 'democracy' or 'autocracy' and GDP can only go so far as an indicator of social and economic health. Alternatively, there could be hundreds or thousands of variables impacting this relationship. When so many variables are introduced into a statistical model, the data can become 'overfit'. This means that the resulting analyses are not likely to be replicated in future studies due to the random variation and collinearity of redundant variables (Hawkins, 2004). If the degree of correlation between variables is high enough, the statistical merit of a study may become questionable.

Occam's Razor, or the principle of parsimony, is a problem-solving technique stating that one should not introduce more complexity (or variables) than is necessary to analyze a problem. In this vein, a way to prevent overfitting and reduce redundant variables is to aggregate variables and fix coefficients a priori to the analysis (Babyak, 2004). For example, one can create composite 'scores' of human development and democracy using multi-dimensional data. This can also make visualization and time-series analysis easier because social-economic development and democracy can each represent one axis on a plane, with time being the 3rd dimension. Unsupervised machine learning can be a practical way to explore this relationship because it can help reveal common characteristics about the dataset without complete information. For instance, companies such as YouTube or Netflix can cluster people into distinct 'recommendation' groups based on their viewing history, without complete data about each person. Similarly, machine learning can cluster countries together based on how their governments and societies change over time. Combined with some historical context, time-series and cluster analysis may be powerful ways to reveal hidden characteristics between these variables. This study aims to tell a story of democracy and human development through visualizations.

Methodology

1. Find timeseries data on democracy and human development for a large sample of countries

This study uses a composite score of democracy created by the V-Dem Institute[1], which measures countries around the world on five high-level principles of democracy: electoral, liberal, participatory, deliberative, and egalitarian. These features aim to capture the complexity of democracy as a system of rule that goes beyond the simple presence of elections (Coppedge et all, 2020). V-Dem uses robust methods for aggregating expert opinions to make these estimates. This aspect is critical because many key features of democracy are not directly observable. V-Dem continually reviews and adjusts its methodology to improve the quality of its indicators (Coppedge et all, 2020). Each nation gets a composite score between 0 and 1 for each calendar year since 1980. For reference, in 2017, Norway had the highest score of 0.87 while China had the lowest score of 0.06. These values are then ranked on a percentile rank of 0 to 100 in order to normalize the scale of the data and make it easier to work with. This value out of 100 will be referred to as the 'Democracy Score' (DEM) throughout this study.

The World Bank[2] has a large repository of economic and social indicators for countries around the world. These time-series data are comprehensive and represent most countries. More importantly, they contain key variables that can combine to create a holistic score of social and economic development. This will be referred to as the 'Social-Economy Score' (SE) throughout the study. The SE score is an average of the following social and economic indicators:

Social development	**Economic development**
University enrollment (% of population)	GDP (per capita)
Urban population (% of population)	Employment (% of labor force)
Renewable and nuclear energy (% of total energy use)	Life expectancy (years)

These indicators were carefully selected – they serve as proxies of distinct phenomena and can represent the health, wealth, and forward-thinkingness of the overall economy and society. It is important that each of these indicators can be normalized onto a 100-point percentile scale, like

[1] The V-Dem Institute is an independent research organization that quantifies democracy using innovative techniques; it comprises over 50 social scientists on six continents and works with more than 3,000 academic experts.

[2] The World Bank is an international financial institution that provides investment, policy advice, and research to governments of poorer countries. It is headquartered in Washington, D.C. and employs over 10,000 people in 120 offices worldwide.

DEM. These variables are also comparable across countries because they are percentages and per capita measures. These six features satisfy the principle of parsimony and can help reduce the likelihood of overfitting as they are set a priori to the study.

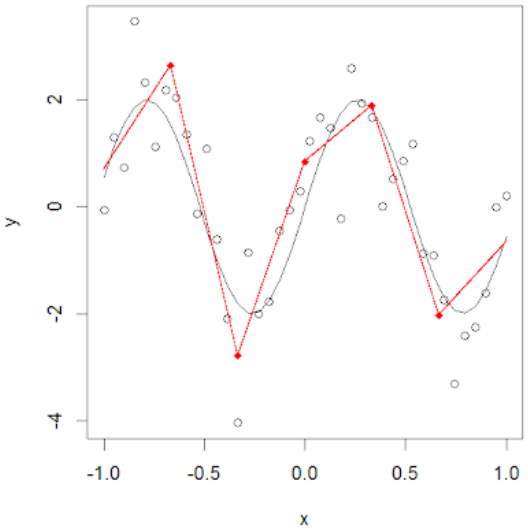
2. Interpolate small gaps in World Bank indicators using regression 'splines'

Along with V-Dem's democracy data, the World Bank's social and economic indicators span from 1980 to 2017 and represent 48 countries. Unlike the democracy data, some countries' economic indicators can have small gaps between years.

Linear and polynomial regression can both be used to fill these gaps with estimates, but both have their drawbacks. A linear relationship is rarely found in nature and polynomial regression is more likely to result in over-fitting.

Regression splines are another non-linear method of interpolating trends. It uses a combination of linear and polynomial functions to fit data. Instead of using one function for the entire dataset, regression splines divide the dataset into multiple 'splices' and fits each splice with a different function:

Figure 1. How Regression 'Splines' Approximate Functions



These splines can be either linear or polynomial functions. Splines also allow for extra flexibility because there can be more where the data is changing or sparser where the data is stable (Singh, 2018).

All missing economic indicators are interpolated using regression splines before being standardized onto a 100-point scale and aggregated into the SE score (link to full python code in Appendix).

3. Project Democracy and Economy Scores into 2030 using autoregression

Autoregression is a statistical technique that uses past values to predict future values in a time series. It is popular for analyzing nature and economics – for example, an autoregressive model can help predict stock prices based on past performance (Brownlee, 2017).

Using previous observations of DEM and SE scores, or training data, the model optimizes the coefficients of a multiple regression equation. The equation can then predict future scores based on an input of X number of years past 2017. In this case, 38 years of observations will help predict 13 future years for all 48 countries (link to full python code in Appendix).

4. Cluster countries using K-means

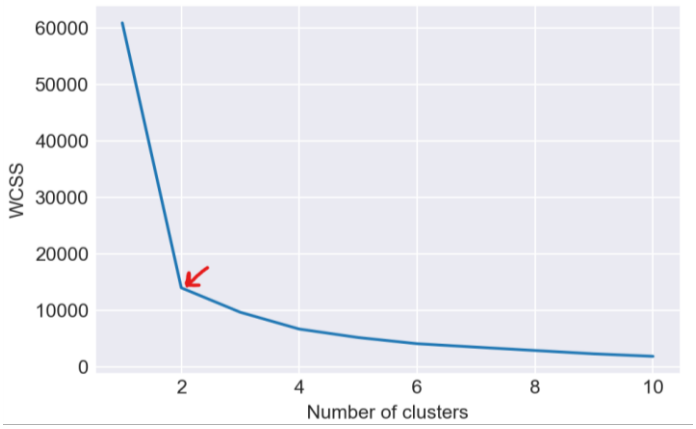
This study uses unsupervised machine learning because the data has not been labeled beforehand – we do not know how these countries will group together. K-means clustering aims to partition N observations (countries) into K clusters, where each observation belongs to the cluster with the nearest mean (called centroid) (Garbade, 2018).

The K-means algorithm works by first randomly selecting a group of centroids, which are used as the beginning centers for every cluster. The algorithm then performs iterative calculations to optimize the positions of the centroids by minimizing the distance between each centroid and its closest observations. The algorithm is completed when either:

- The centroids have stabilized – there are no more changes in their values because the clustering has been successful.
- The preset number of iterations has been achieved.

This study uses a minimum of 100 iterations to reduce error. Additionally, the 'Elbow Method' is employed to find the optimal number of clusters. In the following example, 2 clusters are optimal:

Figure 2. The 'Elbow' Method for Determining Optimal Cluster Size

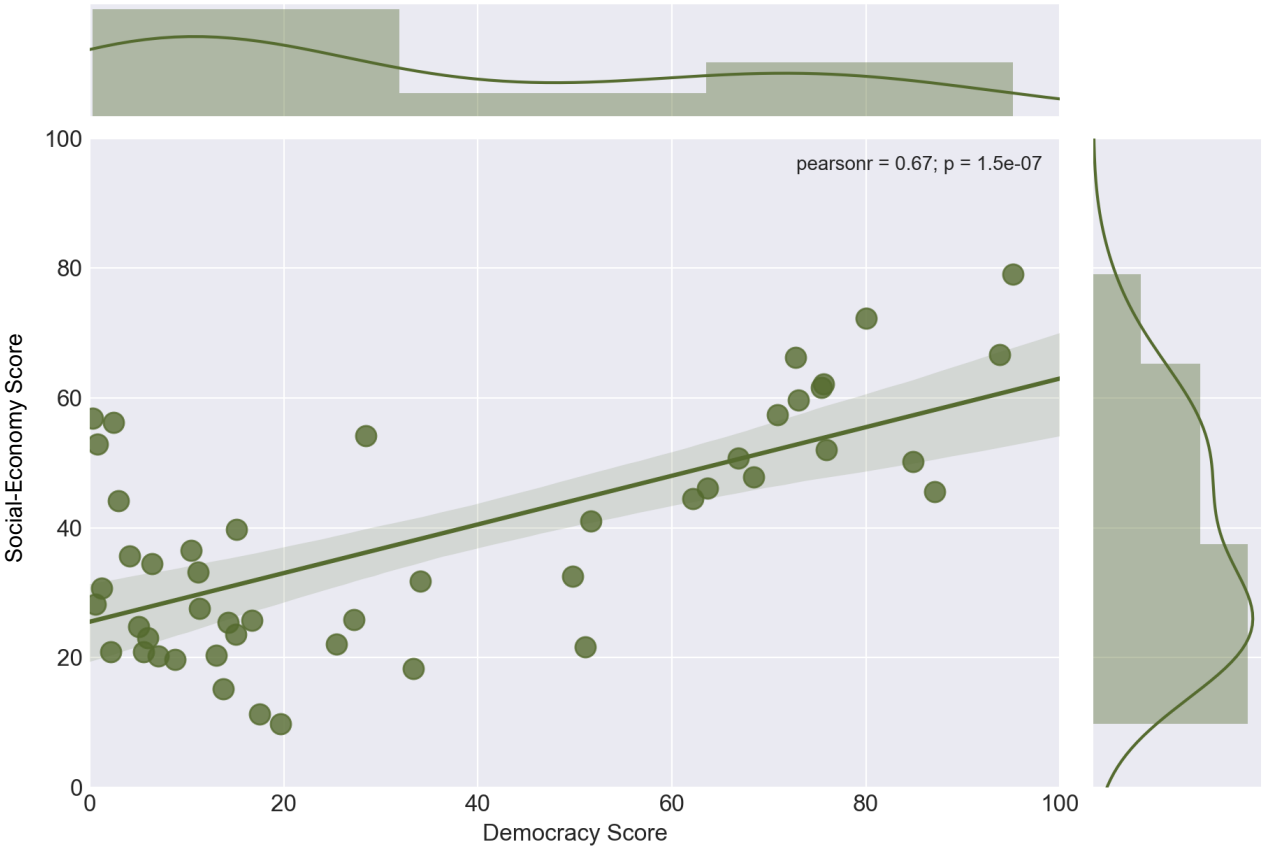


The Elbow method is based on the Within Cluster Sum of Squares (WCSS), which calculates the Euclidean distance of each point within a cluster to the cluster centroid (Gutierrez, 2018). These distances are then averaged and plotted against the number of clusters in the analysis. The optimal number of clusters is indicated by the bend or the 'elbow', which means that the WCSS has been reduced and more clusters will not improve results significantly (link to full python code in Appendix).

Analysis

This first plot of the social-economy (SE) and democracy (DEM) scores of 48 countries in 1980 shows that social-economic development was strongly correlated with democracy (Pearson 'r' > 0.5, $p < 0.05$):

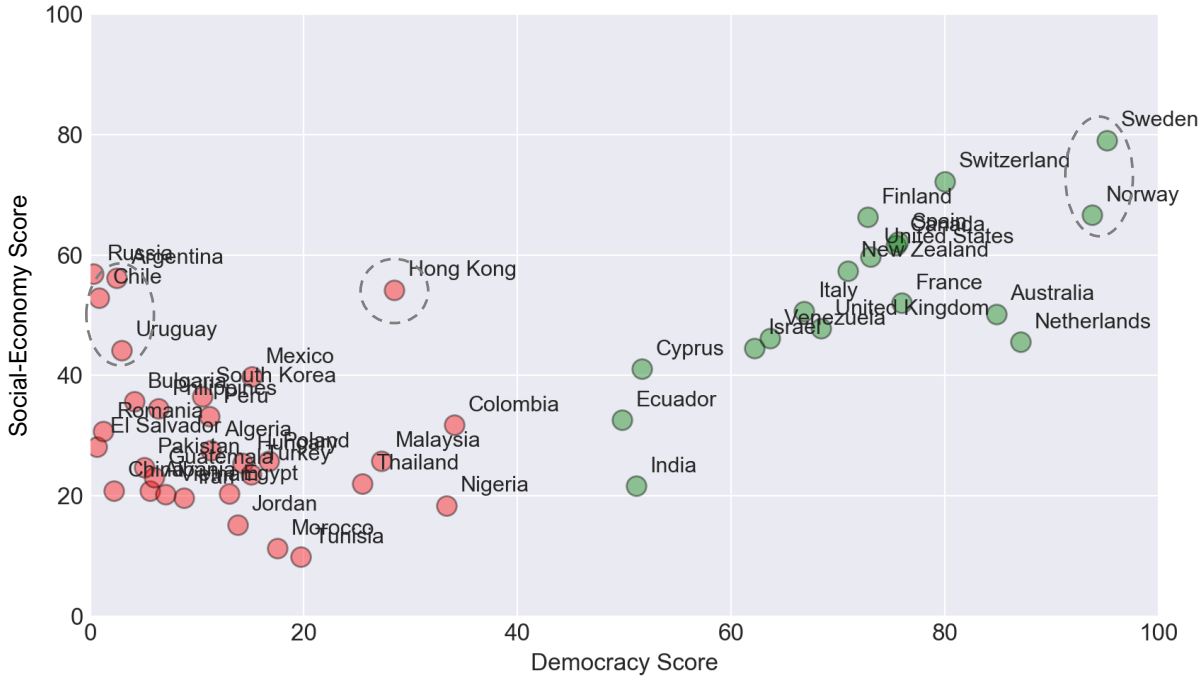
Figure 3. 1980 – SE vs DEM Scatterplot with Distributions



Most countries (56%) fell in the bottom left quadrant, with SE and DEM scores below 50. Surprisingly, there were fewer countries with 'medium' democracies than either weak or strong democracies (seen in the 'V' shaped distribution in the top histogram). This indicates political instability and a divide in the world. Social-economic development followed a more normal pyramid distribution (seen in the histogram on the right).

Next is the result of clustering these same countries using k-means:

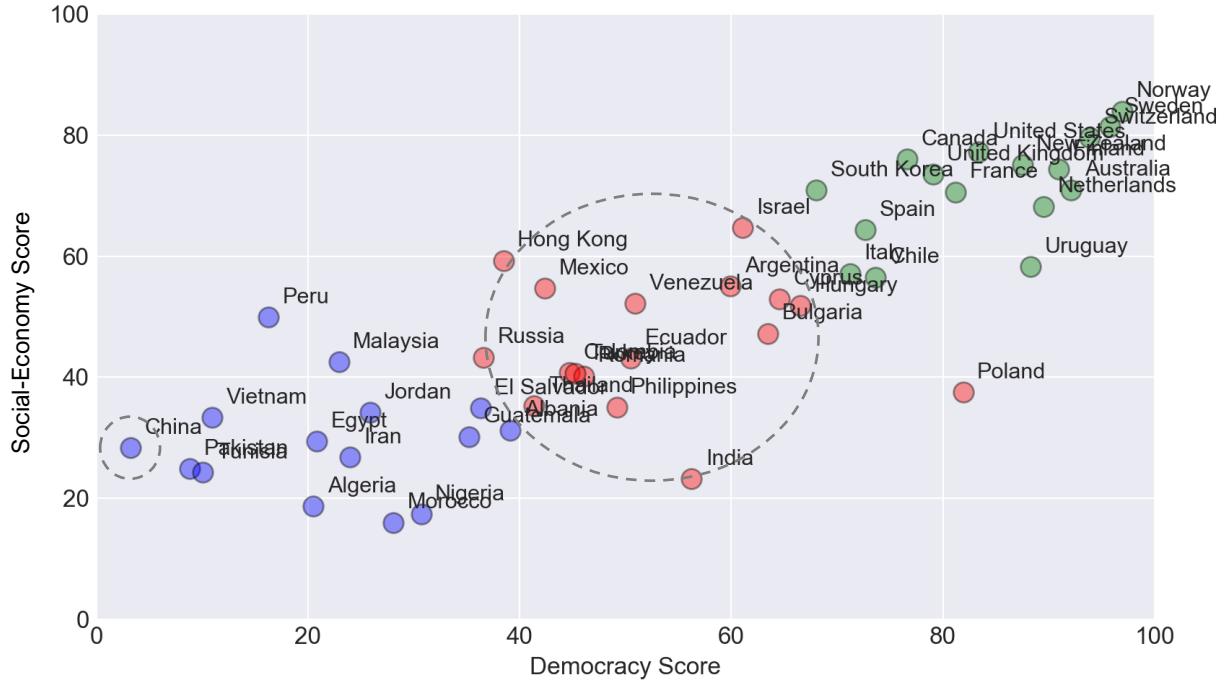
Figure 4. 1980 – SE vs DEM Country Clusters



There are two groups of countries in the world, as foreshadowed by the 'V' shaped distribution in Figure 3. These two clusters are: low-democracy countries with weaker SE scores and high-democracy countries with stronger SE scores. The sub-groupings inside these clusters also tell a story. For example, Argentina, Chile, and Uruguay (circled on the left) are all South American countries that had military dictatorships around 1980 (Cardoso, 1996). Their geopolitical and economic similarities are captured by how close they are on this plot. Similarly, many African and Asian countries in the bottom-left cluster had weak or non-democracies. Hong Kong stands out because of its 'one country two systems' poltical model; it has a free market economy while being under Chinese and socialist rule (Jiang, 2003). Hong Kong was able to grow its economy using free markets and trade, but also had a host of democracy and human rights issues. On the other spectrum, Western and European countries had high SE and DEM scores. Sub-groupings can also be seen here. Canada and the US are almost superimposed in the same spot, and the Scandanavian countries of Norway and Sweden lead the world in both social-economic development and democracy. Norway and Sweden are widely regarded as a couple of the happiest and most well-goverened countries in the world.

These results from 1980 indicate a political divide in the world: there are more low-democracy countries than high-democracy ones, and there is a missing middle-class. This distribution serves as the benchmark for comparing the next cluster of data from 2000:

Figure 5. 2000 – SE vs DEM Country Clusters



By 2000, many low-scoring democracies converged towards the middle, forming a democratic 'middle-class'. There are now 3 main clusters: a lower, middle, and upper-class with increasingly stronger democracies and higher social-economic development. The relationship between SE and DEM became much more linear. The deviation of SE and DEM scores along the line of best fit became tighter and 56% of countries are now in the top right quadrant instead of the bottom left. The distribution of DEM scores became more balanced and the political divide seen in 1980 was erased.

This aligns with the fall of the Soviet Union in the early 1990s. Soviet satellite states – Poland and Hungary – left the union and saw their DEM scores rise by 400% between 1980 and 2000. Levels of democracy increased worldwide as authoritarian influence decreased. Another example is the South American group of Argentina, Chile, and Uruguay, who jumped from the very left of the DEM scale to the right, after transitioning from military dictatorships to democratic republics in the 1980-90s (Cardoso, 1992).

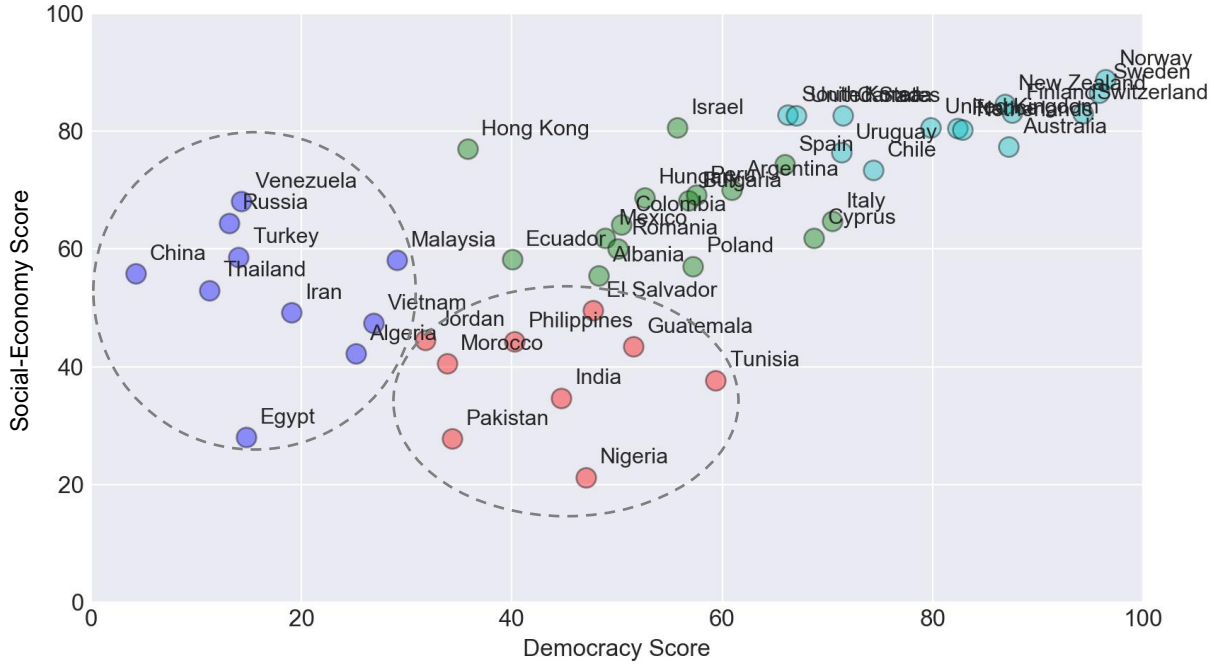
The average global DEM score increased from 35 to 54 between 1980 and 2000. The world also became more prosperous. The average SE score increased from 39 to 49. After transitioning into democracy, many countries saw tremendous social-economic growth. South Korea and Hungary both doubled their SE scores as they became democratic and jumped into the top-right

quadrant. The correlation (Pearson 'r') between democracy and social-economic development increased from 0.67 to 0.83. Growth was happening concurrently with democratization.

China stood out as the least democratic country in 2000, as its former neighbors became more democratic. China's DEM score moved from 2 to 3. This represents one of the smallest changes over this timespan and is comparable to that of Canada and Sweden, which are politically stable countries. At this time, China had one of the most stable autocratic governments in the world.

By 2017, the low-democracy class split into 2 clusters, deviating across the line of best fit:

Figure 6. 2017 – SE vs DEM Country Clusters



This new distribution is more densely clustered in the top-right and sparser in the bottom-left. High DEM scores were strongly correlated with high SE scores: every country with a DEM score greater than 70 also had an SE score greater than 70. This correlation at the top-end makes sense because the more democratic a country is, the more rights and equality its citizens have, which leads to more opportunity and abundance for all. It is hard to imagine that a world-leading country in freedom and equal rights would also lead in poverty. However, having a weak democracy did not necessarily mean that a country would have weak social-economic development.

As DEM scores fell below 60, there was increasing variation among SE scores. For example, Hong Kong had a DEM score close to Pakistan (36 vs 34) but had a much higher SE score than Pakistan (77 vs 28). The left-most blue cluster of countries had weaker democracies than the bottom red

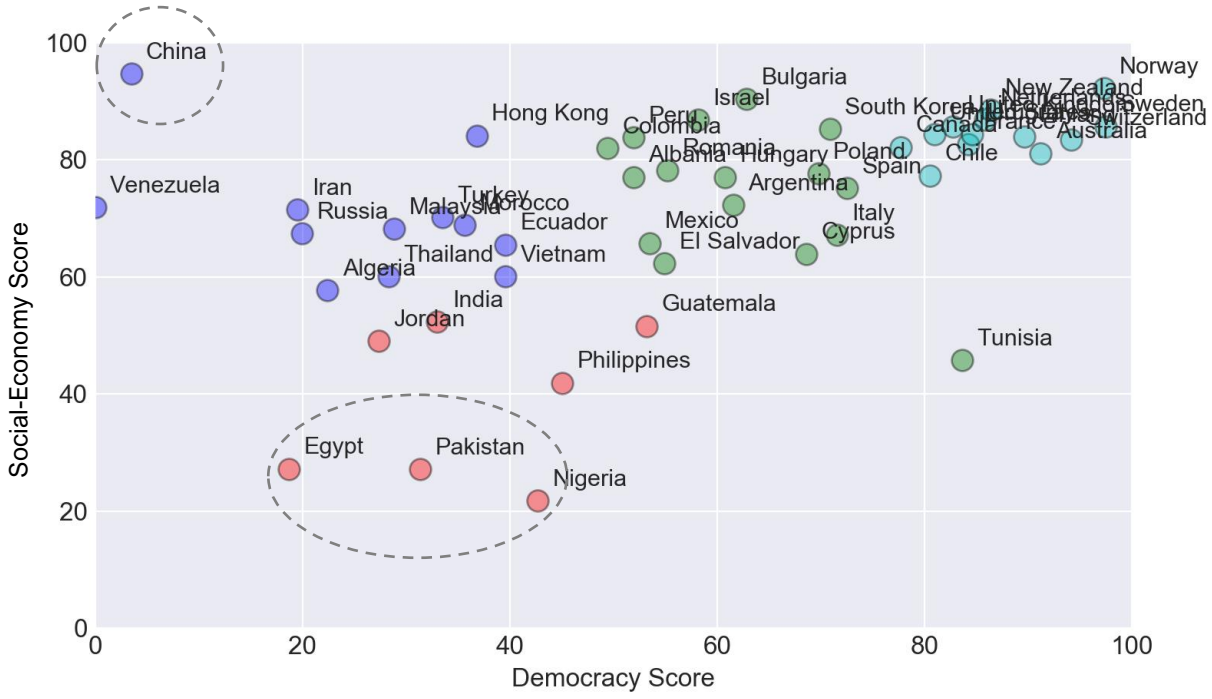
cluster (17 vs 43) but had higher SE scores (52 vs 38). This signals a shift in the trend observed so far. The relationship between democracy and development was no longer linear at lower levels of democracy. As DEM scores decreased, SE scores became less correlated with DEM.

In theory, a well-run autocracy can grow its society using the right rules and incentives. For example, China increased its GDP by 8 times between 2010 and 2017 and became the 2nd largest economy in the world, surpassing the UK, France, Germany, and Japan (World Bank, 2019). China also led the world in exports and global trade. Conversely, a country that is more democratic than China may not achieve the same level of growth. Nigeria, for example, can stagnate and flip-flop between unfair elections and corrupt officials seeking power 'democratically'. It is possible that 'middle-democracies' like Nigeria are less stable than either full autocracies or full democracies, as governmental power is less consolidated. This could explain why the bottom red cluster is more democratic but less productive than the left blue cluster.

The world enjoyed a long era of stability and prosperity since the fall of the Soviet Union and this continued into the 2010s. The average DEM score decreased by 1 point between 2000 and 2017 but the average SE score increased by 14. The number of countries with SE scores over 60 also doubled from 14 to 28. Strong economic development combined with global trade incentivized stability over conflict. The slope of SE vs DEM scores decreased from 0.60 to 0.47, which means that social-economic development is becoming less dependent on democracy. Growth is happening regardless of democracy.

This final cluster analysis uses autoregression-projected data to show the state of the world in 2030:

Figure 7. 2030 – SE vs DEM Country Clusters



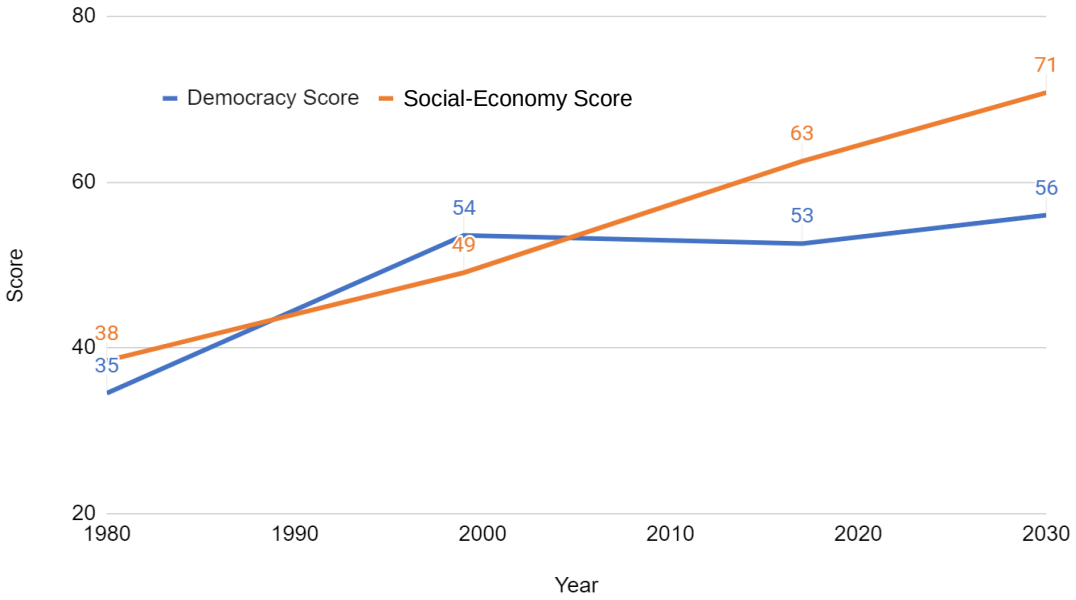
The shape of this distribution is like that of 2017, but with more economic dispersion among the lower democracies. The autoregression algorithm predicts that the average SE score will increase from 63 to 71 and the average DEM score will increase slightly from 53 to 56. This flattens the slope between SE vs DEM even further, from 0.47 in 2017 to 0.31 in 2030. This model predicts that social-economic development will continue to become less correlated with democracy.

Among the biggest outlier countries, China is projected to have by far the highest SE growth while Egypt, Pakistan, and Nigeria stagnate, even though the latter 3 countries are more democratic than China. The way these countries develop have big implications for the world, since they comprise a quarter of the world's population (with 1.4 billion, 98 million, 212 million, and 196 million respectively). Each of these countries – except for China – also has a population growth rate well above the global average (World Bank, 2019).

In 2019, the Egyptian government changed its constitution to consolidate authoritarian rule and expand the military's power to intervene in politics (HRW, 2019). Pakistan currently faces intolerance of diversity and a debt crisis (USIP, 2020). Nigeria is Africa's biggest democracy, but its 2019 election had a historically low voter turnout, which signals a distrust in the government (USIP, 2019). Instability and stagnation in these populous countries can create poverty and mass migration crises in the future. China is expected to have enormous growth but will realistically converge towards the world average as it hits certain social or economic carrying capacities. China has a massive aging population, which was exacerbated by its one-child policy between 1979-2015. This is likely to slow China's growth in the coming decades. However, it is still important to acknowledge China's aggressive and efficient system of governance. Headed by its president for life, general secretary Xi Jinping, China can plan and execute large-scale projects that take decades to complete. One example of focused economic development is the Belt and Road Initiative, a global infrastructure plan for China to invest in 70 countries around Europe and Asia (World Bank, 2019). China plans to pour trillions of dollars into roads, railways, and sea routes to expand its trade and influence. Compared to Egypt, Pakistan, and Nigeria, China's government is more stable and consolidated – it is more efficient at creating economic growth despite a lack in democratic principles.

Between 1980 and 2000, social-economic development around the world seemed to increase at the same rate as democracy. After 2000, changes in democracy slowed considerably, while societies kept growing at a steady rate:

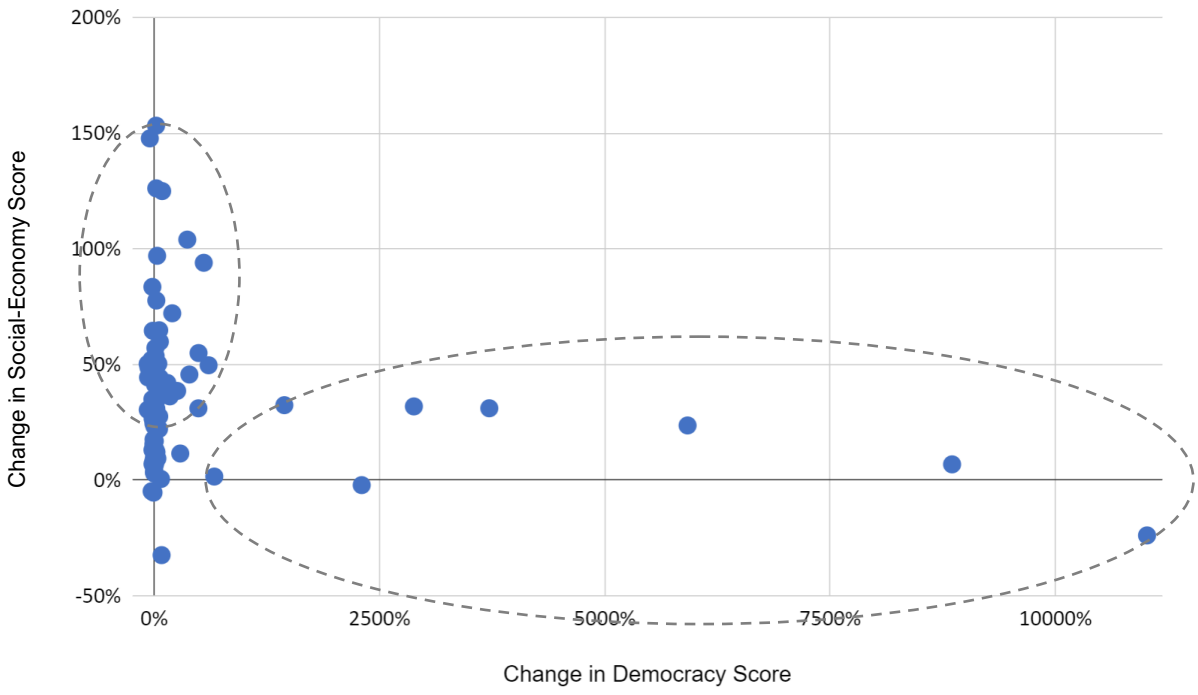
Figure 8. SE and DEM Scores from 1980 to 2030



SE scores became less correlated with DEM scores after 2000, and China continues to be the most influential example of this divergence.

This next graph shows the percent change in SE scores relative to the change in DEM scores over the two observed intervals (1980-2000 and 2000-2017)[3]:

Figure 9. Percent Change of SE and DEM Scores between 1980-2000 and 2000-2017



[3] 1980-2000 is a longer interval of time than 2000-2017. These intervals were chosen for readability and the 3-year difference does not materially impact these results.

Most countries' SE scores increased between 0% to 150% in the observed intervals. The largest changes in SE scores were clustered along the left axis, which means they were more likely to occur during periods of stability (corresponding with smaller changes in DEM scores). Conversely, the biggest changes in DEM scores corresponded with relatively low social-economic growth (bottom circle in Figure 9). This indicates that when countries rapidly democratize, it is difficult for them to also rapidly develop their societies. Political stability can help establish more efficient government systems, which are conducive to sustained growth. Coupled with the previous observation that societies are still growing despite a slowdown in democratization, these data indicate that political stability may have a greater impact on social-economic development than democracy itself.

Conclusion

Data from the V-Dem Institute and World Bank show that democracy has been strongly correlated with social-economic growth since 1980. This correlation is stronger at the top-end: countries with high levels of democracy (Norway, Sweden, Switzerland, etc.) are always seen with high levels of development. However, as nations become less democratic, social-economic outcomes become less predictable.

Fully authoritarian countries like China can have higher growth than weakly democratic countries like Pakistan, who struggle with unfair elections and government uncertainty. One explanation for this is that governments of weaker democracies are less consolidated than that of either full autocracies or full democracies. China can maintain a high rate of growth due to its stable and efficient government, with its president for life and the full nation's resources to support rapid development.

From 1980 to 2017, the highest rates of social-economic growth were most likely to happen during periods of political stability rather than rapid democratization. Democracies may have higher social-economic ceilings, but stability seems to have a greater impact on growth. We cannot confirm the counterfactual to this hypothesis but a reality where social-economic growth increases stability also seems like a positive thing. If countries around the world are more culturally and economically connected, they would be less likely to engage in major conflicts out of negative incentives. The data is selectively optimistic. Countries with high democracy may grow and become more stable over time. However, countries with low democracy and fewer human rights may not rapidly change for the better unless sparked by geopolitical events unpredicted by this data.

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Appendix:

Full python code at: https://github.com/jason-luo-dev/democracy-and-development