Diversification and democracy

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Abstract
Does diversification of an economy improve the chances of democracy? In theory, diversification may reduce elite cohesion and improve citizens' outside options, making democracy more likely. This paper estimates the effect of export diversification on democracy, using data from 143 countries. We use variability within countries in fertile soil as an instrument for diversification, controlling for country size. To address the possibility that current fertile soil variability may have been influenced by historical country characteristics that could also have affected democracy today, we control for historical changes in land cover. We identify a statistically significant, positive effect of diversification on democracy.

Introduction

In a diversified economy, industrial activity is spread over many sectors. In this paper, we analyse whether greater economic diversification increases the chances that a country will be democratic. There are plausible theoretical arguments for a positive impact of diversification on democracy. Diversification of an economy is likely to lead to greater diversity in economic interests, including within elites, and less dependence and hence greater bargaining power for citizens since they face better outside options. If this is the case, diversification should improve chances for democracy. Conversely, incomes that originate from a highly concentrated industrial structure will lead to elites being more cohesive, and citizens more dependent on the elites for survival, reducing the likelihood of democracy.

Our empirical analysis estimates the effect of export diversification on democracy, using data from 143 countries. We use an instrumental variable approach to address the challenge that diversification

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is endogenous. In this way, we get around the problem of reverse causality, i.e. the possibility that elites in non-democracies create entry barriers to new firms, which may reduce diversification (Acemoglu, 2008; Cuberes and Jerzmanowski, 2009). As our instrumental variable we use within-country variation in fertile soil, controlling for country size. We expect (and find) that countries with greater heterogeneity in bio-topographical conditions will have more diversified economies in terms of exports. Controlling for country size, basic bio-topographical conditions are arguably exogenous and can be used to identify the causal effect of diversification on democracy.

Our results show that diversification has a statistically significant, positive effect on democracy. The magnitude of the effect is also sizeable. The results hold for all standard measures of diversification and all standard democracy indices. To address the concern that historical differences between countries in institutional and other factors could have resulted in soil degradation or improvement and also influenced current levels of democracy, we show that our results are robust to the addition of measures of land cover changes since the year 1700, which would capture any such differences. In addition, results are robust to the addition of a number of covariates, including income, population size, ethnic fractionalization, religious composition of the population, inequality, trade, education, latitude, natural resource exports, region and colonial history. We provide tentative evidence for two possible mechanisms behind the results: that diversification reduces elite cohesion, and that it increases citizen power by improving their outside employment options. Moreover, these mechanisms may imply heterogeneous effects of diversification on democracy; if this is the case we show that our estimates identify a local average treatment effect at intermediate levels of diversification.

Our analysis takes the literature on the link between economic and political structure in a new and different direction. Following Lipset (1959), a number of studies have examined the idea that as incomes increase societies are more likely to become democratic, known as the modernization hypothesis (Acemoglu et al., 2008; Boix, 2011; Gundlach and Paldam, 2009; Kennedy, 2010). Other studies have focused more on the relationship between inequality and democracy, tracing their origins back to ideas expressed by Aristotle, de Toqueville and Marx, and offering similarly diverging hypotheses on how inequality affects democracy (Ahlquist and Wibbels, 2012; Ansell and Samuels, 2010; Boix, 2003). We look instead at the effect of industrial concentration, and find little robust evidence that income or inequality has an effect on democracy once the degree of diversification is controlled for. While some previous studies argue that diversification can improve the chances of democracy (Ahlquist and Wibbels, 2012; Boix, 2011), this is mentioned mostly in passing, and the role of diversification in doing so is not sufficiently explained and motivated. We provide a more thorough examination of this relationship, theoretically and empirically.

The paper also speaks to the literature on globalization and development. There is considerable disagreement on the impact of greater openness to trade and investment on democracy, and empirical studies come to different results (Ahlquist and Wibbels, 2012; Freeman and Quinn, 2012; Li and Reuveny, 2003; Liu and Ornelas, 2014; López-Córdova and Meissner, 2008; Rudra, 2005). We complement these studies by analysing the impact of the diversification of exports across sectors, where these studies focus on the total amount of trade or the extent of financial openness. A number of studies also suggest that concentration in particular industries may harm the chances of democracy, in particular concentration in resources such as petroleum and certain minerals (Aslaksen, 2010; Caselli and Tesei, 2016; Ross, 2001; Tsui, 2011). We add to these studies by examining the effect of diversification more generally on democracy. In this, we also add to a literature on diversification that has so far focused on its economic preconditions and effects rather than its political implications (Cadot et al., 2011).

The paper is structured as follows. The next section presents the conceptual framework underlying our empirical analyses, theoretical arguments linking diversification to democracy, and

implications of these arguments for the empirical approach. The third section presents the data used in the empirical analysis, focusing in particular on the operationalization of the instrumental variable, and the democracy and diversification variables. The fourth section presents our main results, and the fifth section robustness tests including controls for historical changes in land cover. A final section concludes.

Conceptual issues

Diversification does not really feature directly in existing political economy models of democracy, such as those of Lipset (1959) or Acemoglu and Robinson (2006). The basic structure of the Acemoglu and Robinson model nevertheless provides a natural starting point for considering the link of diversification to democracy. In very basic terms, their model sees political institutions as determined by elite incentives to permit democracy, and citizen incentives to revolt or fight for democracy. Elites lose from democracy as they will be made to pay higher taxes, but compare this with the costs of a citizen revolt in a non-democratic state and the costs of repression. Citizens similarly compare potential gains they can make from revolting with the costs of staging a revolt. Within this framework, diversification strengthens the relative power of citizens vis-a-vis the elite through two distinct mechanisms, suggesting that diversification improves the chances of transition to, and consolidation of, democracy.

From the perspective of the elite, a more diversified economy introduces the possibility of diverging interests within the elite, making more acute their collective action problem in fighting popular demands for democracy. This is related to the argument mentioned by Ahlquist and Wibbels (2012) that alternative elites may arise in a more diversified economy. These types of arguments seem to rest on the assumption of a sizeable elite with heterogeneous interests. However, even with a small elite and/or one with uniform economic interests, more diversified holdings could make calculations of outcomes from democratization and repression more unclear, making decisive elite action more difficult. A related argument is about risk: a well-diversified elite will be more protected from the risk of a regime change, and hence have less of an incentive to resist democracy.

From the perspective of the citizens, a well-diversified economy will mean that it is easier to switch to a job in a different industry, as there will more likely be industries having similar skill requirements as those that they are currently in. Workers will hence have less to lose from challenging the elite, as job loss poses less of a threat. This in a way also exacerbates the collective action problem of the elite, as employers with lower incentives to resist democracy will attract more workers. Workers with outside options like this may also have lower incentives to take the path of violent revolution, as they have more to lose from the destruction it creates, and hence may choose to pursue democracy through more peaceful means. This is similar to the argument of Lipset (1959) and Acemoglu and Robinson (2006), that a larger middle class with some interest in the status quo tends to temper the strategies of the citizens, making violent and destructive confrontation less likely. However, the argument put forward here emphasizes outside employment options as the key factor, rather than a vaguer notion of middle-class status.

Since economic diversification weakens elite incentives or capabilities to resist democratization and repress the population, and strengthens citizen incentives to pursue democratization, our main hypothesis is that the effect of diversification on democracy is positive. These predictions do not arise solely in a model of elite citizen interaction; elite incentives to introduce democratic elections can similarly be strengthened as the elite grows larger in the minimalist democracy model of Birdner et al. (2014), which sees elections as a form of credible power-sharing mechanism between various parts of the elite.

We note, however, that there are also arguments that point in the opposite direction. In a diversified economy, there will be less macro-economic volatility (Koren and Tenreyro, 2007), and hence less frequent economic crises; and several studies suggest that economic crises reduce the stability of a political system. Acemoglu and Robinson (2001) argue that economic crises represent a situation where the opportunity costs of contesting power are lower, both for citizens attempting to introduce democracy, and for an elite attempting to topple a democracy. Since a diversified economy experiences less frequent crises, we should hence see fewer of these crisis-induced transitions both to and from democracy. If we add to this Huntington's (1991) argument that democratic systems may be less vulnerable to economic downturn 'because failure is blamed on the incumbents instead of the system' (Huntington, 1991: 27), economic crises predominantly destabilize authoritarian political systems. More diversified countries that experience fewer (or less deep) crises should hence see fewer transitions from authoritarianism to democracy than less diversified countries. This provides a volatility-based argument that diversification reduces the chances of democracy.

In testing our main hypothesis, the basis for measuring diversification is an important consideration. Diversification of an economy can in principle be measured in many different ways, the principal ones in the literature tending to be in terms of production, or in terms of exports. Given the theoretical arguments presented above, we would argue that diversification measures based on exports are preferable to measures based on production. A country's export pattern by and large captures the distribution of activity that is competitive internationally, whereas the production pattern is both hard to measure accurately and perhaps more reflective of activities not based on an economic rationale. Diverging interests in the elite will more likely be picked up in competitive export industry data than in production figures that will also reflect rent-seeking activities whose continuation requires the continued coherence of the elite. And similarly, outside employment options for citizens may be perceived as more substantive if tied to internationally competitive firms.

As the above discussion indicates, diversification can be associated with a number of other features of an economy. More diversified economies could be richer, have a more educated population or less inequality, greater trade, or in other ways be different from less diversified economies. Our instrumental variable approach attempts to capture the causal effect of diversification on democracy, i.e. an effect not driven by other underlying characteristics of countries. In addition, we show that the identified effect does not seem to run through variables such as education, inequality or trade, as estimates are relatively unaffected by adding these variables as covariates.

Empirical approach

We address the endogeneity of diversification through an instrumental variable approach, using variability in fertile soil within countries as the instrument. The instrument is based on data on the proportion of a country's area that has fertile soil as calculated by Nunn and Puga (2012). Their calculation is based on work by Fischer et al. (2002), who identify whether each cell on a 5-minute grid covering almost the entire land area of the Earth is subject to various constraints for growing rain-fed crops. The percentage of the land surface area of each country that has fertile soil is then defined as soil not subject to severe constraints for growing rain-fed crops in terms of either soil fertility, depth, chemical and drainage properties, or moisture storage capacity. We use this variable to construct an index of fertile soil variability within countries. If we denote by p_i the percentage of country i's area that has fertile soil, our index of soil variability is calculated as

$$Soil\ variability_i = p_i \cdot (1 - p_i) \qquad (1)$$

This generates an index that runs from 0 to 0.25, where higher values indicate a country whose area is more heterogeneous in terms of fertile soil. For instance, a country whose entire area is either fertile ($p_i = 1$) or wholly infertile ($p_i = 0$), scores zero on the soil variability index. In contrast, a country whose area is half fertile and half infertile soil ($p_i = 0.5$) gets the maximum value of 0.25 on the index.

We expect (and find) that countries with more heterogeneous soil have more diversified economies. The theoretical reasoning behind the instrument is as follows. Ceteris paribus, countries with equal areas of fertile and infertile soil will have more homogeneous input prices than countries with very little or very much fertile soil. Compared to a country half-covered with fertile soil, a country with very little fertile soil will have a high factor price for land relative to other inputs. Similarly, countries with very much fertile land will have high factor prices for other inputs relative to the price for land. Relative factor prices will in a sense be more extreme in countries with little soil variability. This means that some factors will be prohibitively costly in countries that have very little or very much fertile soil, i.e. in countries with little soil variability. These countries will hence be unable to compete in international markets for products that require even a little of the factor they have in relatively short supply, which severely limits the number of product categories they can export, compared to countries with more balanced factor endowments.

These arguments can also be viewed in light of the Hausmann and Hidalgo (2011) model, where different products require different combinations of non-tradable inputs, or capacities, to be produced. Only countries that have the required combination of capacities are able to produce a particular good. In terms of Hausmann and Hidalgo's model, the prohibitively large costs of the relatively scarce factor in countries with high soil variability can be interpreted as not having the capacity in question; though a factor may be physically present in a country, it is too expensive to use for producing goods that are competitive on the international market. Countries with more extreme endowments in terms of fertile soil hence have fewer capacities and can hence produce fewer products for the international market. Countries with high variability in fertile soil, on the other hand, do not face these constraints and can produce more product types.

In instrumenting for diversification with soil variability, we control for physical country size (in millions of square kilometres). We also control for population size and, in line with the large previous literature on modernization, we control for income. Given the size of countries, their heterogeneity in terms of soil composition should be exogenous.[1] The instrument is essentially a measure of the cultivability of land rather than the extent to which land is actually cultivated, and the capacity of soil to be used for growing rain-fed crops is unlikely to be changed on any large scale through human activity. For instance, while irrigation has greatly increased the area of land that is cultivated in many countries, irrigation does not directly affect the area of a country that is cultivable for growing rain-fed crops. Nevertheless, we take seriously the possibility that our instrument captures historical differences between countries in institutional and other factors that could also have influenced current levels of democracy. To this end, we control for historical land cover changes, in particular, changes in cultivated land and desert area. These measures arguably capture any differences between countries that would influence their current soil qualities. In additional estimations, we also control for other factors that soil variability could potentially affect or be correlated with. These include ethnic and other fractionalization, religious composition of the population, inequality, civil war, openness to trade, education, natural resource exports and latitude.

Due to the time-invariant nature of our instrument, we use cross-section instrumental variable estimation to identify the effect of diversification on democracy, as represented by equations (2) and (3). In the first stage, diversification is regressed on variability in fertile soil, and the predicted diversification values are then regressed on democracy. In both stages, we control for country covariates X_i, including income level, country area and population size. Data for both democracy

and diversification are from 2011, the latest available at the time of analysis (results do not change if other years are used). We lag the covariates one period and, for some variables where data are scarce, we use the average over the preceding decade in order to get as many observations as possible (see Table 1 for details).

$$Diversification_i = \alpha_1 + \beta_1 \cdot Soil\ variability_i + \gamma_1 X_i + \varepsilon_{1i} \tag{2}$$

$$Democracy_i = \alpha_2 + \beta_2 \cdot Diversification(predicted)_i + \gamma_2 X_i + \varepsilon_{2i} \tag{3}$$

Our dependent variable Democracy is measured by standard indices commonly used in the literature. In our main estimations we use the Polity IV democracy index, which runs from 0 to 10, with higher values indicating greater democracy. This is an index of institutionalized democracy, which captures the competitiveness of political participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive (see Marshall et al. (2013) for details). To show that our results are robust to the democracy index used, we run additional estimations using the Freedom House political rights and civil liberties indices, which we rescale to the same scale as the Polity IV democracy index to be able to more easily compare results. For reasons of relative conceptual clarity, we prefer the Polity IV democracy index to the composite index used in other studies, which subtracts a measure of autocracy from the democracy score.[2] However, we show that our results are robust to using this composite index as our dependent variable. Moreover, results hold when using the dichotomous democracy measure developed by Przeworski et al. (2000), as elaborated on by Cheibub et al. (2010).

We base our diversification indices on data from the Base pour l'Analyse du Commerce International (BACI), which are based on UN Comtrade data and provides 'comprehensive and disaggregated reconciled values and quantities of international trade' for over 200 countries (Gaulier and Zignago, 2010:7). The most detailed of these data break down bilateral trade volumes between countries according to the product classification of the six-digit harmonized system (hs6). For our purposes, this gives us data on export value (in US$1000) disaggregated into 5111 product categories, for each of the countries covered. We use these data to construct four different indices of export diversification at the country level, to test the robustness of our results to the index used.

The first index is simply the number of products that a country exports, i.e. the number of the 5111 product categories for which a country has a positive export value. While simple, this index provides a view of diversification along the extensive margin, but of course does not reflect any concentration within the group of products actually produced. The other three indices are the Theil index, the Herfindahl index and the Gini index, all adapted from the literature on inequality and industrial organization, and used in earlier studies of diversification. As opposed to the number of export products, the latter three indices are concentration indices, which means that higher scores imply less diversification. The Theil index runs from 0 to $\ln(5111) \approx 8.539$. The Herfindahl and Gini indices range from 0 to 1. For more detail on the calculation of the indices, please refer to Appendix A in the Supplemental Material.

Table 1 includes a full presentation of all the variables used in our analysis. Our main democracy variable is supplemented by four other indices of democracy in robustness tests. To provide some further evidence on the two main mechanisms proposed in the paper, we also use a dummy variable for personalized regimes and an index for the coalition size needed to attain power as proxies for elite cohesion, and two measures of workers' rights as proxies for citizens' outside

Table 1. Main variables.

Variable	Explanation	Source
Dependent variable – main		
Democracy Polity	Polity IV Institutional Democracy Index.	Quality of Government Institute
Dependent variables – mechanisms		
Personalized regime	Dummy variable equal to 1 if a country is classified as a personalized regime type by Geddes et al. (2014), 0 otherwise.	Geddes, Wright and Frantz (GWF) Autocratic Regimes 1.2
Winning coalition	Winning coalition size, a composite index of how large a coalition is needed to attain political power. Scale 0 to 1 with higher values representing a larger winning coalition.	Bueno de Mesquita and Smith (2010)
Worker rights	Dummy variable equal to 1 if workers' rights are not severely restricted according to the Cingranelli–Richards workers' rights index.	Quality of Government Institute
ILO ratifications	Number of ILO core labour conventions a country has ratified by 2011.	Normlex, International Labour Organization
Independent variables		
Exportproducts	Number of hs6 product categories for which a country has positive export values.	BACI International Trade Database
Theil index	Theil index calculated from export values for all hs6 product categories.	BACI International Trade Database
Herfindahl index	Normalized Herfindahl index calculated from export values for all hs6 product categories.	BACI International Trade Database
Gini index	Gini index calculated from export values for all hs6 product categories.	BACI International Trade Database
GDP/capita (ln)	Log of GDP per capita, PPP adjusted, constant 2005 US dollars.	World Development Indicators
Land area	Land area in million square kilometres.	World Development Indicators
Population	Population size in millions.	World Development Indicators
Land cover – developed	Change in percentage of a country's land area covered by cultivated and pasture land from 1700–1990.	Constructed from the ISLSCP II database on Historical Land Cover and Land Use
Land cover – desert	Change in percentage of a country's land area covered by desert from 1700–1990.	Constructed from the ISLSCP II database on Historical Land Cover and Land Use

(Continued)

Table 1. (Continued)

Variable	Explanation	Source
Instrument		
Soil variability	Variation in fertile soil. On the basis of the FAO/UNESCO Digital Soil Map of the World and linked soil association composition table and climatic data compiled by the Climate Research Unit of the University of East Anglia, Fischer et al. (2002) identify whether each cell on a 5-minute grid covering almost the entire land area of the Earth is subject to various constraints for growing rain-fed crops. Based on plates 20 (soil moisture storage capacity constraints), 21 (soil depth constraints), 22 (soil fertility constraints), 23 (soil drainage constraints), 24 (soil texture constraints) and 25 (soil chemical constraints) in Fischer et al. (2002), Nunn and Puga (2012) calculate the percentage of the land surface area of each country that has fertile soil (defined as soil that is not subject to severe constraints for growing rain-fed crops in terms of either soil fertility, depth, chemical and drainage properties, or moisture storage capacity). Denote by p the percentage of the country's area that has fertile soil. Our variable of soil variability is equal to $p*(1 − p)$.	Constructed from Nunn and Puga (2012)

options in the labour market. As noted, our main specification includes income (gross domestic product (GDP) per capita measured in purchasing power parity (PPP) adjusted constant US dollars), land area, and population size. Our main sample thus consists of 143 countries, listed in Table A1 in Appendix A in the Supplemental Material. Additional covariates used in the robustness analysis include changes in land cover, ethnic fractionalization, religious composition, income inequality, civil war, openness to trade, enrolment in tertiary education, latitude, natural resource exports, region and colonial history; these variables are presented in Appendix C in the Supplemental Material. Results are also robust to a range of other covariates, including other measures of fractionalization (religious, linguistic), civil war, education (years of schooling, enrolment in primary and secondary education); we do not, however, report these results.

Table 2 presents descriptive statistics for our main sample of 143 countries, which increases to 167 countries when the Freedom House and Przeworski indices are used as dependent variables. The countries not covered by either sample tend to be concentrated, undemocratic, small and/or poor, which means that any resulting selection bias likely leads our results to underestimate the effect of diversification on democracy. The Exportproducts index shows that the number of product categories exported ranges from 130 to almost 5000, with the mean country exporting about half of the total 5111 products in the hs6 classification. The four diversification indices are highly correlated (not shown in the table), but we notice from Table 2 that the Gini coefficient tends to concentrate in the higher values, reflecting an underlying Lorenz curve that is pushed far to the right by a number of product categories with little or no exports. For the covariates, we see that our sample contains countries with substantial variation in other characteristics.

Further information on how the diversification indices rate countries in terms of diversification can be found in Appendix A in the Supplemental Material. The most concentrated economies tend

Table 2. Summary statistics.

Variable	Obs	Mean	SD	Min	Max
Democracy Polity	143	5.90	3.73	0.00	10.00
Personalized regime	127	0.17	0.38	0.00	1.00
Winning coalition	139	0.68	0.26	0.00	1.00
Worker rights	143	0.59	0.49	0.00	1.00
ILO ratifications	142	7.39	1.28	1.00	8.00
Exportproducts	143	2463.40	1592.11	130.00	4939.00
Theil index	143	4.75	1.67	1.75	8.48
Herfindahl index	143	0.17	0.22	0.00	0.99
Gini index	143	0.95	0.04	0.81	1.00
GDP/capita (ln)	143	8.69	1.29	5.82	11.16
Land area	143	0.83	2.10	0.00	16.38
Population	143	45.57	153.99	0.49	1337.71
Land cover – developed	143	0.25	0.17	0.00	0.66
Land cover – desert	143	−0.02	0.07	−0.53	0.00
Soil variability	143	0.18	0.08	0.00	0.25

Note: For variable definitions, please see Table 1.

to be oil-producing ones in Asia, Africa and Latin America. Iraq has the most concentrated economy in the world, followed by Angola. Among the least concentrated economies are a number of developed European countries, the most diversified being Italy, Germany and Austria, and also the United States and China. Country rankings are largely invariant to the diversification index used, with the exception that countries with the lowest number of export products tend to be small and poor such as Timor-Leste and the Comoros. Appendix A in the Supplemental Material also includes descriptive information on how diversification relates to soil variability, and consistent with our approach the more diversified economies tend to have greater in-country variability in fertile soil.

Results

Table 3 contains the main results from our empirical analysis, using the Polity IV democracy index as the dependent variable. The first two columns of Panel A present the results for the first and second stages of the instrumental variable regression, when the number of export products is used as the index of diversification. The first column reveals that the fertile soil variability instrument is positively and statistically significantly related to diversification in terms of export products. In other words, countries with more variability in fertile soil export more products, as expected. As seen in the bottom row of the first column, the instrument is strong, its first stage F-statistic is just shy of 17, which is above the critical value of the Stock and Yogo (2005) weak identification test with 10 per cent maximal instrumental variable (IV) size. The top row of column two contains our main result, which is that diversification has a statistically significant, positive effect on democracy. Countries that diversify in terms of exporting a higher number of products on average become more democratic. The effect is substantial: an expansion of exports into 100 new product categories increases the score on the democracy index by 0.5 points. The size of the effect is discussed further in Appendix B on local average treatment effects in the Supplemental Material. The third column in Panel A provides corresponding ordinary least squares (OLS) estimates for comparison. The coefficient for diversification here is

Table 3. Main results. Dependent variable: Polity IV democracy index.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	IV – 1st stage Diversification	IV – 2nd stage Democracy Polity	OLS Democracy Polity	IV – 1st stage Diversification	IV – 2nd stage Democracy Polity	OLS Democracy Polity
Exportproducts		0.005***	0.001***			
		(0.00)	(0.00)			
Theil index					-3.184***	-1.275***
					(0.63)	(0.16)
GDP/capita (ln)	901.635***	-3.709***	-0.301	-0.639***	-1.011**	0.189
	(53.53)	(1.22)	(0.37)	(0.08)	(0.48)	(0.25)
Land area	65.576***	-0.287**	-0.121	0.067*	0.272*	0.074
	(23.27)	(0.14)	(0.10)	(0.04)	(0.14)	(0.10)
Population	2.277***	-0.014***	-0.004	-0.003***	-0.010**	-0.004
	(0.52)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Soil variability	4645.419***			-7.657***		
	(1127.57)			(1.62)		
Constant	-6349.533***	26.052***	5.235**	11.718***	30.042***	10.432***
	(454.95)	(7.70)	(2.62)	(0.69)	(6.94)	(2.81)
r^2	0.669	.	0.262	0.415	.	0.348
N	143	143	143	143	143	143
F_instrument	16.973			22.246		

Table 3. (Continued)

Panel B	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	IV – 1st stage Diversification	IV – 2nd stage Democracy Polity	OLS Democracy Polity	IV – 1st stage Diversification	IV – 2nd stage Democracy Polity	OLS Democracy Polity
Herfindahl index		−27.931***	−7.528***			
		(7.15)	(1.17)			
Gini index					−155.361***	−46.076***
					(35.00)	(7.90)
GDP/capita (ln)	−0.042***	−0.157	0.682***	−0.014***	−1.210**	0.338
	(0.01)	(0.46)	(0.23)	(0.00)	(0.53)	(0.28)
Land area	0.005	0.183	0.007	0.003***	0.514**	0.111
	(0.01)	(0.15)	(0.10)	(0.00)	(0.22)	(0.12)
Population	−0.000***	−0.007*	−0.002	−0.000***	−0.015**	−0.004
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Soil variability	−0.873***			−0.157***		
	(0.23)			(0.04)		
Constant	0.692***	12.055**	1.305	1.101***	163.849***	46.721***
	(0.13)	(4.90)	(2.09)	(0.02)	(36.99)	(9.37)
r^2	0.171	.	0.298	0.389	.	0.288
N	143	143	143	143	143	143
F_instrument	14.236			16.177		

Note: Robust standard errors in parentheses, *** indicates significance at the 1% level, ** at 5%, * at 10%. Democracy Polity is the Polity IV index of democracy. Exportproducts is the number of products a country exports. The Theil, Herfindahl and Gini indices are indices of export concentration. For the IV – 2nd stage regressions predicted Exportsproducts, Theil, Herfindahl and Gini Index values from the IV – 1st stage are used, for the OLS regressions the observed values are used. GDP/capita (ln) is the log of GDP per capita, in PPP adjusted, constant 2005 US dollars. Land area is physical country size in million square kilometres. Population is population size in millions. Soil variability is within-country variation in fertile soil.

also significantly positive, but statistically significantly smaller than the estimate from the instrument variable regression ($p < 0.004$).

The results are similar across all four diversification indices. The last three columns of Panel A in Table 3 show the results when the Theil index is used as the main explanatory variable. Column four shows that soil variability is a strong predictor of a country's score on the Theil index. Recall that this index is an index of concentration, so higher values signify less diversification. The negative coefficient for the soil variability index thus means that countries with more variation in fertile soil are less concentrated, i.e. more diversified. The instrument has an F-statistic of more than 22 in the first stage, well above critical values for instrument strength. And there is a statistically significant and negative effect of concentration on democracy in the second stage, as seen in column five. So the earlier finding that diversification increases democracy is upheld. The coefficient is also large: a one standard deviation decrease in the Theil index entails an increase in the Polity democracy index by 5 points. The instrumental variable estimate is again significantly larger than the corresponding OLS estimate ($p < 0.006$).

Panel B of Table 3 yields results for the Herfindahl and Gini indices that are very similar. The instrument is also strong for these measures of diversification, and has the expected sign. Concentration as measured by either index has a significantly negative effect on democracy, and the order of the effect per standard deviation change in diversification is similar to that of the Theil index. The instrumental variable estimates are larger (in absolute terms) than the corresponding OLS estimates ($p < 0.003$ for both indices). The results for all four diversification indices thus provide a stable and consistent picture. As countries diversify their economies, they become more democratic. Further robustness tests reaffirm these results, and are presented in the following section.

For the covariates, examining the first-stage regressions provides the following picture. Richer economies tend to be more diversified (less concentrated) in terms of exports. Larger economies in terms of population size are also more diversified. In the second stage estimations, income is negatively related to democracy. This might suggest that beyond the effect of diversification there is not much of a modernization effect, but we stress that our results only capture correlations for the income variable. Larger countries in terms of population tend to be less democratic, while the pattern for physical country size is unclear.

Further examination of the two main mechanisms behind our main result, that diversification reduces elite cohesion and improves outside options, is constrained by data availability. While both elite cohesion and citizens' outside options can in principle be measured, constructing country-level indices for these variables is not necessarily straightforward. Elite cohesion depends not only on the size of the elite, but also its fractionalization in terms of interests, which in many countries can be hard to document. In measuring the extent of citizens' outside options, the problem arises that simply having outside options increases bargaining power; one does not necessarily have to exercise these options.

Nevertheless, to provide some more tentative evidence on the relationship between diversification and elite cohesion and citizens' outside options, we have performed additional analysis of four indices that capture our mechanisms, if somewhat imperfectly. The first two of these reflect elite cohesion. From the data set of Geddes et al. (2014) on autocratic regimes, we use a dummy variable for whether a country is classified as having a personalized regime, which would indicate a very narrow elite. From Bueno de Mesquita and Smith (2010), we use the winning coalition index, which essentially measures how large a proportion of society you need support from in order to attain political power. One could argue that both these indices are simply indices of democracy, and that the results of an analysis of these variables are unlikely to add much to the previous results using broader democracy indices. However, both indices do highlight and bring out a certain aspect

Table 4. Coefficients for diversification, mechanism regressions, OLS.

Dependent variable	Personalized regime	Winning coalition	Worker rights	ILO ratifications
Exportproducts	−0.0001**	0.0001***	0.0001	0.0002*
p-value	0.02	0.00	0.11	0.09
N	127	139	143	142
Theil index	0.0616**	−0.0838***	−0.0577*	−0.1544**
p-value	0.02	0.00	0.05	0.04
N	127	139	143	142
Herfindahl index	0.4389*	−0.5561***	−0.3369	−0.6928
p-value	0.06	0.00	0.14	0.11
N	127	139	143	142
Gini index	1.3918*	−2.6921***	−2.3023**	−6.2632**
p-value	0.08	0.00	0.04	0.03
N	127	139	143	142

Note: Coefficients, p-values based on robust standard errors and number of observations from OLS regressions using the variable in column headings as dependent variable and diversification index in the row as main explanatory variable. Covariates: GDP/capita (ln), Land area, Population. *** indicates significance at the 1% level, ** at 5%, * at 10%. Personalized regime is a dummy variable for whether a country is governed by a personalized regime. Winning coalition is an index of how large a coalition is needed to attain political power. Worker rights is a dummy variable indicating that worker rights are not severely restricted. ILO ratifications is the number of core ILO labour conventions a country has ratified. Exportproducts is the number of products a country exports. The Theil, Herfindahl and Gini indices are indices of export concentration.

of democracy that is central to the mechanism of elite cohesion, that of the size of a ruling coalition.

We also use two measures of citizens' outside options. Both of these capture the extent of workers' rights in a country. The first is from the Cingranelli–Richards Human Rights Dataset. We use their workers' rights index to construct a dummy variable that takes the value one for countries where workers' rights are not severely restricted. The second is the number of the eight core International Labour Organization (ILO) conventions a country had ratified by 2011. Again, it is not obvious that formal worker rights would necessarily be stronger in countries where citizens have better outside options in the labour market, as this could simply entail less of a need to fight for formal rights. Nevertheless, these indices are as close as we get to capturing the second mechanism using the available data.

Table 4 shows abridged results from 16 different OLS regressions using each of the four indices as dependent variables, and each of the four diversification variables as the main explanatory variable. All regressions feature the same covariates as our main specification, GDP per capita, land area and population, but only the size and p-value of the diversification coefficient is reported, along with the number of observations for each regression. All of the four indices chosen have decent country coverage. From our mechanisms, we would expect more diversified countries to have a lower probability of having a personalized regime, a larger coalition needed for political power and greater worker rights. The coefficients reported in Table 4 all conform to these expectations. With their limitations, these results to some extent corroborate the mechanisms suggested to be behind the effect of diversification on democracy. The indices reflecting elite cohesion do display greater significance than those reflecting workers' outside options, but the latter may reflect a more tenuous link between the chosen index and the underlying mechanism. The importance of

diversification in promoting outside options for citizens is hence a question that deserves further analysis in future work.

The underlying mechanisms of reduced elite cohesion and improved outside options for citizens may imply heterogeneous effects of diversification for countries at different levels of concentration. In Appendix B in the Supplemental Material we show that, if effects of diversification are heterogeneous, our results predominantly capture the effect of diversification in countries at an intermediate level of diversification.

Robustness

To address the possibility that current fertile soil variability could have been influenced by historical country characteristics which could also have affected democracy today, we conducted additional estimations that control for such factors. Table 5 shows results where variables reflecting long-term changes in land cover have been added to the specification. Specifically, we use data from the ISLSCP II database on Historical Land Cover and Land Use, which has georeferenced data with half-by-half degree resolution on land cover for the years 1700–1990. Land cover for each cell in the grid is classified according to 18 different land cover categories. We have mapped this to georeferenced data on the location of current countries (using data from the Gridded Population of the World (GPW) dataset) and generated variables capturing the proportion of a country's surface covered by each of the 18 land cover categories, for the years 1700 and 1990. As land cover variables in Table 5, we have included changes in developed land from 1700–1990 (which includes cultivated land and pasture land), and changes in desert in the same period. Results when using other land change variables or initial levels of land coverage in 1700, rather than changes, are essentially the same. As Table 5 shows, our main results hold when controlling for changes in land cover, and hence for underlying country characteristics that could affect our instrument and, potentially, democracy.

Further robustness results can be found in Appendix C in the Supplemental Material. Table C3 shows that our results are robust to substituting the Freedom House political rights index for the Polity democracy index as our dependent variable. The specifications are otherwise the same. This increases our sample to 167 countries. The soil variability instrument remains sufficiently strong and has the same sign as in regressions using the Polity democracy index. The results for the four diversification variables in the second stage are also similar, albeit with somewhat smaller coefficients (in absolute terms). They remain significantly larger (in absolute terms) than OLS estimates (not shown, $p < 0.003$). Robustness to further democracy indices is demonstrated in Tables C4, C5 and C6. Results are very similar for the Freedom House civil liberties index, for the Polity combined index, and for the democracy dummy of Przeworski et al. (2000).

In Table C7, we add a range of further covariates to our specification, using the Polity IV democracy index as the dependent variable, and the number of export products as the main explanatory variable. The results show that the effect of diversification is not much affected by adding indices of ethnic fractionalization, religious composition of the population, income inequality, civil war, openness to trade, education, latitude, natural resource exports, dummies for colonial history or regional dummies.[3] The estimated coefficients remain statistically significant for combinations of covariates that retain the sample of countries. For combinations that substantially reduce the sample, there is a clear selection problem in that the countries where data are missing tend to be the medium to less diversified ones. This makes the instrument weak, and estimates of diversification more imprecise, but with coefficients similar to the main estimations. This is also reflected in the final column of Table C7, which controls for all the covariates. Tables C8, C9 and C10 provide

Table 5. Results controlling for changes in land cover 1700–1990.

Panel A	(1)	(2)	(3)	(4)
Dependent variable	IV – 1st stage Diversification	IV – 2nd stage Democracy Polity	IV – 1st stage Diversification	IV – 2nd stage Democracy Polity
Exportproducts		0.005***		
		(0.00)		
Theil index				−3.017***
				(0.73)
GDP/capita (ln)	901.700***	−3.580**	−0.620***	−0.883
	(58.87)	(1.44)	(0.08)	(0.54)
Land area	66.265***	−0.265*	0.063*	0.260*
	(22.97)	(0.15)	(0.03)	(0.14)
Population	2.272***	−0.013***	−0.003***	−0.010**
	(0.53)	(0.00)	(0.00)	(0.00)
Land cover – developed	27.955	−0.955	0.524	0.769
	(589.31)	(3.31)	(0.69)	(2.16)
Land cover – desert	620.149	3.993	−1.549	2.461
	(1403.57)	(7.77)	(1.66)	(6.29)
Soil variability	4415.665***		−7.415***	
	(1308.75)		(1.84)	
Constant	−6304.738***	25.667***	11.354***	27.982***
	(532.92)	(9.36)	(0.72)	(7.91)
r^2	0.670		0.424	
N	143	143	143	143
F_instrument	11.384		16.172	

Panel B	(1)	(2)	(3)	(4)
Dependent variable	IV – 1st stage Diversification	IV – 2nd stage Democracy Polity	IV – 1st stage Diversification	IV – 2nd stage Democracy Polity
Herfindahl index		−25.752***		
		(7.68)		
Gini index				−132.235***
				(33.64)
GDP/capita (ln)	−0.037***	0.029	−0.014***	−0.815
	(0.01)	(0.43)	(0.00)	(0.51)
Land area	0.003	0.159	0.003***	0.443**
	(0.00)	(0.13)	(0.00)	(0.19)
Population	−0.000***	−0.006*	−0.000***	−0.013**
	(0.00)	(0.00)	(0.00)	(0.01)
Land cover – developed	0.147	2.966	0.023	2.258
	(0.10)	(2.47)	(0.02)	(2.21)
Land cover – desert	−0.249	0.711	−0.002	6.858
	(0.28)	(9.06)	(0.03)	(5.06)
Soil variability	−0.869***		−0.169***	
	(0.25)		(0.05)	

(Continued)

Table 5. (Continued)

Panel B	(1)	(2)	(3)	(4)
Dependent variable	IV – 1st stage Diversification	IV – 2nd stage Democracy Polity	IV – 1st stage Diversification	IV – 2nd stage Democracy Polity
Constant	0.607***	9.351**	1.091***	138.044***
	(0.13)	(4.64)	(0.02)	(35.65)
r^2	0.195		0.398	
N	143	143	143	143
F_instrument	12.288		13.341	

Note: Robust standard errors in parentheses, *** indicates significance at the 1% level, ** at 5%, * at 10%. Democracy Polity is the Polity IV index of democracy. Exportproducts is the number of products a country exports. The Theil, Herfindahl and Gini indices are indices of export concentration. GDP/capita (ln) is the log of GDP per capita, in PPP adjusted, constant 2005 US dollars. Land area is physical country size in million square kilometres. Population is population size in millions. Land cover – developed is the change from 1700–1990 in percentage of a country's land area covered by cultivated and pasture land, and Land cover – desert the change in percentage covered by desert in the same period. Soil variability is within-country variation in fertile soil.

similar estimations as Table C7, for the Theil, Herfindahl and Gini indices, respectively. All results are essentially the same.

For our main estimations, we have used data from 2011. However, additional estimations show that the results are essentially the same if we use data from any other year for which we have data (1998–2010). Table C11 presents results using data from 1998, 2003 and 2008 as an illustration. Since both the economic and political structure of countries tend to be quite persistent over time, we have used an instrumental variable approach rather than panel data methods in our main estimations. However, in Tables C12 through C15 we present additional results using fixed effects estimations for the years for which we have data (as we lag the diversification variable one year in these estimations, we have data for the period 1999–2011). As expected given the persistence of the diversification and democracy, there are few statistically significant results. However, an interesting pattern emerges as we move from using yearly data in Table C12 to using 3-year intervals in Table C13, 6-year intervals in Table C14, and a 12-year interval in Table C15. The coefficients of the diversification indices attain signs consistent with the results from our instrumental variable analysis, and their coefficients increase in size (in absolute terms) as the length of the interval between observations increases. This suggests that our instrumental variable results capture long-run effects of economic diversification on levels of democracy.

Conclusions

This paper theoretically motivates and empirically estimates the effect of diversification on democracy. A more diversified economy is likely to have a less unified elite, and citizens who have better outside employment options and hence less to lose from challenging the elite. Our empirical analysis suggests that diversification significantly increases chances of democracy. In other words, less concentrated economic power in a society results in more widely distributed political power. Our results have implications for the literature on modernization theory, by emphasizing diversity in industrial structure as a determinant of democracy, where previous studies have stressed income and education levels, or size of the middle class. While the argument that diversification reduces elite cohesion may not be new, the idea that it also improves outside options for citizens seems novel. More work is, however, needed to better understand these mechanisms.

Our analysis seems highly relevant for policy debates on how to promote democracy, but it should be noted that implications for policy may not be straightforward. While diversification improves chances of democracy in a country, it also undermines the power of the elite, and attempts to increase diversification are hence likely to be resisted, undermined, perverted or captured by elites in undemocratic countries. Countries rich in petroleum are a case in point. Diversification is often argued to reduce the challenge of Dutch disease that such economies may face. Our results suggest that by increasing democratic accountability, diversification may also reduce problems of patronage, or the use of resource revenues for political purposes, in such economies (cf. Robinson et al., 2006). However, elites in such economies have an incentive to undermine or capture policies to develop new sectors, to avoid the creation of alternative bases of power that may challenge their access to resource rents. This may be one explanation why diversification efforts in these types of economies are often unconvincing and ultimately unsuccessful.

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Notes

Supplemental material is available online. See http://journals.sagepub.com/home/ips.

1. A similar approach is taken by Gundlach and Paldam (2009), who analyse the effect of income on democracy using measures of prehistoric biological and geographical conditions as their instrument for income. In the literature on diversification, our approach is related to that of Ramcharan (2006), who instruments for diversification of production using within-country variation in topographical conditions, specifically elevation, and estimates the effect of diversification on financial development.
2. See the discussion in Munck and Verkuilen (2002) and Cheibub et al. (2010).
3. In controlling for natural resources, we use total resource exports, rather than the proportion of exports or GDP. Using proportions would have meant having a concentration variable on both the left- and right-hand side of the regression in the first stage of the instrumental variable estimation, which is tautological and soaks up all the variation, leaving little for the other independent variables to explain. We have, however, rerun our analyses using diversification indices with oil excluded, and the results (not reported) hold, so resource dependence does not seem to be the full explanation for our results.

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