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Do institutions promote agricultural productivity?

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Abstract

This study examines how economic and political institutions, particularly economic freedom and electoral democracy, influence agricultural productivity. Agricultural productivity is vital for economic growth and development because it ensures food security, improves health outcomes, and increases rural income, which in turn encourages further investment in farming practices and education. Additionally, higher agricultural productivity enables labor to shift to other sectors, enhancing economic diversification and long-term growth. Using data from 158 countries between 1970 and 2019, this study finds that economic freedom has a significant positive effect on agricultural productivity, with a one-standard-deviation increase in economic freedom leading to an 11.2% increase in agricultural labor productivity. Although electoral democracy alone does not significantly affect agricultural productivity, its interaction with economic freedom is positive and statistically significant. This suggests that the benefits of economic freedom are enhanced when electoral democracy exceeds a certain threshold, and vice versa. This study's findings are robust across various specifications, reinforcing the importance of institutional quality in driving agricultural productivity. Based on these findings, this study concludes that policymakers should consider the synergy between economic freedom and electoral democracy when formulating policies to improve agricultural productivity and promote overall economic growth and development.

Keywords: Agricultural productivity; Institutional quality; Economic freedom; Democracy
JEL Classification: O13; P16; Q10

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1. Introduction

Agricultural productivity plays a crucial role in economic development, particularly in the early stages of a country's growth (Gollin et al., 2002; Caselli, 2005; Restuccia et al., 2008). A more productive agricultural sector enhances food production, ensures food security, and improves overall health outcomes. This is fundamental to building a healthy and capable workforce, which is essential for sustaining economic growth and facilitating structural economic transformation. Moreover, higher agricultural productivity increases the income of farmers and rural populations. As agricultural output increases, farmers generate more revenue from their yield, enabling them to invest in better farming equipment, technology, and education for their children. This creates a cycle of continuous improvement, in which more investment enhances productivity, ultimately raising the standards of living in rural communities.

The surplus generated by a productive agricultural sector also supports industrialization. As efficiency in agriculture improves, less labor is needed, allowing labor to move to other sectors such as manufacturing and services. This transition not only diversifies the economy, but also drives development in non-agricultural industries, which are critical for sustained economic growth (Johnston and Mellor, 1961). Furthermore, agricultural productivity is essential for economic stability. A steady food supply helps stabilize food prices, reducing the risk of inflation and economic instability. This stability is crucial for attracting both domestic and foreign investment, further driving economic growth.

By examining how institutional quality affects agricultural productivity, this study's contribution to the literature is twofold. First, agricultural productivity is closely linked to the per capita gross domestic product (GDP), making it a crucial factor in explaining differences in economic development. Figure 1 depicts the distribution of agricultural labor productivity in 174 countries in 2010. It is divided into four equal parts at the level of agricultural labor productivity. This figure is similar to the distribution of the GDP per capita. Agricultural labor productivity is higher in Europe and North America and lower in Sub-Saharan Africa.[1] Higher agricultural productivity leads to higher output and farmer income, which, in turn, drives overall economic growth. As productivity improves, surplus labor can move to other sectors such as the industrial sector, further contributing to GDP growth (Lewis, 1954). Therefore, analyzing agricultural productivity is the key to understanding cross-country differences in economic development, as it lays the foundation for broader economic transformation and long-term growth.

Second, understanding the significance of institutional quality in economic development is essential (Acemoglu et al., 2005). Strong institutions provide the foundation for effective governance, secure property rights, and transparent legal systems, which are critical for promoting economic growth and development. They foster an environment conducive to business growth, safeguard investments, and ensure efficient resource allocation. Conversely, weak institutions can lead to

[1] Fuglie and Rada (2013) also point out that agricultural productivity in Sub-Saharan African countries remains low.

corruption, inefficiency, and economic stagnation. Understanding the role of institutional quality helps identify the key drivers and obstacles to economic progress. Using a two-sector general equilibrium model, Restuccia et al. (2008) pointed out that differences in economy-wide productivity, barriers to modern intermediate inputs in agriculture, and barriers in the labor market are sources of differences in agricultural labor productivity. Additionally, Adamopoulos and Restuccia (2014) found that measured aggregate factors such as capital, land, and economy-wide productivity explain about a quarter of the observed variation in farm size and productivity, and the remaining differences could potentially be attributed to policies and institutions that lead to resource misallocation among farms.

Our study is related to the extensive literature exploring the relationship between agricultural productivity and economic development (Hayami and Ruttan, 1985; Gollin et al., 2002; Caselli, 2005; Restuccia et al., 2008).[2] Caselli (2005) found that the differences in labor productivity in the agricultural sector are much larger than those in the non-agricultural sector. Lagakos and Waugh (2013) presented a new perspective on these patterns, arguing that sector productivity is driven by the self-selection of heterogeneous workers. Therefore, improving agricultural productivity leads to greater economic development in developing countries (Gollin, 2010). Additionally, using cross-country panel data, Ligon and Sadoulet (2018) found that income growth in the agricultural sector provides relatively greater benefits to the poorest households, especially in poorer countries. de Janvry and Sadoulet (2020) used sectoral- and household-level data and provided additional evidence on this pattern.

Our study also builds on recent studies that investigated the relationship between agricultural productivity, and policies and institutions that lead to resource misallocation (Adamopoulos and Restuccia, 2014, 2020; Adamopoulos et al., 2022). Differences in productivity among countries remain even after considering the differences in the quantity and quality of production factors, such as capital and labor. One explanation for these differences is misallocation (Jones, 2016; Restuccia and Rogerson, 2017). When resources are efficiently allocated, the economy reaches its full production potential. However, the misallocation of resources prevents them from achieving this maximum efficiency. Misallocation arises from statutory provisions such as tax policies and regulations; discretionary provisions such as subsidies and favoritism; and market imperfections such as monopoly power, financial constraints, and weak property rights enforcement (Restuccia and Rogerson, 2017). Given these sources of resource misallocation, this study focuses on economic policies and political institutions. Economic policies include inefficient government regulations, a lack of property rights, and financial market imperfections (Restuccia and Rogerson, 2017). Political institutions also determine economic development and productivity (Acemoglu et al., 2001; 2005). Using firm-level analysis in African countries, limited access to finance and lack of property right protection are important determinants of within-country misallocation (Kalemli-Ozcan and Sørensen, 2016).

Productivity gaps in agriculture between rich and poor countries are vast and driven by the misallocation of resources. Studies have highlighted inefficient land distribution, restrictive policies,

[2] Gollin (2010) provided a theoretical and empirical survey on the relationship between agricultural productivity and economic growth in developing countries.

and institutional barriers. Institutional factors that affect land allocation play a key role in agricultural productivity in Malawi (Chen et al., 2023). Moreover, restricted land market in China hinders productivity in the agricultural sector (Adamopoulos et al., 2022).

This study investigates the impact of economic freedom and electoral democracy on agricultural productivity using data from 158 countries between 1970 and 2019. In our analysis, economic freedom is found to have a significantly positive effect on agricultural productivity, with a one-standard-deviation increase in economic freedom leading to an 11.2% increase in productivity. However, electoral democracy alone does not have a significant impact. When economic freedom and electoral democracy are considered together, their interaction has a significant positive effect on productivity, suggesting that the benefits of economic freedom are enhanced by higher levels of electoral democracy. The positive effect of economic freedom on productivity is significant only when electoral democracy exceeds a certain threshold. Conversely, the positive effect of electoral democracy on productivity becomes stronger when economic freedom surpasses a specified threshold. These findings highlight the importance of institutional quality in driving agricultural productivity.

The remainder of this paper is organized as follows. Section 2 presents the estimation methodology. Section 3 describes the data used in this study. Section 4 presents the results of the estimation and robustness checks, and discusses them. Finally, Section 5 concludes the paper.

2. Estimation methodology

To examine the effects of economic and political institutions on agricultural labor productivity, we use the following equation.

$$\ln y_{it} = \beta_1 Econ_{it} + \beta_2 Pol_{it} + \beta_3 Econ_{it} \times Pol_{it} + \boldsymbol{X}_{it}\gamma + \mu_i + \nu_t + \varepsilon_{it}. \quad (1)$$

y_{it} is agricultural labor productivity in country i in year t; $Econ_{it}$ is economic freedom; Pol_{it} is the political regime measuring the level of democracy; μ_i and υ_t are country- and year-fixed effects, respectively; and ε_{it} is an error term.

$\boldsymbol{X}_{it}$ is a set of control variables that affect agricultural labor productivity. The natural logarithm of the GDP per capita is included as an economic factor. Since the educational level can promote productivity, the human capital index is added. As agricultural factors influence productivity, agricultural land per capita, irrigated areas per hectare, fertilizer input per hectare, and machinery input per hectare are controlled for. Since industrial structure can be a determinant, the manufacturing share and urban population share are included. Finally, because climate change impacts agriculture, we include temperature changes with respect to a baseline climatology, corresponding to the period 1951–1980.

As explained in more detail in the next section, we construct an unbalanced panel dataset using the annual data of 158 countries spanning 1970 to 2019. Given data limitations, we compute five-year

averages for each variable in the baseline sample and obtain a dataset for the following non-overlapping five-year periods: 1970–1974, 1975–1979, …, and 2015–2019.

3. Data

This study uses data obtained from various databases and previous studies. Based on data availability, we construct an unbalanced panel dataset using the annual data of 158 countries for the period 1970–2019. A complete list of the countries included in our sample is provided in Table A.1 of the Appendix.

Agricultural data are obtained from the International Agricultural Productivity database provided by Fuglie (2015). He collected data from various sources, such as the Food and Agricultural Organization (FAO) of the United Nations and International Labour Organization (ILO). Agricultural labor productivity is measured as the total gross value of agricultural output—including crops, livestock, and aquaculture—divided by the number of economically active adults (males and females) engaged in agriculture. However, measuring the number of agricultural workers is difficult. Therefore, following Gollin et al. (2021), we calculate the number of agricultural workers from the agricultural employment share and the working-age population defined as people between the ages of 15 and 64 years. The agricultural employment share is taken from Wingender (2014) and the number of people between 15 and 64 years old is taken from the World Development Indicators by the World Bank (2024). Using this number of agricultural workers, we calculate the alternative agricultural labor productivity.

The economic freedom index, developed by Gwartney et al. (2023), evaluates the extent to which a country's policies and institutions promote economic freedom.[3] This index assesses economic freedom across five key dimensions: size of government, strength of the legal system and property rights, sound money, openness to international trade, and regulatory policies.

We use several democracy indices that are frequently used in the literature. The Varieties of Democracy (V-Dem) provides many democracy indices, and we use electoral democracy and liberal democracy (Coppedge et al., 2024). Their values range from 0 to 1, with a larger value indicating greater democracy. Additionally, we use the Polity democracy index ranging from -10 (less democratic) to 10 (more democratic) provided by the Center for Systemic Peace (2020). Presently, this index is available until 2018.

GDP per capita is the output-side real GDP at chained PPPs divided by the population. Educational level is a human capital index based on years of schooling and returns to education. Both variables are obtained from the Penn World Table version 10.01 (Feenstra et al. 2015).

The variables used as control variables are created from the International Agricultural Productivity database provided by Fuglie (2015). Agricultural land per capita is a quality-adjusted agricultural area in hectares divided by the number of economically active adults (males and females) primarily

[3] The data on economic freedom are available for the years 1970, 1975, …, 1995, and every year since 2000.

employed in agriculture. Irrigated area per hectare is the total area equipped for irrigation divided by the quality-adjusted agricultural area. Fertilizer input per hectare is the total N, P_2O_5, and K_2O nutrients from inorganic fertilizers and N from organic fertilizers applied to soils, in 1000 metric tons divided by the quality-adjusted agricultural area. Machinery input per hectare is determined by the total inventory of farm machinery, including tractors, combine-threshers, and milking machines, measured in thousands of metric horsepower (1000 CV) per quality-adjusted agricultural area.

We calculate the manufacturing share of the GDP using the National Accounts Main Aggregates Database provided by the United Nations (2024). Specifically, we use "GDP and its breakdown at current prices in US dollars" and manufacturing share of GDP is the manufacturing value added divided by GDP. The urban population share is the number of people living in urban areas divided by the total population. This variable is taken from the World Development Indicators of the World Bank (2024).

Temperature change is measured as the deviation in temperature relative to the baseline climatology, which is based on the period from 1951 to1980. The data are obtained from FAOSTAT, provided by the Food and Agriculture Organization of the United Nations (2024).

4. Empirical results

4.1. Main results

In Table 1, we calculate agricultural productivity using the gross value of agricultural output from crops, livestock, and aquaculture, and the number of economically active adults (males and females) primarily employed in agriculture from the International Agricultural Productivity database provided by Fuglie (2015). In column (1), where we include economic freedom and country- and year-fixed effects, the coefficient of economic freedom is significantly positive. As the standard deviation of economic freedom is 1.38, a one-standard-deviation increase in economic freedom is associated with an 11.2% (= 100 × 1.38 × 0.081) more positive agricultural productivity response. Institutions establish a fundamental framework governing economic activities, shaping the incentives and constraints faced by farmers. Well-functioning institutions, characterized by secure property rights, effective contract enforcement, and transparent regulatory frameworks, can significantly enhance agricultural productivity. They provide farmers with stability and confidence to invest in their land, adopt new technologies, and engage in long-term planning. Conversely, weak institutions can create uncertainty, leading to land tenure insecurity, corruption, and inefficiency. These issues discourage investment and innovation, thereby hindering productivity growth in the agricultural sector.

In column (2), where we include electoral democracy from V-Dem instead of economic freedom, the coefficient of electoral democracy is not significant. In column (3), which includes both economic freedom and electoral democracy, the results are consistent with those in columns (1) and (2). In column (4), we include the squared terms of economic freedom and electoral democracy to capture nonlinearity. While the coefficients of electoral democracy in columns (2) and (3) are not significant,

both coefficients of electoral democracy are significant in column (4). The relationship between agricultural labor productivity and electoral democracy is U-shaped, with a turning point of 0.435 for electoral democracy, which is the 45th percentile of electoral democracy.

In column (5), which includes economic freedom, electoral democracy, and their interaction term, the interaction term has a significant positive impact. This result holds in column (6), where we control for several control variables. Although the coefficients of economic freedom are not significant in columns (5) and (6), the coefficients of economic freedom and its interaction with electoral democracy are statistically significant at the conventional significance level.

Figure 2 shows the marginal effect of economic freedom at various levels of electoral democracy, based on the results in column (6). This figure suggests that electoral democracy amplifies the benefits of economic freedom. The partial impact of economic freedom is $-0.036 + 0.166 \times$ Electoral democracy, which provides the threshold value of electoral democracy (0.219) that divides countries according to the partial impact of economic freedom on agricultural productivity. If the degree of electoral democracy is below this threshold, the partial effect of economic freedom on agricultural productivity is negative, whereas if the degree of electoral democracy is above this threshold, the partial effect is positive. This threshold value is the approximate first quartile in our sample. Furthermore, Figure 3 illustrates the marginal effect of electoral democracy at various levels of economic freedom. If economic freedom exceeds the threshold value of 4.551, the positive impact of electoral democracy increases as economic freedom increases.

4.2. Robustness checks

Various robustness checks are conducted. In Table 2, we calculate the agricultural productivity using other data on the number of agricultural workers. Following Gollin et al. (2021), to compute the number of agricultural workers, we multiply the agricultural employment share provided by Wingender (2014) by the working-age population, defined as people aged between 15 and 64 years, provided by the World Bank (2024). Owing to data availability on the agricultural employment share, we use five-year averaged data between 1970 and 2009. The results in Table 2 are similar to those in Table 1, and in columns (5) and (6), the coefficient of economic freedom is additionally significant.

The indices of democracy vary and are actively debated in political science. Democracy indices from V-Dem are popular and frequently used in the economics and political science literature. V-Dem provides several democracy indices in addition to the electoral democracy used in Table 1. In Table 3, we use the liberal democracy index from V-Dem instead of electoral democracy. This index emphasizes the aspects of freedom, that is, protecting individual and minority rights against the tyranny of the state and the majority. The results in Table 3 are almost identical to those in Table 1. Furthermore, in Table 4, we use the democracy index from Polity V, which is widely used in the literature. The results in Table 4 are also the same as in Table 1.

In Table 5, we calculate agricultural labor productivity using the gross value of 162 crop commodities as output, instead of the gross value of agricultural output from crops, livestock, and

aquaculture. The data are obtained from the International Agricultural Productivity database provided by Fuglie (2015). The results in Table 5 are similar to those in Table 1.

In Table 6, we use agriculture value-added per worker as agricultural labor productivity. The data are provided by the FAO (2024) and have been available every year since 2000. Therefore, we use annual data from 2000 to 2019 in Table 6. While none of the coefficients in column (5) are significant, the interaction term between economic freedom and electoral democracy is significantly positive in column (6).

In Table 7, we use agricultural TFP growth instead of agricultural labor productivity. The data are created by Fuglie (2015) and include the growth rate of agricultural TFP, but not its level. Using the annual data from 2000 to 2019, we present the estimation results in Table 7. While economic freedom and electoral democracy do not have significant impacts in columns (1) and (2), the results in columns (5) and (6) are similar to those in Table 1.

5. Conclusion

This study examined the relationship between economic and political institutions, particularly economic freedom and electoral democracy, and agricultural productivity, across 158 countries between 1970 and 2019. The results indicate that economic freedom has a significantly positive effect on agricultural productivity, with a one-standard-deviation increase in economic freedom contributing to an 11.2% increase in agricultural labor productivity. Although electoral democracy alone does not directly impact productivity, its interaction with economic freedom is statistically significant. Specifically, the benefits of economic freedom become more pronounced when electoral democracy exceeds a certain threshold, and vice versa. These results highlight the importance of institutional quality in enhancing agricultural productivity, suggesting that well-functioning institutions create a favorable environment for agricultural growth, which is critical for overall economic growth and development, and structural transformation.

Despite these insights, this study has some limitations. First, its reliance on aggregated national-level data does not account for regional variations within countries. Agricultural productivity, institutional quality, and political conditions can greatly differ between rural and urban areas, meaning that this level of aggregation may obscure important subnational dynamics that can influence agricultural productivity at a more localized level. Second, this study primarily focuses on the interaction between economic freedom and electoral democracy, without fully addressing other aspects of governance, such as regulatory quality and political stability. Future research could benefit from examining these additional aspects as well as the roles of technological advancement, climate change, and global trade policies in shaping agricultural productivity. Third, although this study controls for various factors that may affect productivity, thereby mitigating the endogeneity issues arising from omitted variable bias, it does not fully resolve these concerns. Future research should address this issue more rigorously. Addressing these limitations will provide a more comprehensive understanding of the

drivers of agricultural productivity and their implications for economic development.

The policy implications of this study are significant. Policymakers aiming to improve agricultural productivity should not only promote economic freedom by reducing regulatory burdens and strengthening property rights but also ensure that political institutions foster electoral democracy. These findings suggest that the interaction between economic freedom and electoral democracy is important, implying that reforms should be designed to simultaneously enhance both economic and political institutions. In countries with weak electoral democracy, the full benefits of economic freedom may not be realized, and vice versa. Therefore, an integrated approach to institutional reform is essential for boosting agricultural productivity, which, in turn, can lead to sustainable economic growth, poverty reduction, and higher food security.

Appendix

See Tables A1–A2.

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Table 1. Effects on agricultural labor productivity.

	(1)	(2)	(3)	(4)	(5)	(6)
Economic freedom	0.081***		0.078***	-0.172	-0.055	-0.036
	(0.025)		(0.024)	(0.111)	(0.043)	(0.041)
Electoral democracy		0.162	0.046	-1.558***	-1.571***	-0.754**
		(0.159)	(0.154)	(0.466)	(0.395)	(0.359)
Economic freedom squared				0.022**		
				(0.010)		
Electoral democracy squared				1.792***		
				(0.474)		
Economic freedom					0.290***	0.166**
× Electoral democracy					(0.074)	(0.064)
ln GDP per capita						0.208***
						(0.057)
Human capital						0.298***
						(0.111)
Agricultural land per capita						0.025***
						(0.007)
Irrigation per hectare						1.060**
						(0.473)
Fertilizer per hectare						0.144
						(0.313)
Machinery per hectare						24.117
						(20.863)
Manufacturing share						-0.141
						(0.383)
Urban population						0.015
						(0.442)
Temperature change						0.159***
						(0.046)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Countries	155	155	155	155	155	133
Observations	1200	1200	1200	1200	1200	1079

Notes. The dependent variable is the natural logarithm of agricultural labor productivity. The numbers in parentheses are robust standard errors clustered at the country level. The asterisks ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively.

Table 2. Effects on alternative agricultural labor productivity.

	(1)	(2)	(3)	(4)	(5)	(6)
Economic freedom	0.057***		0.059***	-0.246**	-0.078**	-0.089***
	(0.020)		(0.020)	(0.098)	(0.039)	(0.034)
Electoral democracy		0.046	-0.038	-1.618***	-1.613***	-1.266***
		(0.140)	(0.133)	(0.417)	(0.361)	(0.315)
Economic freedom squared				0.027***		
				(0.009)		
Electoral democracy squared				1.774***		
				(0.460)		
Economic freedom					0.288***	0.242***
× Electoral democracy					(0.070)	(0.058)
Control	No	No	No	No	No	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Countries	133	133	133	133	133	122
Observations	1008	1008	1008	1008	1008	936

Notes. The dependent variable is the natural logarithm of agricultural labor productivity, using other data on the number of agricultural workers. Column (6) includes the same control variables as in column (6) in Table 1; however, the results are not reported. The numbers in parentheses are robust standard errors clustered at the country level. The asterisks ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively.

Table 3. Effects on agricultural labor productivity.

	(1)	(2)	(3)	(4)	(5)	(6)
Economic freedom	0.082***		0.073***	-0.171	-0.032	-0.019
	(0.025)		(0.025)	(0.112)	(0.036)	(0.035)
Liberal democracy		0.301*	0.168	-1.274***	-1.660***	-0.758*
		(0.166)	(0.165)	(0.390)	(0.408)	(0.394)
Economic freedom squared				0.022**		
				(0.010)		
Liberal democracy squared				1.908***		
				(0.511)		
Economic freedom					0.315***	0.170**
× Liberal democracy					(0.072)	(0.066)
Control	No	No	No	No	No	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Countries	155	155	155	155	155	133
Observations	1195	1195	1195	1195	1195	1074

Notes. The dependent variable is the natural logarithm of agricultural labor productivity. Column (6) includes the same control variables as in column (6) in Table 1; however, the results are not reported. The numbers in parentheses are robust standard errors clustered at the country level. The asterisks ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively.

Table 4. Effects on agricultural labor productivity.

	(1)	(2)	(3)	(4)	(5)	(6)
Economic freedom	0.082***		0.090***	-0.203*	0.065**	0.033
	(0.025)		(0.025)	(0.117)	(0.026)	(0.024)
Democracy (Polity)		-0.002	-0.006	-0.006	-0.049***	-0.021*
		(0.006)	(0.006)	(0.005)	(0.015)	(0.013)
Economic freedom squared				0.026**		
				(0.011)		
Democracy (Polity) squared				0.002**		
				(0.001)		
Economic freedom					0.008***	0.004*
× Democracy (Polity)					(0.003)	(0.002)
Control	No	No	No	No	No	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Countries	151	151	151	151	151	131
Observations	1166	1166	1166	1166	1166	1061

Notes. The dependent variable is the natural logarithm of agricultural labor productivity. Column (6) includes the same control variables as in column (6) in Table 1; however, the results are not reported. The numbers in parentheses are robust standard errors clustered at the country level. The asterisks ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively.

Table 5. Effects on agricultural labor productivity of crop production.

	(1)	(2)	(3)	(4)	(5)	(6)
Economic freedom	0.083***		0.079***	-0.142	-0.039	-0.008
	(0.026)		(0.026)	(0.103)	(0.044)	(0.046)
Electoral democracy		0.181	0.064	-1.276**	-1.374***	-0.570
		(0.157)	(0.153)	(0.491)	(0.368)	(0.382)
Economic freedom squared				0.020**		
				(0.009)		
Electoral democracy squared				1.497***		
				(0.466)		
Economic freedom					0.258***	0.137*
× Electoral democracy					(0.071)	(0.070)
Control	No	No	No	No	No	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Countries	155	155	155	155	155	133
Observations	1200	1200	1200	1200	1200	1079

Notes. The dependent variable is the natural logarithm of agricultural labor productivity of crop production. Column (6) includes the same control variables as in column (6) in Table 1; however, the results are not reported. The numbers in parentheses are robust standard errors clustered at the country level. The asterisks ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively.

Table 6. Effects on agricultural labor productivity, 2000–2019.

	(1)	(2)	(3)	(4)	(5)	(6)
Economic freedom	0.096***		0.092***	-0.080	0.076	0.006
	(0.031)		(0.030)	(0.177)	(0.058)	(0.051)
Electoral democracy		0.202	0.133	0.506	-0.109	-0.772
		(0.130)	(0.121)	(0.499)	(0.677)	(0.504)
Economic freedom squared				0.015		
				(0.014)		
Electoral democracy squared				-0.380		
				(0.489)		
Economic freedom					0.039	0.131*
× Electoral democracy					(0.103)	(0.078)
Control	No	No	No	No	No	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Countries	156	156	156	156	156	133
Observations	2846	2846	2846	2846	2846	2439

Notes. The dependent variable is the natural logarithm of agriculture value added per worker. Column (6) includes the same control variables as in column (6) in Table 1; however, the results are not reported. The numbers in parentheses are robust standard errors clustered at the country level. The asterisks ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively.

Table 7. Effects on agricultural TFP growth, 2000–2019.

	(1)	(2)	(3)	(4)	(5)	(6)
Economic freedom	0.000		-0.000	-0.016	-0.016*	-0.013
	(0.005)		(0.005)	(0.030)	(0.009)	(0.009)
Electoral democracy		0.015	0.015	-0.130	-0.227**	-0.189**
		(0.019)	(0.018)	(0.084)	(0.090)	(0.091)
Economic freedom squared				0.001		
				(0.002)		
Electoral democracy squared				0.162**		
				(0.080)		
Economic freedom					0.039***	0.032**
× Electoral democracy					(0.014)	(0.014)
Control	No	No	No	No	No	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Countries	155	155	155	155	155	134
Observations	2821	2821	2821	2821	2821	2456

Notes. The dependent variable is agricultural TFP growth. Column (6) includes the same control variables as in column (6) in Table 1; however, the results are not reported. The numbers in parentheses are robust standard errors clustered at the country level. The asterisks ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively.

Table A1. List of countries.

Albania	Congo, Rep.	India	Mongolia	Slovak Republic
Algeria	Costa Rica	Indonesia	Montenegro	Slovenia
Angola	Croatia	Iran, Islamic Rep.	Morocco	South Africa
Argentina	Cyprus	Iraq	Mozambique	Spain
Armenia	Czechia	Ireland	Myanmar	Sri Lanka
Australia	Cote d'Ivoire	Israel	Namibia	Sudan
Austria	Denmark	Italy	Nepal	Suriname
Azerbaijan	Dominican Republic	Jamaica	Netherlands	Sweden
Bahrain	Ecuador	Japan	New Zealand	Switzerland
Bangladesh	Egypt, Arab Rep.	Jordan	Nicaragua	Syrian Arab Republic
Barbados	El Salvador	Kazakhstan	Niger	Taiwan
Belarus	Estonia	Kenya	Nigeria	Tajikistan
Belgium	Eswatini	Korea, Rep.	North Macedonia	Tanzania
Benin	Ethiopia	Kuwait	Norway	Thailand
Bhutan	Fiji	Kyrgyz Republic	Oman	Timor-Leste
Bolivia	Finland	Lao PDR	Pakistan	Togo
Bosnia and Herzegovina	France	Latvia	Panama	Trinidad and Tobago
Botswana	Gabon	Lebanon	Papua New Guinea	Tunisia
Brazil	Gambia, The	Lesotho	Paraguay	Turkiye
Bulgaria	Georgia	Liberia	Peru	Uganda
Burkina Faso	Germany	Libya	Philippines	Ukraine
Burundi	Ghana	Lithuania	Poland	United Arab Emirates
Cabo Verde	Greece	Luxembourg	Portugal	United Kingdom
Cambodia	Guatemala	Madagascar	Qatar	United States
Cameroon	Guinea	Malawi	Romania	Uruguay
Canada	Guinea-Bissau	Malaysia	Russian Federation	Venezuela, RB
Central African Republic	Guyana	Mali	Rwanda	Viet Nam
Chad	Haiti	Malta	Saudi Arabia	Yemen, Rep.
Chile	Honduras	Mauritania	Senegal	Zambia
China	Hong Kong	Mauritius	Serbia	Zimbabwe
Colombia	Hungary	Mexico	Sierra Leone	
Congo, Dem. Rep.	Iceland	Moldova	Singapore	

Table A2. Descriptive statistics for Table 1.

Variables	Observations	Mean	Std. Dev.	Min	Max
ln Agricultural labor productivity	1,200	8.554	1.411	5.850	12.103
Economic freedom	1,200	6.074	1.379	1.870	8.910
Electoral democracy	1,200	0.500	0.281	0.015	0.921
ln GDP per capita	1,079	8.919	1.188	6.243	12.378
Human capital	1,079	2.248	0.727	1.012	3.808
Agricultural land per capita	1,079	9.079	21.604	0.401	208.431
Irrigation per hectare	1,079	0.112	0.111	0.000	0.463
Fertilizer per hectare	1,079	0.099	0.115	0.001	0.899
Machinery per hectare	1,079	0.001	0.002	0.0000002	0.019
Manufacturing share	1,079	0.153	0.062	0.019	0.374
Urban population	1,079	0.543	0.229	0.031	1
Temperature change	1,079	0.646	0.529	-0.525	2.185

Notes. These statistics are calculated based on the five-year averaged data in Table 1.

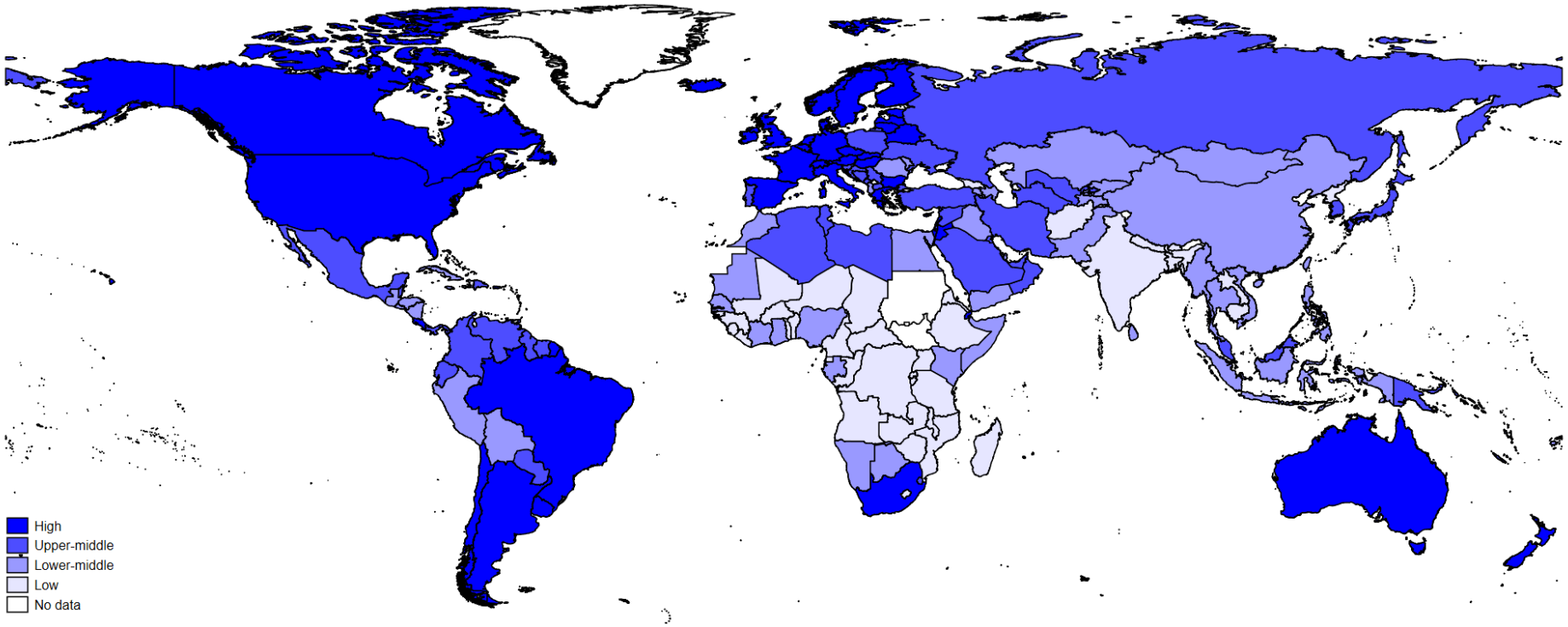

Figure 1. Distribution of agricultural labor productivity in 2010.

Notes. This figure is based on 174 countries with agricultural productivity data for 2010 divided into four equal parts. Agricultural labor productivity is defined as the gross value of agricultural output from crops, livestock, and aquaculture divided by the number of economically active adults (males and females) primarily employed in agriculture. The data are obtained from the International Agricultural Productivity database provided by Fuglie (2015).

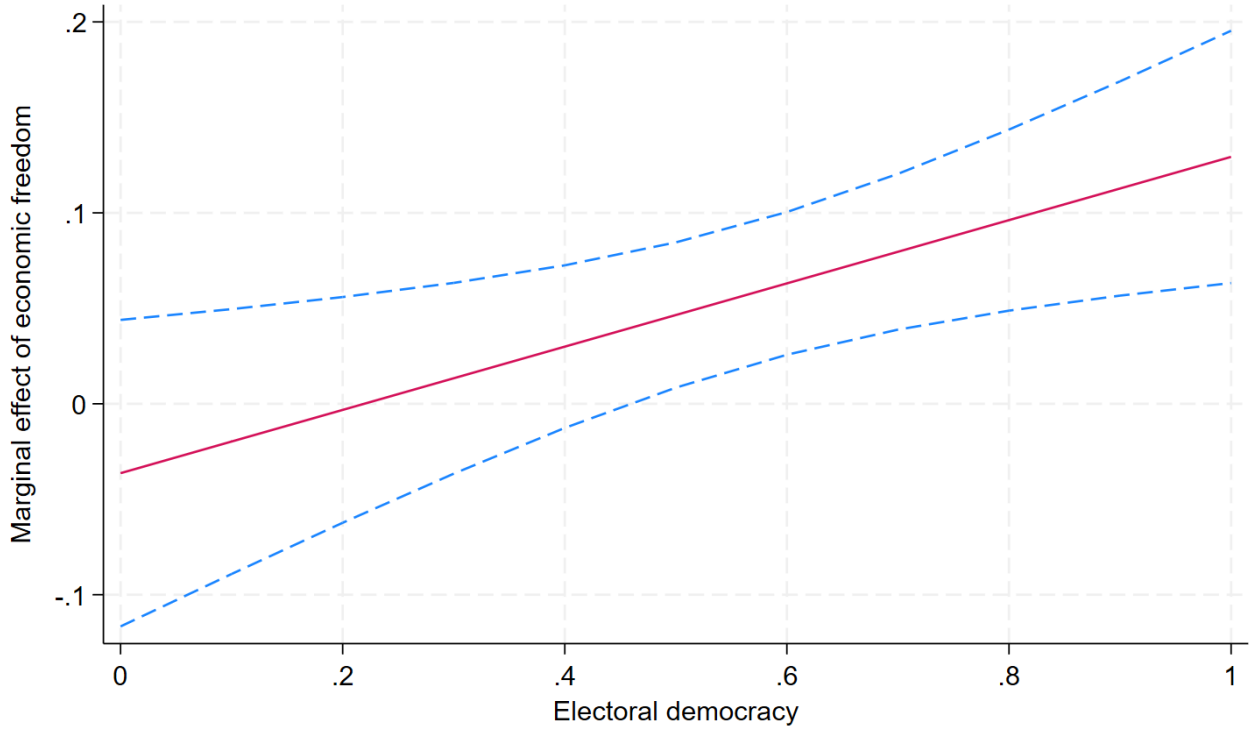

Figure 2. Marginal effect of economic freedom depending on electoral democracy.

Notes. This figure is based on the results in column (6) of Table 1. Dashed lines indicate 95% confidence intervals.

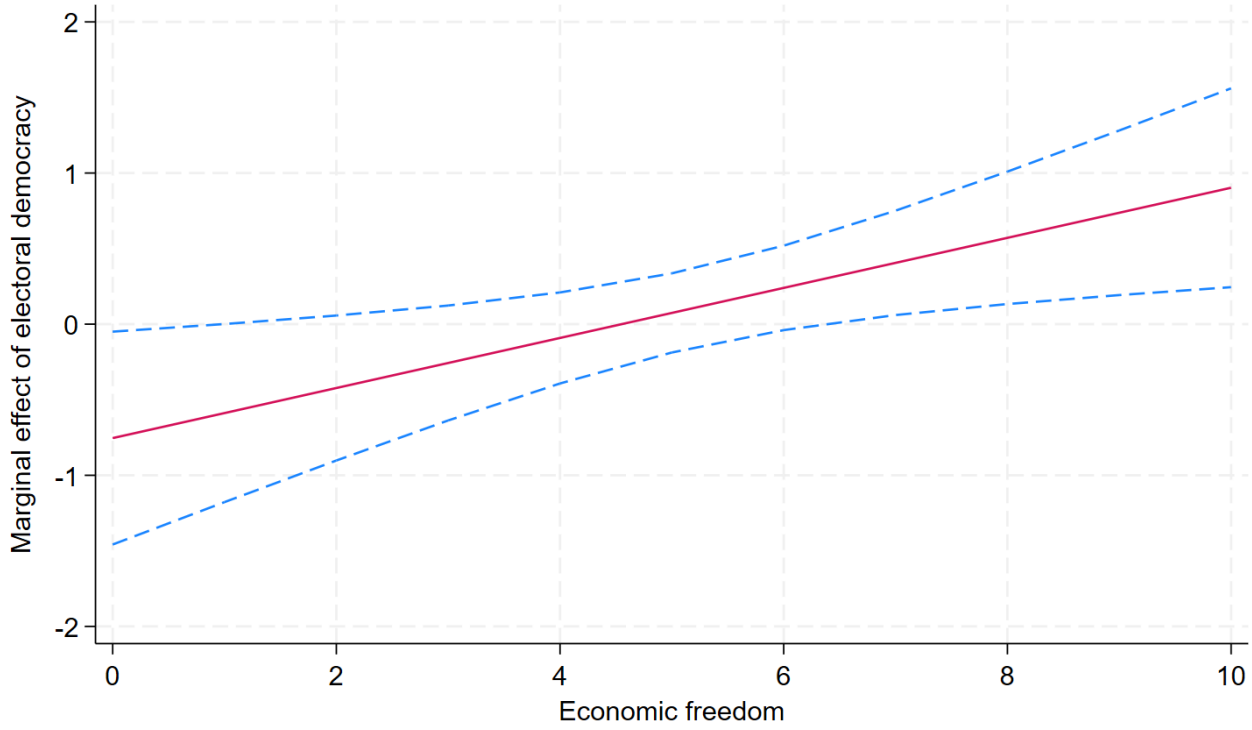

Figure 3. Marginal effect of electoral democracy depending on economic freedom.

Notes. This figure is based on the results in column (6) of Table 1. Dashed lines indicate 95% confidence intervals.