Do political regimes matter for technology diffusion?

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23 October 2020

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October 2020

Abstract

This study examines the effects of political regimes on technology diffusion, using data from a sample of 104 technologies from 137 countries between 1901 and 2000. We find that democracy is positively associated with the diffusion of health and agriculture-related technologies. Furthermore, the diffusion of infrastructure, general, and other sector-specific technologies are not influenced by political regimes.

Keywords: Technology diffusion; Democracy; Dictatorship
JEL Classification: O33; O40; P16

*This work received financial support from the JSPS KAKENHI Grant Number JP20K01697.

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1 Introduction

Productivity growth is important for long-term economic growth, and technology diffusion is one of its key drivers. Many studies examine the determinants of technology diffusion, focusing on factors such as human capital, trade openness, and political regimes (e.g., Benhabib and Spiegel, 2005; Acemoglu et al., 2006; Comin and Hobjin, 2009; Cervellati et al., 2018). These studies mainly use different levels of technology diffusion simultaneously. Given that technology diffusion can be different by industry or technology type, an exploration of its determinants by technology type can provide more insightful implications.

Therefore, focusing on the role of political regimes, this study provides an empirical analysis of the determinants of technology diffusion by considering three different technology types: welfare technologies (related to health); economy-wide technologies (related to infrastructure—including telecommunications and transportation—and general technologies); and sector-specific technologies (related to agriculture, steel, and finance). Our estimation results indicate that a democracy is positively associated with the diffusion of health and agriculture-related technologies. Furthermore, we find that political regimes do not affect the diffusion of infrastructure-related, general, and other sector-specific technologies.

2 Estimation methodology and data

To examine the effects of political regimes on technology diffusion, we use the following equation.

$$\ln(y_{ijt}) = \beta Regime_{it} + \boldsymbol{\gamma}'\mathbf{X}_{it} + \Phi_{ijt} + \varepsilon_{ijt}.$$

y_{ijt} is the adoption of technology i in the country j in year t. *Regime* represents political regimes. Φ_{ijt} is fixed effects, and ε is an error term. $\mathbf{X}$ is both a constant and a set of control variables, such as the natural logarithms of GDP per capita and population. The dependent variable is the technology diffusion measures taken from Comin and Hobijn's (2004) Cross-country Historical Adoption of Technology (CHAT) dataset. The technologies used in our estimation are welfare-related technologies (i.e., health), economy-wide-related technologies such as infrastructure (i.e., telecommunications and transportation) and general technologies, and sector-specific technologies (e.g., agriculture, steel, and finance). An estimation using all these technologies has also been provided for comparison. Our sample includes 104 technologies from 137 countries between 1901 and 2000. Fixed effects control is employed to capture different paths of technology diffusion. Following Comin and Hobijn (2009) and Cervellati et al. (2018), we include both country fixed effects and technology × year fixed effects. Several democracy indices are used for robustness checks, and our main measure is the *polity2* variable in the Polity IV dataset (Marshall et al., 2019), which ranges from –10 (dictatorship) to 10 (democracy). We also employ different types of democracy and dictatorship regimes: par-

liamentary, mixed (semi-presidential), and presidential democracy; and civilian, military, and royal dictatorship (Cheibub et al., 2010). The detailed sources, definitions, and descriptive statistics of each variable are provided in the online appendix.

3 Empirical results

Table 1 shows the estimation results of the effects of democracy on technology diffusion. The *polity2* variable is used as a democracy measure. In column (1), democracy has a non-significant impact on technology diffusion for all available technologies. In more democratic countries, where property rights are likely to be protected and educational levels are likely to be high, innovations and technologies are likely to spread. On the other hand, in more dictatorial countries, technology development is often a national strategy, and huge national projects for research and development (R&D) may be implemented. As a result, if all available technologies are considered, political regimes might not matter for technology diffusion.

In column (2), the diffusion of welfare- (i.e., health-) related technology is positively associated with a higher level of democracy. In more democratic countries, the government provides the vulnerable population with public goods, and as a result, health technologies proliferate. This result is consistent with those of previous studies (Kotera and Okada, 2017; Okada, 2018).

In columns (3) and (4), the associations of democracy with infrastructure-related and general technologies are not statistically significant. These economy-wide technologies are the basis for other technologies. They can be strategic for the economic, political, and military sectors, which are generally highly prioritized in democratic countries, regardless of the level of democracy. For instance, it has been observed that internet technology is well-developed in democratic countries like the United States and the European countries, as well as in authoritarian countries such as China, where it is possibly used as a tool by the government to monitor people.

Column (5) indicates that democracy significantly promotes agriculture-related technology diffusion. Dictatorial regimes might implement urban-biased policies for political purposes. For example, the Chinese government has maintained low levels of government expenditure on agriculture (Yang and Fang, 2003). Columns (6) and (7) suggest that democracy's relationships with the steel and financial sector technologies are not statistically significant. In the case of infrastructure-related and general technologies in columns (3) and (4), these can be strategic for the economic, political, and military sectors. Therefore, political regimes might not matter for their diffusion.

As robustness checks, we conduct the same regression analyses using two additional democracy measures, namely the democracy-dictatorship (DD) index by Cheibub et al. (2010) and electoral democracy measure in Variety of Democracy by Coppedge et al. (2019). The results

are similar to those in Table 1.[1]

[Table 1 here]

Table 2 shows the results on the effects of different types of democracy and dictatorship on technology diffusion. Based on data availability, we use data from 1946 to 2000. Panel A reports the results of our investigation of the three types of democracy, considering dictatorship as a reference group. In column (2) of Panel A, health technology diffusion is positively associated with parliamentary and mixed democracies, whereas it is not in the case of presidential democracy. This result can be explained by the fact that a parliamentary democracy has more redistributive policies than a presidential democracy (Persson and Tabellini, 2003).

In Panel B of Table 2, we report the effects of the three types of dictatorship regimes, considering democracy as a reference group. In column (1), where all technologies are considered, technology diffusion is negatively related to a military dictatorship. Because military regimes tend to be short-lived among dictatorships (Geddes, 1999), political leaders in military regimes are unlikely or have lower incentives to invest in developing new technology. In column (2), health-related technology is negatively associated with all types of dictatorships. Political rulers in dictatorial countries might not put efforts on progressive redistribution, and health expenditure is often relatively low in such countries. In column (6), steel technology diffusion seems to be observed in civilian and royal dictatorships, since steel industries are often national strategies for such countries.

[Table 2 here]

4 Conclusion

This study investigates whether political regimes matter for technology diffusion, using data from 104 technologies from 137 countries for the period between 1901 and 2000. Our estimation results highlight the important role of democracy in the diffusion of health- and agriculture-related technologies. On the contrary, political regimes are unlikely to matter for the diffusion of infrastructure, general, and other sector-specific technologies.

References

[1] Acemoglu, D., Aghion, P., Zilibotti, F., 2006. Distance to frontier, selection, and economic growth. Journal of the European Economic Association 4(1), 37–74.

[2] Benhabib, J., Spiegel, M.M., 2005. Human capital and technology diffusion. In Aghion, P., Durlauf, S.N. (eds.) Handbook of Economic Growth Vol. 1A, Elsevier, Amsterdam, pp. 935–966.

[1] The estimation results can be provided upon request.

[3] Cervellati, M., Naghavi, A., Toubal, F., 2018. Trade liberalization, democratization, and technology adoption. Journal of Economic Growth volume 23(2), 145–173.

[4] Cheibub, J.A., Gandhi, J., Vreeland, J.R., 2010. Democracy and dictatorship revisited. Public Choice 143(1–2), 67–101.

[5] Comin, D., Hobijn, B., 2004. Cross-country technology adoption: Making the theories face the facts. Journal of Monetary Economics 51(1), 39–83.

[6] Comin, D., Hobijn, B., 2009. Lobbies and technology diffusion. Review of Economics and Statistics 91(2), 229–244.

[7] Coppedge, M., Gerring, J., Knutsen, C.H., Lindberg, S.I., Teorell, J., Altman, D., Bernhard, M., Fish, M.S., Glynn, A., Hicken, A., Lührmann, A., Marquardt, K.L., McMann, K., Paxton, P., Pemstein, D., Seim, B., Sigman, R., Skaaning, S.-E., Staton, J., Cornell, A., Gastaldi, L., Gjerløw, H., Mechkova, V., von Römer, J., Sundtröm, A., Tzelgov, E., Uberti, L., Wang, Y., Wig, T., Ziblatt, D., 2019. V-Dem Codebook v9. Varieties of Democracy (V-Dem) Project.

[8] Geddes, B., 1999. What do we know about democratization after twenty years? Annual Review of Political Science 2, 115–144.

[9] Kotera, G., Okada, K., 2017. How does democratization affect the composition of government expenditure? Journal of Economic Behavior & Organization 137, 145–159.

[10] Marshall MG, Gurr TR, Jaggers K., 2019. Polity IV Project, Political Regime Characteristics and Transitions, 1800–2018. Center for Systemic Peace, Vienna.

[11] Okada, K., 2018. Health and political regimes: Evidence from quantile regression. Economic Systems 42(2), 307–319.

[12] Persson, T., Tabellini, G., 2003. The Economic Effects of Constitutions. MIT Press, Cambridge, MA.

[13] Yang, D.T., Fang, C., 2003. The political economy of China's rural-urban divide. In Hope, N.C., Yang, D.T., Li, M.Y. (eds.) How Far Across the River? Chinese Policy Reform at the Millennium. Stanford University Press, Stanford, pp. 389–416.

Table 1: Effects of democracy on technology diffusion.

	(1) All	(2) Health	(3) Infrastructure	(4) General	(5) Agriculture	(6) Steel	(7) Finance
Democracy	0.002	0.018***	-0.003	0.001	0.008**	-0.002	0.167
	(0.003)	(0.007)	(0.003)	(0.006)	(0.004)	(0.008)	(0.124)
GDP per capita (log)	0.562***	0.038	0.655***	0.894***	0.252*	1.155***	0.169
	(0.089)	(0.178)	(0.087)	(0.131)	(0.146)	(0.242)	(0.749)
Population (log)	1.091***	1.273***	1.022***	1.291***	1.073***	1.734***	-0.786
	(0.109)	(0.280)	(0.104)	(0.155)	(0.152)	(0.483)	(0.908)
Fixed effects							
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technology × Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.922	0.965	0.845	0.984	0.936	0.805	0.954
Countries	134	134	134	134	134	86	40
Observations	137,955	12,679	78,880	7,609	23,025	4,508	1,302

Notes: The dependent variable is the natural logarithm of technology adoption. 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 of different types of democracy and dictatorship on technology diffusion.

	(1) All	(2) Health	(3) Infrastructure	(4) General	(5) Agriculture	(6) Steel	(7) Finance
Panel A: Democracy							
Parliamentary democracy	0.064	0.483***	-0.008	0.036	0.231**	-0.158	-1.197***
	(0.079)	(0.149)	(0.090)	(0.155)	(0.101)	(0.129)	(0.095)
Mixed democracy	-0.059	0.242**	-0.088	-0.009	0.036	-0.267	
	(0.063)	(0.093)	(0.087)	(0.127)	(0.082)	(0.163)	
Presidential democracy	0.083	-0.015	0.073	0.163**	0.147*	0.091	0.215
	(0.057)	(0.077)	(0.060)	(0.078)	(0.086)	(0.154)	(0.128)
Panel B: Dictatorship							
Civilian dictatorship	-0.004	-0.234**	0.019	-0.013	-0.147***	0.274**	
	(0.048)	(0.090)	(0.063)	(0.089)	(0.056)	(0.115)	
Military dictatorship	-0.078*	-0.190*	-0.045	-0.137*	-0.145**	-0.021	-0.180
	(0.040)	(0.113)	(0.047)	(0.070)	(0.060)	(0.114)	(0.127)
Royal dictatorship	-0.156	-0.365***	-0.233**	-0.361	-0.505***	0.589**	
	(0.101)	(0.111)	(0.113)	(0.275)	(0.116)	(0.276)	
Fixed effects							
Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technology × Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	136	136	136	136	136	88	42
Observations	128,857	13,314	67,838	7,188	24,114	4,854	1,388

Notes: The dependent variable is the natural logarithm of technology adoption. In both panels A and B, we include GDP per capita and population as in Table 1. 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.