Rise of Democratic Ideas: Why did the Enlightenment begin in the late 17th Century but not earlier?

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Abstract

This work argues that demand for public goods is one of the driving forces for the rise of democracy. Democracy is envisaged as a complete (social) contract through which citizens delegate to a government the task of production of public goods. The delegation however suffers from moral hazard inefficiency and thus autocracy can well be supported by the citizens. In the meantime, accumulation of technological development raises the marginal productivity of public spending, and thus increases the demand for public goods. Moral hazard cost of democracy is shown to fall when the size of the public sector increases. Therefore, citizens prefer democracy when they demand for a larger public sector. This argument explains the timing of Enlightenment, during which thinkers began to recognize the role of the government to rule for the people, after the era of Scientific Revolution. By exploiting a long panel dataset of 11 European countries from 1800 to 1913, significant and positive impact of public revenue on democracy level is found if the country was moderately democratic.

Keywords: Autocracy, Democracy, Enlightenment, Moral Hazard, Size of Public Sector

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1 Introduction

The most interesting era in the Western history is arguably the Early Modern Age (the late 17th and 18th Centuries). Cultivated by the Renaissance and the Science Revolution, the age saw the Enlightenment, the rise of democratic ideas, the General Revolution all over Europe and was finally followed by the Industrial Revolution. Do we have a good theory to explain the sequence of these historical events?

During this fascinating but not always peaceful era, people were gradually awakened and the power of thoughts transformed the society. Historian Jonathan Israel (2010) credits the revolution of mind fostered by several radical enlightenment advocates including d’Holbach (1723-1789) and Spinoza (1632-1677) for precipitating the General Revolution over Europe. One common characteristic of Enlightenment thinkers is the focus of “reason” as the main angle from which human beings should perceive the world. “Enlightened” people began to question the legitimacy of the existing institutions and authorities including clergy and nobles. They challenged any justifications of the current social structure. Taxpayers began to ask why their money are paid for the luxurious life of the “princes”, but not for their own good. Meanwhile scientist’s and engineer’s desire for achieving excellence finally sparked off Industrial Revolution. At first glance, one may conclude the use of reason as one of the causes of Industrial Revolution. Apart from this naive conjecture, are there any complex interactions between the formulation of democratic ideas, technological advances and political transitions?

Today democracy is defined as an implementation of an open (so that everyone satisfying some reasonable requirements is able to be elected and to elect) and fair (so that no one enjoys bigger power in an election) election for electing the de facto head of government. Autocrats can however rule a nation according to democratic ideas, though it usually fails as the selfish autocrats can hardly constrain themselves. Democratic ideas include the ideology of ruling according to wills of the majority, of protecting the benefit of the majority, and of levelling the privileges enjoyed of different classes. This work mainly discuss the rise of democratic ideas or the desire for
democracy, but not aims at explaining a successful revolution.

Democracy is not only about the selection of ruler, but also determines the functions of a government. In theory the same set of functions can be taken up by either an autocratic or a democratic government. During the Enlightenment, philosophers gradually realized the state, if it properly rules, can benefit the general public in a great deal. John Locke wrote in his *Second Treatise on Civil Government* (1689) that “Political power... [is] a right of making laws...for the regulating and preserving of property, and of employing the force of the community, in the execution of such laws, and in the defence of the commonwealth from foreign injury; and all this only for the public good.” Democratization is not only a change of the selection mechanism of ruler, but also a wakening of people’s perception of the legitimate and moral roles of a government.

Full democracy did not come to Europe straight away after the French Revolution in 1789, but democratic ideas were widely spread and deeply rooted in people’s mind. Since the fall of Napoleon, restrained constitutional monarchies were established almost everywhere in Europe. Autocrats collected information and responded to wants of the public through elected representatives. During this gradual rise of democracy, Industrial Revolution was at its peak. James Watt in 1778 succeeded in building his steam engine that hugely raised the generation of power. Technological advances at the same time lifted the capacity of a government, which could now provides more diverse and advanced public goods and services to the public. For example, construction of railways unavoidably involved investment by the state due to its strategic importance (Kemp, 1978, p.89) and the exclusive power of the state over the use of a vast amount of land. As Kemp documents, state intervention, since the beginning of Industrial Revolution, gradually shifted its form from regulations to monetary investment in infrastructure.

This work is to give an economic account of the big picture illustrated above. Public goods, in this work, are defined as any government-provided goods that benefit productions of citizens, for examples, national defence, railways, roads, education and health care. Technology development increases the marginal productivity of public spending, and hence the demand for public goods increases. Democracy is a social contract by which people delegate to the government the pro-
duction of public goods. Delegation however suffers from moral hazard. If the compensation to the government is positively related to the size of the public sector (amount of public goods), and there exists a fixed component of cost of effort, the cost of moral hazard falls when the size of the public sector is larger. Finally when the demand for public goods is sufficiently large, citizens prefer the size of public goods provision to be democratically decided. Taxation under democracy is not distorting private investment and thus technology soars with democracy. This argument is applied to explain the historical sequence from the Scientific Revolution to the end of Renaissance, to the Enlightenment, to the General Revolution of the West, and finally the Industrial Revolution.

To test this hypothesis, this paper exploits the historical dataset compiled by Dincecco (2013) merged with PolityIV Dataset. I argue that demand for public goods is well proxied by the size of public sector, measured by government revenue per capita, and expect the lagged demand for public goods to have positive and significant impact on democracy level.

Apart from explaining the sequence of historical events, this work’s contribution is threefold. This paper supplements the Modernization Theory of democratization (Lipset, 1959), which suggests that economic development favours democratization. The positive correlation between economic performance and democratization is robust but the causal relationship is unclear. Many researchers focus on the impact of economic growth on democratization (Barro, 1990; Przeworski and Limongi, 1997; Acemoglu et al., 2008 and many others) while this current paper pinpoints the importance of the demand for public goods in triggering democratic transition.

Secondly, this work gives an explanation to the backwardness of many autocratic countries. Anticipating the desire for democracy by the public, an autocratic government would try to manipulate the demand for public goods, avoiding or delaying any democratic quest. It could be done by deliberately suppressing public sector and technological progress. This prediction may explain why many autocratic countries have fallen into poverty trap and are heavily religious.\(^1\)

\(^1\)Some may argue that USSR presents a vivid counter-example of my theory. My responses are the following two points. First, USSR indeed presents a failure of the economic thoughts of communism. Second, public funds were
Last but not least, this work provides an explanation of why autocratic governments, like China, can sustain over time. Due to the moral hazard inefficiency of democracy, autocracies can indeed be supported by citizens who prefer a regime that gives rise to higher per-capita income. Acemoglu and Robinson, in their well-received book “Why Nations Fail?” (2012), demonstrate clearly how extractive regimes are deemed to fail. A corresponding question immediately follows: if an autocrat can restrain himself from extracting his people’s wealth, could the autocratic government endure through time? The Qing Dynasty of China was the last imperial dynasty in China that reigned between 1644 and 1912. The 268 years of rule is regarded as a long dynasty in Chinese history. The second emperor of the Qing Dynasty, Kangxi Emperor, ordered in 1712 a commandment for all the subsequent rulers that no further rise in lump-sum tax per head is allowed. This commandment was well observed by his offspring and some argue that this was the foundation of the economic prosperity during the Qianlong’s era from 1735 to 1796. It seems that if the autocrat is able to restrain himself, the regime could well be extended. This work presents a theory to support this ruling philosophy.

The rest of this paper is organised as follows. Section 2 reviews some literature on relationship among technology, democracy and economic growth. Section 3 presents the basic model and Section 4 discusses the incentive of an autocrat to suppress demand for public goods and technological advances. A short textual and historical research is done in Section 5 and empirical tests follow in Section 6. The last section concludes.

2 Literature Review

Lipset (1959) lists economic development as one of the social requisites of democracy. Barro (1990) concludes that increases in standard of living lead to a gradual rise in democracy and poor democracies tend to fail. Przeworski and Limongi (1997) suggest that “a gradual differentiation and specialization of social structures that culminates in a separation of political structures from largely spent on military and space science while other social public goods were supplied but far from sufficient. Majority of citizens were living in poverty. Besides, communism is arguably an anomaly in the history.
other structures and makes democracy possible”, and conclude that democratic transition is more likely as per capita income rises but no more if it is above US$6,000. Acemoglu et al. (2008) revisit the correlation with an instrumental-variable approach and show no impact of income on democracy with a dataset consisting observations of 25 countries over the period 1875-2000. To explain the robust correlation between income and democracy observed today, they propose the “divergent development path” hypothesis, which suggests that countries were sorted into different paths of development at some critical junctures. Some societies were on the way to democracy and prosperity while others autocracy and poverty. In short, the testing of the modernization theory faces the difficulty of disentangling different factors behind economic growth while not so many theoretical models are leading the way. This current paper offers a new theory that singles out the demand for public goods as one important driving force behind modernization and democratization.

Bourguignon and Verdier (1996), come close to this current paper, suggest that public education is provided for the poor and democratic transition is initiated due to pure political economy motive of the elite. Our work recognizes the importance of public good (education) but instead focuses on the desire of the general public for democracy rather than the incentive of the elite to grant franchise extension. The interesting case study on Somalia by Azam (2013) explains why Somaliland could be relatively stable and democratic than its neighbours Puntland and Southern Somalia. It is because the safe and reliable port facilities in Berbera allows Somaliland to extract taxes and customs and then redistribute resources to other groups of people within Somaliland. This current work echoes Azam that a better public infrastructure could help promote democracy.

Acemoglu and Robinson (2000) explain the extension of franchise by the elite as a way to avoid revolution. Due to commitment problem, a redistributive promise is only credible if vote is given to the poor. Their following work (2001) suggests that countries with a high level of income inequality are more likely to swing between democracy and autocracy because revolution and coups are more attractive. Fundamentally their models are built upon class voting theory where the rich are associated with the autocrats, and do not involve elements of economic growth.
Democratic ideas may feedback to promote economic growth. North and Weingast (1989) point out the importance of the transformed institutions after the Glorious Revolution of 1688 in promoting economic growth. The more democratic political system, based on the principle of protecting private property rights, had facilitated the development of capital markets, implying an one-way causal relationship from democratic ideas to economic growth. In the end of their paper, they hint that the better established institutions and the subsequent economic growth had led England to the verge of the Industrial Revolution in the end of 18th-Century. Mokyr (2003) argues that the economic growth during the Industrial Revolution would have been checked without the impact of Enlightenment.

The current work benefits from the literature on autocracy. McGuire and Olson (1996) argue that autocracy can function well as the autocrat is a stakeholder of the economy through taxation collection. Clague et al. (1996) propose that an autocrat with a long time horizon has an incentive to respect private property rights because of the incentive of tax revenue extraction. They show empirically that autocrats in power for a longer period were associated with better private property protection. Boix and Svolik (2013) argue that dictators deliberately set up institutions to constrain themselves so as to promote survival. Although they mention self-imposing constraints to extend an autocrat’s rule, they do not identify planned economic backwardness as one of the mechanisms.

A list of works discusses the empirical correlation between democracy and the size of public sector. Democracy, or extension of franchise, is believed to expand the size of government (Meltzer and Richard, 1976 and 1981; Husted and Kenny, 1997; Lott and Kenny, 1999; Aidt et al. 2006; and many others), but no existing empirical work has examined the impact of public sector size on democracy level. Dincecco (2013) examines the relationship between political transformation and public finance of Europe from 1650 to 1913. He argues and show with a panel dataset that fiscal consolidation and democratization improved the ability to collect taxes and thus the financial health of the governments. He mainly focuses on the impact of political transitions on public finances. The causality goes from political constraints to the ability to tax and the financial health of
of the government. My work instead argues that public finance influences the choice of political regimes.

3 The Model

The population consists of a mass of yeoman-entrepreneurs (citizens), normalized to 1, who produce a final good $y_{it}$. They are identical and possess the same initial endowment income $y_{i0}$. The government, either democratic or autocratic, is managed or controlled by a political ruler, who does not engage in the final good production. Production depends on three factors, namely technology level $A_t$, private capital $k_{it}$, and the effective level of labour input $G_t/l_{it}$. To allow endogenous growth, we assume that $A_t = \overline{A}_t K_t^\alpha$. We assume that $\overline{A}_t$ is exogenous and known before choices are made. The effective level of labour productivity is positively related to a public good $G_t$, which can be interpreted as public education, transportation infrastructures, maintenance of legal system, and so on, as long as the public good positively enhances the labour productivity. Production is however stochastic and the realization depends on the behaviour of the government. At the same time the public good is provided, the government decides whether to exert a costly effort. If the government exerts the non-monetary effort $e_t = 1$, that costs $\psi$, to produce the public good in addition to the monetary spending, the production is successful with probability $\pi_1$ and fails with probability $1 - \pi_1$. If it fails, only $\phi \in (0, 1)$ of the income remains. If no effort is exerted, the production is successful with probability $\pi_0$ and fails with probability $1 - \pi_0$.

At time $t$, the expected individual output of time $t - 1$ is the following:

$$E_t [y_{t+1} | e_{t+1} = 1] = \pi_1 A_{t+1} k_{t+1}^{\beta} (G_{t+1} l_{t+1})^{1-\alpha-\beta} + (1 - \pi_1) \phi A_{t+1} k_{t+1}^{\beta} (G_{t+1} l_{t+1})^{1-\alpha-\beta}$$

One important observation helps us simplify the expected aggregate output. As each citizen is at the same time an entrepreneur and a labourer and no disutility of labour is introduced, labour supply decision degenerates and thus $l_{it} = L_t = 1$ for all $i$ and $t$. The aggregate labour
supply is also 1. Together with the assumption that all individuals are identical in all aspect, in any symmetric equilibrium the aggregate private capital stock is equal to the individual private capital stock, i.e. \( K_t = k_{it} = k_t \). As a result the aggregate output in this atomless-individual economy is the same as the individual output, i.e. \( Y_t = y_{it} = y_t \).

At time \( t \), the expected aggregate output of time \( t + 1 \), denoted by \( E_t [Y_{t+1} | e_{t+1}] \), is the following:

\[
E_t [Y_{t+1} | e_{t+1} = 1] = \pi_1 A_{t+1} K_{t+1}^\beta (G_{t+1} L_{t+1})^{1-\alpha-\beta} + (1 - \pi_1) \phi A_{t+1} K_{t+1}^\beta (G_{t+1} L_{t+1})^{1-\alpha-\beta} = \Pi_1 A_{t+1} K_{t+1}^{\alpha+\beta} G_{t+1}^{1-\alpha-\beta}
\]

if the government pays an unobservable effort to provide the public good, i.e. \( e_{t+1} = 1 \), otherwise:

\[
E_t [Y_{t+1} | e_{t+1} = 0] = \pi_0 A_{t+1} K_{t+1}^\beta (G_{t+1} L_{t+1})^{1-\alpha-\beta} + (1 - \pi_0) \phi A_{t+1} K_{t+1}^\beta (G_{t+1} L_{t+1})^{1-\alpha-\beta} = \Pi_0 A_{t+1} K_{t+1}^{\alpha+\beta} G_{t+1}^{1-\alpha-\beta}
\]

where \( \alpha \) and \( \beta \) are conventionally interpreted. Straightforward from the expressions above, we simplify by defining \( \Pi_1 = \pi_1 + (1 - \pi_1) \phi \) and \( \Pi_0 = \pi_0 + (1 - \pi_0) \phi \). Although mathematically per capita income (capital) and total income (capital) do not differ as \( L_t = 1 \), we keep the difference explicit for more precise interpretation. Besides, we assume full depreciation of both private and public capital after one period throughout the paper.

The equilibrium notion employed throughout the paper is Markov Perfect Equilibrium (MPE), proposed by Acemoglu (2008a, Ch. 22). A MPE consists of a set of strategies at each time \( t \) such that they depend solely on the current payoff-relevant state of the economy. The history of previous plays degenerates into the state variable of the precedent period. MPE is a subset of subgame perfect equilibrium and this equilibrium concept effectively reduces the set of equilibrium conditions.
by deleting any strategies involving punishment according to history. A comparison of after-tax per capita income under the two regimes tells us which regime is preferred by the citizens, showing us the direction of force of political transition. In the basic model, we suppose that the autocratic ruler does not foresee any political transition when determining relevant choice variables.

3.1 Autocracy

The analysis largely follows Acemoglu (2008a, Ch. 22). Under autocracy, the political elite is the residual claimant of the tax revenue collected. The presence of the public capital in the production function ensures that the ruler has incentive to invest in the public good with the tax revenue.

We assume that taxation decision $\tau_t$ and public investment decision $G_{t+1}$ come after the private investment decision. Hold-up problem is implied. To avoid complete expropriation, a tax rate upper limit $\tau \in (0, 1)$ is imposed exogenously. Acemoglu (2008a) interprets this maximum tax rate as a measure of strength of the state. The stronger the state, the more able the state to tax its people. The tax limit also refers to the threshold tax rate above which citizens cease to produce in the taxable economy and move to the black market.

The total tax revenue is:

$$T_t = \tau_t \int_0^1 y_i d_i = \tau_t Y_t$$

By backward induction, we first solve the taxation decision and the public investment decision, given the private investment decision $k_{it+1}$. The expected utility of the elite at time 0 is given by:

$$V^e = E_t \sum_{s=t}^{\infty} \delta^{s-t} (\log R_s - \psi)$$

where $R_s = \tau_s Y_s - G_{s+1}$ and the non-monetary fixed cost of effort enters into the utility function linearly for simplicity. For the sake of exposition, we take for granted that the autocrat elite must
exert effort. Afterwards we verify this assumption by limiting the size of $\psi$ that the additional rent extracted is sufficient to cover the fixed cost. Focusing on the MPE, tax rate must be set at the upper limit because tax rate does not affect the current income $Y_t$. Expanding $V^e$:

$$V^e (G_t) = \max_{G_{t+1}} \{ \log (\tau Y_t - G_{t+1}) - \psi + \delta V^e (G_{t+1}) \}$$

The first-order condition for the ruler is written as:

$$\frac{1}{R_t} = \delta (V^e)' (G_{t+1})$$

and the Envelope condition is:

$$(V^e)' (G_{t+1}) = \frac{1}{E_t [R_{t+1}]} \tau \Pi_1 (1 - \alpha - \beta) A_{t+1} k_{it+1}^\alpha G_{t+1}^{\alpha - \beta}$$

Combining the two conditions:

$$\frac{1}{R_t} = \frac{\delta}{E_t [R_{t+1}]} \tau \Pi_1 (1 - \alpha - \beta) A_{t+1} k_{it+1}^\alpha G_{t+1}^{\alpha - \beta}$$

Now we turn to the private investment decision and then come back to complete the choice of the elite. Expecting $\tau_t = \tau$, citizens maximize its utility, which takes the following form:

$$V^c = E_t \sum_{s=t}^{\infty} \delta^{s-t} \log c_{is}$$

where $c_{is} = (1 - \tau) y_{is} - k_{is+1}$. Similarly the first-order condition of the citizen’s choice is:

$$\frac{1}{c_{it}} = \frac{\delta}{E_t [c_{it+1}]} (1 - \tau) \Pi_1 (\alpha + \beta) A_{t+1} k_{it+1}^\alpha g_{it+1}^{\alpha - \beta} G_{t+1}^{1 - \alpha - \beta}$$
Suppose that over the equilibrium bath $k_{it+1} = \kappa y_{it+1}$. Private consumption is then $c_{it} = (1 - \tau - \kappa) y_{it} = c_t$. The above FOC becomes:

$$k_{it+1} = \delta (\alpha + \beta) (1 - \tau) y_{it} = k_{t+1}$$

We then conclude that $\kappa = \delta (\alpha + \beta) (1 - \tau)$ and verify that the equilibrium private capital investment is linear in $y_{it}$. Similarly we suppose $G_{t+1} = \gamma Y_t$. We have $R_t = (\tau - \gamma) Y_t$. By the equilibrium choice of the citizens for $k_{it+1}$, the FOC of the elite becomes:

$$G_{t+1} = \delta (1 - \alpha - \beta) \tau Y_t$$

We conclude that $\gamma = \delta (1 - \alpha - \beta) \tau$. Now we are ready to write down the MPE expected national income:

$$E_t [Y_{t+1}] = \Pi_1 \delta A_{t+1} [\delta (\alpha + \beta) (1 - \tau) Y_t]^{\alpha+\beta} [\delta (1 - \alpha - \beta) \tau Y_t]^{1-\alpha-\beta}$$

and the after-tax per capita income:

$$E_t [(1 - \tau) y_{it+1}] = \Pi_1 \delta \bar{A}_{t+1} (1 - \tau)^{1+\alpha+\beta} (\alpha + \beta)^{\alpha+\beta} [(1 - \alpha - \beta) \tau]^{1-\alpha-\beta} y_t$$

With the log-utility function, the MPE choice of private and public investment are separated from each other but connected with the income of the previous period. Thus we can easily trace the trajectory of the dynamics of the variables over time. If we start from a low level of capital stock, per capita capital and income grow over time towards the steady state. One important observation is that the after-tax per capita income is hump-shaped over $\tau$. 

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Now we restrict the range of variables over which the autocrat must exert effort.

\[ V^A (G_t | e_{t+1} = 1) \geq V^A (G_t | e_{t+1} = 0) \]

Or:

\[
\begin{align*}
\log (\tau Y_t - G_{t+1} (e_{t+1} = 1)) &- \psi + \delta V^A (G_{t+1} | e_{t+1} = 1) \\
\log (\tau Y_t - G_{t+1} (e_{t+1} = 0)) &+ \delta V^A (G_{t+1} | e_{t+1} = 0)
\end{align*}
\]

By (1), public spending is the same no matter the autocrat exerts effort or not, i.e. \( G_{t+1} (e_{t+1} = 1) = G_{t+1} (e_{t+1} = 0) \). Thus the condition is reduced to:

\[
\begin{align*}
V^A (G_{t+1} | e_{t+1} = 1) - V^A (G_{t+1} | e_{t+1} = 0) &\geq \frac{\psi}{\delta} \\
E_t \left[ \log (\tau Y_{t+1} - G_{t+2} (Y_{t+1})) + \delta V^A (G_{t+2} (Y_{t+1})) | e_{t+1} = 1 \right] &\geq \frac{\psi}{\delta} \\
E_t \left[ \log (\tau Y_{t+1} - G_{t+2} (Y_{t+1})) + \delta V^A (G_{t+2} (Y_{t+1})) | e_{t+1} = 0 \right] &\geq \frac{\psi}{\delta} \\
\pi_1 \log (\tau Y_{t+1} - G_{t+2} (Y_{t+1})) + (1 - \pi_1) \log (\tau \phi Y_{t+1} - G_{t+2} (\phi Y_{t+1})) &\geq \frac{\psi}{\delta} \\
- [\pi_0 \log (\tau Y_{t+1} - G_{t+2} (Y_{t+1})) + (1 - \pi_0) \log (\tau \phi Y_{t+1} - G_{t+2} (\phi Y_{t+1}))] &\geq \frac{\psi}{\delta} \\
(\pi_0 - \pi_1) \log \phi &\geq \frac{\psi}{\delta} \\
| \log \phi | &\geq \frac{\psi}{\delta \Delta \pi}
\end{align*}
\]

Thus, the non-monetary fixed cost \( \psi \) cannot be so large for autocrat benefits from exerting effort.

### 3.2 Democracy

In economics literature, democracy is often modelled as the median voter’s dictatorship. Acemoglu (2008), Acemoglu and Robinson (2000, 2001) further simplify the society by equalising the
public and hence a class of identical poor citizens dictates any policy outcomes under democracy. Building on this foundation, we incorporate a few more details into democracy. First we recognise that citizens can never manage the country without delegating the rule to a small group of people, the government. Second, delegation is never perfect due to moral hazard problem. By taking moral hazard into account, democracy may not be desirable from the perspective of citizens. Democracy in this paper is “perfect” except the moral hazard problem as it is defined as a complete contract that implements the most desirable public good provision and sets the corresponding tax rate. This setting allows me to pinpoint the effect of moral hazard on the desire for democracy.

Citizens are the principal, delegating the task of providing public good $G_{t+1}$ to a government, who chooses from two effort levels, either $e_{t+1} = 1$ or $e_{t+1} = 0$. The success and failure rates are the same as those under autocracy. To motivate the government, citizens design a contract with a compensation $R_t = r_t G_{t+1}$ to be received at the same time as the public investment is spent but before the realization of production. In line with standard moral hazard literature following Laffont and Mortimort (2002), we search for the minimum $R_t$ that motivates the agent. In politics, however, we can seldom reward or punish a politician by writing a contract that compensates the agent according to the realized output. Following Banks and Sundaram (1993), repetitive elections are held to reward successful (not necessary hard-working) politicians. Voters re-elect the current candidate if they observe a high level of production, and vote for another candidate otherwise.

The politician can survive for an infinite number of periods if she gets re-elected every period. Once a politician is voted down another identical politician comes to the power. Given that all parties must observe the contract of all periods, the compensation scheme that motivates the politician to exert effort at time $t$ is designed as follows:

$$V^D_t (G_t \mid e_{t+1} = 1) \geq V^D_t (G_t \mid e_{t+1} = 0)$$
\[
\log r_t G_{t+1} - \psi + \pi_1 \delta V_{t+1}^D \geq \log r_t G_{t+1} + \pi_0 \delta V_{t+1}^D \\
V_{t+1}^D \geq \frac{\psi}{\delta \Delta \pi}
\]

where \(\Delta \pi = \pi_1 - \pi_0\). Arguing that \(E_t[\log r_{t+1} G_{t+2}]\) is a constant over time (verified soon after) and the government, motivated by the contract, exerts effort every period, \(V_{t+1}^D\) is expanded as follows:

\[
E_t[\log r_{t+1} G_{t+2} - \psi + \pi_1 \delta (\log r_{t+2} G_{t+3} - \psi + \pi_1 \delta (\log r_{t+3} G_{t+4} - \psi + \pi_1 \delta (\ldots)))] \geq \frac{\psi}{\delta \Delta \pi}
\]

We rearrange and obtain:

\[
E_s[\log r_{s+1} G_{s+2}] = \psi + \psi \left(1 - \frac{\delta \pi_1}{\delta \Delta \pi}\right) \quad \forall s
\]  

(2)

The second term on the right-hand side is the information rent that is necessary for the constitution writer to motivate effort of the government. The MPE minimum rate of rent required to motivate the government is thus \(r_{t+1} = r(\psi, \delta, \pi_0, \pi_1, G_{t+2})\), which is increasing in \(\psi\) and \(\pi_0\) and decreasing in \(\delta\), \(\pi_1\) and \(G_{t+2}\). One interesting feature is that, to motivate the politician to exert effort at time \(t\) the principal has to promise \(r_{t+1}\) at time \(t\) that depends on \(G_{t+2}\), but not \(G_{t+1}\). In other words, \(r_t\) has already been determined at time \(t - 1\) and is taken as exogenous while determining \(G_{t+1}\). The equilibrium rent is determined in this fashion seems to violate the restriction that only MPE is considered. To avoid this logical inconsistency, we delegate the decision of the political rent to a central planner, or a constitution writer, who designs a contract to take into account the MPE of all periods.

Now we turn to the determination of public spending, which is made by the principle and then delegated to the agent. The tax revenue is spent on either the rent to the politician or the public
investment spending, i.e. \( \tau_t Y_t \geq (1 + r_t) G_{t+1} \). Citizens maximize the expected utility, which is:

\[
V^c = E_s \sum_{s=t}^{\infty} \delta^{s-t} \log c_{is}
\]

where \( c_{is} = y_{is} - (1 + r_s) G_{s+1} - k_{is+1} \). Maximizing the discounted utility by choosing \( G_{t+1} \) and \( k_{it+1} \), the two first-order conditions of the citizens’ choice are:

\[
\frac{1}{c_{it}} = \frac{\delta}{c_{it+1}} \Pi_1 \bar{A}_{t+1} (\alpha + \beta) k_{it+1}^{\alpha + \beta - 1} G_{t+1}^{1 - \alpha - \beta}
\]
\[
\frac{1 + r_t}{c_{it}} = \frac{\delta}{c_{it+1}} \Pi_1 \bar{A}_{t+1} (1 - \alpha - \beta) k_{it+1}^{\alpha + \beta} G_{t+1}^{1 - \alpha - \beta}
\]

Again suppose the solution is of the following form: \( (1 + r_t) G_{t+1} = \gamma Y_t \) and \( k_{it+1} = \kappa y_{it} \). Verifying the solutions by examining the FOCs and we obtain the MPE choices:

\[
k_{it+1} = k_{t+1} = \delta (\alpha + \beta) y_t
\]
\[
G_{t+1} = \frac{\delta (1 - \alpha - \beta)}{1 + r_t} y_t
\]

Hence \( \gamma = \delta (1 - \alpha - \beta) \) and \( \kappa = \delta (\alpha + \beta) \).

The rate of rent at any time \( t \) is determined by the social contract in the previous period and thus is exogenous at time \( t \). Gathering \( r_t \), \( k_{it+1} \) and \( G_{t+1} \), the MPE expected national income is:

\[
E_t [Y_{t+1}] = \Pi_1 \bar{A}_{t+1} [\delta (\alpha + \beta) Y_t]^{\alpha + \beta} \left[ \frac{\delta (1 - \alpha - \beta)}{1 + r_t} Y_t \right]^{1 - \alpha - \beta}
\]
\[
= \Pi_1 \bar{A}_{t+1} [\delta (\alpha + \beta) (1 - \alpha - \beta) \left( \frac{1 - \alpha - \beta}{1 + r_t} \right)]^{1 - \alpha - \beta} Y_t
\]
Budget balance implies:

\[ \tau_t Y_t = (1 + r_t) G_{t+1} = \delta \left( 1 - \alpha - \beta \right) Y_t \]

The expected after-tax per capita income of time \( t + 1 \) at time \( t \) is:

\[ E_t \left[ \left( 1 - \tau_{t+1} \right) y_{t+1}^D \right] = [1 - \delta (1 - \alpha - \beta)] \left[ \Pi_1 \Delta_{t+1} \delta (\alpha + \beta)^{\alpha + \beta} \left( \frac{1 - \alpha - \beta}{1 + r_t} \right)^{1 - \alpha - \beta} \right] y_t \]

Note that \( r_t \) is determined at time \( t - 1 \) with the expectation of \( G_{t+1} \) at time \( t - 1 \). We assume that citizens correctly foresee the equilibrium path and hence \( E_{t-1} [G_{t+1}] \) follows the path of MPE. Thus \( r_t \) always follows the equilibrium path and correctly expected. One important observation is that the private capital decision is now independent of the income tax rate because the rate is determined to barely cover the public investment, and which is a separate decision from private investment.

### 3.3 Comparison

Comparison of regimes involves comparing all the discounted utility up to infinity, but two observations help simplify the analysis. First, citizens’ utility is strictly increasing in after-tax per capita income. Second, there is no cost of regime switch and the switch in any period is not a permanent switch. To rank two regimes, a comparison of the after-tax per capita income of the two regimes in the next period is sufficient. Democracy is preferred at time \( t + 1 \) if

\[ [1 - \delta (1 - \alpha - \beta)] \left[ \Pi_1 \Delta_{t+1} \delta (\alpha + \beta)^{\alpha + \beta} \left( \frac{1 - \alpha - \beta}{1 + r_t} \right)^{1 - \alpha - \beta} \right] y_{t+1} \geq \Pi_1 \delta \Delta_{t+1} (1 - \tau)^{1 + \alpha + \beta} (\alpha + \beta)^{\alpha + \beta} [1 - (1 - \beta) \tau]^{1 - \alpha - \beta} y_{t+1} \]

Or simply:

\[ 1 - \delta (1 - \alpha - \beta) \left[ \Pi_1 \Delta_{t+1} \delta (\alpha + \beta)^{\alpha + \beta} \left( \frac{1 - \alpha - \beta}{1 + r_t} \right)^{1 - \alpha - \beta} \right] y_{t+1} \geq \Pi_1 \delta \Delta_{t+1} (1 - \tau)^{1 + \alpha + \beta} (\alpha + \beta)^{\alpha + \beta} [1 - (1 - \beta) \tau]^{1 - \alpha - \beta} y_{t+1} \]
The right-hand side of (4) is humped-shaped over \( \tau \), i.e. it is increasing in \( \tau \) when \( \tau \) is small and decreasing in \( \tau \) when \( \tau \) is large. The left-hand side is a constant over \( \tau \). Hence over the relevant range of parameters LHS intercepts RHS at two points, and thus when either \( \tau \) is very small or very large democracy is preferred to autocracy.

**Proposition 1:** Whenever the LHS of condition (4) intercepts the RHS twice, democracy is preferred to autocracy if \( \tau \) is small enough or large enough.

The tax rate upper limit \( \tau \) can be interpreted as the degree of extractiveness of the government. If the government cannot restrain itself from taxing too much, citizens tend to prefer democracy. This result correctly describes many revolutions in history, including the French Revolution in 1789 France. On the other hand, if the government cannot tax enough, the state is too weak to provide public good, and democracy is the better form of government.

Another important implication, Proposition 1 predicts, is that autocracy can be well-supported by the citizens if \( \tau \) is moderate. If an autocrat is able to keep the greedy incentive to extract the public at bay, the autocratic government is sustainable over a long period of time.

Notice that the LHS of condition (4) is decreasing in \( r_t \), which is decreasing in \( G_{t+1} \). In words, when the citizens prefer a larger amount of public good at time \( t + 1 \) under a hypothetical democracy, it raises the attractiveness of democracy. It is because when the public sector is larger the fraction of tax revenue needed to incentify the politician to pay effort is smaller. Suppose that the initial \( G_0 \) is smaller than the steady-state level. The increase in public spending would lead the country going through the political transition from autocracy to democracy. It can be represented by an upward shift of the LHS of (4).

**Proposition 2:** Given that the country is currently under the range where autocracy is
preferred, the increasing public spending toward its steady state over time will move the country closer to the range where democracy is preferred.

Technology advances affect democratization through $r_t$, which is inversely related to $G_{t+1}$. A rise in $A_{t+1}$ raises $Y_{t+1}$ and hence $G_{t+2}$, reducing $r_{t+1}$ and pushing the economy closer to democracy. Enlightenment is characterized as an era during which thinkers began to realize the true moral duty of the state: the state should provide adequate public goods to enhance happiness or welfare of the people. The emergence of democratic ideas during the Enlightenment following the Renaissance was not a coincidence but almost a must. The accumulation of technology during the Scientific Revolution toward the end of the Renaissance in the 17th Century had raised the marginal productivity of public spending to a point that the philosophers believed that public goods would have been better provided according to the wills of the people.

Notice that when the economy moves to democracy, the distortion effect of taxation is gone because now the income tax rate is in effect set by the people. There is a discrete rise in private capital stock, and thus technology level. The implication helps explain the emergence of the Industrial Revolution following the Enlightenment. John Locke and Baruch Spinoza were born in 1632, Isaac Newton in 1642, Voltaire in 1694 and Jean-Jacques Rousseau in 1712. Thomas Newcomen in Britain invented the first successful engine powered by steam in 1712, on which James Watt improved a lot in 1776. It could be possible that the power of reason was the main common cause of both significant historical eras, but my conjecture that technological advance “enlightened” those great philosophers to realize the benefit of democracy in public good provision is plausible and worth further research from a historical perspective.

4 Autocratic Economic Backwardness

In the previous section we assume that the autocrat does not foresee the democratic demand from the public and thus not able to take pre-emptive actions to avoid a revolution. Now we allow the autocrat to suppress public spending at time $t$ so as to avoid public demand for democracy.
We specify the timing of the game within any time $t$ between the autocrat and the public as the following.

- **Stage 1:** Given $y_{it} = y_t$, the public invests $k_{it+1} = k_{t+1}$.

- **Stage 2:** The autocrat sets the tax rate $\tau_t$ and sets aside $G_{t+1}$ from the tax revenue for public spending.

- **Stage 3:** The public forms expectation of the after-tax per capita income under two regimes, and also the cost of democracy $r_{t+1}$. If democracy gives rise to higher after-tax per capita income, there will be a successful revolution. Otherwise the same autocrat remains in power.

If a revolution comes, the autocrat is out and never receives any utility in the subsequent periods, and thus the autocrat’s objective is to remain in power by choosing $G_{t+1}$. Theoretically the economy may move back to autocracy if the people demand for it, but there will be another autocrat. Although explicitly the autocrat achieves the aim by choosing $G_{t+1}$, the final aim is to manage $r_t$ so that the inefficiency associated with democracy is high enough. As $r_t$ under a potential democracy is theoretically determined at time $t − 1$ when the autocrat is in control, how the people perceive the cost of democracy matters. We assume that the public determines $r_t$ in the same way as if they were living under democracy at time $t − 1$ given the expectation of the public spending at time $t + 1$ dictated by the autocrat for the sake of completeness.

Management of expectation of $r_t$ is done by at time $t − 1$. Successful management and deterrence require the autocrat’s commitment on the choice of public spending. It turns out not to be a severe problem because the autocrat will face the same expected revolution constraint each period at the margin of revolution.

The revolution decision comes after the production decision, implying that any new regime carries the income determined from the preceding period and determines its new public policy for
the subsequent period. In the equilibrium path, the public should be able to predict any successful revolution and adjust their MPE investment decision. However the autocrat also foresees any successful revolution and avoids it by manipulating the public spending. If there is no shock to the system, i.e. any exogenous and unexpected increase in technology level, the autocrat must be able to carry out pre-emptive action to avoid revolution as long as tax revenue allows.

Suppose that democracy arises at $t + 1$. At $t − 1$, the public forms the expectation of $r_t$ given that $G^A_{t+1}$ determined by the autocrat. By (2), we know that $r_t$ is determined by condition (2):

$$E_{t−1} [\log r_t G^A_{t+1}] = \psi + \psi \left( \frac{1 − \delta \pi_t}{\delta \Delta \pi} \right)$$

(5)

The autocrat is successful in deterring any desire for democracy if the after-tax per capita income is higher under autocracy, or the following condition holds:

$$\delta (1 − \tau) Y_t \gamma^\alpha + \beta G^A_{t+1} 1−\alpha−\beta \quad \geq \quad [1 − \delta (1 − \alpha − \beta)] \delta \left( \frac{1 − \alpha − \beta}{1 + r_t (G^A_{t+1})} \right) 1−\alpha−\beta Y_t$$

(6)

Both sides of (6) are increasing in $G^A_{t+1}$ and thus we are uncertain at first glance that whether the autocrat should raise or reduce the public spending to deter any potential revolution. Put the RHS to the left and denote the whole expression $\chi$. The derivative of $\chi$ with respect to $G^A_{t+1}$ is the following:

$$\frac{d\chi}{dG^A_{t+1}} = (1 − \alpha − \beta) \delta (1 − \tau) Y_t \gamma^\alpha + \beta G^A_{t+1} 1−\alpha−\beta$$

$$− (1 − \alpha − \beta) [1 − \delta (1 − \alpha − \beta)] \delta Y_t (1 − \alpha − \beta) 1−\alpha−\beta (1 + r_t)^\alpha + \beta − 2 \frac{r_t Y_t}{G^A_{t+1}}$$

The sign of this derivative is ambiguous. For the time being, we ignore the assumption that public spending is constrained by the tax revenue, implying that the autocrat is able to choose the
desirable level of public spending to deter any revolution maybe due to foreign borrowing or past-saving. On the top half of Figure 1, the after-tax per capita income of two regimes are drawn along $\tau$. The line of democracy is drawn assuming that the people adjust the expected cost of democracy along $\tau$ taking $G_{t+1}^A = \delta \tau (1 - \alpha - \beta) Y_t$. Shifting the line of democracy up until reaching the tangency point that gives $\tau_0$, which maximises the distance between autocracy and democracy, as shown in the bottom half. The derivative must be positive to the left of $\tau_0$ and turn negative to the right. Remind that the two interceptions on the top graph enclose the range of $\tau$ over which the autocrat does not face any danger of revolution in the current period. When $\tau < \tau_1$, $\chi$ is negative if no pre-emptive action is taken and a revolution will be successful. The autocrat has to raise the public spending to avoid revolution as $d\chi/dG_{t+1}$ is positive over this range. When $\tau > \tau_2$, $\chi$ is also negative but now the autocrat is to reduce public spending to remain in power because $d\chi/dG_{t+1}$ is negative. This may explain why a lot of extractive dictators do not spend much on public goods even though a larger public sector would have helped promoting national income and generated a larger amount of tax revenue. It is indeed a deliberate action to suppress the rise of democracy. The intended and planned economic backwardness is a political poverty trap, from which the public cannot escape without a change in political regime.

Proposition 3: Given that the autocrat foresees any potential political transitions ahead and $\tau > \tau_2$, the autocrat suppresses public investment, compared to a MPE without any foresight of revolution.

To the other extreme, the autocrat may be financially constrained and cannot inject money into the public sector. At $\tau'$, which is the point where $\tau' = \tau_1 \delta (1 - \alpha - \beta)$, the autocrat can just avoid a revolution by spending all of the tax revenue into the public sector. To the left of $\tau$, the autocrat is financially incapable to deter a revolution. It implies that when the state is so weak and not able to finance the public sector, people should turn to democracy. This result comes from the assumption that under democracy there is no tax limit. The democratic government is delegated with the public spending preference and faces no constraint of taxation. It might not
Figure 1: Comparison of Democracy and Autocracy

After-Tax Income

\[ d\chi/dG(t + 1) \]

\[ \tau_1 \quad \tau_0 \quad \tau_2 \]
be true in reality. Perfect (indeed second-best due to the moral hazard inefficiency) democracy is hard to come by. If we assume that the tax rate limit $\tau$ and the cost of motivating politicians $\psi$ are negatively related and driven by the same factor, for example legal system, culture and other intangible social foundations, this range diminishes and is eliminated if $\psi$ is large enough.

A similar argument applies to technological backwardness. The autocrat, if possible, can manipulate technology level to avoid a revolution. Suppose that the autocrat cannot commit to another public spending level other than the MPE no-foresight level and the only variable the autocrat can manage is the expected technology level next period. Notice that the management has to be done at time $t-1$ because $r_t$ is determined at time $t-1$. The autocrat is successful in deterring at time $t-1$ any successful revolution at time $t+1$ if condition (4) does not hold, as reproduced below:

\[
(1 - \tau)^{1+\alpha+\beta} (\tau)^{1-\alpha-\beta} > [1 - \delta (1 - \alpha - \beta)] \left( \frac{1}{1 + \hat{r}_t (G_{t+1} (A_t))} \right)^{1-\alpha-\beta}
\]

A lower technology level reduces current income and hence public spending next period, raising the rate of rent $\hat{r}_t$ and thus making the right-hand side smaller. This conclusion does not alter with respect to the tax rate limit.

**Proposition 4:** Given that the autocrat foresees any potential political transitions ahead and $\tau / \in [\tau_1, \tau_2]$, the autocrat can lower technology level to deter any revolution.

This proposition may explain why in so many autocratic countries advanced technology seems not able to find the ground to prospect and remain religious and superstitious. The management of technology can be done through establishing legal barriers, censoring media, regulating education, and forming a theocracy. Scholars associate the sharp rise in economic growth with the consolidation of democracy (Persson and Tabellini, 2006) and the well-functioning of capitalism (Rueschemeyer et al., 1992). My model presents another face of the coin by arguing that less democratic countries tend to suppress public expenditure and technological growth. This result
is comparable to the work by Aghion et al. (2007), which suggests that autocracies tend to have higher entry barriers to market than democracies.

5 Textual and Historical Research

Let us first identify the rise of democratic ideas. The gradual rise of democratic ideas is noticeable over the Age of Enlightenment. Thomas Hobbes, in his work “Leviathan” in 1651, argues that an absolute autocrat is to rule the people to avoid the society to fall into the horrible “state of nature”. Subsequent philosophers departed from Hobbes’ view and move toward democracy. John Locke, a devoted Christian, in his work “Two Treatises of Government” published in 1689, does not denounce autocratic rulers but proposes that any rulers are responsible for protecting people’s property and prerogative power should be largely limited. Eventually Jean-Jacques Rousseau in his work “Social Contract” published in 1762 advocates that an ideal government is empowered to enforce the “general will” through direct democracy. Since then, the modern notion of democracy had been gradually developed.

Along with the rise of democratic ideas, demand for publicly provided public good was evident. One example is public education. Before the French Revolution in 1789, around 50,000 boys and young men in France were receiving general education locally organized and funded by cash endowments, which were confiscated during the Revolution (Palmer, 1986). Still poor peasants were too poor to afford sending their children to these schools. More expensive and advanced private education for the very rich was to cultivate nobles. The coverage of education over the whole population in 1789, which is estimated to be 26 million (Fish, 1940), was very limited even if we exclude women from the base of population. Condorcet in 1791 proposed to, but then rejected by, the French Legislative Assembly a plan of free, compulsory and universal education to all children in France. Apart from education, thinkers generally believe that the state or the government regardless of its form should “do good” to the public. Thomas Paine (1737-1809) is regarded as the one of the earliest philosophers who proposed a comprehensive public welfare
system (Agassi, 1991). Paine, in his *The Rights of Man*, condemns any wasteful expenditure of the royal family and advocates fiscal prudence of the government, “Public money ought to be touched with the most scrupulous consciousness of honour.” And he proposes to spend the money on poor family subsidies, unemployment benefits, and basic education.

Autocrats did respond to the rise of demand for public good. The enlightened autocrat Frederick the Great of Prussia (reigned from 1740 to 1786), partially due to his desire to strengthen the nation, launched programs to open new farmlands and improve irrigation. He ordered and oversaw construction of canals for facilitating transportation of goods and crops. The subsequent great monarch Napoleon Bonaparte (reigned from 1804 to 1814) codified the laws, modernized national and local administration, abolished feudalism, promoted secular education and scientific research, and facilitated entrepreneurship (Roberts, 2014; Palmer and Colton, 1995). All these efforts were directed to promote commonwealth or the benefit of local citizens. The role of government as a producer, protector and facilitator of public good had become well-accepted by the early 20th Century.

Once democracy had been gradually established along with economic growth, the focus of struggle shifted to between property owners and the working class. The pressure for universal suffrage had raised fears of “tyranny of the majority” among property owners and thus the once dominant classical liberalism was threatened. Bentham’s (1789) *An Introduction to the Principles of Morals and Legislation* established the foundation of utilitarianism and suggested that politicians should rule to maximize pleasure of the society as a whole. Liberalism was then transformed into its modern version that provides a pragmatic argument for government intervention. The impact was finally felt by the world when John Maynard Keynes came to the stage and led the wave of Keynesian economics in the early 20th Century. It broke the laissez-faire economic tradition and governments began to take a much bigger role in managing the economy.
6 Empirical Test

6.1 Hypothesis

The main hypothesis of this work is summarized as the following:

*Hypothesis 1: The larger the demand for public goods, the higher the democracy level of the country.*

A few things to address before we move to estimations. First, the model does not predict a linear relationship between demand for public goods and democracy. Autocratic rulers may deliberately suppress public spending, and thus the demand for it, to delay any demand for democracy. Thus we expect that the effect is absent or even negative when the country is not democratic enough. To another extreme, when the country is highly democratic, the effect is small or insignificant because further improvement is restrained. Thus we expect that the effect depends on the current democracy level and is non-linear. Second, demand for public goods is in principle not observable. What we observe is the actual size of the public sector, measured by government revenue. I will take the lag of public revenue as a proxy for the demand for public goods in the current period. The modified hypothesis is as follows:

*Hypothesis 2: Only if the country is sufficiently democratic, the larger the public sector in the previous period the higher the democracy level of the country in the current period. The impact diminishes as democracy level rises towards the upper limit.*

6.2 Datasets

The historical dataset is borrowed from Dincecco (2013) who documents rich information of public finances of European states from 1650 to 1913. By merging the dataset with the PolityIV project, an unbalanced panel dataset of 11 European states from 1800 to 1913 is created. The proxy...
employed for the demand for public goods is the lagged value of the log of government revenue per head in gold grams. This proxy is arguably reasonable as people expect a government to provide more public goods when the government collects more revenue from the public.

Due to the lack of democracy index for years before 1800, we cannot really estimate the impact in the 18th Century. Considering the fact that the major impact of the Enlightenment reached the European ruling class only after the French Revolution in 1789, the information of the 19th Century is still useful for us to understand the dynamics during the gradual democratization of Europe. For the two-year panel, I take the information every two years, rather than calculating the average. It also applies to the four-year interval panel. The larger the interval, the less likely that the estimations suffer from problems of serial correlation. The lengths of interval ensure that the information of the panel of longer interval is always an extract of the panel of shorter interval.

The measure of democracy is the Polity(2) Index of the PolityIV Project. It assigns a score from -10 to 10 to each country of each year. The higher the score the more democratic the country. In this project I normalize the score between 0 and 1. 2 We report some descriptive statistics in Table 1.

Figure 2 and 3 plot the public revenue per head and the Polity Score of France and Spain from 1800 to 1913.

The left y-axis is plotted the public revenue per capita in gold grams. Over the years the public revenue of France increased from 4.6 grams in 1800 to 42 grams before the First World War. Meanwhile polity score, which is plotted on the right y-axis, fluctuated towards democracy despite the slump during the Napoleon era. Spain illustrated an even clearer pattern. The two variables increased hand in hand over the specified period. But causality is not guaranteed. Econometrics is then helpful for us to test the hypothesis.

2 The normalization is as the following. I first check if the missing data of Polity(2) due to disturbance can be replaced by the disturbance indicators of Polity(1). Then I remove any observations with disturbance indicators. The normalized score is then computed as follows: nPolity = (Polity+10)/20. One can interpret that a country with a score higher than 0.5 is democratic.
### Table 1: Historical Dataset: Descriptive Summary

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<th>Mean</th>
<th>SD</th>
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#### 6.2.1 Econometric Models

Consider the following econometric model:

\[
d_{it} = \alpha d_{it-1} + \beta_1 g_{it-1} + \beta_2 (d_{it-1} \times g_{it-1}) + \beta_3 d_{it-1}^2 + \beta_4 (d_{it-1}^2 \times g_{it-1}) + \mathbf{x}'_{it-1} \delta + \zeta_t + \eta_i + \epsilon_{it} \tag{7}
\]

where \(d_{it}\) is the democracy score of country \(i\) at time \(t\). The lagged value is included on the right-hand side to capture any persistence in democracy. The main variable of interest is \(g_{it-1}\), the lagged value of size of public sector of country \(i\). As briefly discusses above, we expect the impact of the expanding the public sector may vary according to the past democracy level. First the impact is small or negative when the country is autocratic. Second the impact is small or insignif-
significant when the country is highly democratic. The interaction terms of the lagged democracy and the lagged public sector size are included to allow the possibility that the impact of public sector size may vary according to the past democracy level. The coefficients $\beta_1$, $\beta_2$, $\beta_3$ and $\beta_4$ capture the causal effect of size of public sector on democracy. All other covariates are included in the vector $x_{it-1}$. In addition, $\zeta_t$ and $\eta_i$ capture the year fixed effect and the country fixed effect. $\epsilon_{it}$ is the error term and $E[u_{it}] = 0$ for all $i$ and $t$.

Fortunately the data in the historical dataset are not censored at the top (the maximum value is 0.9) and not concentrated at the bottom (only 8.48% of the observations hit the lower bound). We do not employ Tobit model to avoid unnecessary complexities. A more relevant problem is the inclusion of the lagged of the dependent variable in the right-hand side of the regression. As the dependent variable is correlated with the country fixed effect $\eta_i$, the lagged of the dependent variable is also correlated with the country fixed effect, and thus OLS is biased and inconsistent even if the error terms are not serial correlated. But if the length of the panel goes to infinity, the fixed-effect estimator is biased but consistent. As the number of periods is 114 for the one-year panel and 57 for the two-year panel, the panel is considerably long enough to deliver consistent estimator and therefore we will rely mainly on the estimations of fixed-effect OLS. As the panel
dataset is very long relative to the number of the countries, instruments are too many and GMM is then inconsistent and produces unrealistic test statistics (Roodman, 2009). Besides, until now there is no consent of the rules of specifying the estimation in the literature. Results are then hardly robust and fluctuate depending on the options chosen. Despite that, we will report the results of Arellano-Bond System-GMM estimations but readers should be aware of any potential problems.

6.2.2 Results

We first present the results of the one-year interval panel in Table 2. Throughout all eight specifications, we control for lagged (log of) population size, lagged urbanization rate (as a proxy of income level), and year dummies in random-effect and fixed-effect model or linear time trend in Arellano-Bond System-GMM (a linear time trend instead of year dummies helps reduce the number of instruments needed). The first four columns do not include the square of the lagged democracy score and the interaction term of it with the lagged public revenue. The last four columns present the full specification. As the marginal effect of lagged public revenue is not obvious in the table when interaction terms are present, the average marginal effects at three levels,
namely $d_{it-1} = 0.2$, $d_{it-1} = 0.5$ and $d_{it-1} = 0.8$, are computed at the end of the table. A positive
and significant marginal effect implies that a higher public revenue in the previous period led to
an increase in the current democracy level. From the first two columns, we find that the impact
is positive if the lagged Polity score is high enough. Controlling for the country fixed effect, we
find even larger estimates. Column 3 shows us Arellano-Bond System-GMM using two lags of the
endogenous variables ($d_{it-1}$, $g_{it-1}$ and $d_{it-1}g_{it-1}$) as instrumental variables. We do not find signi-
ficant effect of public revenue. Column 4 shows us Arellano-Bond System-GMM using all lags of
the endogenous variables ($d_{it-1}$, $g_{it-1}$ and $d_{it-1}g_{it-1}$) as instrumental variables. Then the num-
ber of instruments expands to 343, implying that the Hansen Test of Overidentification is heavily
weakened. Again we find positive and significant effect of public revenue when the lagged demo-
cracy level is high enough. As we do not include the two quadratic terms, the impact is linear in
the lagged Polity score: the higher the lagged Polity score the larger (more positive) the impact.
It is a piece of evidence supporting Hypothesis 2. However, the specification may be flawed be-
cause it presumes no upper limit of democracy level. In reality a highly democratic country can
hardly improve its polity score. Thus we include the two quadratic terms into the model. Except
column 7, we find that when lagged Polity score equates 0.5, the impact of lagged public revenue
is positive and significant at 1% level. Figure 4 plots the estimated average marginal effect with
90% confidence intervals following the specification of column 6 against the lagged Polity score.
The marginal effect is not significantly different from zero at the two extremes and is positive
and significant if the country is moderately democratic. Given that lagged Polity score is 0.5,
doubling public revenue per capita increases Polity score by 10.1% of a standard deviation.\footnote{ln 2 × 0.0373/0.2559 = 0.1010.}

We replicate the estimations in the two-year interval panel and the four-year panel. We report the
estimations in Table 2 and Table 3. Figure 4 shows the average marginal effect of lagged public
revenue of the fixed-effect model with quadratic terms. Focus on the four-year interval panel,
doubling public revenue per capita increases Polity score by 18.43% of a standard deviation when
the lagged Polity score is 0.5.\footnote{ln 2 × 0.0681/0.2561 = 0.1843.} As expected, the estimated effect is larger in the long-run than in
the short-run, but the confidence intervals are larger as well.

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### 6.2.3 Discussion

We do not find positive impact of public revenue on democracy level if the countries were too autocratic. This is implied by the model because public good provision is distorted by the incentive to suppress democratic ideas by autocrats. Citizens in autocracies may not demand democracy as they know democracy is even more costly. On the other hand, we find positive impact of public
revenue on democracy level for democratic countries. The impact is larger if the countries were still on the way to full democratization. The estimated effect is larger when we take a longer-run perspective. This is expected as the impact is accumulated over time.

The empirical tests are not without problems. The theoretical model argues that the “demand” for public goods will be translated into the “demand” for democracy. But the regressions are instead looking at the relationship between the lagged “actual” government revenue and the current “actual” democracy level. Moreover, public revenue may not be a good measure of the public good provision. A better alternative is public spending as a proportion of GDP, but as far as I know no reliable cross-country historical information is available.

The model is also useful in explaining contemporary democratization over the world. An extension of this work is to test the correlation between public spending and democracy level with contemporary dataset.
7 Conclusion

This paper incorporates political transition into basic neoclassical growth model. Democracy suffers from moral hazard inefficiency while citizens cannot avoid the extractive taxation under autocracy. Democracy is preferred to autocracy if the maximum possible tax rate under autocracy is either very low or very high. Citizens tend to prefer democracy when the expected public spending is larger because it reduces the fraction of tax revenue needed to motivate the government under democracy. Technological advances raise the marginal productivity of public spending and a larger public sector reduces the relative cost of democracy, finally leading to the desire for democratic government. This work allows us to explain the sequence of historical events in the Early Modern Age. The Scientific Revolution preceded the Enlightenment, which in turn sparked off the General Revolution and the rise of democratic ideas in Europe. The well-respected property rights institutions established following democratic wills helped foster the Industrial Revolution, which precipitated our Contemporary Age. To avoid a revolution, the autocrat could reduce public spending to curb the demand for democracy. It explains why many extractive regimes in the world do not invest adequate public goods and deliberately put the country into a poverty trap.

Exploiting the historical dataset by Dincecco (2013), the hypothesis is put into empirical tests with information of 11 European countries from 1800 to 1913. Using the lagged public revenue per capita as a proxy of demand for public good provision, we find that the impact of public revenue on democracy is positive if the country is moderately democratic. The magnitude is larger from a longer-run perspective. The results show that the interaction between the size of public sector and democracy is different in different types of political regimes.
References


Table 3: Historical Dataset: Two-year Interval Panel

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