A Theory of Developmental Dictatorship*

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August, 2024

Abstract

This article studies the developmental motives of a dictator under the modernisation hypothesis. He faces a trade-off between pursuing higher future gains with growing threats from the rise of the middle class and accepting lower gains for a more stable regime. I show that his optimal strategy is to invest in an underdeveloped economy for higher future returns. As the economy matures, investment declines as the focus shifts toward maintaining the regime. Without this threat, the economy regresses or fully develops depending on the profitability of investment and regime stability. My framework helps explain empirical puzzles about why some underdeveloped autocracies achieve faster economic growth. I also analyse how steady state varies by the length of future horizon under consideration. Contrary to Olson (1993)'s traditional theory that longer horizon concern makes high development, I find that a farsighted decision-making leads to a lower steady state.

Keywords: Dictatorship, Democratisation, Democratic Values, Growth, Modernisation Hypothesis, Stationary Bandits

JEL Classification: D02, D72, O12, O43

*This paper previously circulated with the title "Developmental Dictatorship and Middle class-driven democratisation" (2023). I am grateful for Francesco Squintani, Dan Bernhardt and Costas Cavounidis for their invaluable supervision and support. Also, I would like to thank Robert Akerlof, Peter Buisseret, Nathan Canen, Wioletta Dziuda, Gabriele Gratton, Priyama Majumdar, Luis Martinez, Kirill Pogorelskiy, Debraj Ray, Ronny Razin, Maria Titova, Hye Young You, Julia Zimmermann, and participants at Max Planck PolEcCon 2023, Warwick PhD forum, 1st Verona ECWE, NICEP Conference 2024, QMUL PhD Workshop 2024 and SIOE Conference 2024 for helpful comments. Nevertheless, all mistakes are my own.

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1 Introduction

The evidence is clear that some dictatorships pursue economic development. The four Asian tigers demonstrated remarkable economic growth, with annual rates exceeding 6 percent for three decades. Several impoverished nations have escaped poverty under the rule of pro-growth dictators (Glaeser et al., 2004). More interestingly, some autocracies have achieved faster economic growth than democracies over many periods (Luo and Przeworski, 2019).

However, why these developmental dictatorships pursue economic growth remain understudied. In particular, it is unclear why a dictator would promote economic growth when doing so might jeopardise his hold on power. For instance, while numerous studies have highlighted South Korea's miraculous economic development, the question remains as to why the South Korean dictators developed the economy that eventually removed them from power, rather than following the North Korea's path of maintaining a regime without economic development.[1]

This study examines the optimal investment strategy of a dictator in a situation where economic development increases the risk of losing power. Motivated by Olson (1993)'s *stationary bandit*, I focus on the dictator primarily interested in extracting rents while in power. Dictators in poor countries face constraints on extracting rents due to a scarcity of economic resources. Consequently, some may opt to forego immediate rent-seeking in favour of investment, anticipating larger future rents. While pursuing economic development can potentially bring greater affluence to a dictator, it also exposes him to growing demands for democratisation from a burgeoning middle class. This creates a natural trade-off between extracting tiny rents from a politically-stable regime and obtaining substantial rents from a resource-abundant, yet politically-insecure, regime.

The emergence of the middle class as a key protagonist in democratic transitions follows the idea of the *modernisation hypothesis*. As Seymour Martin Lipset put it,

> Increased wealth is not only related causally to the development of democracy by changing the social conditions of the workers, but it also affects the political role of the middle class through changing the shape of the stratification structure (Lipset, 1959).

This newly emerging class, receiving higher education in a more stable environment, has a greater demand for democratic rights and thus cultivates a democratic political culture and institutions.[2]

[1] Przeworski and Limongi (1997) suggest that South Korea is a "dream case" of modernisation theory in democratisation from economic development. Cho (2024) present a range of empirical evidence demonstrating how economic development under South Korea's dictatorship transformed socio-economic conditions, ultimately contributing to the country's democratisation.

[2] Banerjee and Duflo (2008) finds that the middle class tends to have fewer children and invest more in their education and health. According to Inglehart and Welzel (2005), individuals who grew up with less education, economic insecurity, and physical insecurity tend to internalise materialistic values, which are associated with xenophobia and authoritarianism. Conversely, those who grew up with higher levels of education and stable financial and physical circumstances are more likely to embrace post-materialistic values, which are aligned with

Historical evidence supports this hypothesis in democracies of all periods. Famous for his statement, "no bourgeois, no democracy," Moore (1966) claims that the formation of a middle class was crucial to the establishment of modern democracy. According to Huntington (1993) and Glaeser et al. (2007), a well-educated citizenry is associated with the emergence of broad-based opposition groups and popular uprisings against monarchies, leading to the downfall of numerous European monarchies. Similar dynamics have been observed in other regions, including East Asia, the former Soviet Union, and Eastern Europe, culminating in the overthrow of dictatorial regimes. More recently, the expansion of the urban middle classes consistently contributed to mass mobilisation during the Arab Spring in Egypt and Tunisia (Haggard and Kaufman, 2016).

Recent empirical results also support this modernisation hypothesis.[3] Economic growth in autocracies increases the probability of democratisation by making regimes unstable (Abramson and Montero, 2020). It acts as a catalyst for demanding political freedoms (Kennedy, 2010) and mobilising industrial workers (Rueschemeyer et al., 1992; Collier, 1999; Dahlum et al., 2019). It also provides an environment conducive to democratisation in the event of leadership change or regime fragility (Miller, 2012; Treisman, 2015). However, the literature on the modernisation hypothesis has not addressed what motivates a dictator to pursue economic expansion and how much development they would consider ideal.

To address this question, I formulate a political economy model of dictatorship. I construct an overlapping generations model with a dictator who considers current and expected future rents, decides how much to invest and extract rents, and remains in power until the transition to democracy occurs. In this model, parents provide education to bequeath skilled jobs to their children, and democratic values emerge naturally from education.[4] Young citizens participate in collective action for democratic transition based on a global games framework (Morris and Shin, 1998, 2003). Among them, those who adopt democratic values from education have a stronger demand for democracy.

I find that the dictator's optimal strategy is to invest more when the economy is underdeveloped, and to invest little or nothing when it is developed. In underdeveloped economies, fewer people adopt democratic values due to lower levels of education. As a result, the dictator is more likely to stay in power and has the opportunity to increase future profits through investment. However, as the economy grows and more skilled workers become employed, the

egalitarian norms and democratic political cultures.

[3]The relationship between economic development and democratisation has long been debated, with no clear consensus. Some studies, such as Barro (1999), Boix and Stokes (2003), Burkhart and Lewis-Beck (1994), and Epstein et al. (2006), report a positive relationship between income and democracy. Other studies, including Acemoglu et al. (2008, 2009), criticise the hypothesis by reporting no causal relationship. In response to the pessimistic view, Kennedy (2010) points out that these studies neglect the changes in socio-economic conditions brought about by economic growth that contribute to democratisation. In a recent review paper, Treisman (2020) revisits previous studies and finds a causal link between development and democratisation, albeit with a medium lag rather than a simultaneous or short-term relationship.

[4]Specifically, I assume that individuals possess either materialistic or democratic values, and that democratic values are correlated with higher levels of education.

average level of education rises, and more people adopt democratic values and actively participate in collective action. Faced with a higher probability of losing power, the dictator prioritises immediate gains over long-term investment.

I also highlight the conditions under which the dictatorship becomes a regressive or advanced economy. A dictator becomes a kleptocrat and the economy declines if the regime is unstable regardless of the level of growth or if investment costs are too high to create future value. On the other hand, when the middle class is not a threat to the dictator and the expected return on investment is high, the economy grows constantly.

The optimal investment pattern is exemplified by the Soviet Union's dictatorship. In its early phase, Stalin and his inner circle prioritised rapid industrialisation and economic growth to establish a robust socialist state, actively suppressing rent-seeking. However, as the regime matured, the focus shifted towards extracting rents for personal gain rather than the common good, leading to a decline in growth (Belova and Gregory, 2002). The case of South Korean dictator Park Chung-hee shows a similar pattern. In his early years in power, he pursued a high level of efficiency in economic development. However, after the constitutional reforms in 1972 to ensure his long-term rule (the *Yushin* Constitution), the regime's performance deteriorated in every aspect. Moreover, obsessed with maintaining power, the government increasingly used intelligence services to repress citizens (Dominguez, 2011).

To contrast this economic development trajectory with democracy, I introduce an economic growth model of democracy by using a framework of probabilistic voting model. Building on the established view that democratic values and participatory democracy are crucial for economic performance, this model suggests a convex-shaped investment pattern in democracies.[5] Initially, investment may be low in underdeveloped economies. However, as economic growth progresses and education levels rise, this fosters the emergence of a pro-democratic citizenry. These more policy-oriented and less partisan citizens act as a check against rent-seeking behaviour by politicians, leading to increased investment in developed economies. This contrasting growth pattern suggests a potential mechanism for why some autocracies initially outperform democracies in poor countries, whereas in developed economies, democracies tend to surpass autocracies due to the pro-democratic citizenry's role in curbing rent-seeking behaviour.

To provide empirical support for this theoretical prediction, I analyse data from Acemoglu et al. (2019), who examine the impact of democracy on economic growth.[6] My empirical analysis reveals that economic growth under dictatorships varies depending on the level of democratisation threat. Specifically, the findings suggest that the threat of democratisation has a highly significant negative effect on GDP growth for autocratic regimes. Moreover, this anal-

[5] When the analysis is extended to $\mathcal{A} = \mathbb{R}_+$, under suitable conditions, an S-shaped investment pattern emerges. This pattern is characterised by convex investment up to the maximum proportion of skilled workers, after which it transitions to concave-shaped growth.

[6] The data is downloaded from Daron Acemoglu's homepage (https://economics.mit.edu/people/faculty/daron-acemoglu/data-archive).

ysis challenges the conventional wisdom that democracy is a primary driver of growth. When controlling for the threat of democratisation, the effect of democracy on economic growth becomes largely insignificant. These results align with the model's predictions and offer new insights into the complex relationship between regime type, democratisation pressure, and economic growth.

Finally, I analyse how the level of development varies with the time horizon the dictator considers. According to the traditional view of long-lasting dictators with a vested interest in economic performance, a dictator with a farsighted perspective is likely to invest more (Olson, 1993; McGuire and Olson, 1996). Contrary to this prediction, I find that dictators facing the potential threat of a rising middle class tend to invest less as they look further into the future. By slowing economic growth, the dictator can mitigate the increased likelihood of regime collapse and survive for a longer period. This finding offers a novel perspective on the interplay between economic development and the length of autocratic leaders' time horizons, challenging conventional assumptions about the relationship between long-term planning and economic investment in dictatorships.

This paper proceeds as follows: Section 2 reviews the related literature on dictatorship, education and middle class, and democratic transitions. Section 3 develops and analyses a political economy model of developmental dictatorship. Section 4 compares the economic growth trajectory predicted by the model for dictatorships with the growth path observed in democracies. Section 5 explores how the dictator's planning horizon affects optimal investment decisions. Section 6 concludes the paper. All formal proofs are provided in the appendix.

2 Related Literature

This study contributes to the literature on formal models of dictatorships by elucidating a potential mechanism through which authoritarian regimes can foster economic growth. Previous research on the political economy of non-democracies has explored how dictatorships reinforce regime stability through various means: repression (Tyson, 2018; Dragu and Przeworski, 2019; Gitmez and Sonin, 2023), power-sharing (Svolik, 2009; Boix and Svolik, 2013), and control of information (Edmond, 2013; Shadmehr and Bernhardt, 2015; Guriev and Treisman, 2020). Studies have also examined how dictatorships balance competence and regime stability through the appointment of subordinates (Egorov and Sonin, 2011; Zakharov, 2016) and the acceptance of free media (Egorov et al., 2009). Regarding economic growth under dictatorships, Overland et al. (2005) analyse economic development in authoritarian regimes when such development strengthens regime stability. De Luca et al. (2015) explore dictators' incentives for promoting economic growth, which stem from elite support. This support is garnered when elites perceive the dictatorship as more beneficial than a democracy where policies are determined by the median voter. However, few theoretical models focus on the trade-off between economic growth and regime stability, particularly examining why certain dictatorships accommodate growth despite its potential to weaken stability, as suggested by the modernisation hypothesis. This study aims to address this gap in the literature.[7]

This research also contributes to the literature on formal theoretical models of democratic transitions. Existing scholarship has primarily examined democratisation from the perspective of economic interests. Boix (2003) and Acemoglu and Robinson (2000, 2001, 2006) focus on class conflict, arguing that elites must democratise by expanding the franchise to counter the threat of revolt from the poor seeking redistribution. However, Haggard and Kaufman (2012) note that over 40 percent of democratisation cases were achieved under middle and upper-class leadership, which did not necessitate redistribution. Apart from class conflict, Lizzeri and Persico (2004) argue that the demand for public goods provision drives enfranchisement. As Tabellini (2008a) highlights, explaining institutional change solely through economic incentives is limited. In light of these perspectives, this study contributes to the literature by focusing on how an increase in the demand for democracy itself can catalyse democratisation and by explaining how economic change can drive this demand for democratic governance.

In my model, education plays a transformative role in shaping political culture and fostering an environment conducive to the growth of civil society, ultimately leading to the establishment of democracy. Several studies have explored the impact of education on democratic transitions. For instance, Bourguignon and Verdier (2000) demonstrate how a more equitable distribution of education accelerates democratisation in oligarchic societies. Glaeser et al. (2007) examine the correlation between education and democracy, suggesting that education enhances political participation, which in turn catalyses democratic transitions. Murtin and Wacziarg (2014) find that primary education and per capita income are key drivers of democratisation. The primary distinction between this study and others focusing on education and democratisation lies in its assumption that improved education, resulting from the rise of the middle class, increases citizens' likelihood of embracing democratic values. This assumption aligns closely with the concept of post-materialistic versus materialistic value formation, as discussed by Inglehart and Baker (2000), Inglehart and Welzel (2005) and Inglehart (2018). Recent empirical findings lend support to this idea. For example, Enke et al. (2023) observe that wealthy voters are more inclined to vote against their economic interests, suggesting that they prioritise values over material concerns. Furthermore, Apfeld et al. (2024) find that among Romanian students who successfully complete the national baccalaureate exam, those who attend university are more likely to align their preferences with the liberal party.

Finally, this study contributes to the growing body of literature on culture and institutions by examining the emergence of democratic values during democratisation processes.[8] It is closely related to the work of Besley and Persson (2019), who explore the co-evolution of democratic

[7]Similar to this study, Boucekkine et al. (2019) examine the decision-making process of non-democratic regimes under the assumption of the modernisation hypothesis. However, their primary research question differs from ours. They focus on identifying the conditions under which a ruler chooses to democratise or maintain autocracy in pursuit of their own interests.

[8]Refer to Lowes (2022) for review of literature on culture and institutions.

values and institutions. However, this study differs from their research by investigating how economic changes can give rise to democratic values. Numerous studies in social science have discussed the role of democratic values as a key component of economic growth within democratic institutions. For instance, in the field of economics, Persson and Tabellini (2009) analyse how democratic capital – including historical experience with democracy and its prevalence in neighboring countries – can strengthen and enhance the functioning of democratic systems. Despite this existing research, few studies have formally examined how democratic values emerge and function within dictatorships. Our study aims to address this gap by focusing specifically on the development of democratic values in non-democratic contexts.

3 Developmental Dictatorship

3.1 Model

I build an overlapping generation model with a dictator to describe how economic growth promotes democratic values. In this model, a continuum of citizens with unit mass is born in each period and lives for only two periods. I call citizens in her first period "young" citizens and in the second periods "old" citizens or parents. Each young citizen $i \in [0,1]$ acquires education from her parent i, becomes either a democratic type (d) or a materialistic type (m), and decides whether to participate in the collective action. In the subsequent period, she works in either an industrial economy or a rural economy, consumes for herself, and educates her offspring. The dictator weighs the immediate benefits of rent extraction against the potential future gains from promoting economic growth, and remains in power until the collective action successfully overthrows them.

Economy. The degree of the economy is represented by the level of infrastructure. The economy begins with an initial level of infrastructure $A_1 \in \text{int}\mathcal{A}$ where $\mathcal{A} = [0, \bar{A}]$ is the set of infrastructure. Infrastructure is accumulated according to $A_{t+1} = \min\{(1-\delta)A_t + I_t, \bar{A}\}$ where $\delta \in (0,1]$ is the depreciation rate and I_t is the investment of the dictator in period t. Each old citizen is either skilled or unskilled, and skilled workers are more productive than unskilled workers. Let $q_t \in [0,1]$ be the proportion of skilled workers, and let π_h and π_l be the production parameters for skilled and unskilled workers.[9] The production of economy in period t, Y_t, is

$$Y_t = \pi_h \sqrt{A_t} q_t + \pi_l \sqrt{A_t}(1-q_t). \tag{1}$$

Workers receive efficiency wages as pretax wages. That is, skilled workers get $\pi_h\sqrt{A_t}$ and unskilled workers get $\pi_l\sqrt{A_t}$ in period t. An exogenous proportional income tax $\tau \in (0,1)$

[9]Given that the model begins with $t = 1$, it is imperative to provide the initial proportion of skilled labour, denoted as q_1. I restrict q_1 to be consistent with A_1, i.e., $q_1 = \gamma\Delta\pi\sqrt{A_1}$, which will be elaborated upon in Section 3.2.2.

is imposed only on skilled workers, while unskilled workers are untaxed. Posttax income for skilled workers is denoted as $w_{ht} = (1-\tau)\pi_h\sqrt{A_t}$, which is greater than the wage of unskilled workers $w_{lt} = \pi_l\sqrt{A_t}$.

Education Provision by Parents. Each old citizen i in period t gets either a skilled or unskilled wage w_{it} and educates her offspring to bequeath human capital. Let $e_{it} \geq 0$ denote the provision of education by a parent i to a young citizen i. The preferences of a parent i are given by

$$\left\{w_{it} - \frac{e_{it}^2}{2}\right\} + \gamma\mathbb{E}[w_{it+1}|e_{it}] \tag{2}$$

The first term in the utility function captures parents' current consumption, while the second term represents their empathy towards their offspring's expected future wages. Parents derive greater satisfaction when their children are expected to earn higher wages. From the education choice of parent i, the offspring obtains human capital and secures a skilled job with probability e_{it}. With $1 - e_{it}$, the offspring fails to acquire human capital and becomes an unskilled worker. This means that without education, the offspring becomes an unskilled worker by default. The expected wage for a young citizen i given e_{it} is $\mathbb{E}[w_{it+1}|e_{it}] = e_{it}w_{ht+1} + (1-e_{it})w_{lt+1}$. For non-negative consumption, parent i faces the budget constraint $e_{it}^2/2 \leq w_{it}$.

The following parametric assumptions are introduced to ensure that the probability e_{it} is within the $[0,1]$ range for all $A_t \in \mathcal{A}$, and that the choice of e_{it} is an interior solution, resulting in positive consumption for parent i regardless of the wage type. The wage parameter differential is denoted as $\Delta\pi(\tau) = (1-\tau)\pi_h - \pi_l$, and the shorthand $\Delta\pi$ is used when the tax rate τ is not the main focus of the discussion.

Assumption 1. $\gamma^2\Delta\pi^2\bar{A} < 1$.

Higher education not only improves job prospects, but also fosters democratic values among young citizens. Let $v_{it} \in \{d, m\}$ denote the value type of young citizen i. The probability that a young citizen i embraces democratic values $v_{it} \in d, m$ given their education level e_{it} is given by $\Pr[v_{it} = d|e_{it}] = \mu e_{it}^2$ for $\mu \in (0,1]$.[10]

This dynamic of values evolving through education is also modelled in the literature on cultural transmission (Bisin and Verdier, 2001, 2023; Tabellini, 2008b). However, the current study differs from this literature in that education is driven by economic incentives, whereas cultural transmission models emphasise the motivation to transmit specific cultural values from parents to children.

Collective Action. Each young citizen i decides whether to participate, $a_{it} = 1$, or not, $a_{it} = 0$, in collective action that can overthrow the regime. Participation is costly, as citizens may

[10]The convex increasing function reflects the dictator's growing concern about potential threats arising from a larger middle class and pro-democratic citizenry, as predicted by the modernisation hypothesis. This concern is further supported by evidence of hostile policies towards tertiary education observed in many autocratic regimes (Connelly and Grüttner, 2010).

be subject to dictatorial repression as a result of their involvement. I assume that democratic citizens have lower participation costs than materialistic citizens. That is, $0 < c_d \leq c_m < 1$ where c_d and c_m are the participation cost for democratic and materialistic citizens, respectively. Let $\bar{d}_t = \int_0^1 \mathbb{1}[v_{it} = d]di$ represent the mass of young citizens with democratic values in period t, where $\mathbb{1}[\cdot]$ is an indicator function, and $\bar{c}_t = \bar{d}_t c_d + (1-\bar{d}_t)c_m$ denote the average participation cost.

Regime change is desirable for all citizens: Participants earn positive payoffs when the collective action succeeds. When it fails, they receive negative payoffs due to the participation cost. Citizens who do not participate in the collective action get zero. Collective action is successful and the regime changes if the mass of participants $M_t = \int_0^1 a_{it}di$ exceeds a threshold $1-\theta_t$ and it fails otherwise. Here, θ_t represents the regime vulnerability, which is independently and identically distributed over time according to a uniform distribution with its domain $[\underline{\theta}, \bar{\theta}]$ where $\underline{\theta} < -\sigma$ and $\bar{\theta} > 1+\sigma$ and $\sigma \in (0, 1/2]$. When $\theta_t \geq 1$, the regime naturally collapses on its own, while $\theta_t \leq 0$ means that there is no hope of removing the dictator from power through collective action. The mean of regime vulnerability $\mathbb{E}[\theta_t]$ is assumed to be between 0 and 1. The preferences of a young citizen i are given by

$$\{\mathbb{1}[M_t > 1 - \theta_t] - c_{it}\}\, a_{it}. \tag{3}$$

The dictator knows the distribution of θ_t. Citizens, on the other hand, do not have prior information about θ_t. Instead, they receive a private signal $s_{it} = \theta_t + \sigma\varepsilon_{it}$ where the random error ε_{it} follows a uniform distribution on $[-1, 1]$ and is independent and identically distributed for all $i \in [0, 1]$ and t. Based on the signal received, citizens construct beliefs about the realisation of θ_t, make inferences about the beliefs of others, and decide whether to participate ($a_{it} = 1$) or not ($a_{it} = 0$).

Dictator's Investment Decision. The government's revenue, denoted as G_t, is derived from levying a tax τ on skilled workers, given by $G_t = \tau\pi_h\sqrt{A_t}q_t$. This revenue increases when the productivity parameter π_h or infrastructure A_t is high and the economy has a substantial proportion of skilled labour q_t. The dictator then allocates G_t between personal consumption and investment to modernise the economy, thereby augmenting the resources at his disposal. The cost of generating one unit of infrastructure is $\kappa > 0$. An investment I_t is considered feasible if the cost κI_t does not exceed the available government revenue G_t. Similarly, I call the next-period infrastructure level A_{t+1} feasible in A_t if it lies within the range $[(1-\delta)A_t, (1-\delta)A_t + G_t/\kappa]$, where δ is the depreciation rate.

The dictator may or may not continue to the next period, depending on the result of collec-

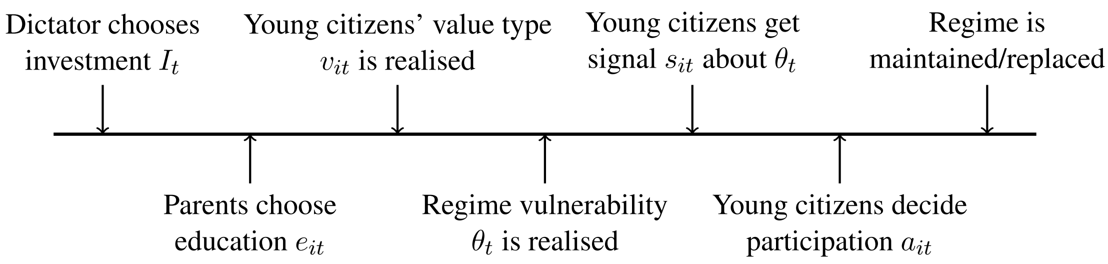


Figure 1: Timeline of events in period t

tive action. The expected payoffs of the dictator are given by

$$\{G_1 - \kappa I_1\} + \sum_{t=2}^{\infty} \beta^{t-1} \{G_t - \kappa I_t\} \prod_{s=1}^{t-1} \Pr[M_s \leq 1 - \theta_s | \bar{d}_s] \tag{4}$$

where $\beta \in (0, 1]$ is a time discount rate and $\prod_{s=1}^{t-1} \Pr[M_s \leq 1 - \theta_s | \bar{d}_s]$ is the probability that the dictator survives until period t.

Timing. I have described the education provision by parents, collective action, and the dictator's investment decision. For each period t, the timing of the events is summarised as follows (see Figure 1):

(i) Given the government budget G_t, dictator chooses investment I_t.

(ii) After observing I_t, each parent $i \in [0, 1]$ receives wages w_{it} and educates e_{it} the offspring. Young citizens become either democratic or materialistic from the education.

(iii) Nature chooses the regime vulnerability θ_t, each young citizen receives a private signal s_{it} about θ_t and decides whether to participate in collective action.

(iv) If the collective action is successful, democracy begins from period $t + 1$; otherwise the dictator maintains power in period $t + 1$.

3.2 Analysis

3.2.1 Democratic Values and Regime Change.

I describe the equilibrium for young citizens' participation in collective action and derive the probability of democratic transition as a function of $\bar{d}_t$.

Proposition 1. *There is a unique Bayes-Nash equilibrium such that each young citizen with signal s_{it} and values $v_{it} \in \{d, m\}$ follows a cutoff strategy:*

$$a_{it}(s_{it}, v_{it}) = \begin{cases} 1 & \text{if} \quad s_{it} \geq s_t^*(v_{it}) \\ 0 & \text{if} \quad s_{it} < s_t^*(v_{it}) \end{cases} \tag{5}$$

where $s_t^*(d) = \sigma(2c_d - 1) + \bar{c}_t$ *and* $s_t^*(m) = \sigma(2c_m - 1) + \bar{c}_t$*. Moreover, collective action succeeds in overthrowing the regime if* $\theta_t \geq \bar{c}_t$ *and fails if* $\theta_t < \bar{c}_t$*. The ex-ante probability of collective action success is* $\Pr[M_t > 1 - \theta_t | \bar{d}_t] = \{\bar{\theta} - \bar{c}_t\}/\{\bar{\theta} - \underline{\theta}\}$.

Proposition 1 shows that each citizen participates in the collective action only when their signal exceeds a certain type-specific cutoff in equilibrium. This cutoff is lower for democratic type than for materialistic type, which is due to the difference in participation cost. Intuitively, materialistic citizens need more confidence than democratic citizens to join the collective action, as participation is more costly to them. Further, both cutoffs are decreasing in $\bar{c}_t$. Both types are more likely to participate if there are more citizens with democratic type. When $\bar{d}_t$ increases, protest becomes larger not just by the increasing number of democratic citizens itself, but also by the spillover effect of democratic values on the protest. From the dictator's perspective, what matters is whether to survive from collective action or not. This proposition tells that the average cost $\bar{c}_t$ serves as the threshold for regime change. The regime survives whenever the regime vulnerability is distributed below $\bar{c}_t$ and changes otherwise. An increase in $\bar{d}_t$ reduces $\bar{c}_t$, thereby lowering the probability of survival of the regime.[11]

3.2.2 Parental Education, Human Capital, and Democratic Values.

The next task is to analyse the optimal education choice of parents. In the model, education serves a twofold role. First, it is the key determinant of the human capital of the next generation, directly influencing the level of productivity in the subsequent period. Second, education shapes the values of society and thus plays a central role in transitions to democracy.

Each parent i in period t chooses e_{it} that solves

$$\begin{aligned} \max_{e_{it}\geq 0} \quad & \left\{ w_{it} - \frac{e_{it}^2}{2} \right\} + \gamma\{e_{it} w_{ht+1} + (1 - e_{it}) w_{lt+1}\} \\ \text{subject to} \quad & w_{it} - \frac{e_{it}^2}{2} \geq 0. \end{aligned} \tag{6}$$

By Assumption 1, the solution e_{it}^* for both wage types is in the interior for all A_t and any feasible A_{t+1} in $\mathcal{A}$. From the first-order condition, the solution to the problem e_{it}^* is derived as $\gamma(w_{ht+1} - w_{lt+1}) = \gamma\Delta\pi\sqrt{A_{t+1}}$. This indicates that parents are incentivised to educate more when the economy develops because the wage gaps between skilled and unskilled workers become larger. As this condition is common to all parents, the proportion of skilled labour workers in the next period q_{t+1} is derived as $q_{t+1} = \int_0^1 e_{it} di = \gamma\Delta\pi\sqrt{A_{t+1}}$, which is indepen-

[11] The result of this regime change model is consistent with recent studies of the modernisation hypothesis (Kennedy, 2010; Miller, 2012; Treisman, 2015). These studies highlight that economic growth can make democratisation more likely from trigger events due to the resulting socio-economic and institutional changes. Regarding the trigger events, Miller (2012) and Kennedy (2010) focus on periods of regime vulnerability and economic crises. Meanwhile, Treisman (2015) considers leadership turnover, such as the death of Generalisimo Franco in Spain. In the model, the average participation cost $\bar{c}_t$ captures the institutional and socio-economic changes, and the realisation of θ_t captures the period of these trigger events.

dent of A_t. Thus, in equilibrium, $q_t = \gamma\Delta\pi\sqrt{A_t}$ for all $t \geq 2$. On the other hand, q_1 is given at the beginning of the game. To be consistent with this optimality result, I assume that q_1 is also $\gamma\Delta\pi\sqrt{A_1}$.

Next, I derive the proportion of young citizens with democratic values and how it constitutes the ex-ante probability of collective action success. From the solution to the parents' problem e^*_{it}, the proportion $\bar{d}_t = \int_0^1 \mu e^{*2}_{it} di$ in the equilibrium is derived as $\mu\gamma^2\Delta\pi^2 A_{t+1}$. Using the result of Proposition 1, the equilibrium probability of regime survival in period $t+1$ is derived as

$$\Phi(A_t) = \bar{\phi} + \phi A_t \tag{7}$$

where $\bar{\phi} = \{c_m - \underline{\theta}\}/\{\bar{\theta} - \underline{\theta}\}$ and $\phi = (c_d - c_m)\{\mu\gamma^2\Delta\pi^2\}/\{\bar{\theta} - \underline{\theta}\}$. Because $c_d \leq c_m$, this equilibrium probability Φ shows a linear decrease in the level of infrastructure in the next period if $c_d < c_m$ and it becomes constant if $c_d = c_m$.

3.2.3 Optimal investment of the dictator

Economic growth poses a double-edged challenge for the dictator. On the upside, it allows for higher expected returns by increasing productivity and the proportion of skilled workers through greater educational investment. This, in turn, boosts tax revenues. However, the downside is that the increased education also leads to stronger public pressure for regime change. Consequently, the dictator faces a trade-off between maintaining a more secure regime with fewer resources for rent-seeking, or accepting a less secure regime with more resources at their disposal. To navigate this trade-off, the analysis now turns to the dictator's optimal investment decision.

Substituting the proportion of skilled workers q_t derived in the parents' optimisation problem into the government revenue G_t, I get equilibrium revenue $G^*_t = \tau\gamma\pi_h\Delta\pi A_t = g^* A_t$, which is linearly increasing in A_t. Then, the dictator's optimal investment, $\{I^{\text{dict}}_t\}_{t=1}^{\infty}$, solves the following problem:

$$\begin{aligned}
\max_{\{I_t\}_{t=1}^{\infty} \in \mathbb{R}^{\infty}_{+}} \quad & \{G^*_1 - \kappa I_1\} + \sum_{t=2}^{\infty} \beta^{t-1} \{G^*_t - \kappa I_t\} \prod_{s=1}^{t-1} \Phi(A_{s+1}) \\
\text{subject to} \quad & A_{t+1} = \min\left\{(1-\delta)A_t + I_t, \bar{A}\right\}, \\
& I_t \in [0, G^*_t/\kappa].
\end{aligned} \tag{8}$$

The constraints correspond to the accumulation of infrastructure and the feasibility condition. This problem indicates that, holding others constant, an increase in I_t increases G^*_{t+k} for all $k \geq 1$. When $c_d < c_m$, an increase in I_t leads to a higher e^*_t and $\bar{d}_t$, hence decreasing $\Phi(A_{t+k})$. When $c_d = c_m$, the values types do not affect the equilibrium probability of regime survival. Hence, the absolute value of the marginal change of $\Phi(A_t)$ with respect to A_t, i.e.,

$|\phi|$, can be interpreted as the *modernisation effect*.

Benchmark: Optimal investment without modernisation effect. I begin with a benchmark problem in which the modernisation effect does not exist. In this case, $\phi = 0$ and $\Phi(A_t) = \bar{\phi}$, where $\bar{\phi}$ represents the constant probability of regime survival. Without the modernisation effect, the dictator's problem is equivalent to comparing the instantaneous gain and profitability of investment in the future. The solution involves discounting by a factor of $\beta\bar{\phi}$. Given the linear increase of G_t^* with investment, the solution is to fully invest if the expected marginal payoff exceeds the marginal cost and to refrain from investing otherwise.

Proposition 2. *In the problem without modernisation effect ($c_d = c_m$), the dictator's optimal investment I_t^{nm} is*

1. *to invest $I_t^{\mathrm{nm}} = G_t^*/\kappa$ if $\kappa < \bar{\kappa}$,*
2. *no invest if $\kappa > \bar{\kappa}$,*
3. *any investment $I_t^{\mathrm{nm}} \in [0, G_t^*/\kappa]$ if $\kappa = \bar{\kappa}$*

where $\bar{\kappa} = \{\beta\bar{\phi}\tau\gamma\pi_h\Delta\pi\}/\{1-\beta(1-\delta)\bar{\phi}\}$.

Note that the threshold $\bar{\kappa}$ increases with the probability $\bar{\phi}$, which is an increasing function of c_m. This relationship suggests that regimes with lower c_m values tend to be inherently less stable, consequently reducing the likelihood of economic growth. In contrast, when c_m is high, the younger generation may be reluctant to participate in collective action, thereby enhancing the stability of the regime. This, in turn, makes it more probable for economic growth to materialise. This benchmark result is consistent with the findings of previous studies. Alesina et al. (1996) and Aisen and Veiga (2013) indicate that persistent political instability significantly impedes economic growth.

However, the benchmark's assumption that the probability of regime change is exogenous to the level of economic development is limited in aligning with empirical patterns. This assumption fails to capture the intricate relationship between economic growth and regime stability.[12] Additionally, it does not adequately explain why dictatorships often express concerns about education and structural changes resulting from economic growth, as these factors may be perceived as potential threats to the regime's hold on power. Therefore, I explore the optimal economic growth strategy of the dictatorship under the influence of the modernisation effect. This analysis could provide insights into how dictatorships navigate the delicate balance between fostering economic progress and maintaining political control.

[12] For example, Przeworski et al. (2000) estimate the probability of democracy as a function of per capita income and Abramson and Montero (2020) estimate a learning model of democratisation. Both studies show that economic growth can have a destabilising effect on autocratic regimes.

Optimal investment under the modernisation effect. I now analyse the dictator's optimisation problem in which the cost of participation in collective action differs by value types. In this scenario, the dictator's economic growth undermines the regime's survival probability by fostering pro-democratic citizens who are more likely to fight for regime change.

Similar to the results in the benchmark, the economy can evolve to prosperity or decline. Suppose that the marginal cost of investment is lower than the marginal expected future payoff when infrastructure is high. Despite the presence of a substantial proportion of young citizens who embrace democratic values, the dictatorship remains profitable in cultivating economic growth, culminating in convergence to $\bar{A}$. On the other hand, consider the situation where the cost of investment is greater than the marginal expected payoffs even without the emergence of citizens embracing democratic values. In this case, the economy converges to 0, the lowest level of infrastructure. These two cases indicate that the dictatorship is unconstrained by the modernisation effect.

Next, differing from the benchmark results, let us consider the dictator whose optimal strategy is constrained by the modernisation effect as follows: When infrastructure is low, the dictator has a higher incentive to invest due to a low proportion of young citizens with democratic values. However, when infrastructure is high, the dictator is less incentivised to invest because the expected future payoffs are highly discounted by the low probability of regime survival.

Proposition 3. *Let the thresholds $\bar{\kappa}$ and $\underline{\kappa}$ be*

$$\bar{\kappa} = \frac{\beta\bar{\phi}g^*}{1-\beta(1-\delta)\bar{\phi}}, \quad \underline{\kappa} = \frac{\beta g^* \left\{\bar{\phi} + \phi\bar{A}\left(1 + \dfrac{1}{1-\beta\Phi(\bar{A})}\right)\right\}}{1-\beta(1-\delta)\Phi(\bar{A}) + \dfrac{\beta\delta\phi\bar{A}}{1-\beta\Phi(\bar{A})}}. \tag{9}$$

1. *the level of infrastructure converges to 0 if $\kappa \geq \bar{\kappa}$, and converges to $\bar{A}$ if $\kappa \leq \bar{\kappa}$,*

2. *If $\kappa \in (\underline{\kappa}, \bar{\kappa})$, there exist thresholds A_{LB} and A_{UB} such that optimal investment I_t^{dict} strictly increases in A_t for all $A_t \leq A_{\text{LB}}$, strictly decreases in A_t for all $A_t \in [A_{\text{LB}}, A_{\text{UB}}]$, $I_t^{\text{dict}} = 0$ for all $A_t \geq A_{\text{UB}}$, and a unique steady state A_{ss} in $(A_{\text{LB}}, A_{\text{UB}})$.*

Figure 2 graphically illustrates the second part of Proposition 3. The economy grows when investment exceeds depreciation and declines when it falls below. The steady state is the level of A_t that equalises investment and depreciation. Furthermore, the infrastructure level at which the dictatorship begins to reduce investment is contingent upon the unit price of infrastructure, κ. For instance, an increase in κ to κ' lowers the threshold A_{LB} at which the dictatorship curtails investment, resulting in a convergence to a reduced level of steady state.

Corollary 1. *A_{LB} converges to $\bar{A}$ as κ goes to $\underline{\kappa}$, and converges to 0 as κ goes to $\bar{\kappa}$.*

Given that the emergence of a middle class has historically been a driver of democratisation in many countries, this finding suggests that the developmental dictatorship would not promote

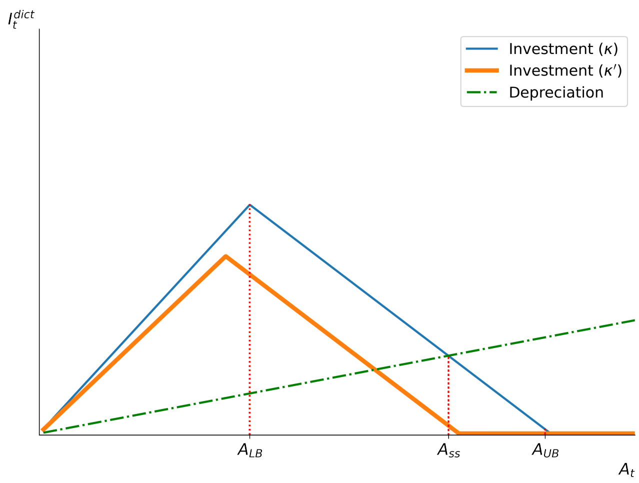


Figure 2: Optimal Investment of Developmental Dictatorship under Modernisation Effect

perpetual growth; instead, the dictator stimulates growth only for a mediocre economy. Furthermore, depending on the initial level of development, the dictatorship may be observed to allow only an economic downturn in some cases. For example, a dictator who comes to power through a coup may perceive that the society already has abundant revenue to extract. In this scenario, the dictatorship may focus on maximising extraction while maintaining power for a longer period, rather than promoting further economic growth.

This theoretical prediction provides a possible mechanism for explaining why some poor dictatorships promote faster economic growth. It also suggests that the scarcity of developed economies under dictatorships indicates that most authoritarian regimes are constrained by the modernisation effect. Singapore's advanced economy, which may seem a counterexample to the model, can be viewed as a result of the dictatorship not being overly concerned about the effects of modernisation. In an environment where the rule of law is promoted and property rights are secured, citizens' demands for democratic reform are weakened.[13] This stability, in turn, has provided the Singaporean leadership with a strong incentive for continuous economic growth.

3.3 Comparative Static

Collective Action and Modernisation Effect. The analysis in the previous section describes how growth differs depending on the cost of infrastructure investment. It demonstrates that the dictatorship is constrained by the modernisation effect, leading to limited growth, when κ falls within the range $[\underline{\kappa}, \bar{\kappa}]$. Note that the threat of democratisation depends on citizens' cost of participation in collective actions and the regime's vulnerability. Specifically, the thresholds $\underline{\kappa}$ and $\bar{\kappa}$ are determined by c_m, c_d, and the distribution of θ_t.

For the first comparative static analysis, I focus on the relationship between the cost of

[13] According to Huat (2005), the Singapore government has expanded civil society and responded to its demands, which has prevented political movements from demanding regime change.

participation, the distribution of regime vulnerability, and the economic growth path. The following lemma shows how they are related to the equilibrium probability of regime survival $\Phi(A_t)$.

Lemma 1. *The effect of the participation costs, c_m and c_d, and regime vulnerability, θ_t, on the probability of regime survival, $\Phi(A_t) = \bar{\phi} + \phi A_t$, given in (7) are as follows:*

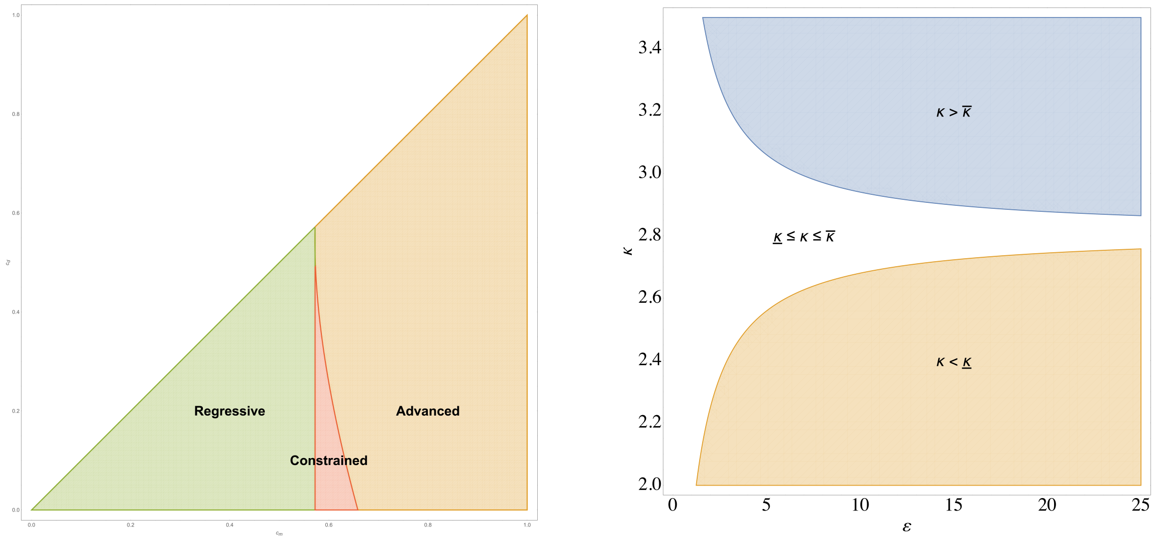
1. *The probability of regime survival when all citizens are materialistic values type, $\bar{\phi}$, increases as the cost of participation for materialistic types c_m increases,*
2. *The modernisation effect on regime survival, $|\phi|$, increases with the difference between c_d and c_m. The effect diminished to 0 when $c_d = c_m$,*
3. *An increase in the average of θ_t lowers $\bar{\phi}$, but it does not affect $|\phi|$.*
4. *An increase in the variance of θ_t lowers $|\phi|$.*

According to points 1 and 3, a low participation cost for the materialistic type and a high average level of regime vulnerability lead to a constant decrease in the probability of regime survival. This decreased survival probability may reduce the regime's incentive to invest in infrastructure, regardless of the emergence of pro-democratic citizens, as the expected returns on investment diminish. Points 2 and 4 highlight that a small difference in participation costs between materialistic and democratic types, i.e., $c_m - c_d$, and a high variance in the distribution of regime vulnerability both weaken the effect of an increasing proportion of pro-democratic citizens. As a result, the regime may be less concerned about this emergence when making decisions about development and rent-seeking, which is reflected in the shrinking interval of $[\underline{\kappa}, \bar{\kappa}]$ in the next proposition.

Proposition 4. *The width of interval $[\underline{\kappa}, \bar{\kappa}]$, where the dictatorship is constrained by the modernisation effect, shrinks to 0 as both $|c_d - c_m| \to 0$ and $|\bar{\theta} - \underline{\theta}| \to \infty$.*

This proposition can be proved by showing that $|\phi|$ goes to 0 when either the distance of participation cost $|c_d - c_m| \to 0$ or the distribution of regime vulnerability $|\bar{\theta} - \underline{\theta}| \to \infty$. From the expressions of $\bar{\kappa}$ and $\underline{\kappa}$, we see that $\underline{\kappa}$ converges to $\bar{\kappa}$ as either $|c_d - c_m| \to 0$ or $|\bar{\theta} - \underline{\theta}| \to 0$.

The proposition implies that the dictatorship is less likely to be constrained by the modernisation effect if: i) the demand for democracy is not very different between democratic types and materialistic types, and ii) the fate of regime is less likely to be determined by the collective action. Figure 3 (a) illustrates the impact of varying participation costs on the economic growth trajectory of a dictatorship. A low participation cost for materialistic type incentivise kleptocratic behaviour rather than economic investment, leading to economic regression. Conversely, a high c_m coupled with a close value of c_d reduces the threat of democratisation, allowing the dictator to prioritise economic development. A sufficiently small c_d relative to c_m forces the dictator to strike a balance between future economic interests and regime stability.



(a) Participation cost and the type of dictatorship. (b) Thresholds $\bar{\kappa}$ and $\underline{\kappa}$ by the regime vulnerability.

Figure 3: Growth type of dictatorship by participation cost and regime vulnerability .
Notes: Parametric values are $\underline{\theta} = -0.001$, $\bar{\theta} = 1.001$, $\beta = 0.9$, $\delta = 0.2$, $\kappa = 0.35$, $\gamma = 0.2$, $\mu = 0.8$, $\tau = 0.5$, $\pi_h = 10$, $\pi_l = 1$, $\bar{A} = 1$. For (a), x axis and y axis is c_m and c_d, respectively. For (b), $c_m = 0.8$ and $c_d = 0.2$. x axis indicates the variance of the regime vulnerability reflected by ε, i.e., $\underline{\theta} = -\varepsilon$ and $\bar{\theta} = 1 + \varepsilon$.

Regarding the distribution of regime vulnerability, Figure 3 (b) illustrates that when the distance between $\bar{\theta}$ and $\underline{\theta}$ increases, the region of $[\underline{\kappa}, \bar{\kappa}]$, for which the dictatorship's optimal investment is constrained by the modernisation effect, shrinks. Note that $\bar{\theta} > 1$ signifies a regime change without citizen action, while $\underline{\theta} < 0$ indicates inherent stability regardless of protest. Therefore, a higher variance in θ_t, i.e., $\bar{\theta}$ and $\underline{\theta}$ are more distanced, implies a lower probability of the regime's fate being determined by citizens' collective actions. This is because a wider spread of vulnerability reduces the density of values within the interval $[0, 1]$.

Finally, I analyse how the dictator responds to the emergence of democratic citizens when democratic values are more or less likely to be embraced among the population. The parameter μ determines the probability with which each young citizen i adopts democratic values, given by μe_{it}^2. A higher μ implies that society would have more pro-democratic citizens for the same level of education. The question then arises: how does the dictator manage the equilibrium regime survival probability and economic growth in response to changes in μ?

Proposition 5. *Suppose that $\kappa \in (\underline{\kappa}, \bar{\kappa}]$. An increase in the propensity of accepting democratic values μ lowers the steady state of the economy, A_{ss}, but remains the same equilibrium probability of regime survival $\Phi(A_{ss})$.*

The proposition demonstrates that when citizens have a greater tendency to adopt democratic values through education, the dictator becomes more concerned about regime stability, leading to a much lower steady state. However, even though this trend makes the regime more unstable as a result of economic growth, in equilibrium, the regime is equally likely to survive. This is because the dictatorship promotes economic growth only until the regime reaches a certain level of stability.

Fiscal Capacity. Fiscal capacity, which refers to a government's ability to generate revenue primarily through taxation, is a pivotal determinant of economic growth (Besley and Persson, 2013). It enables investments in infrastructure, education, health, and other sectors, thereby enhancing productivity and elevating living standards. Empirical findings indicate that fiscal capacity increased worker productivity (Dincecco and Prado, 2012), greater state capacity to extract tax revenue improved economic performance among European countries (Dincecco and Katz, 2016), and high fiscal capacity reduces state failure in sub-Saharan Africa (Thies, 2015).

However, it is not obvious how high fiscal capacity in a dictatorship translates into substantial public spending on social welfare. In particular, unlike democracies, a dictator might prioritise short-term interests and reduce the provision of public goods under high public pressure (Przeworski et al., 2000). To examine this dynamic, I conduct a comparative static analysis to investigate how an exogenously given tax rate influences a dictator's optimal investment path.

In the model, the tax rates have the multifaceted effects. While raising tax rates increases revenue from skilled workers in the short term, it can also discourage investment in education. This leads to a decline in the number of skilled workers and potentially fewer citizens who have democratic values.

The model's equilibrium government revenue is given by $G_t^* = \tau\gamma\pi_h\Delta\pi(\tau)A_t$, demonstrating a Laffer Curve relationship. Government revenue is maximized at the specific tax rate $\{\pi_h - \pi_l\}/2\pi_h$. As long as the tax rate remains below this level, the positive revenue effect outweighs the disincentive for education investment. Therefore, the analysis focuses on the range from 0 to the revenue-maximizing tax rate.

Proposition 6. *Consider the range of tax rates $\tau \in (0, \{\pi_h - \pi_l\}/2\pi_h]$ and suppose that the unit cost of infrastructure κ falls below the threshold $\bar{\kappa}$ for some tax rate.*

1. *There is a threshold of tax rates $\bar{\tau}$ such that for all $\tau \in [0, \bar{\tau}]$ the steady state is zero.*

2. *If the steady state is positive for some tax rate τ, the steady state is also positive for a tax rate greater than τ.*

3. *For a sufficiently high τ, the steady state is increasing in τ.*

The results suggest how fiscal capacity influences economic growth in underdeveloped autocracies. While higher tax rates discourage investment in education and the development of skilled labour, the increased tax revenues available to the government can offset this effect. Additionally, the smaller wage differential between skilled and unskilled workers due to the high tax rate slows the emergence of educated, pro-democratic citizens. This contributes to the stability of the autocratic regime.

4 Dictatorship versus Democracy

4.1 Model

I describe the economic growth of democracy using the probabilistic voting model of electoral competition. In my model of dictatorship, the emergence of democratic values was the driving force of democratisation. In democracy, I assume democratic values to be the crucial element of participatory democracy, thereby fostering economic growth.

Suppose that the level of infrastructure in the first period, A_1, and its corresponding proportion of skilled labour, q_1, are given. The government revenue is $G_t^* = \tau\pi_h\sqrt{A_1}q_1$ and a proportion ρ_1^* of G_t^* is invested in infrastructure, i.e., $I_1 = \rho_1^* G_1/\kappa$.[14] I assume that the optimal education decision and the corresponding evolution of the values types remain the same in the model of dictatorship.

There are two parties, A and B, who propose policies ρ_{t+1}^A and ρ_{t+1}^B in $[0, 1]$, respectively. Once the values types have been revealed, each young citizen votes under the majority rule. She considers both her partisan preference and the proposed policy. Let the partisan preference of young citizen i for party A in period t be $\xi_{it} = \xi_t^m + \xi_{it}^v$, where ξ_t^m and ξ_{it}^v capture the average and variance of the bias. The terms ξ_t^m and ξ_{it}^v are distributed uniformly on $[-1/2, 1/2]$ and independent for all $i \in [0, 1]$ and $t \in \mathbb{N}$. Depending on their values types, voters vary in their concerns of partisan preference. Specifically, the democratic values types are less inclined to vote according to their partisan preferences.[15] Citizen i votes for party A if

$$\rho_{t+1}^A + \lambda c_{v_{it}} \xi_{it} > \rho_{t+1}^B \tag{10}$$

and for party B if the inequality is reversed. Note that c_m and c_d in the dictatorship model can be interpreted as the intensity of democratic culture. Hence, I use them to describe the different participatory cultures between types. The parameter $\lambda > 0$ adjusts the effect of political culture on democracy. When λ is too large, zero investment can be made in the society. So, I introduce the parametric assumption that $\lambda < 2/c_m$ in this analysis.

The winning party's policy is adopted, which determines the investment in the next-period. That is, when party $j \in \{A, B\}$ wins the election in period t, the investment in period $t + 1$ is chosen as $I_{t+1}^{\text{dem}} = \rho_{t+1}^j G_{t+1}$. The rest $\{1 - \rho_{t+1}^j\} G_{t+1}^*$ is obtained by the incumbent as a rent, while the opposition party gets 0. The expected payoffs of each party $j \in \{A, B\}$ are described

[14] To be consistent with the equilibrium result in (12), I assume that $\rho_1^* = 1 - \frac{1}{2}\left\{\frac{\lambda c_m c_d}{c_d + (c_m - c_d)\bar{d}_0}\right\}$.

[15] Note that the election outcome does not directly affect the wage level of the voters, as the investment policy is adopted in the next period. Hence, this assumption can be interpreted as follows: citizens with democratic values are more concerned about the community, whereas those with materialistic values are myopic and focus only on their own interest. This assumption is evidenced by recent studies (e.g., Enke et al., 2023).

as

$$\psi_j(\rho^A_{t+1}, \rho^B_{t+1})\{1 - \rho^j_{t+1}\}G^*_{t+1} \tag{11}$$

where ψ_j is party j's probability of winning the election.

In equilibrium, both parties propose the same policy ρ^*_{t+1}, which is derived as

$$\rho^*_{t+1} = 1 - \frac{1}{2}\left\{\frac{\lambda c_m c_d}{c_d + (c_m - c_d)\bar{d}_t}\right\}. \tag{12}$$

The derivation is provided in Appendix A.1. This equilibrium indicates that ρ^*_t is in the interior of $[0, 1]$, and the proportion of revenue spent on infrastructure is increasing in $\bar{d}_t$.

Proposition 7. *In the model of democracy,*

1. *The lowest infrastructure,* 0*, is a steady state if* $\lambda > \underline{\lambda}$*.*

2. *The highest infrastructure,* $\bar{A}$*, is a steady state if* $\lambda < \bar{\lambda}$

where $\bar{\lambda}$ *and* $\underline{\lambda}$ *are defined as*

$$\bar{\lambda} = \frac{2}{c_m c_d}\left\{1 - \frac{\delta\kappa}{\tau\gamma\pi_h\Delta\pi}\right\}\{c_d + (c_m - c_d)\mu\gamma^2\Delta\pi\bar{A}\}, \tag{13}$$

$$\underline{\lambda} = \frac{2}{c_m}\left\{1 - \frac{\delta\kappa}{\tau\gamma\pi_h\Delta\pi}\right\}. \tag{14}$$

Proposition 7 indicates that the economy converges to the lowest or highest level of infrastructure. Specifically, when $\lambda \in (\underline{\lambda}, \bar{\lambda})$, there is a threshold in $\mathcal{A}$ such that the infrastructure converges to 0 for any initial level below the threshold and converges to $\bar{A}$ for any level above it.[16] This implies that the more partisan citizens' preferences are in elections, the more the economy tends to converge to the lowest level of infrastructure. For example, Figure 4 illustrates that when $\lambda < \bar{\lambda}$ is applied, the investment exceeds the depreciation for any given A_t. However, when λ changes to $\lambda' \in (\underline{\lambda}, \bar{\lambda})$, a threshold at approximately 0.5 determines whether the investment is greater or smaller than the depreciation, depending on whether the infrastructure level is above or below this value. When A_t exceeds the threshold, the investment surpasses the depreciation, and the economy tends toward $\bar{A}$. Conversely, when A_t falls below the threshold, the investment is lower than the depreciation, causing the economy to converge to 0.

Next, I compare the economic growth of a democracy with that of a dictatorship. Previously, I have analysed that the trajectory under the dictatorship has three directions. It is obvious that the dictatorship provides a lower investment and a higher investment if $\kappa \geq \bar{\kappa}$ and $\kappa \leq$

[16]This pattern is also found in other economic models of democracy. For example, Bernhardt et al. (2022) show that electoral competition with a demagogue leads to long-term economic decline, called the "death spiral", if the initial capital level falls below a certain threshold.

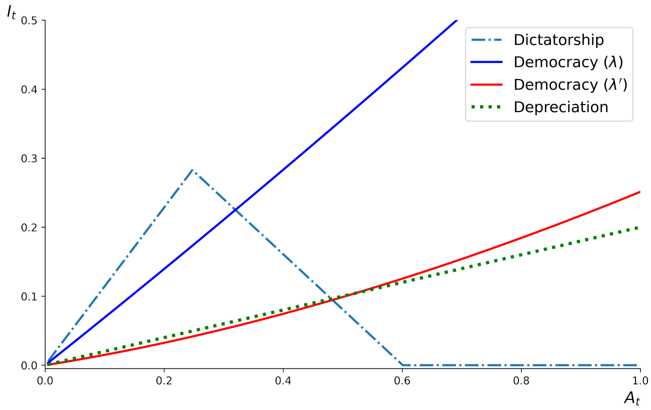


Figure 4: Economic Growth: Dictatorship vs. Democracy
Notes: Parametric values are $\lambda = 1$ and $\lambda' = 2.2$. Other parameter values are the same in Figure 3.

$\underline{\kappa}$, respectively. In the following proposition, I compare dictatorship with $\kappa \in (\underline{\kappa}, \bar{\kappa})$ and democracy with regard to investment.

Proposition 8. *Suppose that $\kappa \in (\underline{\kappa}, \bar{\kappa})$ and $\lambda \in (\underline{\lambda}, \bar{\lambda})$. Then there is a threshold level of infrastructure A^{reg} such that the equilibrium investment under the dictatorship is higher if $A_t < A^{\text{reg}}$ and lower if $A_t > A^{\text{reg}}$.*

Proposition 8 tells that the democratic institution provides more investment than the developmental dictatorship with concerns about the effect of modernisation only when the economy achieves a certain level of development. This result holds regardless of the parametric assumption of λ in Proposition 7. In dictatorship, the incentives for economic growth is high when underdeveloped and decrease as the economy grows. In democracy, with a less institutionalised democratic culture, the policies implemented expend government revenue mostly on rents rather than investment. On the other hand, in a developed economy, rent-seeking by politicians is limited by the democratic checks and balances of citizens, represented by policy sensitivity, thus leading to economic prosperity (see Figure 4). This result is consistent with Persson and Tabellini (2009) that higher democratic capital promotes growth, which, in turn, consolidates democracy through the accumulation of democratic capital.

This comparison offers a theoretical response to the question of why certain autocracies experience faster economic growth than democracies. Depending on the incentives for future rent extraction, an underdeveloped dictatorship can achieve high economic growth. But as soon as the emerging middle class becomes a potential threat to the regime, it deliberately refrains from developing an advanced economy.

4.2 Empirical Evidence

I revisit the empirical relationship between regime type and economic growth in light of this theoretical implication. Meta-analyses suggest a positive effect of democracy on economic

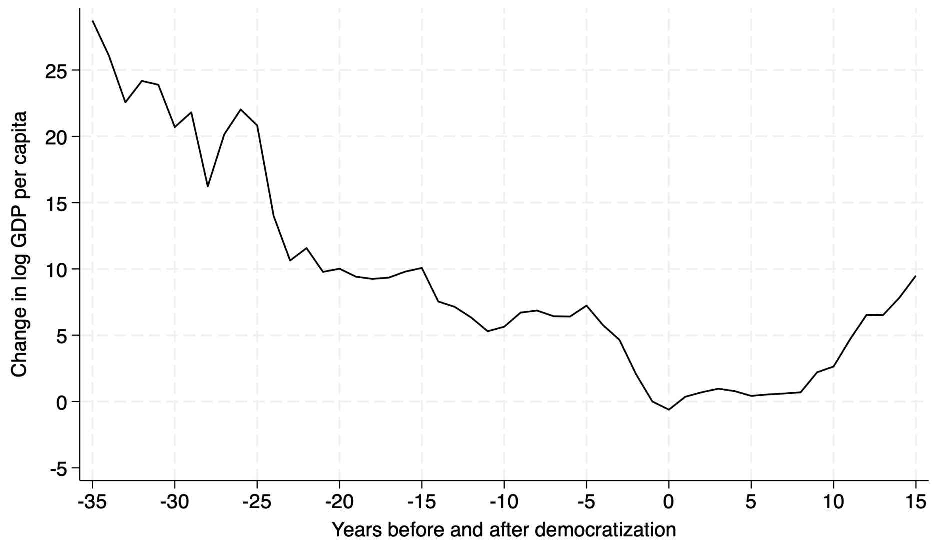


Figure 5: Per capita GDP dip preceding democratic transitions
Notes: This figure expands on Figure 1 from Acemoglu et al. (2019), extending the pre-democratisation period to 35 years. It plots changes in log GDP per capita relative to countries that remained non-democratic, normalizing the value to 0 in the year before democratization. The x-axis represents years relative to the democratisation event and y-axis represents the change of log GDP per capita.

growth (Doucouliagos and Ulubaşoğlu, 2008; Colagrossi et al., 2020). Previous studies on regime types and growth often treat autocracies as homogeneous, focusing primarily on comparing the performance of different regime types. However, as illustrated in Figure 5, the long-term GDP decline preceding democratisation remains a puzzling phenomenon.

My theoretical model addresses this puzzle by predicting that autocracies might promote faster economic growth when free from the threat of democratisation. This perspective suggests that the observed long-term decline in GDP per capita results from dictatorships striving to balance economic performance against the risk of regime change. To explore the empirical relevance of my model, I extend the regression analysis of Acemoglu et al. (2019), a seminal work in recent literature, by incorporating the democratisation threat faced by the dictatorship. Their study employs various empirical strategies accounting for country-specific fixed effects and GDP per capita dynamics, revealing substantial long-run effects of democracy. The dataset includes 175 countries from 1960 to 2010, providing a dichotomous measure of democracy, social unrest, average democracy within the region, and the log of GDP per capita and education enrolment from the World Bank Development Indicators.

Identifying countries under democratisation pressure presents a challenge, as political and economic factors constituting regime stability vary across countries and threats are not directly observable. To address this, I assume that countries that underwent democratisation within the sample period had faced a potential threat. Additionally, I posit that dictatorships in regions with higher average levels of democracy would face greater pressure to democratise.[17] Based

[17]This idea is well-established in the literature. For example, Huntington (1993) discusses the spillover of

Table 1: Effect of Democratisation Threat on (Log) GDP per capita

	(1)	(2)	(3)	(4)	(5)
Average democracy in the region	1.089	0.392	0.0727	0.157	-0.319
	(0.775)	(0.590)	(0.645)	(0.624)	(0.648)
Democratising Autocracy	0.0858	1.072	1.201	1.199	1.069
	(1.001)	(0.762)	(0.789)	(1.081)	(0.902)
Democratising Autocracy	-3.882	-2.623	-2.401	-1.963	-2.185
× Average democracy in the region	(1.007)	(0.731)	(0.812)	(0.689)	(0.883)
Democracy	-0.0638	1.013	1.299	1.211	1.037
	(0.941)	(0.650)	(0.651)	(0.882)	(0.796)
Log GDP lag	Yes	Yes	Yes	Yes	Yes
Log GDP lags 2-4	No	Yes	Yes	Yes	Yes
Log GDP lags 5-8	No	No	Yes	Yes	Yes
Unrest lags 1-4	No	No	No	Yes	No
Trade lags 1-4	No	No	No	No	Yes
Observations	6761	6313	5673	5165	5315
Countries	174	174	174	169	171

Notes: This table presents estimates of the interaction effect between autocracies transitioning to democracy and the average democracy level in the region (as a democratization threat) on log GDP per capita. All specifications include country and year fixed effects. Column 1 controls for a one-year lag of log GDP. Column 2 includes 4 lags of log GDP, while Column 3, the main regression, incorporates 8 lags. Columns 4 and 5 demonstrate robustness: Column 4 controls for 4 lags of unrest, and Column 5 accounts for 4 lags of trade exposure (defined as imports plus exports over GDP). Standard errors, robust against heteroscedasticity and serial correlation at the country level, are reported in parentheses.

on these assumptions, I employ the following simple regression equation:

$$\Delta y_{it} = \alpha_i + \beta \text{DA}_{it} \times \text{ADR}_{it} + \delta \text{Dem}_{it} + \mathbf{\Gamma}'\mathbf{X}_{it} + \sum_{r=1}^{p} \varphi_r y_{it-1} + \eta_t + \varepsilon_{it} \tag{15}$$

where y is the log of GDP per capita, Δy is the log GDP change, DA is the indicator of a dictatorship that would later democratise in the sample period, ADR is the average democracy level within the region, Dem is the democracy dummy, and $\mathbf{X}$ is the set of covariates, including DA and ADR. Here, I consider the estimation of the interaction term (DA $\times$ DR) to be the potential threat to the regime.

Table 1 presents the fixed effect regression results. The first column shows estimates controlling for a single lag of GDP per capita. The interaction of autocracies that become democracies and average democracy in the region as the threat of democratisation demonstrates a highly significant negative effect on GDP change, while the positive effect of democracy on GDP growth becomes insignificant. This negative coefficient remains highly significant across

democracy and democratisation, famously termed "the waves of democracy." Also, Kelejian et al. (2013) analyses the spatial spillover of institutions, demonstrating the significant impact of a country's immediate neighbours on its institutions.

various specifications, including those with different lagged GDP controls in columns 2 and 3. The effect of democracy on GDP growth is estimated to be positive, though its significance varies across specifications.

To address potential alternative mechanisms, I consider two possibilities: (1) the negative effect of the democratisation threat on GDP change may be due to trade isolation, and (2) the negative effect may indirectly result from more frequent unrest rather than directly from pressures engendered by neighbouring democracies. To account for these possibilities, columns 6 and 7 include additional controls: four lags of trade as a share of GDP and four lags of unrest, respectively. In both cases, the negative coefficient of the democratisation threat remains significant.

Next, instead of using the average democracy in the region, I explore secondary education attainment as an alternative potential threat to dictatorships. My theoretical model suggests that autocratic regimes face increased pressure for democratic transition as the proportion of educated citizens with high democratic values grows. The regression equation is

$$\Delta y_{it} = \alpha_i + \beta \text{DA}_{it} \times \text{SE}_{it-1} + \delta \text{Dem}_{it} + \gamma \text{DA}_{it} + \lambda \text{SE}_{it-1} + \sum_{r=1}^{p} \varphi_r y_{it-1} + \eta_t + \varepsilon_{it} \quad (16)$$

where SE is the secondary education enrolment. The main focus is the coefficient of the interaction term between autocracies that transition to democracy and lagged secondary education enrolment.

Table 2 displays the estimation results. Consistent with previous estimations, I find a negative coefficient for the interaction effect on GDP growth, which remains highly significant even after controlling for various lags of GDP per capita and four lags of unrest. This indicates that autocracies likely to transition to democracy experience slower GDP growth as secondary education attainment increases. Notably, the coefficient for the effect of democracy on GDP growth is insignificant.

In summary, this empirical exercise reveals that dictatorships are not homogeneous in terms of economic growth and may have varying development incentives based on the level of democratisation threat they face. As predicted by the theory, authoritarian regimes balance stability and future economic incentives. The desired level of development varies among dictatorships; some autocrats may maintain lower development levels because promoting economic growth risks triggering demands for democracy. Moreover, contrary to the established notion that democracy causes growth, the effect of democracy on economic growth may become insignificant when controlling for the threat of democratisation. This suggests that democracies may not achieve faster economic growth than dictatorships if the latter are not constrained by the threat of democratic transition.

Table 2: Effect of Secondary Education for Democratising Autocracies on (Log) GDP per capita

	(1)	(2)	(3)	(4)	(5)
Democratising Autocracy	-0.0387	-0.0419	-0.0503	-0.0396	-0.0396
× Secondary Educucation lag	(0.0146)	(0.0113)	(0.0127)	(0.0150)	(0.0150)
Democracy	-0.632	0.390	0.746	0.583	0.583
	(1.100)	(0.838)	(0.760)	(1.046)	(1.046)
Secondary Educucation lag	-0.0244	-0.00368	0.000152	-0.000000510	-0.000000510
	(0.0166)	(0.0129)	(0.0129)	(0.0112)	(0.0112)
Democratising Autocracy	-0.00274	1.625	2.197	1.779	1.779
	(1.231)	(0.995)	(0.989)	(1.301)	(1.301)
log GDP lag	Yes	Yes	Yes	Yes	Yes
log GDP lags 2-4	No	Yes	Yes	Yes	Yes
log GDP lags 5-8	No	No	Yes	Yes	Yes
Unrest lags 1-4	No	No	No	Yes	Yes
Observations	4353	4236	4053	3750	3750
Countries	170	170	170	165	165

Notes: This table presents estimates of the interaction effect between autocracies that transition to democracy during the sample period and secondary education enrollment (as a democratisation threat) on log GDP per capita. All specifications include country and year fixed effects. Column 1 controls only for a one-year lag of log GDP. Columns 2 and 3 control for 4 and 8 lags of log GDP, respectively. Column 5 additionally controls for 4 lags of unrest. Standard errors, robust against heteroscedasticity and serial correlation at the country level, are reported in parentheses.

5 Forward-Looking and Development

Autocratic regimes, characterised by highly centralised decision-making often concentrated in the hands of a single leader, place significant importance on leader characteristics (Jones and Olken, 2005). These leaders frequently prioritise their own survival and personal gain over the well-being and development of their citizens. This often leads to the adoption of short-sighted and inconsistent policies.

The question of whether a shortsighted or farsighted dictator contributes more to economic development has been a subject of discussion. Drawing on the analogy of stationary vs. roving bandits, Olson (1993) argues that dictatorships with long-term interests are more incentivised to promote economic development. He predicts that the longer the horizon the dictator considers, the more prosperity the dictator provides, which I term *Olson's hypothesis*:

> ...the king's subjects ...have more reason to be sincere when they say "long live the king." If the king anticipates and values dynastic succession, that further lengthens the planning horizon and is good for his subjects. (Olson, 1993)

Olson's hypothesis may hold true if citizens remain obedient under a dictator's rule. However, historical evidence suggests that economic development fosters a growing demand for democratic institutions. This raises a key question: Does a dictator with a longer time horizon, as

Olson proposed, offer greater economic prosperity given the potential threat of democratisation from a rising middle class? This question, despite its theoretical importance, has been neglected in previous studies. Therefore, I revisit Olson's hypothesis by analysing how the optimal level of investment varies with the dictator's time horizon, assuming the validity of the modernisation hypothesis.

I explore the case of a dictator who makes an optimal investment decision by looking ahead T periods.[18] This strategy is dynamically inconsistent, as the dictator updates the strategy by taking into account an additional period.

Definition 1. The dictator is *T-period foward-looking* if his expected payoffs are

$$\{G_t - \kappa I_t\} + \sum_{k=1}^{T} \beta^k \{G_{t+k} - \kappa I_{t+k}\} \prod_{s=1}^{k} \Pr[M_s \leq 1 - \theta_s | \bar{d}_s] \tag{17}$$

for all $t \in \mathbb{N}$. The dictator is said to be *non-myopic* if $T = \infty$.

For a given length of horizon $T \geq 1$ and infrstructure A_t, the T-period forward-looking dictator maximises his expected payoffs subject to the constraint that all citizens choose their best responses. Using the probability of regime survival in equilibrium, Φ, the value function V_s for period k, $s \geq 1$, with infrastructure A_k is defined as

$$\begin{aligned} V_s(A_k) = \max_{I_k \in [0, G_k/\kappa]} & \{G_k - \kappa I_k\} + \beta \Phi(A_{k+1}) V_{s-1}(A_{k+1}) \\ \text{subject to} \quad & A_{k+1} = \min\{(1-\delta)A_k + I_k, \bar{A}\} \end{aligned} \tag{18}$$

for all $i \in [0, 1]$ and

$$\begin{aligned} V_0(A_k) = \max_{I_k \in [0, G_k/\kappa]} \quad & \{G_k - \kappa I_k\} \\ \text{subject to} \quad & A_{k+1} = \min\{(1-\delta)A_k + I_k, \bar{A}\}. \end{aligned} \tag{19}$$

Note that the value function V_s considers both the current gain and the expected payoffs for the remaining $s + 1$ periods. Let I_t^T be the optimal investment chosen by the T-period forward-looking dictator in period t.

The condition for the economy to collapse to zero infrastructure in the steady state is the same as $\kappa \geq \bar{\kappa}$ for all $T \geq 2$, and $\kappa \geq \beta\tau\gamma\pi_h\Delta\pi\bar{\phi}$ for $T = 1$. Let $\bar{\kappa}^T$ denote this threshold for T. Note that the threshold for this regressive economy is higher in $T \geq 2$ than in $T = 1$. This implies that a dictator who only considers the current and next period is more likely to choose policies that lead to economic decline in the long run. This suggests that a short-sighted dictator can be more exploitative of the economy.

[18] Another scenario to consider the myopic dictatorship is to have a low β (discount heavily for the future), which trivially leads to a lower steady state.

To see whether the dictator who looks further into the future invests more, I analyse how the steady state in a non-regressive economy varies with forward-looking horizon. For a non-myopic dictator, the optimal investment follows Proposition 3. On the other hand, a finite-period forward-looking dictator solves for (18) for each period. The steady state for a forward-looking dictator is defined as follows:

Definition 2. For a given $T \geq 1$, infrastructure A_{ss}^T is the *T-period forward-looking steady state* if the optimal investment I_t^T is δA_{ss}^T for $A_t = A_{ss}^T$.

This means that the steady state for the forward-looking dictator is the level of infrastructure that can be sustained by the optimal investment chosen each period through the forward-looking update. Since $\Phi(A)V_s(A)$ is strictly concave for all $s \geq 0$, for the steady state to be at $\bar{A}$ for the T-period forward-looking dictator, the following condition must hold:

$$\kappa \leq \underline{\kappa}^T = \frac{\partial}{\partial A}\{\beta\Phi(\bar{A})V_{T-1}(\bar{A})\}. \tag{20}$$

When $\kappa > \underline{\kappa}^T$, analogous to the case of the non-myopic dictator analysed in Proposition 3, there exist thresholds for infrastructure denoted by A_{LB}^T and A_{UB}^T such that the forward-looking dictator's investment depends on whether the infrastructure is below or above the thresholds. And the steady state lies in between these two thresholds.

Corollary 2. *For a T-period forward-looking dictator, suppose that $\kappa \in (\underline{\kappa}^T, \bar{\kappa}^T)$. optimal investment I_t^T strictly increases in A_t for all $A_t \leq A_{\text{LB}}^T$, strictly decreases in A_t for all $A_t \in [A_{\text{LB}}^T, A_{\text{UB}}^T]$, $I_t^T = 0$ for all $A_t \geq A_{\text{UB}}^T$, and a unique steady state A_{ss}^T in $(A_{\text{LB}}^T, A_{\text{UB}}^T)$.*

There are two qualitative implications when comparing dictatorships based on their horizons. First, when considering a one-period planning horizon, the dictator only focuses on how investment increases government revenue in the next period. This short-sighted view ignores the long-term impact of investment on infrastructure accumulation, which could explain why Olson's hypothesis suggests a myopic dictator might lead to low economic growth.[19] Second, among forward-looking dictatorships with planning horizons of two periods or more, those with a longer horizon consider extracting benefits for a longer period. In other words, a far-sighted dictator, compared to a short-sighted dictator, might prioritise both the high potential gains from current investments and the stability of the regime in future periods.

Proposition 9. *Suppose that $\kappa \in (\underline{\kappa}, \bar{\kappa})$. For any $T \geq 2$, the T-period forward-looking steady state is greater than the $T+1$-period forward-looking steady state.*

The proposition suggests that the long-run level of infrastructure declines as the dictator's planning horizon gets longer for $T \geq 2$. This is in contrast to Olson's hypothesis that farsighted

[19]Whether a one-period forward-looking dictator or a higher-period forward-looking dictator maintains a higher level of steady state depends on the parameters, which is analysed in Appendix A.2.

dictators are monotonically more likely to lead to high economic growth. Our analysis suggests that farsighted dictators, while planning for the future, prioritise regime stability over economic growth. As a result, they may limit investments that could lead to long-term economic benefits but might also empower the middle class.

This offers a novel theoretical perspective on how economic development unfolds under dictatorships with structurally different environments. For example, North Korea, with its hereditary dictatorship, exhibits persistently low economic growth. South Korea, in contrast, underwent significant economic expansion under a military dictatorship, which seized power through a coup under the pretext of ensuring social security and temporary control of economic growth. To extend his rule, the dictator needed to amend the constitution, requiring him to establish legitimacy and overcome public opposition.[20] This may have limited his planning horizon.

This analysis sheds light on the potential implications of recent change in China's political landscape. Historically, China's leadership system imposed a maximum term of 10 years, leading each leader to prioritise economic development within this limited timeframe. As Xi Jinping extends his rule, the Chinese dictatorship is likely adopting a longer planning horizon. Our analysis suggests that this shift towards a longer planning horizon could lead to a decrease in economic growth, as the regime prioritises long-term stability over economic reforms that might empower the populace.

6 Concluding Remarks

I have analysed the dictator's optimal investment decisions under the modernisation hypothesis. Economic growth expands job opportunities and skilled job wages. In an environment where education correlates with embracing democratic values over materialistic ones, this growth incentivises citizens to further their education in pursuit of skilled employment, thereby fostering pro-democratic citizens in society. From the dictator's standpoint, economic growth promises greater future revenues. At the same time, it increases the risk of regime instability due to increased demands for democracy. This dilemma exposes the dictator to a trade-off between maintaining a 'stable poor' or venturing into an 'unstable rich' regime.

The findings indicate that the dictator allocates a larger portion of the revenue to investment when the economy is underdeveloped, gradually reducing it to zero as the economy advances. If the potential threat of emerging pro-democratic citizens is not a significant factor in the dictator's decision-making process, the economy either regresses or prospers depending on the regime stability. Also, I explore how economic development varies depending on his length of forward-looking in decision-making. Contrary to Olson (1993)'s hypothesis that longer-

[20] Related to this, Park Chung-hee's attempt to extend his rule through a constitutional amendment allowing a third term resulted in a rapid decline in support, with students, intellectuals, and workers turning against the government (Kim, 2011).

term interests yield economic prosperity, I find that a dictator with a longer horizon drives the economy to a lower steady state.

This study contributes to the literature on formal models of non-democracies. It links decision-making under dictatorship to the stylised fact that the emerging middle class significantly influenced democratisation. Also, the model suggests a mechanism for the puzzle of regime and economic growth. It has long been debated whether democracy or dictatorship provides high economic growth. Although recent studies point to positive results for democracy (Acemoglu et al., 2019; Colagrossi et al., 2020; Madsen et al., 2015), as Luo and Przeworski (2019) pointed out, it remains a question as to why dictatorships show faster economic growth than democracies among underdeveloped economies and why poor countries tend to be dictatorships. My model predicts that a dictator in an underdeveloped economy, facing little demand for democracy, is motivated to invest. This investment continues until it destabilises the regime as a result of rising pro-democratic citizens.

While this study explores the double-edged nature of educated citizens for dictatorships, it leaves open the question of how dictators actively suppress demands for democratic institutions while benefiting from the skilled workforce that increased education creates. In response to this threat, regimes often attempt to stifle the growing desire for democracy by intervening in the education system. For instance, Alesina et al. (2021) argue that dictators have a stronger incentive to use primary education to create a unified national identity under the threat of democratisation. Cantoni et al. (2017) examine curriculum changes in China and find that these changes were often successful in shaping students' beliefs about the regime and their policy preferences. Dictatorships also attempt to mitigate pressure for change from the middle class by employing this group and maintaning close ties with them (Rosenfeld, 2020). Future studies could explore these suppressive strategies regarding education in greater details.

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A Appendix

A.1 Derivation of Equilibrium in Democracy

Fix ρ_{t+1}^A and ρ_{t+1}^B. Citizen i votes for party A if the following inequality holds:

$$\lambda c_{v_{it}}(\xi_t^m + \xi_{it}^v) \geq \rho_{t+1}^B - \rho_{t+1}^A.$$

For a citizen i with $v_{it} = m$, she votes for party A if $\xi_{it}^v \geq \{\rho_{t+1}^B - \rho_{t+1}^A\}/\{\lambda c_m\} - \xi_t^m$. Because ξ_{it}^v and v_{it} are independent, the mass of voters for party A whose type is m is

$$\begin{cases} 1-\bar{d}_t & \text{if} \quad \{\rho_{t+1}^B - \rho_{t+1}^A\}/\{\lambda c_m\} - \xi_t^m < -1/2, \\ 0 & \text{if} \quad \{\rho_{t+1}^B - \rho_{t+1}^A\}/\{\lambda c_m\} - \xi_t^m > 1/2, \\ (1-\bar{d}_t)\left\{1/2 - (\rho_{t+1}^B - \rho_{t+1}^A)/(\lambda c_m) + \xi_t^m\right\} & \text{otherwise.} \end{cases}$$

Similarly, the mass of voters for party A whose type is d is

$$\begin{cases} \bar{d}_t & \text{if} \quad \{\rho_{t+1}^B - \rho_{t+1}^A\}/\{\lambda c_d\} - \xi_t^m < -1/2, \\ 0 & \text{if} \quad \{\rho_{t+1}^B - \rho_{t+1} A\}/\{\lambda c_d\} - \xi_t^m > 1/2, \\ \bar{d}_t\{1/2 - (\rho_{t+1}^B - \rho_{t+1}^A)/(\lambda c_d) + \xi_t^m\} & \text{otherwise.} \end{cases}$$

Consider the case where $\{\rho_{t+1}^B - \rho_{t+1} A\}/\{\lambda c_d\} - \xi_t^m \in [-1/2, 1/2]$ and $\{\rho_{t+1}^B - \rho_{t+1} A\}/\{\lambda c_m\} - \xi_t^m \in [-1/2, 1/2]$. the mass of voters for party A is

$$\frac{1}{2} + \xi_t^m - (\rho_{t+1}^B - \rho_{t+1}^A)\left\{\frac{\bar{d}_t}{\lambda c_d} + \frac{1-\bar{d}_t}{\lambda c_m}\right\}.$$

And the probability of winning the election is

$$\begin{aligned} \psi_A(\rho_{t+1}^A, \rho_{t+1}^B) &= \Pr\left[\frac{1}{2} + \xi_t^m - (\rho_{t+1}^B - \rho_{t+1}^A)\left\{\frac{\bar{d}_t}{\lambda c_d} + \frac{1-\bar{d}_t}{\lambda c_m}\right\} \geq \frac{1}{2}\right] \\ &= \Pr\left[\xi_t^m \geq (\rho_{t+1}^B - \rho_{t+1}^A)\left\{\frac{\bar{d}_t}{\lambda c_d} + \frac{1-\bar{d}_t}{\lambda c_m}\right\}\right] \end{aligned}$$

Because $\xi_t^m \sim \text{Unif}[-1/2, 1/2]$,

$$\psi_A(\rho_{t+1}^A, \rho_{t+1}^B) = \frac{1}{2} + (\rho_{t+1}^A - \rho_{t+1}^B)\left\{\frac{\bar{d}_t}{\lambda c_d} + \frac{1-\bar{d}_t}{\lambda c_m}\right\}.$$

From the first-order condition and rearranging the terms, the best response $\rho_{t+1}^A(\rho_{t+1}^B)$ is derived as

$$\rho_{t+1}^A(\rho_{t+1}^B) = \frac{1}{2} - \frac{1}{4}\left\{\frac{\bar{d}_t}{\lambda c_d} + \frac{1-\bar{d}_t}{\lambda c_m}\right\}^{-1} + \frac{1}{2}\rho_{t+1}^B$$

The second-order condition holds:

$$\frac{\partial^2}{\partial {\rho_{t+1}^A}^2}\psi_A(\rho_{t+1}^A, \rho_{t+1}^B)\{1-\rho_{t+1}^A\}G_{t+1} = -2\left\{\frac{\bar{d}_t}{\lambda c_d} + \frac{1-\bar{d}_t}{\lambda c_m}\right\} < 0.$$

Because party B is symmetric, the equilibrium is derived as

$$\rho_{t+1}^* = \rho_{t+1}^A = \rho_{t+1}^B = 1 - \frac{1}{2}\left\{\frac{\lambda c_m c_d}{c_d + (c_m - c_d)\bar{d}_t}\right\}.$$

It is easy to see that this equilibrium is unique.

A.2 Recursive Formulation of Dictator's Problem

Dictator's problem in (8) can be expressed as the following recursive formulation: For $A \in \mathcal{A}$ be the level of infrastructure and $G(A)$ be the equilibrium government revenue, and I be the investment,

$$\begin{aligned} V(A) = \max_{I\in[0,G^*(A)/\kappa]} \quad & \{G^*(A) - \kappa I\} + \beta\Phi(A')V(A') \\ \text{subject to} \quad & A' = \min\{(1-\delta)A + I, \bar{A}\} \end{aligned} \tag{21}$$

The finite-horizon version of the recursive equation is described in (18) and (19). To show that $\lim_{k\to\infty} V_k = V$, define the map $\mathbb{T}$ as

$$\begin{aligned} \mathbb{T}(W(A)) = \max_{I\in[0,G^*(A)/\kappa]} \quad & G(A) - \kappa I + \beta\Phi(A')W(A') \\ \text{subject to} \quad & A' = \min\{(1-\delta)A + I, \bar{A}\} \end{aligned}$$

By showing the monotonicity and discounting, $\mathbb{T}$ fulfils the Blackwell sufficient conditions for contraction. To show monotonicity, suppose that $V(A) \geq W(A)$ for all A. It is desired to show that $\mathbb{T}(V(A)) \geq \mathbb{T}(W(A))$. Let $A \in \mathcal{A}$ be given.

$$\begin{aligned} \mathbb{T}V(A) = & \max_{I\in[0,G^*(A)/\kappa]} G^*(A) - \kappa I + \beta\Phi(A')V(A') \\ \geq & G^*(A) - \kappa\tilde{I} + \beta\Phi(\tilde{A}')V(\tilde{A}') \end{aligned}$$

where $\tilde{I} \in [0, G^*(A)]$, $A' = \min\{(1-\delta)A + I, \bar{A}\}$, and $\tilde{A}' = \min\{(1-\delta)A + \tilde{I}, \bar{A}\}$. Let I_W^* be the maximiser for $\max_{I\in[0,G^*(A)/\kappa]} G^*(A) - I + \beta\Phi(A')W(A')$, and let $A'_W = \min\{(1-\delta)A + I_W^*, \bar{A}\}$. Because I_W^* is feasible, i.e., $I_W^* \in [0, G^*(A)/\kappa]$,

$$\begin{aligned} \mathbb{T}V(A) \geq & G^*(A) - \kappa I_W^* + \beta\Phi(A'_W)V(A'_W) \\ \geq & G^*(A) - \kappa I_W^* + \beta\Phi(A'_W)W(A'_W) = \mathbb{T}W(A) \end{aligned}$$

where the second inequality comes from $V(A) \geq W(A)$ for all $A \in \mathcal{A}$.

To show discounting, let a constant $c > 0$ be given. We want to show that $\mathbb{T}\{V + c\} \leq \mathbb{T}V + \beta c$.

$$\begin{aligned} \mathbb{T}\{V(A) + c\} = & \max_{I\in[0,G^*(A)/\kappa]} G^*(A) - \kappa I + \beta\Phi(A')\{V(A') + c\} \\ = & \max_{I\in[0,G^*(A)/\kappa]} G^*(A) - \kappa I + \beta\Phi(A')V(A') + \beta\Phi(A')c \\ < & \max_{I\in[0,G^*(A)/\kappa]} G^*(A) - \kappa I + \beta\Phi(A')V(A') + \beta c = \mathbb{T}V(A) + \beta c. \end{aligned}$$

The inequality holds because $\Phi(A) < 1$ for all $A \in \mathcal{A}$. Therefore, $\mathbb{T}$ is a contraction. By the contraction mapping theorem, we conclude that $V_k \to V$ uniformly.

Strict concavity of the value function My analysis of the dictator problem depends on the strict concavity of the value function V. In this section, I construct $\mathcal{A}$ that makes V strictly concave.

Lemma A.1. *Suppose that* $\frac{d}{dA}\{\Phi(A)V_s(A)\} \geq 0$ *and* $\frac{d^2}{dA^2}\{\Phi(A)V_s(A)\} < 0$ *for all* $A \in [0, \tilde{A}] \subset \mathcal{A}$. *Then* $\frac{d^2}{dA^2}\{\Phi(A)V_{s+1}(A)\} < 0$ *for all* $A \in [0, \min\{\tilde{A}(1-\delta)^{-1}, \bar{A}\}]$.

Proof. For a given $1 < t \leq T$ and $s = T - t$. suppose that $\frac{d}{dA}\{\Phi(A_t)V_s(A_t)\} \geq 0$ and $\frac{d^2}{dA^2}\{\Phi(A_t)V_s(A_t)\} <$

0 for all $A_t \in [0, \tilde{A}]$. For any $A_{t-1} \leq A_t/(1-\delta)$, the first-derivative is

$$\frac{d}{dA_{t-1}}\{\Phi(A_{t-1})V_{s+1}(A_{t-1})\} = \Phi'(A_t)V_{s+1}(A_{t-1}) + \Phi(A_{t-1})V'_{s+1}(A_{t-1}).$$

Because $V_{s+1}(A_{t-1})$ is

$$V_{s+1}(A_{t-1}) = G^*_{t-1} - \kappa\{A_t - (1-\delta)A_{t-1}\} + \beta\Phi(A_t)V_s(A_t),$$

$V'_{s+1}(A_{t-1})$ is

$$\begin{aligned} V'_{s+1}(A_{t-1}) &= g^* + \kappa(1-\delta) + \left[-\kappa + \beta\frac{d}{dA_t}\{\Phi(A_t)V_s(A_t)\}\right]\frac{dA_t}{dA_{t-1}} \\ &= g^* + \beta(1-\delta)\frac{d}{dA_t}\{\Phi(A_t)V_s(A_t)\} > 0 \end{aligned}$$

where $\frac{dA_t}{dA_{t-1}} = 1 - \delta$. The second-derivative is

$$\begin{aligned} \frac{d^2}{dA_{t-1}^2}\{\Phi(A_{t-1})V_{s+1}(A_{t-1})\} &= 2\phi V'_{s+1}(A_{t-1}) + \Phi(A_{t-1})V''_{s+1}(A_{t-1}) \\ &= 2\phi V'_{s+1}(A_{t-1}) + \Phi(A_{t-1})\beta(1-\delta)\frac{d^2}{dA_t^2}\{\Phi(A_t)V_s(A_t)\}\frac{dA_t}{dA_{t-1}} \\ &= 2\phi V'_{s+1}(A_{t-1}) + \Phi(A_{t-1})\beta(1-\delta)^2\frac{d^2}{dA_t^2}\{\Phi(A_t)V_s(A_t)\}, \end{aligned}$$

which is negative because $\phi < 0$ and $\frac{d^2}{dA_t^2}\{\Phi(A_t)V_s(A_t)\} < 0$. And, if $\frac{d}{dA}\{\Phi(A)V_s(A)\} \geq 0$ and $\frac{d^2}{dA^2}\{\Phi(A)V_s(A)\} < 0$ for all $A \in \mathcal{A}$, in this procedure, we can show that the second-derivative $\frac{d^2}{dA^2}\{\Phi(A)V_{s+1}(A)\} < 0$ for all $A \in \mathcal{A}$. □

Using this lemma, I construct a set of A such that the value functions for both finite and infinite horizons are increasing and strictly concave.

Lemma A.2. *There is $\hat{A} \in \mathcal{A}$ such that the value function $\Phi(A)V_s(A)$ is increasing and strictly concave in A for all $A \in [0, \hat{A}]$ and all $s \in \mathbb{N} \cup \{\infty\}$.*

Proof. Let me begin from period T. Differentiating,

$$\begin{aligned} \frac{d}{dA_T}\{\Phi(A_T)V_0(A_T)\} &= \Phi'(A_T)G^*_T + \Phi(A_T)G^{*\prime}_T && (22) \\ &= \bar{\phi}g^* + 2\phi g^* A_T && (23) \end{aligned}$$

Because $\bar{\phi} > 0$ and $\phi < 0$, there exists $\hat{A}_0 > 0$ such that $V'_0 \geq 0$ for all $A_T \leq \hat{A}_0$. Differentiating twice,

$$\frac{d}{dA_T}\{\Phi(A_T)V_0(A_T)\} = 2\phi g^* < 0$$

as $\phi < 0$. This indicates that V_0 is increasing and strictly concave on $\hat{\mathcal{A}} = [0, \hat{A}_0]$. Using Lemma A.1, we see that the second derivative $\frac{d^2}{dA^2}\{\Phi(A)V_1(A)\} < 0$ for all $A \in [0, \min\{\hat{A}_0(1-\delta)^{-1}, \bar{A}\}]$. Because $\Phi(A)V_1(A)$ is strictly positive for a sufficiently small $A \in \mathcal{A}$, let $\hat{A}_1 \in [0, \min\{\hat{A}_0(1-\delta)^{-1}, \bar{A}\}]$ be such that $\frac{d}{dA}\{\Phi(A)V_1(A)\} \geq 0$ for all $A \leq \hat{A}_1$. Then $\Phi(A)V_1$ is increasing and strictly concave for all $A \in \hat{\mathcal{A}}_1 = [0, \hat{A}_1]$. By iterating this construction for $s \geq 2$, I get $\hat{A}_s$ and $\hat{\mathcal{A}}_s$ such that $\Phi(A)V_s(A)$ is increasing and strictly concave on $\hat{\mathcal{A}}_s = [0, \hat{A}_s]$. Since $V_s \to V$ uniformly, $\hat{\mathcal{A}}_s \to \hat{\mathcal{A}}$ and ΦV is strictly concave on $\hat{\mathcal{A}}$. □

Note that because $\bar{A}$ is exogenously given, by letting $\bar{A} = \hat{A}$, ΦV increases and is strictly concave on $\mathcal{A}$. Also, with this construction, it is easy to show that V is also increasing and concave: for $A, A' \in \mathcal{A}$

$$V'(A) = g^* + \beta(1-\delta)\frac{d}{dA'}\{\Phi(A')V(A')\} > 0$$

and

$$V''(A) = \beta(1-\delta)^2\frac{d^2}{dA'^2}\{\Phi(A')V(A')\} < 0$$

so that V is increasing and concave.

Shortsighted versus Farsighted Dictatorship. I have discussed how the steady state differs by the length of horizon in Section 5. In this appendix, I show that the steady state for the one-period forward looking dictator may be higher or lower than the higher-period forward looking dictators depending on the parameter.

When κ is $\kappa \in \left[\beta\bar{\phi}g^*, \bar{\kappa}\right)$, the one-period forward looking dictator is regressive, while higher-period forward looking dictators are not. Then, it is obvious that this shortsighted dictator will provide lower development.

Next, suppose that $\kappa < \beta\bar{\phi}g^*$. If $A^1_{ss} < \bar{A}$, it satisfies the following first-order condition:

$$\beta\frac{d}{dA}\left\{\Phi(A^1_{ss})V_0(A^1_{ss})\right\} = \beta g^*\Phi(A^1_{ss}) + \beta\phi g^* A^1_{ss} = \kappa. \tag{24}$$

Similarly,

$$\beta\frac{d}{dA}\left\{\Phi(A^T_{ss})V_{T-1}(A^T_{ss})\right\} = \beta\{g^* + \kappa(1-\delta)\}\Phi(A^T_{ss}) + \beta\phi V_{T-1}(A^T_{ss}) = \kappa. \tag{25}$$

Note that $V'_{T-1}(A^T_{ss}) = g^* + \kappa(1-\delta)$ is derived using the envelope theorem. Since the values for (24) and (25) are the same as κ, using $\Phi(A) = \bar{\phi} + \phi A$ and simplifying,

$$0 = 2g^*\phi\{A^T_{ss} - A^1_{ss}\} + \kappa(1-\delta)\Phi(A^T_{ss}) + \phi\{\beta\Phi(A^{T-1}_{ss})V_{T-2}(A^{T-1}_{ss}) - \kappa A^{T-1}_{ss}\} + \phi\kappa(1-\delta)A^T_{ss}.$$

Expressing in terms of A^1_{ss},

$$A^1_{ss} = A^T_{ss} + \frac{\kappa(1-\delta)}{2g^*}A^T_{ss} + \frac{\bar{\phi}\kappa(1-\delta)}{2g^*\phi} + \frac{\beta\Phi(A^{T-1}_{ss})V_{T-2}(A^{T-1}_{ss}) - \kappa A^{T-1}_{ss}}{2g^*}.$$

By construction,

$$\frac{\bar{\phi}\kappa(1-\delta)}{2g^*\phi} < 0, \quad \frac{\beta\Phi(A^{T-1}_{ss})V_{T-2}(A^{T-1}_{ss}) - \kappa A^{T-1}_{ss}}{2g^*} > 0.$$

Note that the second inequality holds because A^{T-1}_{ss} is chosen to make the derivative of $\beta\Phi(A)V_{T-2}(A)$ equal to κ. Therefore, $A^1_{ss} - A^T_{ss}$ can be either positive or negative depending on the parameters.

For example, to show that A^1_{ss} is greater than A^T_{ss} for a sufficiently high δ, suppose that $T = 2$. Assume, for contradiction, that $A^2_{ss} > A^1_{ss}$ for any δ. Because the value function is concave, with A^1_{ss},

$$-\kappa + \beta\{g^* + \kappa(1-\delta)\}\Phi(A^1_{ss}) + \beta\phi\left\{(g^* - \delta\kappa)A^1_{ss} + \beta\Phi(A^1_{ss})V_0(A^1_{ss})\right\} > 0.$$

Substituting (24) and dividing by β,

$$\kappa(1-\delta)\Phi(A^1_{ss}) + \phi\left\{\beta\Phi(A^1_{ss})V_0(A^1_{ss}) - \delta\kappa A^1_{ss}\right\} > 0$$

When $\delta \to 0$, the first term on the LHS goes to zero. Also, since $\phi < 0$ and $\beta\Phi(A^1_{ss})V_0(A^1_{ss}) - \delta\kappa A^1_{ss}$ for all $\delta \in [0,1]$, the LHS becomes negative, which is a contradiction. From Proposition 9, it follows that A^2_{ss} is greater than higher-period forward-looking steady states $\geq A^T_{ss}$ for $T \geq 3$. Therefore, for any $T \geq 2$, for a sufficiently high δ, A^1_{ss} is greater than A^T_{ss}.

A.3 Proofs

Proof of Proposition 1.

Suppose that all citizens use cutoff strategies with $s^*_t(d)$ and $s^*_t(m)$ depending on their value types. When a citizen i gets signal s_{it}, her posterior belief of θ_t is uniform on $[s_{it}-\sigma, s_{it}+\sigma]$. If $\theta_t > s^*_t(m)+\sigma$, every citizen of type m gets a signal above $s^*_t(m)$. And if $\theta_t < s^*_t(m)-\sigma$, they get signals below $s^*_t(m)$. Accordingly, the mass of participants whose type is m is $1-\bar{d}_t$ if $\theta_t > s^*_t(m)+\sigma$ and 0 if $\theta_t < s^*_t(m)-\sigma$. If $\theta_t \in [s^*_t(m)-\sigma, s^*_t(m)+\sigma]$, the mass is $(1-\bar{d}_t)\{\theta_t + \sigma - s^*_t(m)\}/2\sigma$. Similarly, the mass of participants whose type is d is $\bar{d}_t$ if $\theta_t > s^*_t(d)+\sigma$, 0 if $\theta_t < s^*_t(d)-\sigma$, and $\bar{d}_t\{\theta_t+\sigma-s^*_t(d)\}/2\sigma$ if $\theta_t \in [s^*_t(d)-\sigma, s^*_t(d)+\sigma]$. Let $p^*(s_{it})$ be the posterior belief of regime change conditional on the signal s_{it}. Note that when a citizen i of type v_{it} receives the signal $s_{it} = s^*_t(v_{it})$, choosing $a_{it} = 1$ and $a_{it} = 0$ is indifferent, which means $p^*(s^*_t(v_{it})) = c_{v_{it}}$. I explore the distance between the two cutoffs from the following lemma:

Lemma A.3. *The distance between cutoffs $s^*_t(m)$ and $s^*_t(d)$ is less than 2σ.*

Proof. Suppose that the distance between $s^*_t(m)$ and $s^*_t(d)$ is greater than or equal to 2σ. If a citizen i of type m receives a signal $s_{it} = s^*_t(m)$, the posterior belief is $p^*(s^*_t(m)) = c_m$. Since the distance between the cutoffs is greater than 2σ, the mass of participants is $M_t = \bar{d}_t + (1-\bar{d}_t)\{\theta_t+\sigma-s^*_t(m)\}/2\sigma$, i.e., all democratic citizens participate. This means

$$p^*(s^*_t(m)) = \frac{1}{2\sigma}\left[s^*_t(m) + \sigma - \frac{(1-\bar{d}_t)(\sigma + s^*_t(m))}{1-\bar{d}_t+2\sigma}\right]$$

and it follows that $s^*_t(m) = c_m(1-\bar{d}_t+2\sigma)-\sigma$. Next, assume that a democratic citizen j gets a signal $s_{jt} = s^*_t(d)$. Then it satisfies $p^*(s^*_t(d)) = c_d$. Also, M_t is derived as $M_t = \bar{d}_t\{\theta_t+\sigma-s^*_t(d)\}/2\sigma$. Hence,

$$p^*(s^*_t(d)) = \frac{1}{2\sigma}\left[s^*_t(d) + \sigma - \frac{\bar{d}_t(s^*_t(d)-\sigma)+2\sigma}{\bar{d}_t+2\sigma}\right]$$

and I get $s^*_t(d) = c_d(\bar{d}_t+2\sigma)+1-\bar{d}_t-\sigma$. The cutoffs $s^*_t(d)$ and $s^*_t(m)$ must satisfy $s^*_t(m)-s^*_t(d) \geq 2\sigma$. Substituting the cutoffs and proceeding the calculation,

$$0 \geq (1-c_m)(1-\bar{d}_t) + 2\sigma(1-c_m+c_d) + d_t c_d$$

which is impossible. Therefore, the distance between the cutoffs is less than 2σ. □

From Lemma A.3, the cutoffs $s^*_t(m)$ and $s^*_t(d)$ are closer than 2σ. So, for given θ_t, the density M_t is

$$M_t = \bar{d}_t\left\{\frac{\theta_t+\sigma-s^*_t(d)}{2\sigma}\right\} + (1-\bar{d}_t)\left\{\frac{\theta_t+\sigma-s^*_t(m)}{2\sigma}\right\}.$$

Hence,

$$p^*(s_t^*(m)) = \Pr\left[\theta_t \geq \bar{d}_t\left\{\frac{s_t^*(d)+\sigma}{2\sigma+1}\right\} + (1-\bar{d}_t)\left\{\frac{s_t^*(m)+\sigma}{2\sigma+1}\right\}\right]$$
$$= \frac{1}{2\sigma}\left[s_t^*(m)+\sigma-\bar{d}_t\left\{\frac{s_t^*(d)+\sigma}{2\sigma+1}\right\} - (1-\bar{d}_t)\left\{\frac{s_t^*(m)+\sigma}{2\sigma+1}\right\}\right]$$

and it follows that $s_t^*(m) = \left\{2\sigma(2\sigma+1)c_m + \bar{d}_t s_t^*(d) - 2\sigma^2\right\}/(\bar{d}_t+2\sigma)$. Similarly, $s_t^*(d)$ is derived as $s_t^*(d) = \left\{2\sigma(2\sigma+1)c_d + (1-\bar{d}_t)s_t^*(m) - 2\sigma^2\right\}/(1-\bar{d}_t+2\sigma)$. Using these two, the equilibrium cutoffs are derived as $s_t^*(m) = \sigma(2c_m-1)+\bar{c}_t$ and $s_t^*(d) = \sigma(2c_d-1)+\bar{c}_t$ where $\bar{c}_t = \bar{d}_t c_d + (1-\bar{d}_t)c_m$ is average participation cost. It is easy to check that $s_t^*(d) < s_t^*(m)$. And it is shown in Morris and Shin (2003) and Sakovics and Steiner (2012) that the cutoff strategy is the unique BNE, which is achieved from iterated elimination of strictly dominated strategies.

Next, I derive the ex-ante probability of regime change $\Pr[M_t \geq 1-\theta_t]$. Suppose that $\bar{d}_t$ is given. For all θ_t weakly smaller than $s_t^*(d)-\sigma$, the probability of collective action success $\Pr[M_t \geq 1-\theta_t]$ is 0 because all citizens receive signals lower than the cut-off points, so that no one participates. Next, suppose that $\theta_t \in (s_t^*(d)-\sigma, s_t^*(m)-\sigma]$. Then only democratic citizens participate, so the mass of participants M_t is $\bar{d}_t\left\{\theta_t+\sigma-s_t^*(d)\right\}/2\sigma$ and

$$\Pr[M_t \geq 1-\theta_t] = \Pr\left[\theta_t \geq \frac{2\sigma+\bar{d}_t(s_t^*(d)-\sigma)}{2\sigma+\bar{d}_t}\right]. \tag{26}$$

When $\theta_t = s_t^*(m)-\sigma$, the highest value in the interval,

$$\theta_t - \frac{2\sigma+\bar{d}_t(s_t^*(d)-\sigma)}{2\sigma+\bar{d}_t} = -\frac{2\sigma}{2\sigma+\bar{d}_t}\left\{(2\sigma+1)(1-c_m)\right\} < 0 \tag{27}$$

where the second equality is obtained by substituting the values $s_t^*(m)$ and $s_t^*(d)$. This means that, for any θ_t on the interval, the collective action is not successful. Finally, suppose that $\theta_t \in (s_t^*(m)-\sigma, s_t^*(d)+\sigma]$. On this interval, the mass of participants M_t is $\bar{d}_t\left\{\theta_t+\sigma-s_t^*(d)\right\}/2\sigma+(1-\bar{d}_t)\left\{\theta_t+\sigma-s_t^*(m)\right\}/2\sigma$. And the probability of regime change is

$$\Pr[M_t \geq 1-\theta_t] = \Pr\left[\theta_t \geq \bar{d}_t\left\{\frac{s_t^*(d)+\sigma}{2\sigma+1}\right\} + (1-\bar{d}_t)\left\{\frac{s_t^*(m)+\sigma}{2\sigma+1}\right\}\right]. \tag{28}$$

It is trivial to see that $M_t < 1-\theta_t$ when $\theta_t = s_t^*(m)-\sigma$. If $\theta_t = s_t^*(d)+\sigma$, substituting $s_t^*(d)$ and $s_t^*(m)$,

$$\theta_t - \bar{d}_t\left\{\frac{s_t^*(d)+\sigma}{2\sigma+1}\right\} - (1-\bar{d}_t)\left\{\frac{s_t^*(m)+\sigma}{2\sigma+1}\right\} = \frac{2\sigma}{2\sigma+1}c_d(1+2\sigma) > 0. \tag{29}$$

The left-hand side of (29) is continuous and strictly increasing in θ_t. By the intermediate value theorem, we know that there is a unique $\bar{\theta}_t$ such that $M_t = 1-\bar{\theta}_t$. From the algebra, the threshold level of regime vulnerability $\bar{\theta}_t$ that makes the left-hand side of (29) is $\bar{c}_t$. This means that the regime changes if the regime vulnerability θ_t is greater than the average participation cost $\bar{c}_t$ and continues otherwise.

Proof of Proposition 2.

Suppose that $c_d = c_m$. Then $\phi = 0$ and $\Phi(A_t) = \bar{\phi}$, which means a constant probability of regime change. Hence, parents' education provision matters only for the human capital accumulation. The dictator's problem when there is no modernisation effect is

$$\max_{\{I_t\}_{t=1}^{\infty}\in\mathbb{R}_+^{\infty}} \quad \{G_1^* - \kappa I_t\} + \sum_{t=1}^{\infty} \beta^t \bar{\phi}^t \{G_{t+1}^* - \kappa I_{t+1}\}.$$

As a result of parents' optimal provision of education, the government revenue in equilibrium G_t^* is linearly increasing in A_t. Therefore, if $\kappa < \bar{\kappa}$, the marginal utility from the investment is always positive until the infrastructure level reaches $\bar{A}$. Conversely, if $\kappa > \bar{\kappa}$, the marginal utility from the investment is always negative, so no investment is optimal for all $A_t \in \mathcal{A}$. When $\kappa = \bar{\kappa}$, the marginal utility from the investment is always zero, so any investment is indifferent for the dictator.

Proof of Proposition 3.

By expressing the dictator's problem as recursive formulation (refer to A.2 for technical details), the value function is

$$V(A) = \max_{A'\in\Gamma(A)} \quad G^*(A) - \kappa\{A' - (1-\delta)A\} + \beta\Phi(A')V(A')$$

where $\Gamma(A) = [(1-\delta)A, \min\{(1-\delta)A + G^*(A)/\kappa, \bar{A}]$. The condition for zero steady state is when no investment is optimal for all A. Otherwise, if a certain investment $I > 0$ is optimal for a certain $A > 0$, then $A' = (1-\delta)A + I$ must be a steady state. From the first-order condition,

$$\beta \frac{d}{dA'}\{\Phi(A')V(A')\} < \kappa \tag{30}$$

for all $A' \in \mathcal{A} \setminus \{0\}$. Because V is strictly concave, (30) is trivially satisfied if

$$\lim_{A'\to 0} \beta \frac{d}{dA'}\{\Phi(A')V(A')\} \leq \kappa. \tag{31}$$

The left-hand side is derived as

$$\lim_{A'\to 0} \beta \frac{d}{dA'}\{\Phi(A')V(A')\} = \lim_{A'\to 0} \beta\bar{\phi}\frac{d}{dA'}V(A') = \beta\bar{\phi}\{g^* + (1-\delta)\kappa\}$$

because $\lim_{A'\to 0} V(0) = 0$. By rearranging terms and simplifying, we get

$$\kappa \geq \frac{\beta\bar{\phi}g^*}{1 - \beta(1-\delta)\bar{\phi}} = \bar{\kappa}.$$

Therefore, the steady state is zero if $\kappa \geq \bar{\kappa}$.

Next, I derive the condition for $A_{ss} = \bar{A}$ (the highest possible level of infrastructure). In order for $\bar{A}$ to be steady state, it requires to satisfy that

$$\bar{A} = \arg\max_{A'\in\Gamma(\bar{A})} \quad G^*(\bar{A}) - \kappa\{A' - (1-\delta)\bar{A}\} + \beta\Phi(A')V(A'). \tag{32}$$

If (32) is satisfied, the value function at $\bar{A}$, $V(\bar{A})$, can be expressed as

$$V(\bar{A}) = \frac{\{g^* - (1-\delta)\kappa\}\bar{A}}{1 - \beta\Phi(\bar{A})}$$

because the state is maintained to be $\bar{A}$ for every period, and for doing so, the investment is equal to the depreciation $\delta\bar{A}$. From the first-order condition, κ needs to satisfy

$$\kappa \leq \lim_{A' \to \bar{A}} \beta \frac{d}{dA'}\{\Phi(A')V(A')\} = \beta\phi V(\bar{A}) + \beta\Phi(\bar{A})\{g^* + (1-\delta)\kappa\}.$$

By rearranging the terms,

$$\kappa \leq \frac{\beta g^* \left\{\bar{\phi} + \phi\bar{A}\left(1 + \frac{1}{1-\beta\Phi(\bar{A})}\right)\right\}}{1 - \beta(1-\delta)\Phi(\bar{A}) + \frac{\beta\delta\phi\bar{A}}{1-\beta\Phi(\bar{A})}} = \underline{\kappa}$$

To prove the second part, assume that $\kappa \in (\underline{\kappa}, \bar{\kappa})$. Let $I_t = G_t^*/\kappa$; the dictator invests in the whole budget. When $A_t \to 0$, the government budget G_t^* decreases to 0, so that the infrastructure in the next period A_{t+1} also goes to 0 with this investment. Then the average cost of participation $\bar{c}_t$ converges to c_m, as $\bar{e}_t \to 0$. Define marginal expected payoffs from investment as

$$\frac{d}{dI_t}\left\{G_t^* - \kappa I_t + \beta\Phi((1-\delta)A_t + I_t)V((1-\delta)A_t + I_t)\right\}.$$

Marginal expected payoffs from the investment with $I_t = G_t^*/\kappa$, i.e., $-\kappa + \beta\frac{d}{dA'}\{\Phi((1-\delta)A_t + G_t^*/\kappa)V((1-\delta)A_t + G_t^*/\kappa)\}$, is positive for a sufficiently small A_t (because $\kappa < \bar{\kappa}$) and negative for a sufficiently large A_t (because $\kappa > \underline{\kappa}$). Note that the marginal expected payoffs is continuous and strictly decreasing in A_t, by the intermediate value theorem, there is a unique A_t, which I denote as A_{LB}, that makes the marginal expected payoffs equal to zero.

Next, because $\kappa > \underline{\kappa}$, optimal investment is strictly smaller than $\delta\bar{A}$ when the infrastructure is $\bar{A}$. If I_t^{dict} with $A_t = \bar{A}$ is strictly positive, let $A^{\text{UB}} = \bar{A}$. Consider the case that $I_t^{\text{dict}} = 0$ when $A_t = \bar{A}$. Fix $I_t = 0$. Then the marginal expected payoffs from investment at $I_t = 0$ is positive for sufficiently low A_t and negative for a sufficiently high A_t. Therefore, there is A_t such that it becomes zero, which I call A^{UB}.

To check whether the investment decreases in an interval $[A^{\text{LB}}, A^{\text{UB}}]$, suppose that there are two levels of infrastructure $A, A' \in (A_{\text{LB}}, A_{\text{UB}})$ such that $A' > A$. And let I and I' be the optimal investments for A and A'. To obtain a contradiction, assume that $I' \geq I$. From the optimality condition, the marginal expected payoffs from investment at $A_t = A$ and $I_t = I$ is zero. Because the marginal expected payoffs decreases in both I_t and A_t in this interval, the marginal expected payoffs at $A_t = A'$ and $I_t = I'$ must be negative, which violates the assumption that I' is optimal for A'.

To show the existence of a steady state A_{ss}, for $A \in [A_{\text{LB}}, A_{\text{UB}}]$, the dictator's budget set is $[0, G_t^*]$, which is compact and continuous in A_t. By *Berge's maximum theorem*, optimal investment I_t is continuous in A_t; write it as $I(A_t)$. The steady state satisfies $I(A) - \delta A = 0$. By construction, $I(A_{\text{LB}}) - \delta A_{\text{LB}} > 0$ and $I(A_{\text{UB}}) - \delta A_{\text{UB}} < 0$. By the intermediate value theorem, there is $A_{ss} \in (A_{\text{LB}}, A_{\text{UB}})$ such that $I(A_{ss}) - \delta A_{ss} = 0$. This steady state is unique, as the marginal expected payoffs of investment for $I_t = \delta A_t$ is strictly decreasing and continuous in A_t on this interval.

Proof of Lemma 1.

From the derivation $\bar{\phi} = \{c_m - \underline{\theta}\}/\{\bar{\theta} - \underline{\theta}\}$ and $\phi = \mu\gamma^2\Delta\pi^2\{c_d - c_m\}/\{\bar{\theta} - \underline{\theta}\}$. First and second parts of lemma are straightforward to show.

To see the mean effect of θ_t, define another regime vulnerability $\theta_t' \sim \text{Unif}[\underline{\theta} + \varepsilon, \bar{\theta} + \varepsilon]$ such that $\varepsilon > 0$ and $\underline{\theta} + \varepsilon < 0$. By construction, θ_t' has higher mean, but the variance is the same to θ_t. Because

$$\bar{\phi}' = \frac{c_m - \{\underline{\theta} + \varepsilon\}}{\{\bar{\theta} + \varepsilon\} - \{\underline{\theta} + \varepsilon\}} < \frac{c_m - \underline{\theta}}{\bar{\theta} - \underline{\theta}} = \bar{\phi}, \quad \phi' = \frac{c_d - c_m}{\{\bar{\theta} + \varepsilon\} - \{\underline{\theta} + \varepsilon\}}\mu\gamma^2\Delta\pi^2 = \phi,$$

$\bar{\phi}$ decreases as mean of θ_t increases and ϕ is the same.

For the last part of lemma, to see how ϕ depends on $\bar{\theta}-\underline{\theta}$, suppose now that $\theta_t' \sim \text{Unif}[\underline{\theta}-\varepsilon, \bar{\theta}+\varepsilon]$ for $\varepsilon > 0$. Then

$$\phi' = \frac{c_d - c_m}{\bar{\theta}-\underline{\theta}+2\varepsilon} < \phi.$$

Note that $\bar{\phi}$ with θ_t' may be either greater or smaller. Let $\bar{\phi}'$ be $\bar{\phi}$ with θ_t'.

$$\frac{\partial \bar{\phi}}{\partial \varepsilon} = \frac{1}{\bar{\theta}-\underline{\theta}+2\varepsilon} - \frac{c_m+\varepsilon-\underline{\theta}}{(\bar{\theta}-2\underline{\theta}+2\varepsilon)^2}.$$

Rearranging the terms, at $\varepsilon \to 0$, the sign follows $\{\bar{\theta}-c_m\} - \{c_m - \underline{\theta}\}$.

Proof of Proposition 5.

Let H be the first-order condition at the steady state. Then

$$H = -\kappa + \beta\phi \frac{g^* A_{ss} - \delta\kappa A_{ss}}{1-\beta\Phi(A_{ss})} + \beta\Phi(A_{ss})\{g^* + \kappa(1-\delta)\} = 0$$

We are interested in the effect of μ on the steady state. By implicit function theorem,

$$\frac{\partial A_{ss}}{\partial \mu} = -\frac{\partial H/\partial \mu}{\partial H/\partial A_{ss}}.$$

Differentiating H with respect to A_{ss},

$$\begin{aligned}\frac{\partial H}{\partial A} =& \beta\phi \frac{g^*-\delta\kappa}{1-\beta\Phi(A_{ss})} + \beta^2\phi^2 \frac{g^*A_{ss}-\delta\kappa A_{ss}}{\{1-\beta\Phi(A_{ss})\}^2} + \beta\phi\{g^*+\kappa(1-\delta)\} \\ =& \frac{\beta\phi(g^*-\delta\kappa)}{\{1-\beta\Phi(A_{ss})\}^2}\{(1-\beta\Phi(A_{ss})) + \beta\phi A_{ss})\} + \beta\phi\{g^*+\kappa(1-\delta)\} \\ =& \beta\phi(g^*-\delta\kappa)\frac{1-\beta\bar{\phi}}{\{1-\beta\Phi(A_{ss})\}^2} + \beta\phi\{g^*+\kappa(1-\delta)\}\end{aligned}$$

which is negative because $\phi < 0$. Hence, $\partial A_{ss}/\partial\mu$ is negative if the derivative of H with respect to μ is negative.

$$\frac{\partial H}{\partial \mu} = \beta\frac{\partial \phi}{\partial \mu}\left[\frac{(g^*-\delta\kappa)A_{ss}}{\{1-\beta\Phi(A_{ss})\}^2}(1-\beta\bar{\phi}) + \{g^*+\kappa(1-\delta)\}A_{ss}\right] < 0$$

because $\partial\phi/\partial\mu < 0$. Therefore, A_{ss} decreases in μ.

Next, I show that the equilibrium probability of regime survival $\Phi(A_{ss})$ does not change from μ. The partial effect of μ on Φ is

$$\frac{\partial \Phi(A_{ss})}{\partial \mu} = \frac{\partial \phi}{\partial \mu}A_{ss} + \phi\frac{\partial A_{ss}}{\partial \mu} = \frac{\partial \phi}{\partial \mu}A_{ss} - \phi\frac{\partial H/\partial\mu}{\partial H/\partial A_{ss}} = \frac{1}{\partial H/\partial A_{ss}}\left\{\frac{\partial\phi}{\partial\mu}\frac{\partial H}{\partial A}A_{ss} - \phi\frac{\partial H}{\partial \mu}\right\}.$$

By substituting $\partial H/\partial A$ and $\partial H/\partial \mu$, we can verify that the derivative $\partial\Phi(A_{ss})/\partial\mu$ is zero.

Proof of Proposition 6.

Note that both g^* and ϕ increases in τ on $\tau \in (0, \{\pi_h - \pi_l\}/2\pi_h]$. To prove the first part, let us fix the cost of investment κ. From the threshold of zero steady state, $\bar{\kappa}$, i.e., $\bar{\kappa} = \{\beta\bar{\phi}g^*\}/\{1-\beta(1-\delta)\bar{\phi}\}$. The term for government revenue g^* converges to 0 as τ goes to 0. Hence, for any fixed small κ, we can find τ small enough that makes the threshold $\bar{\kappa}$ lower than κ.

To prove the second part, suppose that the steady state A_{ss} for a certain tax rate τ on the interval is strictly positive. By Proposition 3, this is equal to $\kappa < \bar{\kappa}$ with this τ. Let τ' such that $\tau' > \tau$ and $\tau' \leq \{\pi_h - \pi_l\}/2\pi_h$. Because g^* strictly increases in τ on $(0, \{\pi_h - \pi_l\}/2\pi_h]$ while others in the expression of $\bar{\kappa}$ are constants, $\bar{\kappa}$ with τ' is greater than that with τ. Therefore, $\kappa < \bar{\kappa} < \bar{\kappa}'$ so that A_{ss} with τ' is also positive.

To show that A_{ss} increases in τ for a sufficiently high τ on $(0, \{\pi_h - \pi_l\}/2\pi_h]$, consider the first-order condition at the steady state

$$H = -\kappa + \beta\phi\frac{g^* A_{ss} - \delta\kappa A_{ss}}{1 - \beta\Phi(A_{ss})} + \beta\Phi(A_{ss})\{g^* + \kappa(1-\delta)\} = 0.$$

Using the implicit function theorem, we get

$$\frac{\partial A_{ss}}{\partial \tau} = -\frac{\partial H/\partial \tau}{\partial H/\partial A_{ss}}.$$

Because $\partial H/\partial A_{ss} < 0$, it needs to show that $\partial H/\partial \tau > 0$ for a sufficiently high τ. The partial derivative of H with respect to τ is derived as

$$\begin{aligned}\frac{\partial H}{\partial \tau} =& \beta\frac{\partial \phi}{\partial \tau}\left[\frac{(g^* - \delta\kappa)A_{ss}}{\{1-\beta\Phi(A_{ss})\}^2}(1-\beta\bar{\phi}) + \{g^* + \kappa(1-\delta)\}A_{ss}\right] \\ &+ \beta\frac{\partial g^*}{\partial \tau}\left[\frac{\phi A_{ss}}{1-\beta\Phi(A_{ss})} + \frac{\Phi(A_{ss})\{1-\beta\Phi(A_{ss})\}}{1-\beta\Phi(A_{ss})}\right].\end{aligned}$$

If partially differentiating g^* with respect to τ,

$$\frac{\partial g^*}{\partial \tau} = \frac{\partial}{\partial \tau}\left[\tau\alpha\gamma\pi_h\{(1-\tau)\pi_h - \pi_l\}\right] = \alpha\gamma\pi_h\{(1-2\tau)\pi_h - \pi_l\}.$$

Notice that the derivative is positive and goes to zero if $\tau \to \{\pi_h - \pi_l\}/2\pi_h$. It follows that

$$\lim_{\tau \to \frac{\pi_h - \pi_l}{2\pi_h}} \frac{\partial H}{\partial \tau} = \beta\frac{\partial \phi}{\partial \tau}\left[\frac{(g^* - \delta\kappa)A_{ss}}{\{1-\beta\Phi(A_{ss})\}^2}(1-\beta\bar{\phi}) + \{g^* + \kappa(1-\delta)\}A_{ss}\right]$$

which is positive strictly, because $\partial\phi/\partial\tau > 0$.

Proof of Proposition 7.

Suppose that λ satisfies $\lambda > \frac{2}{c_m}\left\{1 - \frac{\delta\kappa}{\tau\alpha\gamma\pi_h\Delta\pi}\right\}$. To show that 0 constitutes a steady state, the investment must be smaller than the depreciation for a small A_t, so that the infrastructure decreases in the next period. Letting $A_t \to 0$,

$$\lim_{A_t \to 0} \rho_t^* = 1 - \frac{1}{2}\left\{\frac{\lambda c_m c_d}{c_d}\right\} = 1 - \frac{\lambda c_m}{2}$$

so that

$$\left\{1 - \frac{1}{2}\lambda c_m\right\} g^* < \left\{1 - \left(1 - \frac{\delta\kappa}{\tau\alpha\gamma\pi_h\Delta\pi}\right)\right\} g^* = \delta\kappa$$

Because ρ_t^* increases continuously in A_t, there is $\tilde{A} \in \mathcal{A}$ such that $\rho_t^* g^* < \delta\kappa$ for all $A_t < \tilde{A}$, which means that $A_{t+1} < A_t$ for such $A_t < \tilde{A}$.

Suppose that λ satisfies

$$\frac{2}{c_m c_d}\left\{1-\frac{\delta\kappa}{\tau\alpha\gamma\pi_h\Delta\pi}\right\}\{c_d+(c_m-c_d)\mu\gamma^2\Delta\pi\bar{A}\}>\lambda$$

Similar to the previous steps, we can show that $\bar{A}$ is a steady state. By letting $A_t \to \bar{A}$, $\lim_{A_t\to\bar{A}} \rho_t^* g^* > \delta\kappa$. Therefore, $A_{t+1} > A_t$ for sufficiently high $A_t < \bar{A}$.

Proof of Proposition 8.

From Proposition 3, optimal investment for the dictator is G_t^* for all $A_t \leq A_{\text{LB}}$, 0 for all $A_t \geq A_{\text{UB}}$. And I_t^{dict} is continuous and strictly decreasing in $A_t \in [A_{\text{LB}}, A_{\text{UB}}]$. Investment under democracy $I_t^{\text{dem}} = \rho_t^* G_t^*/\kappa$ is in the interior of $[0, G_t/\kappa]$ and strictly increases in A_t. Then $I_t^{\text{dict}} - I_t^{\text{dem}} > 0$ for all $A_t \leq A_{\text{LB}}$ and $I_t^{\text{dict}} - I_t^{\text{dem}} < 0$ for all $A_t \geq A_{\text{UB}}$. On $[A_{\text{LB}}, A_{\text{UB}}]$, because I_t^{dict} strictly decreases and I_t^{dem} strictly increases in A_t, there is $A_t = A^{\text{reg}}$ such that $I_t^{\text{dict}} - I_t^{\text{dem}} = 0$. Then, $I_t^{\text{dict}} > I_t^{\text{dem}}$ for all $A_t < A^{\text{reg}}$ and $I_t^{\text{dem}} > I_t^{\text{dict}}$ for all $A_t > A^{\text{reg}}$, as desired.

Proof of Proposition 9.

Let $T \geq 2$ be given. To obtain contradiction, suppose that $A_{ss}^{T+1} \geq A_{ss}^T$. From the first-order conditions,

$$\beta\frac{d}{dA}\{\Phi(A_{ss})V_{T-1}(A_{ss}^T)\} = \beta\frac{d}{dA}\{\Phi(A_{ss}^{T+1})V_T(A_{ss}^{T+1})\} = \kappa.$$

By the strict concavity of ΦV_k (refer to A.2 for technical details), we have

$$\beta\frac{d}{dA}\{\Phi(A_{ss}^T)V_T(A_{ss}^T)\} \geq \kappa.$$

Expanding the first-order conditions,

$$\beta\frac{d}{dA}\left\{\Phi(A_{ss}^T V_T(A_{ss}^T)\right\} = \beta\Phi(A_{ss}^T)\{g+\kappa(1-\delta)\} + \beta\phi V_T(A_{ss}^T)$$

and

$$\beta\frac{d}{dA}\left\{\Phi(A_{ss}^T)V_{T-1}(A_{ss}^T)\right\} = \beta\Phi(A_{ss}^T)\{g+\kappa(1-\delta)\} + \beta\phi V_{T-1}(A_{ss}^T)$$

By the monotonicity of the value functions, $V_T(A_{ss}^T) > V_{T-1}(A_{ss}^T)$ for all $A_{ss}^T > 0$. Because $\phi < 0$, $\beta\phi V_T(A_{ss}^T) < \beta\phi V_{T-1}(A_{ss}^T)$, and it follows that

$$\beta\frac{d}{dA}\left\{\Phi(A_{ss}^T)V_T(A_{ss}^T)\right\} < \beta\frac{d}{dA}\left\{\Phi(A_{ss}^T)V_{T-1}(A_{ss}^T)\right\} = \kappa$$

which is a contradiction. Since $T \geq 2$ is arbitrary, this result applies to any $T \geq 2$.