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Abstract

In this paper, I propose a theory that explains why the landowning elite promoted industrialization in the second half of the 19th century. I argue that this elite used public investment (e.g. railroad construction) strategically to undermine capitalists' support for revolution and thereby stabilize the existing political regime. Specifically, increased public investment enhanced the productivity of the industrial sector, thereby increasing capital income and augmenting capitalists' wealth. Greater wealth among capitalists translated into heightened potential losses from redistributive policies if political power shifted to the working class, which imposes higher taxes. If there is a positive probability that the working class will take power, the potential higher degree of public investment they will impose will always mean that capitalists will prefer to maintain the political regime of landowners.

Keywords

Industrialization, political commitment, democratization.

JEL Classification : D72; D74; O14

1 Introduction

Modern differences in incomes per capita are directly related to the different timing of the transition from pre-industrial stagnation to a modern growth regime (Galor and Weil, 2000).

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During this transition, government policies that promoted including the development of infrastructure and education, played an important role. However, government policy was largely determined by the political and economic interests of the ruling elite. In particular, the ruling landowning elite could hinder industrial progress if such progress increased the probability of losing political power (Acemoglu and Robinson, 2006) or reduced land rents (Galor et al., 2009). For example, representing the interests of the landowning elite, the emperors Nicholas I of Russia and Francis I of Austria restrained railroad construction (Acemoglu and Robinson, 2012). At the same time, there are many historical examples showing that landowning elite promoted industrialization. For instance, in Prussia, the aristocratic government eliminated the feudal laws of serfdom, abolished internal barriers to trade, invested in education, and encouraged railroad construction (Fulbrook, 2019). United Germany ultimately increased its per-capita level of industrialization more than 5 times between 1860 and 1913. (Bairoch, 1982). Another example is Japan, where Emperor Meiji implemented a pro-industrial policy by investing in education and different types of infrastructure, including extensive railroad construction (Jansen (Ed.), 1989, Chapters 8 and 9). In general, considering data for the second half of the 19th century, industrialization developed in all the great-power countries, despite continuing rule by landowning elite in many cases. (See Table 1).

	1750	1800	1830	1860	1913
Austria-Hungary	7	7	8	11	32
France	9	9	12	20	59
Germany	8	8	9	15	85
Italy	8	8	8	10	26
Russia	6	6	7	8	20
Japan	7	7	7	7	20

Table 1: Per-Capita Levels of Industrialization (United Kingdom (UK) 1900 is 100). Source: (Bairoch, 1982).

Why did the landowning elite eventually industrialize economies in the 19th century? To answer this question, I present a simple political economy model of industrialization in a two-agent society consisting of a landowner and a capitalist. There are three possible political regimes: the landowner's regime, the capitalist's regime, and the worker's regime. The initial regime is the landowner's regime. The capitalist can attempt to overthrow the landowner. If the attempt is successful, the capitalist's regime is realized with some probability, and, with the complementary probability, the worker's regime is realized. By assumption, in the worker's regime, capital is nationalized, so the capitalist loses the capital.

I propose a theory in which the landowner makes an irreversible public investment to persuade the capitalist to support the existing political regime. The public investment increases capital income. A higher degree of public investment leads to higher capital income and, therefore, increases the expected losses from nationalization in the worker's regime. As a result, the risk of losing higher capital income induces the capitalist to support the landowner's regime. Thus, sufficiently high public investment enables the landowner to secure the support of the capitalist and thereby avoid losing political power.

As an extension of the baseline model, I consider an environment in which, in addition to redistribution, the capitalist derives utility from a policy dimension that can be either the status quo or pro-industrial (e.g., abolition of internal trade barriers, free labor mobility, or patent protection). Assuming complementarity between public investment and economic policy, I demonstrate that when the landowner has a stake in industrialization (e.g., through capital ownership), public investment can serve as a commitment device to pro-industrial policy in situations where the landowner retains political power. Finally, I show that, as in a basic model, high public investment enables the landowner to secure the support of the capitalist and thereby to avoid losing political power.

This paper contributes to several strands of literature. Firstly, I contribute to the political economy of development, in particular, to the industrialization literature. Acemoglu and Robinson (2006) argue that the landowning elite industrialized the economy in any one of the following cases: when there was a high degree of political competition, when the elite was highly entrenched, or when there was an external threat. I show that promotion of industrialization allowed the elite to strengthen its political position. Specifically, a large enough public investment persuades capitalists to support the landowning elite's political power. I also contribute to the field of the political economy of development literature, which considers roles of investment in political outcomes. For example, a broad literature on clientelism shows how underinvestment makes people poorer and therefore more willing to sell their vote for some benefit (see, e.g., Robinson and Verdier, 2013; Shchukin and Arbatli, 2022). At the same time, there are cases when politicians use large public investment to bias elections. Robinson and Torvik (2005) present a framework in which public investment is a particular type of inefficient redistribution. In my model, the ruling elite invests heavily to persuade an opposing group not to struggle against the elite's political power.

Secondly, this paper contributes to the literature on democratization in Europe in the 19th century. Acemoglu and Robinson (2000) argue that the democratization process was a strategic decision of the political elite to prevent revolution and social unrest. In their framework, democratization is a credible device to provide desirable income redistribution for citizens in the future. In my model, I consider a social conflict between the political elite and citizens over a multidimensional policy that includes redistribution and economic policy. I show that a large enough public investment makes regime change unfavorable for capitalists and inclines them to support the landowning elite.

Acemoglu et al. (2022) demonstrate that the rise in the popularity of the Socialist Party in Italy after World War I led to local elites (landowners and capitalists) supporting the fascist party to prevent a communist revolution in Italy. My model shows that the threat of a radical redistribution created an opportunity to use industrialization as a tool to persuade capitalists to support landowners' political power.

The paper is organized as follows. Section 2 presents the main model and my comparative statics results. In section 3, I consider a setting with a policy dimension beyond redistribution. Section 4 presents an extension in which the landowner has a stake in industrialization. Section 5 concludes.

2 Model

Agents and political regimes

There are two agents in the model: a landowner (L) and a capitalist (C). There are three possible political regimes ($\mathcal{R}$): Landowner's regime ($\mathcal{L}$), Worker's regime ($\mathcal{W}$), and Capitalist's regime ($\mathcal{C}$). Thus, $\mathcal{R}$ is a political regime: for instance, $\mathcal{R} = \mathcal{W}$ means that the political regime is a Worker's regime.

I assume that an initial regime is the Landowner's regime. For this reason, the landowner makes the first move.

Timing

Firstly, the landowner chooses public investment I with linear costs: I. Observing the landowner's choice, the capitalist chooses efforts to overthrow the landowner $e^C \in \{0, \bar{e}\}$ where $\bar{e} \in (0, 1]$. There are no costs of efforts for the capitalist. The probability that the landowner will be overthrown is $\pi = e^C$. If the landowner is overthrown, then the Worker's regime will occur with probability $q \in (0, 1)$ and the Capitalist's regime will occur with probability $(1 - q)$. In a realized political regime, every agent obtains his payoff (described below).

In summary, the timing of the game is

1. The landowner chooses a degree of public investment, I;
2. The capitalist chooses a level of effort to overthrow the landowner, e^C;
3. A new political regime is realized, and the agents obtain their payoffs.

Private incomes and payoffs

The capitalist's private income is a capital income $r(I)$, where I is the public investment. $r(I)$[1] which is a continuously differentiable function with properties: $r'(I) > 0$ and $\underset{I \to +\infty}{lim} r(I) = +\infty$. The landowner's private income is a land income $\rho(I)$. $\rho(I)$ is a continuously differentiable function with properties: $\rho'(I) < 0$ and $\underset{I \to +\infty}{lim} \rho(I) = 0$.

I define $M^j(I)$ as a private income of agent j. Thus,

$$M^j(I) = \begin{cases} r(I), & \text{if } j = C \\ \rho(I), & \text{if } j = L \end{cases}$$

As I describe above, after the capitalist's move, either the landowner retains political power or the capitalist the worker takes political power. The agent who holds political

[1] To focus on the main mechanisms of my theory, here I present a reduced-form model, i.e., agents' incomes are abstract functions with given properties. However, these functions could be derived from a two-sector general equilibrium model in which one sector is industrial and another is agricultural. In such a model, there are three factors of production: capital, land, and labor. Capital is used in the industrial sector, land is used in the agricultural sector, and labor is used in both sectors. For instance, capital income $r(I) = \tilde{r}(I) \cdot k^C$, where $\tilde{r}(I)-$ capital rent and k^C- amount of capital that the capitalist has. $\tilde{r}(I)$ is derived in a standard way as a price for capital that a competitive firm pays. These derivations appear in the Appendix.

Public investment (e.g., railroads) increases the productivity of the industrial sector. Higher productivity leads to higher productivity of capital and higher capital income. For details, see the Appendix.

power obtains office rents $m \in \mathbb{R}_{++}$. Thus, I define m^j as an additional prize from being in power:

$$m^j = \begin{cases} m, & \text{if } j \text{ has political power} \\ 0, & \text{if } j \text{ does not have political power} \end{cases}$$

Finally, there is an income tax τ such that:[2]

$$\tau = \begin{cases} 1, & \text{if } \mathcal{R} = \mathcal{W} \\ 0, & otherwise \end{cases}$$

Because, in the model, consumption consists of income, $M^j(I)$, income tax rate, τ, and office rents, m^j, I have the following optimization problems for the agents:

The landowner solves the optimization problem:

$$\max_{I \geq 0} \ \mathbb{E}[(1-\tau) \cdot M^L(I) + m^L] - I \tag{1}$$

The capitalist solves the optimization problem:

$$\max_{e^C \in \{0, \bar{e}\}} \ \mathbb{E}[(1-\tau) \cdot M^C(I) + m^C] \tag{2}$$

Equilibrium

I solve the model for the subgame-perfect Nash equilibrium (SPNE) in pure strategies. For this, I apply backward induction.

At the end of the game, the new political regime is realized. There are three possible political regimes ($\mathcal{R}$): the Landowner's regime ($\mathcal{L}$), the Capitalist's regime ($\mathcal{C}$), and the Worker's regime ($\mathcal{W}$). From now on, for the equilibrium private income for a particular regime, equilibrium utility for a particular regime, etc., I use this notation because private income, utility, etc., levels can differ across different political regimes. I use the notation $M^j(\mathcal{R}), u^j(\mathcal{R})$, etc., where $\mathcal{R}$ is a political regime, $\mathcal{R} \in \{\mathcal{W}, \mathcal{L}, \mathcal{C}\}$.

Using assumptions on m^j and τ I obtain the following utility levels:

1. In the Worker's regime ($\mathcal{W}$), equilibrium utility levels are $u^L(\mathcal{W}) = 0$, and $u^C(\mathcal{W}) = 0$.

[2] This assumption states that, under the worker's regime, the tax rate is higher than in the other regimes, as it derives from the premise that the worker constitutes the poorest agent in society.

2. In the Capitalist's regime ($\mathcal{C}$), equilibrium utility levels are $u^L(\mathcal{C}) = \rho(I)$, and $u^C(\mathcal{C}) = r(I) + m$.

3. In the Landowner's regime ($\mathcal{L}$), equilibrium utility levels are $u^L(\mathcal{L}) = \rho(I) + m$, and $u^C(\mathcal{L}) = r(I)$.

Capitalist's choice

I now move backward to the capitalist's choice. First, I derive the capitalist's objective function in period 1:

$$\mathbb{E}[(1-\tau) \cdot M^C + m^C] = \pi \cdot (q \cdot 0 + (1-q) \cdot (r(I) + m)) + (1-\pi) \cdot r(I)$$

Rearranging, I obtain:

$$\mathbb{E}[(1-\tau) \cdot M^C + m^C] = r(I) + \pi \cdot \Delta^C, \text{ where } \Delta^C = -q \cdot r(I) + (1-q) \cdot m$$

Plugging $\pi = e^C$, I obtain the following optimization problem for the capitalist:

$$\max_{e^C \in \{0, \bar{e}\}} \; r(I) + e^C \cdot \Delta^C \tag{3}$$

This is a simple optimization problem in which the capitalist's choice depends on the sign of Δ^C. If $\Delta^C > 0$ the capitalist chooses $e^C = \bar{e}$, if $\Delta^C \leq 0$ the capitalist chooses $e^C = 0$ (I assume that when the capitalist is indifferent he chooses $e^C = 0$). From the above calculations, $\Delta^C = -q \cdot r(I) + (1-q) \cdot m$, that is Δ^C is a function from public investment, I, and I can write $\Delta^C(I)$.

Assumption 1. m is sufficiently large such that $-q \cdot r(0) + (1-q) \cdot m > 0$.

Assumption 1 implies that when public investment is zero, $\Delta^C(0) > 0$ and, consequently, the capitalist chooses positive efforts, $e^C = \bar{e}$. In addition, Assumption 1 restricts a maximum possible value of q: $q < \frac{m}{r(0)+m} = \bar{q} < 1$.

Proposition 1. *1. There exists a unique degree of public investment, $\tilde{I} > 0$, such that if $0 \leq I < \tilde{I}$, the capitalist chooses $e^{C*} = \bar{e}$ and if $\tilde{I} \leq I$, the capitalist chooses $e^{C*} = 0$.*

Proof. Because $r'(I) > 0$ for all $I \in [0, +\infty)$, $\frac{d\Delta^C}{dI} = -q \cdot r'(I) < 0$ for all $I \in [0, +\infty)$, that is $\Delta^C(I)$ is a strictly decreasing function from I for all $I \in [0, +\infty)$.

In addition, because $\lim_{I \to +\infty} r(I) = +\infty$, I have $\lim_{I \to +\infty} \Delta^C(I) = -\infty$.

Because $\Delta^{\mathcal{C}}(0) > 0$ (By Assumption 1), $\lim_{I \to +\infty} \Delta^{\mathcal{C}}(I) = -\infty$, and $\Delta^{\mathcal{C}}(I)$ is a continuous function, by the Intermediate Value Theorem, there exists $\tilde{I} > 0$ such that $\Delta^{\mathcal{C}}(\tilde{I}) = 0$. Moreover, because $\Delta^{C}(I)$ is a strictly decreasing function for all $I \in [0, +\infty)$, $\tilde{I}$ is unique. Thus, if $0 \leq I < \tilde{I}$, $\Delta^{C}(I) > 0$ and the capitalist chooses $e^{C*} = \bar{e}$ while if $\tilde{I} \leq I$, $\Delta^{C}(I) \leq 0$ and the capitalist chooses $e^{C*} = 0$.

□

Proposition 1 shows the capitalist's optimal choice. The expected capital income from political change (overthrow of the landowner), $\{(1-q) \cdot r(I)\}$, is smaller than capital income when the landowner retains political power, $r(I)$. Despite this, by Assumption 1, for zero public investment ($I = 0$), the capitalist prefers political regime change (because of a positive expected transfer, $(1-q) \cdot m$). The political regime change comes with a risk of income loss: in the Worker's regime, the capitalist loses capital income and does not obtain office rents. An increase in public investment raises the loss of capital income in the Worker's regime. At one point ($I = \tilde{I}$), the loss of capital income becomes large enough (in comparison with the expected office rents) that the capitalist prefers not to struggle with the Landowner ($e^{C*} = 0$). Thus, public investment, I, affects the capitalist's choice: if $0 \leq I < \tilde{I}$, the capitalist chooses $e^{C*} = \bar{e}$ and if $\tilde{I} \leq I$, the capitalist chooses $e^{C*} = 0$.

Thus, the capitalist's best response is:

$$e^{C*}(I) = \begin{cases} \bar{e}, & \text{if } 0 \leq I < \tilde{I} \\ 0, & \text{if } \tilde{I} \leq I \ . \end{cases}$$

Consequently, the probability that the landowner will be overthrown is

$$\pi(I) = e^{C*}(I) = \begin{cases} \bar{e}, & \text{if } 0 \leq I < \tilde{I} \\ 0, & \text{if } \tilde{I} \leq I \ . \end{cases}$$

Proposition 2. *When q becomes higher, the threshold degree of public investment, $\tilde{I}$ decreases.*

Proof. By definition $\Delta^{\mathcal{C}}(\tilde{I}) = 0$.

$$\Delta^{C}(\tilde{I}) = -q \cdot r(\tilde{I}) + (1-q) \cdot m = 0$$

By the implicit function theorem

$$\frac{d\tilde{I}}{dq} = -\frac{\frac{\partial \Delta^C}{\partial q}}{\frac{\partial \Delta^C}{\partial I}} = -\frac{-r(I) - m}{-q \cdot r'(I)} < 0$$

because $r'(I) > 0$, and $r(I) > 0$ for all $I \in [0, +\infty)$.

□

The intuition is straightforward: higher q means a higher chance of the Worker's regime and a lower probability that the capitalist will take power (because $(1-q)$ becomes lower). Consequently, the capitalist's expected transfer and expected capital income become smaller for all possible I. For this reason, it is necessary smaller degree of public investment such that the capitalist will not struggle against the landowner.

Landowner's choice

I now move backward to the first stage where the landowner makes a choice.

$$\max_{I \geq 0} \ \mathbb{E}[(1-\tau) \cdot M^L(I) + m^L] - I \tag{4}$$

I work with the objective function:

$\mathbb{E}[(1-\tau) \cdot M^L + m^L] = \pi \cdot (1-q) \cdot \rho(I) + (1-\pi) \cdot (\rho(I) + m) = \rho(I) + m + \pi \cdot \Delta^L$

Thus, the optimization problem can be rewritten as:

$$\max_{I \geq 0} \ \rho(I) + m + \pi \cdot \Delta^L(I) - I \tag{5}$$

where $\Delta^L(I) = -q \cdot \rho(I) - m$

According to Proposition 1, I affects the capitalist's choice. Ultimately, I can rewrite the optimization problem as:

$$\max \ \{U_1^{L*}, U_2^{L*}\} \tag{6}$$

where

$$U_1^{L*} = \sup_{0 \leq I < \hat{I}} \ U_1^L \tag{7}$$

$U_1^L = (1 - \bar{e} \cdot q) \cdot \rho(I) + (1 - \bar{e}) \cdot m - I$

$$U_2^{L*} = \underset{\tilde{I} \leq I}{max} \quad U_2^L \tag{8}$$

$U_2^L = \rho(I) + m - I$

Because $\rho'(I) < 0$ both U_1^L and U_2^L are strictly decreasing functions in I. Therefore, I have: 1) $\underset{0 \leq I < \tilde{I}}{argmax} \quad U_1^L = 0$, 2) $\underset{\tilde{I} \leq I}{argmax} \quad U_2^L = \tilde{I}$.

Ultimately, the optimization problem can be simplified and rewritten as:

The landowner chooses $I = \tilde{I}$ over $I = 0$ when (I assume that if the landowner is indifferent, he chooses a higher degree of public investment)

$$U_2^L(\tilde{I}) \geq U_1^L(0) \tag{9}$$

or

$$\rho(\tilde{I}) + m - \tilde{I} \geq (1 - \bar{e} \cdot q) \cdot \rho(0) + (1 - \bar{e}) \cdot m - 0 \tag{10}$$

or

$$\underbrace{\bar{e} \cdot m}_{\substack{\text{Expected} \\ \text{office rents}}} \geq \underbrace{\{(1 - \bar{e} \cdot q) \cdot \rho(0) - \rho(\tilde{I})\}}_{\substack{\text{Difference in} \\ \text{expected land income}}} + \underbrace{\{\tilde{I} - 0\}}_{\substack{\text{Difference in the costs of} \\ \text{public investment}}} \tag{11}$$

Proposition 3. *1. If expression (11) is satisfied, then the equilibrium public investment is* $I^* = \tilde{I}$.

2. If expression (11) is not satisfied, then the equilibrium public investment is $I^* = 0$.

Proposition 3 says that the landowner chooses a relatively high degree of public investment (i.e. $I^* = \tilde{I}$) when expression (11) is satisfied. This expression means that holding political power is lucrative enough for the landowner to exert costs of public investment and sacrifice land income due to a higher degree of public investment.

The left-hand side, $\bar{e} \cdot m$, represents the expected losses in office rents if the landowner chooses $I = 0$. The right-hand side, $\{(1 - \bar{e} \cdot q) \cdot \rho(0) - \rho(\tilde{I})\} + \{\tilde{I} - 0\}$, represents the sum of the difference in expected land income and the difference in the costs of public investment. The difference in expected land income, $\{(1 - \bar{e} \cdot q) \cdot \rho(0) - \rho(\tilde{I})\}$, can be positive or negative because, on the one hand, higher public investment leads to smaller land income, that is,

$\rho(0) > \rho(\tilde{I})$ (because $\rho'(I) < 0$). On the other hand, when public investment is zero, there is a risk of losing some of the land income $\rho(0)$ with probability $\bar{e} \cdot q$. The second term, $\{\tilde{I} - 0\}$, reflects costs of public investment that the landowner has to make to keep political power.

Proposition 4. *1. Higher $\bar{e}$ makes it more likely that the landowner will choose $I^* = \tilde{I}$.*

2. Higher q makes more it likely that the landowner will choose $I^* = \tilde{I}$.

Proof. See the Appendix.

□

The intuition of the first part of Proposition 4 is straightforward: higher $\bar{e}$ means a greater chance of political change and, consequently, a greater chance of losing office rents and part of the land income.

The intuition of the second part of Proposition 4 is the following: a higher value of q makes holding political power more lucrative for the landowner and losing political power more harmful for him. Being in power becomes more lucrative, because with higher q, land income, $\rho(\tilde{I})$, becomes larger. Indeed, according to Proposition 2, with higher q, the value of $\tilde{I}$ (degree of public investment that guarantees landowner political power) becomes lower. Finally, because $\rho'(I) < 0$, land income becomes higher. Losing political power becomes more harmful because higher q means that the Worker's regime is more probable and, consequently, there is a higher chance that the landowner will have nothing after losing political power. Another interpretation of the second part of Proposition 4 is that the landowner and the capitalist become closer to each other in the sense of their desire to avoid the Worker's regime.

3 Model

Now I extend the model such that agents care about both redistribution and policy, which can be either pro-industrial or status quo. In the text below, I describe parts that differ from the basic model.

Payoffs

The capitalist's income is a capital income $r(I,p)$, where I is the public investment and p is an economic policy (e.g., abolition of internal trade barriers, free labor mobility). $r(I,p)$[3] which is a twice continuously differentiable function with properties: $\underset{I\to+\infty}{lim} r(I,p) = +\infty$, $r'_p(I,p) > 0$, $r'_I(I,p) > 0$, and $r''_{Ip}(I,p) > 0$. The properties mean that 1) a higher value of economic policy / public investment benefits capital income 2) higher values of both economic policy and public investment have a larger positive effect on capital income. Finally, the landowner has a land income $\rho(I,p)$. $\rho(I,p)$ is a twice continuously differentiable function. $\rho(I,p)$ has properties: $\underset{I\to+\infty}{lim} \rho(I,p) = 0$, $\rho'_p(I,p) < 0$, $\rho'_I(I,p) < 0$, and $\rho''_{Ip}(I,p) > 0$. Here the properties mean that 1) a higher value of economic policy / public investment decreases the land income 2) for higher public investment, the negative effect from economic policy on the land rent is weaker.

I define M^j as an income of agent j. Thus,

$$M^j(I,p) = \begin{cases} r(I,p), & \text{if } j = C \\ \rho(I,p), & \text{if } j = L \end{cases}$$

After the capitalist's move, either the landowner retains political power or the capitalist or the worker takes political power. The agent who has political power maximizes his consumption by choosing an economic policy, p. Economic policy p can be status quo: $p = \underline{p}$ or pro-industrial (increase the productivity of the industrial sector): $p = \bar{p}$ with $0 < \underline{p} < \bar{p}$.

As in the basic model, there are office rents, m^j, and an income tax τ:

$$m^j = \begin{cases} m, & \text{if } j \text{ has political power} \\ 0, & \text{if } j \text{ does not have political power} \end{cases}$$

[3]Again, to focus on the main mechanisms of my theory, here I present a reduced-form model, i.e., agents' incomes are abstract functions with given properties.

Public investment (e.g., railroads) and pro-industrial economic policy (e.g., abolition of internal trade barriers, free labor mobility) increase the productivity of the industrial sector. Higher productivity in the industrial sector increases marginal labor productivity and, consequently, the wage in this sector. Labor supply in the agricultural sector decreases because workers employed in the agricultural sector prefer to go to the industrial sector. Higher productivity also leads to higher productivity of capital and higher capital income. Because higher productivity of labor leads to lower supply of labor in the agricultural sector, land income will decrease. See the Appendix for details.

$$\tau = \begin{cases} 1, & \text{if } \mathcal{R} = \mathcal{W} \\ 0, & otherwise \end{cases}$$

Because, in the model, consumption consists of income, $M^j(I,p)$, and transfer, m^j, I have the following optimization problem for the agents:

The landowner solves the following optimization problem:

$$\underset{I \geq 0}{max} \ \mathbb{E}[(1-\tau) \cdot M^L(I,p) + m^L] - I \tag{12}$$

The capitalist solves the following optimization problem:

$$\underset{e^C \in \{0,\,\bar{e}\}}{max} \ \mathbb{E}[(1-\tau) \cdot M^C(I,p) + m^C] \tag{13}$$

Equilibrium

Worker's regime ($\mathcal{W}$)

As in the basic model, in the Worker's regime, utility levels are $u^L(\mathcal{W}) = 0$, and $u^C(\mathcal{W}) = 0$.

Capitalist's regime ($\mathcal{C}$)

In the Capitalist's regime, the capitalist chooses economic policy p.

The capitalist maximizes his utility, which is $\{M^C + m^C\}$. Thus, the optimization problem is:

$$\underset{p \in \{\underline{p}, \bar{p}\}}{max} \ M^C + m^C \tag{14}$$

Using $M^C = r(I,p)$ and $m^C(\mathcal{C}) = m$, and $\tau(\mathcal{C}) = 0$ I can rewrite the optimization problem as:

$$\underset{p \in \{\underline{p}, \bar{p}\}}{max} \ r(I,p) + m \tag{15}$$

Because $(r(I,p) + m)'_p = r'_p(I,p) > 0$, $(r(I,p) + m)$ is strictly increasing in p and the capitalist chooses $p(\mathcal{C}) = \bar{p}$.

Thus, in Capitalist's regime, equilibrium values of the policy variables are $p(\mathcal{C}) = \bar{p}$, $m^L(\mathcal{C}) = 0$, $m^C(\mathcal{C}) = m$, and $\tau(\mathcal{C}) = 0$.

In the Capitalist's regime, equilibrium utility levels are $u^L(\mathcal{C}) = \rho(I, \bar{p})$, and $u^C(\mathcal{C}) = r(I, \bar{p}) + m$.

Landowner's regime ($\mathcal{L}$)

In the Landowner's regime, the landowner chooses economic policy p. I have the following optimization problem:

$$\max_{p \in \{\underline{p}, \bar{p}\}} \quad M^L + m^L \tag{16}$$

Using $M^L = \rho(I, p)$, $m^L(\mathcal{L}) = m$, and $\tau(\mathcal{L}) = 0$, I can rewrite the optimization problem as:

$$\max_{p \in \{\underline{p}, \bar{p}\}} \quad \rho(I, p) + m \tag{17}$$

Because $(\rho(I, p) + m)'_p = \rho'_p(I, p) < 0$, $(\rho(I, p) + m)$ is strictly decreasing in p and the landowner chooses $p(\mathcal{L}) = \underline{p}$.

Thus, in the Landowner's regime, values of the equilibrium policy variables are $p(\mathcal{L}) = \underline{p}$, $m^L(\mathcal{L}) = m$, $m^C(\mathcal{L}) = 0$, and $\tau(\mathcal{L}) = 0$.

In the Landowner's regime, equilibrium utility levels are $u^L(\mathcal{L}) = \rho(I, \underline{p}) + m$, and $u^C(\mathcal{L}) = r(I, \underline{p})$.

Period 1

I now move backward to the capitalist's choice. First, let's derive the capitalist's objective function in period 1:

$\mathbb{E}[M^C + m^C] = \pi \cdot (q \cdot (1 - \tau(\mathcal{W})) \cdot (M^C(\mathcal{W}) + m^C(\mathcal{W})) + (1 - q) \cdot ((1 - \tau(\mathcal{C})) \cdot M^C(\mathcal{C}) + m^C(\mathcal{C}))) + (1 - \pi) \cdot ((1 - \tau(\mathcal{L})) \cdot M^C(\mathcal{L}) + m^C(\mathcal{L}))$

This formula reflects the capitalist's expected utility in the second period, taking into account probabilities of political regimes in the second period.

Using $m^C(\mathcal{L}) = 0$ and $m^C(\mathcal{C}) = m$ I obtain:

$\mathbb{E}[M^C + m^C] = \pi \cdot (1 - q) \cdot (M^C(\mathcal{C}) + m) + (1 - \pi) \cdot M^C(\mathcal{L})$

Rearranging, I obtain:

$\mathbb{E}[M^C + m^C] = M^C(\mathcal{L}) + \pi \cdot \Delta^C$, where $\Delta^C = ((1-q) \cdot M^C(\mathcal{C}) - M^C(\mathcal{L})) + (1-q) \cdot m = ((1-q) \cdot r(I, \bar{p}) - r(I, \underline{p})) + (1-q) \cdot m$ (Here I used $M^C(\mathcal{C}) = r(I, \bar{p})$ and $M^C(\mathcal{L}) = r(I, \underline{p})$)

Plugging $\pi = e^C$, I obtain the following optimization problem for the capitalist:

$$\max_{e^C \in \{0, \bar{e}\}} M^C(\mathcal{L}) + e^C \cdot \Delta^C \tag{18}$$

This is a simple optimization problem in which the capitalist's choice depends on the sign of Δ^C. If $\Delta^C > 0$ the capitalist chooses $e^C = \bar{e}$, if $\Delta^C \leq 0$ the capitalist chooses $e^C = 0$ (I assume that when the capitalist is indifferent he chooses $e^C = 0$). From the above calculations, $\Delta^C = ((1-q) \cdot r(I, \bar{p}) - r(I, \underline{p})) + (1-q) \cdot m$, that is Δ^C is a function from public investment, I, and I can write $\Delta^C(I)$.

Assumption 2. $r(I, p) = p \cdot f(I)$ with $f(0) > 0$,$f'(I) > 0$.

Assumption 2 specifies a particular functional form, which is adopted for simplicity. The main results will be the same for a general functional form of $r(I, p)$ that is a twice continuously differentiable function with properties: $\lim_{I \to +\infty} r(I, p) = +\infty$, $r'_p(I, p) > 0$, $r'_I(I, p) > 0$, and $r''_{Ip}(I, p) > 0$.

Assumption 3. $\bar{p}$ is sufficiently large such that $((1-q) \cdot r(0, \bar{p}) - r(0, \underline{p})) + (1-q) \cdot m > 0$.

Assumption 3 implies that when public investment is zero, $\Delta^C(0) > 0$ and, consequently, the capitalist chooses positive efforts, $e^C = \bar{e}$. In addition, Assumption 3 restricts a maximum possible value of q: $q < \frac{(r(0,\bar{p}) - r(0,\underline{p})) + m}{r(0,\bar{p}) + m} = \bar{q} < 1$. Plugging $r(I, p) = p \cdot f(I)$, I can rewrite this inequality as: $q < \frac{(\bar{p} - \underline{p}) \cdot f(0) + m}{\bar{p} \cdot f(0) + m} = \bar{q} < 1$.

Proposition 5. *1. If $(1-q) \cdot \bar{p} \geq \underline{p}$, the capitalist chooses $e^{C*} = \bar{e}$ for all $I \in [0, +\infty)$*
2. If $(1-q) \cdot \bar{p} < \underline{p}$, there exists a unique degree of public investment, $\tilde{I} > 0$, such that if $0 \leq I < \tilde{I}$, the capitalist chooses $e^{C*} = \bar{e}$ and if $\tilde{I} \leq I$, the capitalist chooses $e^{C*} = 0$.

Proof. See the Appendix.

□

Proposition 5 shows the capitalist's optimal choice. There are two cases. In the first case ($(1-q) \cdot \bar{p} \geq \underline{p}$), the expected capital income from political change is larger or equal to capital income when the landowner retains political power. Because the capitalist also has a chance to obtain benefits from redistribution, the capitalist tries to overthrow the landowner ($e^{C*} = \bar{e}$). In the second case ($(1-q) \cdot \bar{p} < \underline{p}$), the expected capital income from political change is smaller than capital income when the landowner retains political power. Despite this, by Assumption 3, for zero public investment ($I = 0$), the capitalist prefers the political regime change (because of a positive expected transfer, $(1-q)\cdot m$). Political regime change comes with a risk of income loss: in the Worker's regime, the capitalist loses capital income and does not obtain a transfer. An increase in public investment raises the loss of capital income in the Worker's regime. At one point ($I = \tilde{I}$), the loss of capital income becomes large enough (in comparison with the expected transfer) such that the capitalist prefers not to struggle with the Landowner ($e^{C*} = 0$). Thus, when $(1-q)\cdot\bar{p} < \underline{p}$, public investment, I, affects the capitalist's choice: if $0 \leq I < \tilde{I}$, the capitalist chooses $e^{C*} = \bar{e}$ and if $\tilde{I} \leq I$, the capitalist chooses $e^{C*} = 0$.

Thus, the capitalist's best response is:

1. If $(1-q)\cdot\bar{p} \geq \underline{p}$, then $e^{C*} = \bar{e}$.

2. If $(1-q)\cdot\bar{p} < \underline{p}$, then $e^{C*}(I) = \begin{cases} \bar{e}, & \text{if } 0 \leq I < \tilde{I} \\ 0, & \text{if } \tilde{I} \leq I\ . \end{cases}$

Consequently, the probability that the landowner will be overthrown is

1. If $(1-q)\cdot\bar{p} \geq \underline{p}$, then $\pi = e^{C*} = \bar{e}$.

2. If $(1-q)\cdot\bar{p} < \underline{p}$, then $\pi(I) = e^{C*}(I) = \begin{cases} \bar{e}, & \text{if } 0 \leq I < \tilde{I} \\ 0, & \text{if } \tilde{I} \leq I\ . \end{cases}$

Proposition 6. *When q becomes higher, the threshold degree of public investment, $\tilde{I}$ decreases.*

Proof. See the Appendix.

□

Intuition is straightforward: higher q means a higher chance of the Worker's regime and a lower probability that the capitalist will take power (because $(1-q)$ becomes lower). Consequently, the capitalist's expected transfer and expected capital income become smaller for all possible I. For this reason, a smaller amount of public investment is needed, such that the capitalist will not struggle against the landowner.

Landowner's choice

I now move backward to the first stage where the landowner makes a choice.

$$\max_{I \geq 0} \; \mathbb{E}[M^L + m^L] - I \tag{19}$$

I work with the objective function:

$\mathbb{E}[M^L+m^L] = \pi\cdot(q\cdot((1-\tau(\mathcal{W}))\cdot M^L(\mathcal{W})+m^L(\mathcal{W})))+(1-q)\cdot((1-\tau(\mathcal{C}))\cdot M^L(\mathcal{C})+m^L(\mathcal{C})))+ (1-\pi)\cdot((1-\tau(\mathcal{C}))\cdot M^L(\mathcal{L})+m^L(\mathcal{L})) = \pi\cdot(q\cdot 0+(1-q)\cdot\rho(I,\bar{p}))+(1-\pi)\cdot(\rho(I,\underline{p})+m) = \rho(I,\underline{p})+m+\pi\cdot\Delta^L$

Thus, the optimization problem can be rewritten as:

$$\max_{I \geq 0} \; \rho(I,\underline{p}) + m + \pi\cdot\Delta^L - I \tag{20}$$

where $\Delta^L = ((1-q)\cdot\rho(I,\bar{p}) - \rho(I,\underline{p})) - m$

There are two possible cases:

1. $(1-q)\cdot\bar{p} \geq \underline{p}$

In this case, $e^{C*} = \bar{e}$ and, consequently, $\pi = \bar{e}$. Thus, I can rewrite the optimization problem as:

$$\max_{I \geq 0} \; (1-\bar{e})\cdot\rho(I,\underline{p}) + \bar{e}\cdot(1-q)\cdot\rho(I,\bar{p}) + (1-\bar{e})\cdot m - I \tag{21}$$

The first order condition is:

$$(1-\bar{e})\cdot\rho'_I(I,\underline{p}) + \bar{e}\cdot(1-q)\cdot\rho'_I(I,\bar{p}) - 1 < 0 \tag{22}$$

It means that the objective function is strictly decreasing. Consequently, $I^* = 0$.

2. $(1-q)\cdot\bar{p} < \underline{p}$

I assume that the budget is large enough that the landowner can choose $\tilde{I}$ to affect the capitalist's choice.

According to Proposition 5, I affects the capitalist's choice. Ultimately, we can rewrite the optimization problem as:

$$\max \; \{U_1^{L*}, U_2^{L*}\} \tag{23}$$

where

$$U_1^{L*} = \sup_{0 \le I < \hat{I}} \; U_1^L \tag{24}$$

$U_1^L = (1-\bar{e}) \cdot \rho(I, \underline{p}) + \bar{e} \cdot (1-q) \cdot \rho(I, \bar{p}) + (1-\bar{e}) \cdot m - I$

$$U_2^{L*} = \max_{\tilde{I} \le I} \; U_2^L \tag{25}$$

$U_2^L = \rho(I, \underline{p}) + m - I$

Because $\rho'_I(I, p) < 0$ both U_1^L and U_2^L are strictly decreasing functions in I. Therefore I have: 1) $\underset{0 \le I < \tilde{I}}{argmax} \; U_1^L = 0$, 2) $\underset{\tilde{I} \le I}{argmax} \; U_2^L = \tilde{I}$.

Ultimately, the optimization problem can be simplified and rewritten as:

The landowner chooses $I = \tilde{I}$ over $I = 0$ when (I assume that if the landowner is indifferent, he chooses a higher degree of public investment)

$$U_2^L(\tilde{I}) \ge U_1^L(0) \tag{26}$$

or

$$\rho(\tilde{I}, \underline{p}) + m - \tilde{I} \ge (1-\bar{e}) \cdot \rho(0, \underline{p}) + \bar{e} \cdot (1-q) \cdot \rho(0, \bar{p}) + (1-\bar{e}) \cdot m \tag{27}$$

or

$$\rho(\tilde{I}, \underline{p}) + \bar{e} \cdot m \ge (1-\bar{e}) \cdot \rho(0, \underline{p}) + \bar{e} \cdot (1-q) \cdot \rho(0, \bar{p}) \tag{28}$$

Proposition 7. *1. If expression (28) is satisfied, then the equilibrium public investment is* $I^* = \tilde{I}$.

2. If expression (28) is not satisfied, then the equilibrium public investment is $I^* = 0$.

Proof. See the Appendix.

□

The intuition is similar to the intuition of Proposition 3.

4 Landowner with two assets

Now I extend the model such that the landowner has two sources of income: land income, $\rho(I,p)$, and expected imperialist rent, $R(I,p)$[4]. $R(I,p)$ is a twice continuously differentiable function with $R(I,p) > 0$, $R'_p(I,p) > 0$, $R'_I(I,p) > 0$, and $R''_{Ip}(I,p) > 0$ for any $p > 0$ and $I \in [0, I_3^*]$. I define I_3^* below.

I solve the extended model by backward induction in a similar way as the basic model.

Period 2

The Worker's regime and the Capitalist's regime are the same as in the previous section. For this reason, I skip consideration of them.

Landowner's regime ($\mathcal{L}$)

In the Landowner's regime, I have the following optimization problem:

$$\max_{p \in \{\underline{p}, \bar{p}\}} \quad M^L + m^L \tag{29}$$

Using $M^L = \rho(I,p) + R(I,p)$ and $m^L(\mathcal{L}) = m$, I can rewrite the optimization problem as:

$$\max_{p \in \{\underline{p}, \bar{p}\}} \quad \rho(I,p) + R(I,p) + m \tag{30}$$

Assumption 4. $\rho(0,\bar{p}) + R(0,\bar{p}) < \rho(0,\underline{p}) + R(0,\underline{p})$.

Assumption 4 means that without any public investment the landowner prefers status-quo policy (i.e. $p = \underline{p}$).

Proposition 8. *There exists a unique degree of public investment, $\hat{I} > 0$, such that the landowner chooses pro-industrial economic policy (i.e. $p(\mathcal{L}) = \bar{p}$) for any $I \in [\hat{I}, +\infty)$.*

Proof. See the Appendix. □

[4] I interpret the expected imperialist rent, $R(I,p)$, as the expected income derived from activities such as colonization, military expansion, or other forms of external resource extraction. Alternatively, $R(I,p)$ can be viewed as the expected return on the capital stock possessed by the landowner.

Proposition 8 claims that for a sufficiently large public investment level ($I = \hat{I}$), pro-industrial economic policy is the optimal choice for the landowner ($p(\mathcal{L}) = \bar{p}$). This occurs because an increase in public investment leads to a larger difference in the expected imperialist rent and a smaller difference in the land income between the case of pro-industrial policy ($p = \bar{p}$) and the case of status quo policy ($p = \underline{p}$).

Thus, in equilibrium in the Landowner's regime, values of the policy variables are $m^L(\mathcal{L}) = m$, $m^C(\mathcal{L}) = 0$, and

$$p(\mathcal{L}) = \begin{cases} \underline{p}, & \text{if } 0 \leq I < \hat{I} \\ \bar{p}, & \text{if } \hat{I} \leq I \end{cases} \tag{31}$$

In equilibrium in the Landowner's regime utility levels are $u^L(\mathcal{L}) = \rho(I, p(\mathcal{L})) + R(I, p(\mathcal{L})) + m$, and $u^C(\mathcal{L}) = r(I, p(\mathcal{L}))$.

Period 1

I now move backward to the capitalist's choice. As in the basic model, I first write the capitalist's objective function in period 1:

Using similar steps as in the basic model, I obtain

$\mathbb{E}[M^C + m^C] = M^C(\mathcal{L}) + \pi \cdot \Delta^C$, where $\Delta^C = ((1-q) \cdot M^C(\mathcal{C}) - M^C(\mathcal{L})) + (1-q) \cdot m^C(\mathcal{C}) = ((1-q) \cdot r(I, \bar{p}) - r(I, p(\mathcal{L}))) + (1-q) \cdot m$

This expression is almost the same as in the previous section, but it differs in terms of capital income in the landowner's regime, $r(I, p(\mathcal{L})))$. In the previous section, in the landowner's regime, capital income is always $r(I, \underline{p})$, but in the current setting, $r(I, p(\mathcal{L})))$ depends on the public investment level I, because $p(\mathcal{L}) = \begin{cases} \underline{p}, & \text{if } 0 \leq I < \hat{I} \\ \bar{p}, & \text{if } \hat{I} \leq I \end{cases}$.

Using $\pi = e^C$ I obtain the following optimization problem for the Capitalist:

$$\max_{e^C \in \{0, \bar{e}\}} \; M^C(\mathcal{L}) + e^C \cdot \Delta^C \tag{32}$$

Now I can formulate a Proposition that is analogous to Proposition 1:

Proposition 9. *1. There exists a unique degree of public investment, $\tilde{I} > 0$, such that if $0 \leq I < \tilde{I}$, the capitalist chooses $e^{C*} = \bar{e}$ and if $\tilde{I} \leq I$, the capitalist chooses $e^{C*} = 0$.*

2. If $(1-q) \cdot \bar{p} \geq \underline{p}$, I have $\tilde{I} \geq \hat{I}$.

If $(1-q) \cdot \bar{p} < \underline{p}$, there are two possible subcases: i) $\tilde{I} < \hat{I}$ and ii) $\tilde{I} \geq \hat{I}$.

Proof. See the Appendix.

□

The first part of Proposition 9 is similar to Proposition 5: it shows the capitalist's optimal choice. As in Proposition 5, there are two cases: $\{(1-q) \cdot \bar{p} \geq \underline{p}\}$ and $\{(1-q) \cdot \bar{p} < \underline{p}\}$. However, unlike Proposition 5, in both cases $\tilde{I}$ exists. In the first case $\{(1-q) \cdot \bar{p} \geq \underline{p}\}$, for $I = 0$, the capitalist a change in political regime because, in the Capitalist's regime, he obtains: 1) larger capital income due to the choice of pro-industrial economic policy and 2) positive transfer. However, the change of political regime comes with a risk of income loss: in the Worker's regime, the capitalist loses capital income and does not obtain a transfer. When public investment is larger than $\hat{I}$, in the Landowner's regime, pro-industrial economic policy is chosen (Proposition 8) that makes capital income the same as in the Capitalist's regime and larger than in the Worker's regime. Thus, large enough public investment ($I = \hat{I}$) decreases the difference in expected capital income between the case of political change and the case when the landowner retains political power. A further increase in public investment increases the losses of capital income in the Worker's regime. At one point ($I = \tilde{I}$), the losses of capital income become large enough (in comparison with the expected transfer) such that the capitalist prefers not to struggle with the Landowner ($e^{C*} = 0$). The second part of the Proposition 9 states that for $(1-q) \cdot \bar{p} \geq \underline{p}$ I have $\tilde{I} \geq \hat{I}$.

In the second case $\{(1-q) \cdot \bar{p} < \underline{p}\}$, the expected capital income from political change is smaller than capital income when the landowner keeps political power. At the same time, by Assumption 1, for zero public investment ($I = 0$), the capitalist prefers the political regime change (because of a positive expected transfer, $(1-q) \cdot m$). The first part of Proposition 9 says that $\tilde{I}$ exists when $(1-q) \cdot \bar{p} < \underline{p}$ and the second part of Proposition 6 claims that there are two possible subcases when $(1-q) \cdot \bar{p} < \underline{p}$: i) $\tilde{I} < \hat{I}$ and ii) $\tilde{I} \geq \hat{I}$. In subcase (i), the threat of the Worker's regime is relatively high, such that the capitalist chooses not to struggle ($e^{C*} = 0$) when the landowner chooses a relatively low degree of public investment, $\tilde{I} < \hat{I}$ and, consequently, status-quo policy, that is $p(\mathcal{L}) = \underline{p}$ (due to Proposition 8). In this subcase, the intuition of the existence of $\tilde{I}$ is the same as in Proposition 5 (Part 2). In subcase (ii), the threat of the Worker's regime is relatively low, such that the capitalist can choose not to struggle ($e^{C*} = 0$) only when the policy in the Landowner's regime will be pro-industrial ($p(\mathcal{L}) = \bar{p}$), that is when $\tilde{I} \geq \hat{I}$ (due to Proposition 8). In this subcase, the intuition of the existence of $\tilde{I}$ is the same as in case $(1-q)\cdot\bar{p} \geq \underline{p}$ of the current Proposition.

Proposition 9 shows that sufficiently large public investment changes the capitalist's choice.

Thus, the capitalist's best response is $e^{C*}(I) = \begin{cases} \bar{e}, & \text{if } 0 \leq I < \tilde{I} \\ 0, & \text{if } \tilde{I} \leq I \ . \end{cases}$

Consequently, the probability that the landowner will be overthrown is

$$\pi(I) = e^{C*}(I) = \begin{cases} \bar{e}, & \text{if } 0 \leq I < \tilde{I} \\ 0, & \text{if } \tilde{I} \leq I \ . \end{cases}$$

Proposition 10. *When q becomes higher, the threshold degree of public investment, $\tilde{I}$ decreases in both cases: $(1-q)\cdot\bar{p} \geq \underline{p}$ and $(1-q)\cdot\bar{p} < \underline{p}$.*

Proof. See the Appendix.

□

The intuition of Proposition 10 is the same as the intuition of Proposition 2.

Landowner's choice

I now move backward to the first stage where the landowner makes a choice.

$$\max_{I\geq 0} \ \mathbb{E}[M^L + m^L] - I \tag{33}$$

I work with the objective function:

$\mathbb{E}[M^L+m^L] = \pi\cdot(q\cdot 0+(1-q)\cdot(M^L(\mathcal{C})+m^L(\mathcal{C}))+(1-\pi)\cdot(M^L(\mathcal{L})+m^L(\mathcal{L})) = \pi\cdot(q\cdot 0+(1-q)\cdot(\rho(I,\bar{p})+0))+(1-\pi)\cdot(\rho(I,p(\mathcal{L}))+R(I,p(\mathcal{L}))+m) = \rho(I,p(\mathcal{L}))+R(I,p(\mathcal{L}))+m+\pi\cdot\Delta^L$

where $\Delta^L = ((1-q)\cdot\rho(I,\bar{p}) - \rho(I,p(\mathcal{L})) - R(I,p(\mathcal{L}))) - m$

Thus, the optimization problem can be rewritten as:

$$\max_{I\geq 0} \ \rho(I,p(\mathcal{L})) + R(I,p(\mathcal{L})) + m + \pi(I)\cdot\Delta^L(I) - I \tag{34}$$

where $\Delta^L(I) = ((1-q)\cdot\rho(I,\bar{p}) - \rho(I,p(\mathcal{L})) - R(I,p(\mathcal{L}))) - m,$

$$p(\mathcal{L}) = \begin{cases} \underline{p}, & \text{if } 0 \leq I < \hat{I} \\ \bar{p}, & \text{if } \hat{I} \leq I \end{cases}, \text{ and } \quad \pi(I) = e^{C*}(I) = \begin{cases} \bar{e}, & \text{if } 0 \leq I < \tilde{I} \\ 0, & \text{if } \tilde{I} \leq I \end{cases}.$$

In optimization problem (34), the objective function represents the landowner's expected utility. In particular, the expression $\{\rho(I, p(\mathcal{L})) + R(I, p(\mathcal{L})) + m\}$ presents the landowners' utility if he keeps political power; expression $\{\pi(I) \cdot \Delta^L\}$ presents the landowners' expected utility losses if he loses political power. In problem (34), the landowner chooses public investment, I, which directly affects land income, $\rho(I, p(\mathcal{L}))$ and the expected imperialist rent, $R(I, p(\mathcal{L}))$. At the same time, I affects economic policy $p(\mathcal{L})$ (Proposition 8) and probability of the political change, $\pi(I)$ (because of $\pi(I) = e^{C*}(I)$ and Proposition 9). Because $p(\mathcal{L})$ and $\pi(I)$ are piecewise functions from I, the objective function in (34) is also a piecewise function from I, partitioned into several intervals by $\hat{I}$ and $\tilde{I}$. Proposition 9 shows that $\hat{I}$ and $\tilde{I}$ can relate differently to each other (depending on the parameters of the model), such that there are two cases: $\tilde{I} < \hat{I}$ and $\tilde{I} \geq \hat{I}$ (and several corresponding subcases). Depending on the parameters, optimization problem (34) also has several cases but most are qualitatively similar. To focus only on qualitatively different cases, in the following text, I solve the optimization problem (34) for only two cases (all other possible cases are qualitatively similar to one of considered in the text below). In the first case, I have $(1-q) \cdot \bar{p} \geq \underline{p}$ and $-q \cdot \bar{p} \cdot f(\hat{I}) + (1-q) \cdot m > 0$, which means, according to Proposition 9, that the capitalist chooses not to struggle with the landowner ($e^{C*} = 0$) only when the economic policy is credibly pro-industrial in the Landowner's regime, that is, when $\tilde{I} > \hat{I}$. In the second case, I have $(1-q) \cdot \bar{p} < \underline{p}$ and $((1-q) \cdot \bar{p} - \underline{p}) \cdot f(\hat{I}) + (1-q) \cdot m < 0$, which means, according to Proposition 9, that $\tilde{I} < \hat{I}$. Condition $\tilde{I} < \hat{I}$ means that the capitalist chooses not to struggle with the landowner ($e^{C*} = 0$) even when the economic policy is not pro-industrial in the Landowner's regime.

Assumption 5. 1. For all $I \in [0, \tilde{I}]$, $\rho'_I(I, \bar{p}) + R'_I(I, \bar{p}) > 1$ and 2. For all $I \in [0, \hat{I}]$, $\rho'_I(I, \underline{p}) + R'_I(I, \underline{p}) < 0$.

The first part of Assumption 5 means that $\{\rho(I, \bar{p}) + R(I, \bar{p}) - I\}$ is a strictly increasing function. The second part of Assumption 5 means that $\{\rho(I, \underline{p}) + R(I, \underline{p})\}$ is a strictly decreasing function.

1. $(1-q) \cdot \bar{p} \geq \underline{p}$ and $-q \cdot \bar{p} \cdot f(\hat{I}) + (1-q) \cdot m > 0$

I can rewrite optimization problem (34) as:

$$max \quad \{U_1^{L*}, U_2^{L*}, U_3^{L*}\} \tag{35}$$

where

$$U_1^{L*} = \max_{0 \leq I < \hat{I}} \quad U_1^L \tag{36}$$

$U_1^L = (1-\bar{e}) \cdot (\rho(I, \underline{p}) + R(I, \underline{p})) + \bar{e} \cdot (1-q) \cdot \rho(I, \bar{p}) + (1-\bar{e}) \cdot m - I$

$\frac{dU_1^L}{dI} = (1-\bar{e}) \cdot (\rho_I'(I, \underline{p}) + R_I'(I, \underline{p})) + \bar{e} \cdot (1-q) \cdot \rho_I'(I, \bar{p}) - 1 < 0$

Because $\rho_I'(I, \underline{p}) + R_I'(I, \underline{p}) < 0$ for $I \in [0, \hat{I})$ (Assumption 5), $\rho_I'(I, \bar{p}) < 0$, I have $\frac{dU_1^L}{dI} < 0$ for $I \in [0, \hat{I})$, that is U_1^L is a strictly decreasing function in I. Therefore I have: $\underset{0 \leq I < \hat{I}}{argmax} \quad U_1^L = 0$.

$$U_2^{L*} = \max_{\hat{I} \leq I < \tilde{I}} \quad U_2^L \tag{37}$$

$U_2^L = (1 - \bar{e} \cdot q) \cdot \rho(I, \bar{p}) + (1-\bar{e}) \cdot R(I, \bar{p}) + (1-\bar{e}) \cdot m - I$

Assumption 6. There exists $I_2^* = \underset{\hat{I} \leq I < \tilde{I}}{arg\,max} \quad U_2^L$.

$$U_3^{L*} = \max_{\tilde{I} \leq I} \quad U_3^L \tag{38}$$

$U_3^L = \rho(I, \bar{p}) + R(I, \bar{p}) + m - I$

F.O.C.:

$\rho_I'(I, \bar{p}) + R_I'(I, \bar{p}) - 1 = 0$

Assumption 7. $\lim_{I \to +\infty} \rho_I'(I, \bar{p}) + R_I'(I, \bar{p}) < 1$.

Assumption 7 guarantees that the problem $\max_{\tilde{I} \leq I} \quad U_3^L$ has a solution.

Because for $I \in [0, \tilde{I}]$, $\rho_I'(I, \bar{p}) + R_I'(I, \bar{p}) > 1$ (Assumption 5) and $\lim_{I \to +\infty} \rho_I'(I, \bar{p}) + R_I'(I, \bar{p}) < 1$, by the Intermediate Value Theorem, I have $\underset{\tilde{I} \leq I}{arg\,max} \quad U_3^L = I_3^* \in (\tilde{I}, +\infty)$.

Below I prove that $U_2^{L*} < U_3^{L*}$.

Proposition 11. $U_2^{L*} < U_3^{L*}$

Proof. Because for $I \in [0, \tilde{I}]$, $\rho'_I(I, \bar{p}) + R'_I(I, \bar{p}) > 1$ (Assumption 5) and $\lim\limits_{I \to +\infty} \rho'_I(I, \bar{p}) + R'_I(I, \bar{p}) < 1$, by the Intermediate Value Theorem, I have $\underset{I \geq 0}{arg\,max} \quad U_3^L = I_3^* \in (\tilde{I}, +\infty)$. Consequently, $U_3^L(I_3^*) > U_3^L(I_2^*)$.

Thus, I have $U_3^{L*} = U_3^L(I_3^*) = \rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m - I_3^* > U_3^L(I_2^*) = \rho(I_2^*, \bar{p}) + R(I_2^*, \bar{p}) + m - I_2^* > (1 - \bar{e} \cdot q) \cdot \rho(I_2^*, \bar{p}) + (1 - \bar{e}) \cdot R(I_2^*, \bar{p}) + (1 - \bar{e}) \cdot m - I_2^* = U_2^L(I_2^*) = U_2^{L*}$ □

This result is quite intuitive. First, in both optimization problems (37) and (38) I have $I \geq \hat{I}$ which means $p(\mathcal{L}) = \bar{p}$ in both (37) and (38) (Proposition 8), that is, public investment is sufficiently high such that pro-industrial policy ($p(\mathcal{L}) = \bar{p}$) is beneficial for the landowner. Because for all $I \in [0, \tilde{I}]$, $\rho'_I(I, \bar{p}) + R'_I(I, \bar{p}) > 1$ (Assumption 5), it is better for the landowner to have $I = I_3^*$ when policy is pro-industrial, that is, when $p(\mathcal{L}) = \bar{p}$. This is the first reason why U_3^{L*} is larger than U_2^{L*}. Secondly, in optimization problem (38), the landowner keeps political power for sure (because $\tilde{I} \leq I$ and Proposition 6), while in optimization problem (37), the landowner has a chance to lose political power (because $I \in [\hat{I}, \tilde{I})$ and Proposition 9) and consequently, to lose land income, $\rho(I, \bar{p})$, expected imperialist rent, $R(I, \bar{p})$, and transfer, m.

Due to Proposition 11, the optimization problem can be simplified and rewritten as:

The landowner chooses $I = I_3^*$ over $I = 0$ when

$$U_3^L(I_3^*) \geq U_1^L(0) \tag{39}$$

or

$$\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m - I_3^* \geq (1 - \bar{e}) \cdot (\rho(0, \underline{p}) + R(0, \underline{p}) + m) + \bar{e} \cdot (1 - q) \cdot \rho(0, \bar{p}) \tag{40}$$

or

$$\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + \bar{e} \cdot m - I_3^* \geq (1 - \bar{e}) \cdot (\rho(0, \underline{p}) + R(0, \underline{p})) + \bar{e} \cdot (1 - q) \cdot \rho(0, \bar{p}) \tag{41}$$

Assumption 8. $\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) - I_3^* < \rho(0, \underline{p}) + R(0, \underline{p})$

Assumption 8 states that it is better for the landowner to have low public investment ($I = 0$) and status quo policy ($p = \underline{p}$) than to have high public investment ($I = I_3^*$) and pro-industrial policy ($p = \bar{p}$).

Proposition 12. *1. If $\bar{e}$ is sufficiently close to 1, and $\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m - I_3^* > (1-q) \cdot \rho(0, \bar{p})$ then the equilibrium public investment is $I^* = I_3^*$.*

2. If $\bar{e}$ is sufficiently close to 0, then the equilibrium public investment is $I^* = 0$.

Proof. See the Appendix.

□

The first part of Proposition 12 states that the landowner chooses a high degree of public investment (i.e. $I^* = I_3^*$) when two assumptions hold. The first assumption is that the capitalist is strong enough to overthrow the landowner (i.e. $\bar{e}$ is sufficiently close to 1). The second assumption, $(\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m > (1-q) \cdot \rho(0, \bar{p})$ means that holding political power is more lucrative for the landowner than losses in terms of land income due to a higher degree of public investment. The left-hand side, $\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m$, represents utility when the landowner keeps political power and, for this reason, obtains transfer, m and expected imperialist rent, $R(I_3^*, \bar{p})$. In this case, the landowner chooses pro-industrial policy because high enough public investment $I_3^* > \hat{I}$ makes pro-industrial policy beneficial for the landowner (Proposition 8). The right-hand side, $(1-q) \cdot \rho(0, \bar{p})$, represents the expected utility when the landowner loses political power. The landowner has zero payoff with probability q and he has $\rho(0, \bar{p})$ with probability $(1-q)$. An important point is that, in general case, I cannot say whether expression, $\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m$, or expression, $(1-q) \cdot \rho(0, \bar{p})$, is larger (because $\rho_I'(I, p) < 0$ and $I_3^* > 0$; $\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) < \rho(0, \underline{p}) + R(0, \underline{p})$ (Assumption 8)).

The second part of Proposition 9 states that, when there is almost no political risk for the landowner (i.e. $\bar{e}$ is sufficiently close to 0), he chooses his first best degree of public investment: $I^* = 0$.

Proposition 13. *Higher value of q makes it more likely that the landowner will choose $I^* = I_3^*$.*

Proof. The result follows from the fact that the right-hand side of inequality (39) becomes smaller when q increases.

□

The intuition is straightforward: higher q means a higher chance of losing everything (including land income). For this reason, it is better for the landowner to keep political power, that is to choose a degree of public investment $I^* = I_3^*$.

2. $(1-q)\cdot\bar{p} < \underline{p}$ and $((1-q)\cdot\bar{p}-\underline{p})\cdot f(\hat{I}) + (1-q)\cdot m < 0$

I can rewrite optimization problem (34) as:

$$max \quad \{U_1^{L*}, U_2^{L*}, U_3^{L*}\} \tag{42}$$

where

$$U_1^{L*} = \max_{0\le I<\tilde{I}} \quad U_1^L \tag{43}$$

$U_1^L = (1-\bar{e})\cdot(\rho(I,\underline{p}) + R(I,\underline{p})) + \bar{e}\cdot(1-q)\cdot\rho(I,\bar{p}) + (1-\bar{e})\cdot m - I$

F.O.C.:

$\frac{dU_1^L}{dI} = (1-\bar{e})\cdot(\rho_I'(I,\underline{p}) + R_I'(I,\underline{p})) + \bar{e}\cdot(1-q)\cdot\rho_I'(I,\bar{p}) - 1 < 0$

Because $\rho_I'(I,\underline{p}) + R_I'(I,\underline{p}) < 0$ for $I \in [0,\hat{I})$ (Assumption 5), $\rho_I'(I,\bar{p}) < 0$, I have $\frac{dU_1^L}{dI} < 0$ for $I \in [0,\tilde{I})$, that is U_1^L is a strictly decreasing function in I. Therefore I have: $\underset{0\le I<\tilde{I}}{argmax} \quad U_1^L = 0$.

$$U_2^{L*} = \max_{\tilde{I}\le I<\hat{I}} \quad U_2^L \tag{44}$$

$U_2^L = \rho(I,\underline{p}) + R(I,\underline{p}) + m - I$

F.O.C.:

$\frac{dU_2^L}{dI} = \rho_I'(I,\underline{p}) + R_I'(I,\underline{p}) - 1 < 0$

Because $\rho_I'(I,\underline{p}) + R_I'(I,\underline{p}) < 0$ for $I \in [\tilde{I},\hat{I})$ (Assumption 5), I have $\frac{dU_2^L}{dI} < 0$ for $I \in [\tilde{I},\hat{I})$, that is U_2^L is a strictly decreasing function in I. Therefore I have: $\underset{\tilde{I}\le I<\hat{I}}{argmax} \quad U_2^L = \tilde{I}$.

$$U_3^{L*} = \max_{\hat{I}\le I} \quad U_3^L \tag{45}$$

$U_3^L = \rho(I,\bar{p}) + R(I,\bar{p}) + m$

Optimization problem (45) has a solution because 1. for $I \in [0,\tilde{I}]$, $\rho_I'(I,\bar{p}) + R_I'(I,\bar{p}) > 1$ (Assumption 5) and 2. $\lim_{I\to+\infty} \rho_I'(I,\bar{p}) + R_I'(I,\bar{p}) < 1$. Therefore, I have: $\underset{\hat{I}\le I}{argmax} \quad U_3^L = I_3^* \in [\tilde{I},+\infty)$.

The landowner chooses $I^* = I_3^*$ when the following two conditions are satisfied (I assume that if the landowner is indifferent, he chooses a higher degree of public investment):

$$(1-\bar{e})\cdot(\rho(0,\underline{p}) + R(0,\underline{p})) + \bar{e}\cdot(1-q)\cdot\rho(0,\bar{p}) + (1-\bar{e})\cdot m \le \rho(I_3^*,\bar{p}) + R(I_3^*,\bar{p}) + m - I_3^* \tag{46}$$

$$\rho(\tilde{I},\underline{p}) + R(\tilde{I},\underline{p}) + m - \tilde{I} \leq \rho(I_3^*,\bar{p}) + R(I_3^*,\bar{p}) + m - I_3^* \tag{47}$$

More details about the landowner's choice are given in Proposition 14.

Proposition 14. *1. The equilibrium public investment is $I^* = I_3^*$ if the following conditions are satisfied:*

- *$\bar{e}$ is sufficiently close to* 1
- $\rho(I_3^*,\bar{p}) + R(I_3^*,\bar{p}) + m - I_3^* > (1-q)\cdot\rho(0,\bar{p})$
- $\rho(I_3^*,\bar{p}) + R(I_3^*,\bar{p}) - I_3^* > \rho(\tilde{I},\underline{p}) + R(\tilde{I},\underline{p}) - \tilde{I}.$

2. The equilibrium public investment is $I^* = \tilde{I}$ if the following conditions are satisfied:

- *$\bar{e}$ is sufficiently close to* 1
- $\rho(\tilde{I},\underline{p}) + R(\tilde{I},\underline{p}) - \tilde{I} > (1-q)\cdot\rho(0,\bar{p})$
- $\rho(\tilde{I},\underline{p}) + R(\tilde{I},\underline{p}) - \tilde{I} > \rho(I_3^*,\bar{p}) + R(I_3^*,\bar{p}) - I_3^*.$

3. If $\bar{e}$ is sufficiently close to 0*, then the equilibrium public investment is $I^* = 0$.*

Proof. See the Appendix.

□

In general, the intuition of Proposition 14 is similar to the intuition of Proposition 12. However, there is an additional condition: $\rho(I_3^*,\bar{p}) + R(I_3^*,\bar{p}) - I_3^* > \rho(\tilde{I},\underline{p}) + R(\tilde{I},\underline{p}) - \tilde{I}$. This condition exists because, when $(1-q)\cdot\bar{p} < \underline{p}$, to hold political power for sure is enough to invest $\tilde{I}$, which is less than $\hat{I}$, that is, the landowner can hold political power without providing pro-industrial policy. In the general case, I cannot determine whether expression, $\{\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})-I_3^*\}$, or expression, $\{\rho(\tilde{I},\underline{p})+R(\tilde{I},\underline{p})-\tilde{I}\}$, is larger because land income, $\rho(I,p)$, is smaller with higher public investment and pro-industrial policy: $\rho(I_3^*,\bar{p}) < \rho(\tilde{I},\underline{p})$ while the expected imperialist rent, $R(I,p)$, is larger with higher public investment and pro-industrial policy: $R(I_3^*,\bar{p}) > R(\tilde{I},\underline{p})$. Finally, the costs of public investment are higher with a higher degree of public investment; that is, costs are higher when I_3^* is chosen.

5 Conclusion

Industrialization was essential for the transition from Malthusian stagnation to a modern growth regime. However, the landowning elite initially restrained industrial development to maintain political stability and high land rents. Conversely, in the second half of the 19th century, the landowning elite promoted industrialization. In this paper, I suggest a theoretical framework that explains the change in the landowning elite's behavior. I argue that the landowning elite strategically advanced industrialization to undermine capitalists' support for revolution and thereby stabilize the existing political regime. Specifically, the promotion of industrialization eliminated capital gains from political change and simultaneously increased expected losses from redistribution for capitalists in the event of a change of the political regime. Ultimately, capitalists preferred to save the existing political regime, and the landowning elite became more entrenched in political power.

Appendix

Proof of Proposition 5:

Proof. Because $r(I,p) = p \cdot f(I)$, I can rewrite $\Delta^C(I)$ as $\Delta^C(I) = ((1-q)\cdot\bar{p} - \underline{p})\cdot f(I) + (1-q)\cdot m$.

Let's consider two cases:

1. $(1-q)\cdot\bar{p} \geq \underline{p}$.

1.1 $(1-q)\cdot\bar{p} > \underline{p}$.

In this case, because $f'(I) > 0$, $\frac{d\Delta^C}{dI} = ((1-q)\cdot\bar{p} - \underline{p})\cdot f'(I) > 0$ for all $I \in [0,+\infty)$ that is $\Delta^C(I)$ is a strictly increasing function from I for all $I \in [0,+\infty)$. Due to $\Delta^C(0) > 0$ (By Assumption 3), I have $\Delta^C(I) > 0$ for all $I \in [0,+\infty)$. Thus, the capitalist chooses $e^{C*} = \bar{e}$ for all $I \in [0,+\infty)$.

1.2 $(1-q)\cdot\bar{p} = \underline{p}$.

In this case, $\Delta^C(I) = (1-q)\cdot m > 0$ for all $I \in [0,+\infty)$. Thus, the capitalist chooses $e^{C*} = \bar{e}$ for all $I \in [0,+\infty)$.

2. $(1-q)\cdot\bar{p} < \underline{p}$.

In this case, because $f(0) > 0$ and $f'(I) > 0$, $\frac{d\Delta^C}{dI} = ((1-q)\cdot\bar{p} - \underline{p})\cdot f'(I) < 0$ for all $I \in [0,+\infty)$, that is $\Delta^C(I)$ is a strictly decreasing function from I for all $I \in [0,+\infty)$.

In addition, because $\lim_{I\to+\infty} f(I) = +\infty$, I have $\lim_{I\to+\infty} \Delta^{\mathcal{C}}(I) = -\infty$.

Because $\Delta^{\mathcal{C}}(0) > 0$ (By Assumption 3), $\lim_{I\to+\infty} \Delta^{\mathcal{C}}(I) = -\infty$, and $\Delta^{\mathcal{C}}(I)$ is a continuous function, by the Intermediate Value Theorem, there exists $\tilde{I} > 0$ such that $\Delta^{\mathcal{C}}(\tilde{I}) = 0$. Moreover, because $\Delta^{C}(I)$ is a strictly decreasing function for all $I \in [0, +\infty)$, $\tilde{I}$ is unique. Thus, if $0 \leq I < \tilde{I}$, $\Delta^{C}(I) > 0$ and the capitalist chooses $e^{C*} = \bar{e}$ while if $\tilde{I} \leq I$, $\Delta^{C}(I) \leq 0$ and the capitalist chooses $e^{C*} = 0$.

□

Proof of Proposition 6:

Proof. By definition $\Delta^{\mathcal{C}}(\tilde{I}) = 0$.

$\Delta^{C}(\tilde{I}) = ((1-q)\cdot\bar{p} - \underline{p})\cdot f(\tilde{I}) + (1-q)\cdot m = 0$

By the implicit function theorem

$$\frac{d\tilde{I}}{dq} = -\frac{\frac{\partial\Delta^{C}}{\partial q}}{\frac{\partial\Delta^{C}}{\partial I}} = -\frac{-\bar{p}\cdot f(I) - m}{((1-q)\cdot\bar{p} - \underline{p})\cdot f'(I)} < 0$$

because $f'(I) > 0$, $(1-q)\cdot\bar{p} - \underline{p} < 0$, and $f(I) > 0$ for all $I \in (0, +\infty)$.

□

Proof of Proposition 3:

Proof. 1. First, note that:

$\lim_{\bar{e}\to 1} \{\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + \bar{e}\cdot m\} = \rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m$

$\lim_{\bar{e}\to 1} \{(1-\bar{e})\cdot\rho(0, \underline{p}) + \bar{e}\cdot(1-q)\cdot\rho(0, \bar{p})\} = (1-q)\cdot\rho(0, \bar{p})$

Due to the continuity in $\bar{e}$ of both the left and right sides of inequality (23), and by assumption that $\rho(\tilde{I}, \underline{p}) + m > (1-q)\cdot\rho(0, \bar{p})$, I have the result.

2. First, calculation of limits:

$\lim_{\bar{e}\to 0} \{\rho(\tilde{I}, \underline{p}) + \bar{e}\cdot m\} = \rho(\tilde{I}, \underline{p})$

$\lim_{\bar{e}\to 0} \{(1-\bar{e})\cdot\rho(0, \underline{p}) + \bar{e}\cdot(1-q)\cdot\rho(0, \bar{p})\} = \rho(0, \underline{p})$

Second, because $\rho_I'(I, p) < 0$ and $\tilde{I} > 0$, I have $\rho(\tilde{I}, \underline{p}) < \rho(0, \underline{p})$.

Again, due to the continuity in $\bar{e}$ of both the left and right sides of inequality (23), and the fact that $\rho(\tilde{I},\underline{p}) < \rho(0,\underline{p})$, I have the result.

□

Proof of Proposition 4:

Proof. 1. A higher value of q makes it more likely that inequality (23) holds because the right-hand side (RHS) of inequality (23) decreases with higher q and the left-hand side (LHS) of inequality (23) increases with higher q:

LHS: $(\rho(\tilde{I}(q),\underline{p}) + \bar{e}\cdot m)'_q = \rho'_I(\tilde{I}(q),\underline{p})\cdot\frac{d\tilde{I}}{dq} > 0$, where I have used $\rho'_I(I,p) < 0$ and $\frac{d\tilde{I}}{dq} < 0$ (from Proposition 2).

RHS: $((1-\bar{e})\cdot\rho(0,\underline{p}) + \bar{e}\cdot(1-q)\cdot\rho(0,\bar{p}))'_q = -\bar{e}\cdot\rho(0,\bar{p}) < 0$

2. First, note that:

$\lim_{\bar{e}\to 1}\{\rho(\tilde{I},\underline{p}) + \bar{e}\cdot m\} = \rho(\tilde{I},\underline{p}) + m$

$\lim_{\bar{e}\to 1}\{(1-\bar{e})\cdot\rho(0,\underline{p}) + \bar{e}\cdot(1-q)\cdot\rho(0,\bar{p})\} = (1-q)\cdot\rho(0,\bar{p})$

Due to the continuity in q of both the left and right sides of inequality (23), and by assumption that $\rho(\tilde{I}(\bar{q}),\underline{p}) + m > (1-\bar{q})\cdot\rho(0,\bar{p})$, I have the result.

□

Proof of Proposition 8:

Proof. The landowner prefers pro-industrial economic policy when

$$\rho(I,\bar{p}) + m + R(I,\bar{p}) \geq \rho(I,\underline{p}) + m + R(I,\underline{p}) \tag{48}$$

or

$$X(I) \geq Z(I) \tag{49}$$

or

$$\frac{X(I)}{Z(I)} \geq 1 \tag{50}$$

where

$X(I) = R(I,\bar{p}) - R(I,\underline{p})$

$Z(I) = \rho(I,\underline{p}) - \rho(I,\bar{p})$

First, I prove that $\lim\limits_{I \to +\infty} \frac{X(I)}{Z(I)} = +\infty$.

$\lim\limits_{I \to +\infty} Z(I) = \lim\limits_{I \to +\infty} \{\rho(I, \underline{p}) - \rho(I, \bar{p})\} = 0 - 0 = 0$

Because $R(0, p) > 0$ for any $p > 0$, $R''_{Ip}(I, p) > 0$, and $0 < \underline{p} < \bar{p}$, I have $X(0) = R(0, \bar{p}) - R(0, \underline{p}) > 0$.

Because $R''_{Ip}(I, p) > 0$, I have $\lim\limits_{I \to +\infty} X(I) \geq X(0) = \lim\limits_{I \to +\infty} X(0)$.

Consequently, there are two possible cases: 1. $\lim\limits_{I \to +\infty} X(I) = l \in \mathbb{R}_{++}$ 2. $\lim\limits_{I \to +\infty} X(I) = +\infty$

In any case, I have $\lim\limits_{I \to +\infty} \frac{X(I)}{Z(I)} = +\infty$.

From Assumption 4 and properties of function $R(I, p)$ ($R(0, p) > 0$ for any $p > 0$, $R'_p(I, p) > 0$), I have $0 < X(0) < Z(0)$ or $0 < \frac{X(0)}{Z(0)} < 1$. Moreover, $\frac{X(I)}{Z(I)}$ is a continuous function for all $I \geq 0$ and $\lim\limits_{I \to +\infty} \frac{X(I)}{Z(I)} > 1$. Thus, by the Intermediate Value Theorem, there exists $\hat{I} > 0$ such that $\frac{X(\hat{I})}{Z(\hat{I})} = 1$.

Finally, because $X(I)$ is a strictly increasing function (because $R'_I(I, p) > 0$, and $R''_{Ip}(I, p) > 0$) and $Z(I)$ is a strictly decreasing function (because $\rho'_I(I, p) < 0$ and $\rho''_{Ip}(I, p) > 0$), the function $\frac{X(I)}{Z(I)}$ is a strictly increasing function. Thus, $\frac{X(I)}{Z(I)}$ achieves value 1 exactly at one point ($I = \hat{I}$) and for all $I \in (\hat{I}, +\infty)$, $\frac{X(I)}{Z(I)} > 1$.

□

Proof of Proposition 9:

Proof. Because $r(I, p) = p \cdot f(I)$, I can rewrite $\Delta^C(I)$ as $\Delta^C(I) = ((1 - q) \cdot \bar{p} - p(\mathcal{L})) \cdot f(I) + (1 - q) \cdot m$.

$$\text{where } p(\mathcal{L}) = \begin{cases} \underline{p}, & \text{if } 0 \leq I < \hat{I} \\ \bar{p}, & \text{if } \hat{I} \leq I \ . \end{cases}$$

As in Proposition 5, I consider two cases (with corresponding subcases): when $(1 - q) \cdot \bar{p} \geq \underline{p}$ and when $(1 - q) \cdot \bar{p} < \underline{p}$.

1. $(1 - q) \cdot \bar{p} \geq \underline{p}$.

Because for all $\tilde{I} \leq I$, the capitalist chooses $e^{C*} = 0$, it must be that $\Delta^C(\tilde{I}) \leq 0$. Because $(1 - q) \cdot \bar{p} \geq \underline{p}$, $f(I) > 0$ for all $[0, +\infty)$, and for all $I \in [0, \hat{I})$, $p(\mathcal{L}) = \underline{p}$, I have $\Delta^C(I) = ((1 - q) \cdot \bar{p} - \underline{p}) \cdot f(I) + (1 - q) \cdot m > 0$ for all $I \in [0, \hat{I})$. Thus, when $(1 - q) \cdot \bar{p} \geq \underline{p}$ it is not possible that $\tilde{I} \in [0, \hat{I})$. Below, I show that when $(1 - q) \cdot \bar{p} \geq \underline{p}$, there exists $\tilde{I}$ such that $\Delta^C(\tilde{I}) \leq 0$ and $\tilde{I} \geq \hat{I}$.

1.1. $I \in [0, \hat{I})$

As I show above, when $0 \leq I < \hat{I}$, $\Delta^C(I) = ((1-q) \cdot \bar{p} - \underline{p}) \cdot f(I) + (1-q) \cdot m > 0$. Thus, the capitalist chooses $e^{C*} = \bar{e}$ for all $I \in [0, \hat{I})$.

1.2 $I \in [\hat{I}, +\infty)$

If $\hat{I} \leq I$, $p(\mathcal{L}) = \bar{p}$, $\Delta^C(I) = ((1-q) \cdot \bar{p} - \bar{p}) \cdot f(I) + (1-q) \cdot m = -q \cdot \bar{p} \cdot f(I) + (1-q) \cdot m$.

In this subcase, because $f'(I) > 0$ for all $I \in [0, +\infty)$, $\frac{d\Delta^C}{dI} = -q \cdot \bar{p} \cdot f'(I) < 0$ for all $I \in [\hat{I}, +\infty)$, that is $\Delta^C(I)$ is a strictly decreasing function for all $I \in [\hat{I}, +\infty)$.

In addition, because $\lim_{I \to +\infty} f(I) = +\infty$, I have $\lim_{I \to +\infty} \Delta^C(I) = -\infty$.

1.2.1 $I \in [\hat{I}, +\infty)$ and $-q \cdot \bar{p} \cdot f(\hat{I}) + (1-q) \cdot m \leq 0$

Condition $-q \cdot \bar{p} \cdot f(\hat{I}) + (1-q) \cdot m \leq 0$ means that $\Delta^C(\hat{I}) \leq 0$. From $\Delta^C(\hat{I}) \leq 0$, I have $\Delta^C(I) \leq 0$ for all $I \in [\hat{I}, +\infty)$ because $\Delta^C(I)$ is a strictly decreasing function for all $I \in [\hat{I}, +\infty)$. Thus, I have $\hat{I} = \tilde{I}$.

1.2.2 $I \in [\hat{I}, +\infty)$ and $-q \cdot \bar{p} \cdot f(\hat{I}) + (1-q) \cdot m > 0$

Condition $-q \cdot \bar{p} \cdot f(\hat{I}) + (1-q) \cdot m > 0$ means that $\Delta^C(\hat{I}) > 0$. Due to $\Delta^{\mathcal{C}}(\hat{I}) > 0$, $\lim_{I \to +\infty} \Delta^{\mathcal{C}}(I) = -\infty$, and $\Delta^{\mathcal{C}}(I)$ is a continuous function on $I \in [\hat{I}, +\infty)$, by the Intermediate Value Theorem, there exists $\tilde{I} > \hat{I}$ such that $\Delta^{\mathcal{C}}(\tilde{I}) = 0$. Moreover, because $\Delta^C(I)$ is a strictly decreasing function for all $I \in [\hat{I}, +\infty)$, $\tilde{I}$ is unique.

Thus, when $(1-q) \cdot \bar{p} \geq \underline{p}$ holds: if $0 \leq I < \tilde{I}$, $\Delta^C(I) > 0$ and the capitalist chooses $e^{C*} = \bar{e}$ while if $\tilde{I} \leq I$, $\Delta^C(I) \leq 0$ and the capitalist chooses $e^{C*} = 0$. In addition, $\tilde{I} \geq \hat{I}$.

2. $(1-q) \cdot \bar{p} < \underline{p}$.

In this case, because $f'(I) > 0$ for all $I \in [0, +\infty)$, I have $\frac{d\Delta^C}{dI} = ((1-q) \cdot \bar{p} - \underline{p}) \cdot f'(I) < 0$ for all $I \in [0, \hat{I})$ and $\frac{d\Delta^C}{dI} = -q \cdot \bar{p} \cdot f'(I) < 0$ for all $I \in [\hat{I}, +\infty)$. Moreover, for any $\varepsilon > 0$ such that $(\hat{I} - \varepsilon) \in [0, \hat{I})$, I have $((1-q) \cdot \bar{p} - \underline{p}) \cdot f(\hat{I} - \varepsilon) + (1-q) \cdot m > -q \cdot \bar{p} \cdot f(\hat{I}) + (1-q) \cdot m$ because $f(\hat{I}) > f(\hat{I} - \varepsilon)$ (due to $f'(I) > 0$ for all $I \in [0, +\infty)$), $q \cdot \bar{p} > -((1-q) \cdot \bar{p} - \underline{p})$ (due to $\bar{p} > \underline{p}$). Thus, $\Delta^C(I)$ is a strictly decreasing function for all $I \in [0, +\infty)$.

Below I show that when $(1-q) \cdot \bar{p} < \underline{p}$, there exists $\tilde{I}$ such that $\Delta^C(\tilde{I}) \leq 0$ and there are two possible situations: $\tilde{I} \geq \hat{I}$ and $\tilde{I} < \hat{I}$.

2.1 $((1-q) \cdot \bar{p} - \underline{p}) \cdot f(\hat{I}) + (1-q) \cdot m < 0$

Consider a function $F(I) = ((1-q)\cdot\bar{p} - \underline{p})\cdot f(I) + (1-q)\cdot m$. By construction, $F(I) = \Delta^C(I)$ for all $I \in [0, \hat{I})$. Moreover, because $f'(I) > 0$ for all $I \in [0, +\infty)$, $F'(I) = ((1-q)\cdot\bar{p} - \underline{p})\cdot f'(I) < 0$ for all $I \in [0, +\infty)$, that is $F(I)$ is a strictly decreasing function for all $I \in [0, +\infty)$.

By Assumption 3, $F(0) > 0$. Because $((1-q)\cdot\bar{p} - \underline{p})\cdot f(\hat{I}) + (1-q)\cdot m < 0$, I have $F(\hat{I}) < 0$. Because and $F(I)$ is a continuous function on $I \in [0, \hat{I}]$, by the Intermediate Value Theorem, there exists $\tilde{I} \in (0, \hat{I})$ such that $F(\tilde{I}) = \Delta^C(\tilde{I}) = 0$. Moreover, because $F(I)$ is a strictly decreasing function for all $I \in [0, \hat{I}]$, $\tilde{I}$ is unique.

2.2 $((1-q)\cdot\bar{p} - \underline{p})\cdot f(\hat{I}) + (1-q)\cdot m \geq 0$

2.2.1 $((1-q)\cdot\bar{p} - \underline{p})\cdot f(\hat{I}) + (1-q)\cdot m > 0$

Because $(1-q)\cdot\bar{p} - \underline{p})\cdot f(\hat{I}) + (1-q)\cdot m > 0$, $F(\hat{I}) > 0$. Because $F(I)$ is a strictly decreasing function for all $I \in [0, \hat{I}]$ and $F(\hat{I}) > 0$, I have $F(I) > 0$ for all $I \in [0, \hat{I}]$. Consequently, $\Delta^C(I) > 0$ for all $I \in [0, \hat{I})$.

2.2.1.1 $((1-q)\cdot\bar{p} - \underline{p})\cdot f(\hat{I}) + (1-q)\cdot m > 0$ and $-q\cdot\bar{p}\cdot f(\hat{I}) + (1-q)\cdot m > 0$

Condition $-q\cdot\bar{p}\cdot f(\hat{I}) + (1-q)\cdot m > 0$ means that $\Delta^C(\hat{I}) > 0$. Because $\Delta^{\mathcal{C}}(\hat{I}) > 0$, $\underset{I\to+\infty}{lim}\Delta^{\mathcal{C}}(I) = -\infty$, and $\Delta^{\mathcal{C}}(I)$ is a continuous function on $I \in [\hat{I}, +\infty)$, by the Intermediate Value Theorem, there exists $\tilde{I} > \hat{I}$ such that $\Delta^{\mathcal{C}}(\tilde{I}) = 0$. Moreover, because $\Delta^C(I)$ is a strictly decreasing function for all $I \in [\hat{I}, +\infty)$, $\tilde{I}$ is unique.

2.2.1.2 $((1-q)\cdot\bar{p} - \underline{p})\cdot f(\hat{I}) + (1-q)\cdot m > 0$ and $-q\cdot\bar{p}\cdot f(\hat{I}) + (1-q)\cdot m \leq 0$

Condition $-q\cdot\bar{p}\cdot f(\hat{I}) + (1-q)\cdot m \leq 0$ means that $\Delta^C(\hat{I}) \leq 0$. If $\Delta^C(\hat{I}) \leq 0$, then $\Delta^C(I) \leq 0$ for all $I \in [\hat{I}, +\infty)$ because $\Delta^C(I)$ is a strictly decreasing function for all $I \in [\hat{I}, +\infty)$. Thus, here I have $\hat{I} = \tilde{I}$.

2.2.2 $((1-q)\cdot\bar{p} - \underline{p})\cdot f(\hat{I}) + (1-q)\cdot m = 0$

$\Delta^C(\hat{I}) = -q\cdot\bar{p}\cdot f(\hat{I}) + (1-q)\cdot m < ((1-q)\cdot\bar{p} - \underline{p})\cdot f(\hat{I}) + (1-q)\cdot m = 0$. Consequently, $\Delta^C(\hat{I}) < 0$. If $\Delta^C(\hat{I}) < 0$, then $\Delta^C(I) < 0$ for all $I \in [\hat{I}, +\infty)$ because $\Delta^C(I)$ is a strictly decreasing function for all $I \in [\hat{I}, +\infty)$. Thus, here I have $\hat{I} = \tilde{I}$.

□

Proof of Proposition 10**:**

Proof. Proposition 9 claims that there are two possible cases: 1. $\tilde{I} \in [0, \hat{I})$ and 2. $\tilde{I} \in [\hat{I}, +\infty)$. In addition, from Proposition 9 I have $\Delta^C(\tilde{I}) \leq 0$.

1. $\tilde{I} \in [0, \hat{I})$

In this case, $\Delta^C(\tilde{I}) = ((1-q)\cdot\bar{p} - \underline{p})\cdot f(\tilde{I}) + (1-q)\cdot m = 0$

By Proposition 9, it can be only when $(1-q)\cdot\bar{p} < \underline{p}$. Thus, by the implicit function theorem

$$\frac{d\tilde{I}}{dq} = -\frac{\frac{\partial\Delta^C}{\partial q}}{\frac{\partial\Delta^C}{\partial I}} = -\frac{-\bar{p}\cdot f(I) - m}{((1-q)\cdot\bar{p} - \underline{p})\cdot f'(I)} < 0$$

2. $\tilde{I} \in [\hat{I}, +\infty)$

In this case, there are two subcases.

2.1 $\Delta^C(\tilde{I}) = -q\cdot\bar{p}\cdot f(\tilde{I}) + (1-q)\cdot m = 0$

By the implicit function theorem

$$\frac{d\tilde{I}}{dq} = -\frac{\frac{\partial\Delta^C}{\partial q}}{\frac{\partial\Delta^C}{\partial I}} = -\frac{-\bar{p}\cdot f(I) - m}{-q\cdot\bar{p}\cdot f'(I)} < 0$$

2.2 $\Delta^C(\tilde{I}) = -q\cdot\bar{p}\cdot f(\tilde{I}) + (1-q)\cdot m = const < 0$

Thus, $\Delta^C(\tilde{I}) - const = -q\cdot\bar{p}\cdot f(\tilde{I}) + (1-q)\cdot m - const = 0$

By the implicit function theorem

$$\frac{d\tilde{I}}{dq} = -\frac{\frac{\partial(\Delta^C - const)}{\partial q}}{\frac{\partial(\Delta^C - const)}{\partial I}} = -\frac{-\bar{p}\cdot f(I) - m}{-q\cdot\bar{p}\cdot f'(I)} < 0$$

□

Proof of Proposition 11:

Proof. First, define $I_2^* \in [\hat{I}, \tilde{I}]$ such that $U_2^L(I_2^*) = \sup_{\hat{I} \le I < \tilde{I}} U_2^L$.

Thus, I have:

$U_2^L(I_2^*) = (1-\bar{e}\cdot q)\cdot\rho(I_2^*,\bar{p}) + (1-\bar{e})\cdot R(I_2^*,\bar{p}) + (1-\bar{e})\cdot m = (1-\bar{e})\cdot(\rho(I_2^*,\bar{p}) + R(I_2^*,\bar{p}) + m) + \bar{e}\cdot(1-q)\cdot\rho(I_2^*,\bar{p})$

By definition of U_3^{L*} I have:

$U_3^{L*} = \rho(I_3^*,\bar{p}) + R(I_3^*,\bar{p}) + m = (1-\bar{e})\cdot(\rho(I_3^*,\bar{p}) + R(I_3^*,\bar{p}) + m) + \bar{e}\cdot(\rho(I_3^*,\bar{p}) + R(I_3^*,\bar{p}) + m),$

Now demonstrate that $U_3^{L*} > U_2^L(I_2^*)$ comparing the first term of U_3^{L*} with corresponding first term of $U_2^L(I_2^*)$ and comparing the second term of U_3^{L*} with corresponding second term of $U_2^L(I_2^*)$. Next, I will show that (i) $\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})+m>\rho(I_2^*,\bar{p})+R(I_2^*,\bar{p})+m$ and (ii) $\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})+m>(1-q)\cdot\rho(I_2^*,\bar{p})$:

(i) $\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})+m>\rho(I_2^*,\bar{p})+R(I_2^*,\bar{p})+m$, because for $I\in[0,+\infty)$, $(\rho(I,\bar{p})+R(I,\bar{p})+m)'_I=\rho'_I(I,\bar{p})+R'_I(I,\bar{p})>0$,

(ii)$\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})+m>\rho(I_2^*,\bar{p})+R(I_2^*,\bar{p})+m>\rho(I_2^*,\bar{p})>(1-q)\cdot\rho(I_2^*,\bar{p})$.

The first inequality comes from the fact that for $I\in[0,+\infty)$, $(\rho(I,\bar{p})+R(I,\bar{p})+m)'_I=\rho'_I(I,\bar{p})+R'_I(I,\bar{p})>0$. I have the second inequality because $R(I_2^*,\bar{p})>0$ and $m>0$. Finally, I have the last inequality because $(1-q)\in(0,1)$.

□

Proof of Proposition 12**:**

Proof. 1. First, note that:

$$\underset{\bar{e}\to 1}{lim}\{\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})+\bar{e}\cdot m-I_3^*\}=\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})+m-I_3^*$$

$$\underset{\bar{e}\to 1}{lim}\{(1-\bar{e})\cdot(\rho(0,\underline{p})+R(0,\underline{p}))+\bar{e}\cdot(1-q)\cdot\rho(0,\bar{p})\}=(1-q)\cdot\rho(0,\bar{p})$$

Due to the continuity in $\bar{e}$ of both the left and right sides of inequality (41), and by assumption that $\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})+m-I_3^*>(1-q)\cdot\rho(0,\bar{p})$, I have the result.

2. First, calculation of limits:

$$\underset{\bar{e}\to 0}{lim}\{\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})+\bar{e}\cdot m-I_3^*\}=\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})-I_3^*$$

$$\underset{\bar{e}\to 0}{lim}\{(1-\bar{e})\cdot(\rho(0,\underline{p})+R(0,\underline{p}))+\bar{e}\cdot(1-q)\cdot\rho(0,\bar{p})\}=\rho(0,\underline{p})+R(0,\underline{p})$$

Second,by Assumption 8, I have $\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})-I_3^*<\rho(0,\underline{p})+R(0,\underline{p})$.

Again, due to the continuity in $\bar{e}$ of both the left and right sides of inequality (41), and the fact that $\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})-I_3^*<\rho(0,\underline{p})+R(0,\underline{p})$, I have the result.

□

Proof of Proposition 14**:**

Proof. 1. First, note that:

$$\underset{\bar{e}\to 1}{lim}\{U_1^{L*}\}=\underset{\bar{e}\to 1}{lim}\{(1-\bar{e})\cdot(\rho(0,\underline{p})+R(0,\underline{p}))+\bar{e}\cdot(1-q)\cdot\rho(0,\bar{p})+(1-\bar{e})\cdot m\}=(1-q)\cdot\rho(0,\bar{p})$$

$$\underset{\bar{e}\to 1}{lim}\{U_2^{L*}\}=\underset{\bar{e}\to 1}{lim}\{\rho(\tilde{I},\underline{p})+R(\tilde{I},\underline{p})+m-\tilde{I}\}=\rho(\tilde{I},\underline{p})+R(\tilde{I},\underline{p})+m-\tilde{I}$$

$$\underset{\bar{e}\to 1}{lim}\{U_3^{L*}\}=\underset{\bar{e}\to 1}{lim}\{\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})+m-I_3^*\}=\rho(I_3^*,\bar{p})+R(I_3^*,\bar{p})+m-I_3^*$$

Due to the continuity in $\bar{e}$ of U_1^{L*}, U_2^{L*}, and U_3^{L*}, and by assumption that $\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m - I_3^* > (1-q) \cdot \rho(0, \bar{p})$ and $\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) - I_3^* > \rho(\tilde{I}, \underline{p}) + R(\tilde{I}, \underline{p}) - \tilde{I}$, I have the result.

2. This part is proven similarly to part 1.

3. First, calculation of limits:

$\underset{\bar{e}\to 0}{lim} \{U_1^{L*}\} = \underset{\bar{e}\to 0}{lim} \{(1-\bar{e}) \cdot (\rho(0, \underline{p}) + R(0, \underline{p})) + \bar{e} \cdot (1-q) \cdot \rho(0, \bar{p}) + (1-\bar{e}) \cdot m\} = \rho(0, \underline{p}) + R(0, \underline{p}) + m$

$\underset{\bar{e}\to 0}{lim} \{U_2^{L*}\} = \underset{\bar{e}\to 0}{lim} \{\rho(\tilde{I}, \underline{p}) + R(\tilde{I}, \underline{p}) + m - \tilde{I}\} = \rho(\tilde{I}, \underline{p}) + R(\tilde{I}, \underline{p}) + m - \tilde{I}$

$\underset{\bar{e}\to 0}{lim} \{U_3^{L*}\} = \underset{\bar{e}\to 0}{lim} \{\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m - I_3^*\} = \rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m - I_3^*$

Second,by Assumption 8, I have $\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) - I_3^* < \rho(0, \underline{p}) + R(0, \underline{p})$ or $\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m - I_3^* < \rho(0, \underline{p}) + R(0, \underline{p}) + m$.

Third, by Assumption 5, I have for all $I \in [0, \hat{I}]$, $\rho_I'(I, \underline{p}) + R_I'(I, \underline{p}) < 0$ which implies that $\rho(0, \underline{p}) + R(0, \underline{p}) + m > \rho(\tilde{I}, \underline{p}) + R(\tilde{I}, \underline{p}) + m$.

Finally, due to the continuity in $\bar{e}$ of U_1^{L*}, U_2^{L*}, and U_3^{L*}, and the fact that $\rho(I_3^*, \bar{p}) + R(I_3^*, \bar{p}) + m - I_3^* < \rho(0, \underline{p}) + R(0, \underline{p}) + m$ and $\rho(0, \underline{p}) + R(0, \underline{p}) + m > \rho(\tilde{I}, \underline{p}) + R(\tilde{I}, \underline{p}) + m - \tilde{I}$, I have the result.

□

In the main text, I consider a reduced-form model in which wage, capital rent, and land rent are given. Here I derive them.

I present a general equilibrium model. There are two sectors of the economy: traditional (T) and modern (M). The traditional sector uses land T and labor L_T as inputs, according to the following Cobb-Douglas technology:

$$Y_T = A_T T^\alpha L_T^{1-\alpha}, \tag{51}$$

where $A_T > 0$ is the exogenous T-sector productivity level. The modern sector employs physical capital K and labor L_M as inputs. The productivity level in the modern sector is A_M. Therefore, with Cobb-Douglas technology, I have:

$$Y_M = A_M K^\alpha L_M^{1-\alpha}. \tag{52}$$

I consider $A_M(I, p)$ as a function of public investment I and economic policy p. I assume that

$$A_M(I, p) = p \cdot \sqrt{\bar{I} + I} \tag{53}$$

where $\bar{I} > 0$ is given.

In the model, the landowner has land and expected imperialist rent (or capital), the capitalist owns capital, and the worker has labor. I assume that the worker provides unity of labor inelastically, which means that labor supply is equal to 1 in the given economy.

Capital K and land T are constant and non-tradable. I assume that labor is perfectly mobile[5] and chooses the sector where a wage is higher. The aggregate product of the economy is a sum of products of two sectors, i.e. $Y = Y_M + Y_T$. In addition, the two goods produced in the sectors are perfect substitutes in consumption. Thus, this is a single-good economy, and the price of the final good is normalized to one.

Because there is constant returns to scale technology in both sectors, I have the following factor incomes:

$$w_T = (1 - \alpha) A_T (T/L_T)^{\alpha} \tag{54}$$

$$\rho = \alpha A_T (L_T/T)^{1-\alpha} \tag{55}$$

$$w_M = (1 - \alpha) A_M (K/L_M)^{\alpha} \tag{56}$$

$$r = \alpha A_M (L_M/K)^{1-\alpha} \tag{57}$$

Finally, consider function a particular example of the function $R(I, p)$:
$R(I, p) = 1 - e^{-\frac{A_M(p,I)}{V}} = 1 - e^{-\frac{p\sqrt{\bar{I}+I}}{V}}$

Check its properties:

$R'_I = e^{-\frac{p\sqrt{\bar{I}+I}}{V}} \cdot \frac{p}{V} \cdot \frac{1}{2\sqrt{\bar{p}+I}} > 0$

$R'_i = e^{-\frac{p\sqrt{\bar{I}+I}}{V}} \cdot \frac{\sqrt{\bar{I}+I}}{V} > 0$

$R''_{Ip} = e^{-\frac{p\sqrt{\bar{I}+I}}{V}} \cdot \frac{1}{2V} \cdot [-\frac{p}{V} + \frac{1}{\sqrt{\bar{I}+I}}]$

Thus, $R''_{Ip} > 0$ when $\frac{V}{\sqrt{\bar{p}+I_3^*}} > p$ that is when V is sufficiently large.

[5]My results do not change if I relax the assumption about perfect mobility or even if I make labor mobility part of the policy vector.

Economic equilibrium

Firstly, find equilibrium wages, capital rent, and land rent.

In equilibrium, wages in the modern and traditional sectors are equal, that is, there is no incentive for labor to move to another sector: $w_T = w_M$ or

$$(1-\alpha)A_T(T/L_T)^\alpha = (1-\alpha)A_M(K/L_M)^\alpha \tag{58}$$

In addition, the total amount of labor in the economy is 1, while labor demand is: $L_T + L_M$. Thus, in equilibrium:

$$L_T + L_M = 1 \tag{59}$$

Taking into account both of conditions (58) and (59), I obtain the system:

$$\begin{cases} w_T = w_M \\ L_T + L_M = 1 \end{cases} \tag{60}$$

The solution for this system provides an equilibrium wage and equilibrium employment in each sector. Equilibrium wage is

$$w^* = (1-\alpha)A_M(K + T \cdot (\frac{A_T}{A_M})^{1/\alpha})^\alpha \tag{61}$$

Equilibrium employment in the modern sector:

$$L_M^* = \frac{1}{1 + \frac{T}{K} \cdot (\frac{A_T}{A_M})^{1/\alpha}} \tag{62}$$

and equilibrium employment in the traditional sector:

$$L_T^* = \frac{\frac{T}{K} \cdot (\frac{A_T}{A_M})^{1/\alpha}}{1 + \frac{T}{K} \cdot (\frac{A_T}{A_M})^{1/\alpha}} \tag{63}$$

Finally, equilibrium capital and land rents are:

$$r^* = \alpha A_M(K + T \cdot (\frac{A_T}{A_M})^{1/\alpha})^{\alpha-1} \tag{64}$$

$$\rho^* = \alpha A_T(\frac{T \cdot (\frac{A_T}{A_M})^{1/\alpha}}{K + T \cdot (\frac{A_T}{A_M})^{1/\alpha}})^{1-\alpha} \tag{65}$$

Now, I investigate the effects of public investment and economic policy on the factor incomes.

Proposition 15. *Increase of public investment in the modern sector leads to*

1. *increase of equilibrium wage, i.e.,* $\frac{\partial w^*}{\partial I} > 0$;

2. *increase of equilibrium capital rent, i.e.,* $\frac{\partial r^*}{\partial I} > 0$;

3. *decrease of equilibrium land rent, i.e.,* $\frac{\partial \rho^*}{\partial I} < 0$.

Proof. Differentiate w^*, r^*, and ρ^* with respect to I:

$$\frac{\partial w^*}{\partial I} = (1-\alpha)\frac{\partial A_M}{\partial I}(K + T(\frac{A_T}{A_M})^{1/\alpha})^{\alpha}(1 - \frac{T(\frac{A_T}{A_M})^{1/\alpha}}{K+T(\frac{A_T}{A_M})^{1/\alpha}}) > 0$$

$$\frac{\partial r^*}{\partial I} = \alpha\frac{\partial A_M}{\partial I}(K + T(\frac{A_T}{A_M})^{1/\alpha})^{\alpha-2}(K + \frac{T}{\alpha}(\frac{A_T}{A_M})^{1/\alpha}) > 0,$$

$$\frac{\partial \rho^*}{\partial I} = -\frac{A_T}{A_M}(1-\alpha)(\frac{T\cdot(\frac{A_T}{A_M})^{1/\alpha}}{K+T\cdot(\frac{A_T}{A_M})^{1/\alpha}})^{2-\alpha}\frac{K}{T(\frac{A_T}{A_M})^{1/\alpha}}\frac{\partial A_M}{\partial I} < 0$$

where $\frac{\partial A_M}{\partial I} = \frac{p}{2\sqrt{\bar{I}+I}} > 0$

□

1. Public investment has two effects on the equilibrium wage. Firstly, it increases the marginal productivity of labor in the modern sector and, consequently, the modern sector wage. Secondly, a higher wage in the modern sector attracts more labor to this sector; that is, labor supply increases in the modern sector. This effect decreases the modern sector wage. At the same time, labor supply declines in the traditional sector, which raises the traditional sector wage. In equilibrium, wages are the same in both sectors and in the modern sector, the effect of wage increase dominates. Thus, with larger public investment, the equilibrium wage is higher.

2. Public investment also has two effects on the equilibrium capital rent. Firstly, it increases the marginal productivity of capital, which makes capital rent higher directly. Secondly, as described above, public investment causes the reallocation of labor from the traditional sector into the modern one. The reallocation of labor increases the marginal product of capital and, therefore, capital rent.

3. As described above, public investment leads to reallocation of labor from the traditional sector into the modern one. Reallocation of labor makes the marginal product of land smaller. As a consequence, the land rent becomes smaller.

Proposition 16. *Pro-industrial economic policy (higher p) leads to*

1. *increase of equilibrium wage, i.e.,* $\frac{\partial w^*}{\partial p} > 0$

2. *increase of equilibrium capital rent, i.e.,* $\frac{\partial r^*}{\partial p} > 0$

3. *decrease of equilibrium land rent, i.e.,* $\frac{\partial \rho^*}{\partial p} < 0$

Proof. Differentiate w^*, r^*, and ρ^* with respect to p:

$$\frac{\partial w^*}{dp} = (1-\alpha)\frac{\partial A_M}{\partial p}(K + T(\frac{A_T}{A_M})^{1/\alpha})^{\alpha}(1 - \frac{T(\frac{A_T}{A_M})^{1/\alpha}}{K+T(\frac{A_T}{A_M})^{1/\alpha}}) > 0$$

$$\frac{\partial r^*}{\partial p} = \alpha\frac{\partial A_M}{\partial p}(K + T(\frac{A_T}{A_M})^{1/\alpha})^{\alpha-2}(K + \frac{T}{\alpha}(\frac{A_T}{A_M})^{1/\alpha}) > 0,$$

$$\frac{\partial \rho^*}{\partial p} = -\frac{A_T}{A_M}(1-\alpha)(\frac{T\cdot(\frac{A_T}{A_M})^{1/\alpha}}{K+T\cdot(\frac{A_T}{A_M})^{1/\alpha}})^{2-\alpha}\frac{K}{T(\frac{A_T}{A_M})^{1/\alpha}}\frac{\partial A_M}{\partial p} < 0$$

where $\frac{\partial A_M}{\partial p} = \sqrt{\bar{I} + I} > 0$

□

The economic intuition for the economic policy is the same as for public investment in Proposition 15.

References

Acemoglu, D., Giuseppe D.F., Giacomo D. L., and Gianluca R. (2022), "War, Socialism, and the Rise of Fascism: an Empirical Exploration", The Quarterly Journal of Economics, 137 (2),1233–1296.

Acemoglu, D. and Robinson, J. (2000), "Why Did the West Extend the Franchise? Democracy, Inequality, and Growth in Historical Perspective", The Quarterly Journal of Economics, 115 (4), 1167-1199.

Acemoglu, D. and Robinson, J. (2006), "Economic Backwardness in Political Perspective", American Political Science Review, 100 (1), 115-131.

Acemoglu, D. and Robinson, J. (2012) Why Nations Fail: The Origins of Power, Prosperity and Poverty (New York: Crown Publishers).

Acemoglu, D., Verdier, T., and Robinson J. (2004), "Kleptocracy and Divide-and-Rule: A Model of Personal Rule", Journal of the European Economic Association, 2, 162–192.

Bairoch, P. (1982), "International Industrialization Levels from 1750 to 1980", Journal of European Economic History, 11, 269-333.

Chickering, R., Showalter, D., and Van de Ven, H. (Eds.) (2012) The Cambridge History of War (Cambridge History of War) (Cambridge: Cambridge University Press).

Fu Q., Wu Z., and Zhu Y. (2023), "Bid Caps in Noisy Contests", American Economic Journal: Microeconomics, 15 (3), 426–73.

Fullbrook, M. (2019) A Concise History of Germany (Cambridge: Cambridge University Press).

Galor O. and Moav O. (2004), "From Physical to Human Capital Accumulation: Inequality and the Process of Development", Review of Economic Studies, 71, 1001–1026.

Galor O., Moav O., and Vollrath D. (2009), "Inequality in Landownership, the Emergence of Human-Capital Promoting policy, and the Great Divergence", Review of Economic Studies, 76, 143–179.

Galor, O. and Weil, D. (2000), "Population, Technology, and Growth: From the Malthusian Regime to the Demographic Transition and Beyond", American Economic Review, 90, 806–828.

Gordon, A. (1992) Labor and Imperial Democracy in Prewar Japan (Los Angeles: University of California Press)

Headrick D. (1981) The Tools of Empire: Technology and European Imperialism in the Nineteenth Century (New York and Oxford: Oxford University Press).

Jansen, M. (Ed.) (1989) The Cambridge History of Japan (Cambridge History of Japan) (Cambridge: Cambridge University Press).

Lizzeri A. and Persico N. (2004), "Why Did the Elites Extend the Suffrage? Democracy and the Scope of Government, with an Application to Britain's "Age of Reform", The Quarterly Journal of Economics, 119 (2), 707–765.

Marx, K., Engels, F., and Toews J. (2018) The Communist Manifesto: With Related Documents (Boston: Bedford/St. Martin's).

Price, R. (2001) The French Second Empire: An Anatomy of Political Power (New Studies in European History) (Cambridge: Cambridge University Press).

Robinson J. and Torvik R. (2005), "White Elephants", The Journal of Public Economics, 89, 197–210.

Robinson J. and Verdier T. (2013), "The Political Economy of Clientelism", The Scandinavian Journal of Economics, 115(2), 260-291.

Shchukin V. and Arbatli E. (2022), "Clientelism and development: Vote-buying meets patronage", Journal of Theoretical Politics, 34(1), 3–34.

Abstrakt

V tomto článku navrhuji teorii, která vysvětluje, proč elita vlastníků půdy ve druhé polovině 19. století podporovala industrializaci. Tvrdím, že tato elita strategicky využívala veřejné investice (např. výstavbu železnic) k podkopání podpory revoluce ze strany kapitalistů a tím ke stabilizaci stávajícího politického režimu. Konkrétně zvýšené veřejné investice zvýšily produktivitu průmyslového sektoru, čímž se zvýšily kapitálové příjmy a bohatství kapitalistů. Vyšší bohatství kapitalistů se promítlo do zvýšených potenciálních ztrát z přerozdělovacích politik, pokud by se politická moc přesunula k dělnické třídě, která by uvalila vyšší daně. Pokud existuje pozitivní pravděpodobnost, že se dělnická třída ujme moci, potenciálně vyšší míra veřejných investic, které uvalí, bude vždy znamenat, že kapitalisté budou dávat přednost zachování politického režimu vlastníků půdy.

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