The Political Economy of Industrialization

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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 strategically used public investment (e.g. railroad construction) 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. This greater wealth translated into heightened potential losses from redistributive policies if political power shifted to the working class, which imposes higher taxes. I show that if there is a positive probability that the working class takes power, the landowning elite can induce the capitalist to support its political regime by imposing a higher level of public investment. In addition, my theoretical framework reveals how the landowning elite could guarantee future pro-industrial economic policy without sharing political power.

Keywords

Industrialization, political commitment, democratization.

JEL Classification : D72; D74; O14

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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). During this transition, government policies that promoted, among other things, 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). Conversely, there are many historical examples showing that the 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 fivefold between 1860 and 1913 (Bairoch, 1982). In general, considering data for the second half of the nineteenth century, industrialization developed in all the great-power countries, despite continuing rule by the landowning elite in many cases (see Table 1).

Table 1. Per-capita levels of industrialization (United Kingdom in 1900 = 100).

	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

Source: (Bairoch, 1982).

Why did the landowning elite industrialize economies in the nineteenth century, despite potential risks of losing political power? 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. I show that pro-industrial public investment makes political change for the capitalist less favorable than the status quo regime (the landowner's regime) because of uncertain outcome of the political change.

To contextualize my argument clearly it is necessary to understand the historical background of industrialization in the second half of the 19th century. The revolutions of 1848 showed European capitalists the costs of political upheaval. Recalling those events, the French industrialist Pouyer-Quertier

declared, "I want as much liberty as possible but I detest disorder and am the enemy of revolution" (quoted in Price, 2001, p. 299). Beyond the immediate risk of damage to capital, capitalists faced the prospect of redistribution under a new regime. The Communist Manifesto, published in 1848, expressed the radical ambitions of the emerging workers' movement: "The proletarians have nothing to lose but their chains. They have a world to win" (Marx and Engels, 2018, p. 95).

In this paper, I develop a political economy model with three possible political regimes: the landowner's regime, the capitalist's regime, and the worker's regime (Section 2). The landowner initially holds political power, while the capitalist can attempt to overthrow him. Such an attempt entails the risk that the worker gains power and nationalizes capital. The landowner makes irreversible public investments that increase capital income, thereby raising the capitalist's potential losses under the worker's regime. When public investment is sufficiently high, this risk induces the capitalist to support the landowner, allowing the latter to retain political power. However, public investment reduces the landowner's income, creating a trade-off between income and political power.

As an extension of the baseline model (Section 4), I consider an environment in which, in addition to redistribution, the capitalist derives utility from a policy dimension that can take one of two forms: the status quo or a pro-industrial policy (e.g., the abolition of internal trade barriers, free labor mobility, or patent protection). In equilibrium, the landowner always maintains the status quo, whereas the capitalist prefers the pro-industrial policy. I show that this extension admits two types of equilibria: one in which the capitalist supports the landowner, as in the baseline model, and another in which the capitalist attempts to overthrow him. The latter arises when the benefits of the pro-industrial policy to the capitalist are sufficiently large.

Extending the model further (Section 6), I show that when the landowner has a stake in industrialization (e.g., through capital ownership), public investment can serve as a commitment device to adopting a pro-industrial policy when the landowner retains political power. Finally, I demonstrate that, as in the baseline model, sufficiently high public investment enables the landowner to secure the capitalist's support and thereby retain political power.

This paper contributes to several strands of literature. First, I contribute to the political economy of development, in particular to the literature on industrialization. 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 the promotion of industrialization allowed the elite to strengthen its political position. Specifically, in my model, a sufficiently large public investment persuades capitalists to support the political power of the landowner. I also contribute to the political economy of development literature

that considers the role 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 votes for some benefit (Robinson and Verdier, 2013; Shchukin and Arbatli, 2022). Conversely, there are cases in which politicians use large public investments to influence 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 (the landowner) invests heavily to persuade an opposing group (the capitalist) not to challenge the elite's (the landowner's) political power.

Second, this paper contributes to the literature on democratization in nineteenth-century Europe. Acemoglu and Robinson (2000) argue that the democratization process was a strategic decision by the political elite to prevent revolution and social unrest. In their framework, democratization is a credible device for providing citizens with desirable income redistribution in the future. In my model, I consider a social conflict between the landowner and the capitalist over a multidimensional policy that includes redistribution and economic policy. I show that a sufficiently large public investment makes regime change unfavorable for the capitalist and induces them to support the landowner's political regime.

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

The paper is organized as follows. Section 2 introduces the basic model, while Section 3 characterizes its equilibrium and presents the comparative statics results. Section 4 extends the model by introducing a policy dimension beyond redistribution, and Section 5 characterizes the equilibrium of this extended model. Section 6 considers an extension in which the landowner has a stake in industrialization, while Section 7 characterizes the corresponding equilibrium and presents the comparative statics results. Section 8 provides historical evidence, and Section 9 concludes.

2 Basic model

2.1 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.

2.2 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.

2.3 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 $\lim_{I \to +\infty} r(I) = +\infty$. The landowner's private income is a land income $\rho(I)$. $\rho(I)$ is a continuously differentiable function with properties: $\rho'(I) < 0$ and $\lim_{I \to +\infty} \rho(I) = 0$.

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

[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.

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

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:

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

The capitalist solves the optimization problem:

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

3 Equilibrium (basic model)

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 (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, $\mathcal{R} \in \{\mathcal{W}, \mathcal{L}, C\}$.

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

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

[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.

3.1 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:

$\mathbb{E}[(1-\tau)\cdot M^C + m^C] = r(I) + \pi\cdot\Delta^C$, 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 $\Delta^C(0) > 0$ (By Assumption 1), $\lim_{I\to+\infty} \Delta^C(I) = -\infty$, and $\Delta^C(I)$ is a continuous function, by the Intermediate Value Theorem, there exists $\tilde{I} > 0$ such that $\Delta^C(\tilde{I}) = 0$. 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 $\Delta^C(\tilde{I}) = 0$.

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

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.

3.2 Landowner's choice

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

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

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:

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

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:

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

where

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

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

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

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

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.

4 Two-dimensional industrialization

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.

4.1 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: $\lim_{I\to+\infty} r(I,p) = +\infty$, $r'_p(I,p) > 0$, $r'_I(I,p) > 0$, 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: $\lim_{I\to+\infty} \rho(I,p) = 0$, $\rho'_p(I,p) < 0$, $\rho'_I(I,p) < 0$, 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,

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

[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.

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:

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

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

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:

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

The capitalist solves the following optimization problem:

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

5 Equilibrium (Two-dimensional industrialization)

5.1 Stage 3 of the game

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 (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:

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

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

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

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

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

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

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 $u^C(\mathcal{L}) = r(I,\underline{p})$.

5.2 Stage 2 of the game

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

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

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 $m^C(C) = m$ I obtain:

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

Rearranging, I obtain:

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

5.3 Stage 1 of the game

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

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

I work with the objective function:

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

Thus, the optimization problem can be rewritten as:

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

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:

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

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:

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

where

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

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

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

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

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

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)

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

or

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

or

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

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.

6 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.

[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.

7 Equilibrium (Landowner with two assets)

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

7.1 Stage 3 of the game

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.

□

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 $u^C(\mathcal{L}) = r(I, p(\mathcal{L}))$.

7.2 Stage 2 of the game

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

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.

7.3 Stage 1 of the game

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

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

I work with the objective function:

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

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:

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

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

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

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

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

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: $\underset{0\leq I<\hat{I}}{arg\,max}\ U_1^L=0$.

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

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

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

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

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

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 $\max_{\tilde{I} \leq I} \; U_3^L$ 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 $\arg\max_{\tilde{I} \leq I} \; U_3^L = I_3^* \in (\tilde{I}, +\infty)$.

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 $\lim_{I \to +\infty} \rho'_I(I, \bar{p}) + R'_I(I, \bar{p}) < 1$, by the Intermediate Value Theorem, I have $\arg\max_{I \geq 0} \; U_3^L = I_3^* \in (\tilde{I}, +\infty)$. 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

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

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

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: $\underset{0\le I<\tilde{I}}{argmax} \quad U_1^L = 0$.

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

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

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: $\underset{\tilde{I}\le I<\hat{I}}{argmax} \quad U_2^L = \tilde{I}$.

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

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

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: $\underset{\hat{I} \leq I}{argmax} \;\; U_3^L = I_3^* \in [\tilde{I}, +\infty)$.

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):

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

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

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.

8 Historical Evidence

A. Prussia / the German Empire

Industrialization in Germany occurred in the political context of the rise of Prussia within the German federation of states and the subsequent creation of the German Empire in 1871. German economic development was closely intertwined with the preservation of the political dominance of the landed aristocracy, the Junkers, and the emergence of a political alliance between agrarian and industrial elites. Historians have frequently described this coalition as the alliance of "Iron and Rye," reflecting the cooperation between heavy industry and the landed aristocracy against the growing socialist movement and demands for democratic reform. A number of historians have emphasized that industrialization in Germany did not initially emerge from a conflict between feudal elites and the bourgeoisie, but rather from cooperation between them (see literature review in (Brophy, 1998)). In his study of railway construction in Prussia before 1848, Dietrich Eichholtz argues that the expected class antagonism between the nobility and capitalist entrepreneurs "did not develop to the point of clearing away the remnants of feudal society." Using the railroad industry as an example, he shows how the bourgeoisie established an "unholy alliance" with the Junkers and relied on the Prussian absolutist state to facilitate industrialization through subsidies, loans, stock subscriptions, and legal decrees accelerating land appropriation. According to Eichholtz, "from the beginning the Prussian way was a compromise between the bourgeoisie and the old ruling classes by which both Junker and capitalist profited." The Revolution of 1848 played a decisive role in strengthening this alliance. Faced with the simultaneous threat of democratic revolution from below and political instability, many representatives of the German bourgeoisie sided with the monarchy and landed elites rather than with democratic or socialist forces. Historians have described this development as the beginning of a conservative and anti-democratic political tradition within the German bourgeoisie. During the revolutionary crisis, liberal businessmen and industrialists increasingly entered into a "junior partnership" with the aristocratic elites in exchange for political stability and protection of property rights. This political realignment was accompanied by the rapid expansion of industrial capitalism in the second half of the nineteenth century. German industrialization was strongly supported by the state through railway construction, military contracts, tariff protection, and industrial policy. At the same time, the Junkers preserved substantial political influence within the institutions of the Empire, especially through the Prussian state apparatus, the Bundesrat, and the conservative domination of the officer corps and bureaucracy. As a result, industrialization did not undermine the old agrarian elites but instead reinforced a coalition between traditional landowners and modern industrial capitalists. The emergence of mass socialist politics further strengthened the

alliance between agrarian and industrial elites. The rapid growth of the Social Democratic Party (SPD), the expansion of the industrial working class, and fears of socialist revolution encouraged conservative landowners and industrialists to cooperate politically despite earlier conflicts of interest. Historians have argued that the alliance of "Iron and Rye" was fundamentally shaped by a common opposition to socialism and labor radicalism. Protectionist tariffs introduced under Bismarck after 1879 reflected this compromise between heavy industry and agriculture and provided economic benefits to both industrial and agrarian elites. The political consolidation of this coalition became especially visible in the late nineteenth century. Historians describe the emergence of Sammlungspolitik as an attempt to create a broad conservative alliance uniting heavy industry, agrarian interests, and nationalist political forces behind the imperial state. The objective of this strategy was to provide the government with a stable parliamentary base while isolating the socialist movement and preventing democratic reforms that could weaken elite dominance. In this sense, industrialization in Imperial Germany occurred not through the political displacement of traditional elites, but through their incorporation into a broader authoritarian coalition with industrial capital.

B. The Second French Empire

The Second French Empire is often portrayed as a regime that combined rapid industrial modernization with authoritarian political control. Historians have emphasized that the regime of Napoleon III relied on an alliance between traditional elites and emerging capitalist groups, while simultaneously seeking to neutralize the growing socialist and working-class threat that had become especially visible during the Revolution of 1848. As Roger Price notes, the memory of the revolutionary upheavals of 1848 deeply shaped the political orientation of the regime and the fear of socialism and social disorder remained one of the essential foundations of Bonapartist support (Price, 2001).

The socialist threat played a central role in bringing together landowners, conservative elites, and industrial and financial bourgeoisie behind the imperial regime. Plessis argues that many propertied groups regarded the Empire primarily as a guarantee of social order after the revolutionary crises of the mid-nineteenth century. The Revolution of 1848 and the June Days uprising convinced many elites that democratization could lead to socialist mobilization and attacks on property rights (Plessis, 1985). The imperial state therefore attempted to construct a broad conservative coalition. Large landowners, financiers, railway entrepreneurs, and industrialists benefited from economic modernization promoted by Napoleon III. The regime encouraged railway construction, banking expansion, urban reconstruction, and industrial growth, creating substantial opportunities for private capital. At the same time, economic

modernization was accompanied by political repression directed against republicans, socialists, and radical workers' organizations. Price notes that the Empire rested upon a coalition of notables, businessmen and administrative elites united by their commitment to order and hostility toward revolutionary politics. Industrial and financial elites increasingly viewed the authoritarian state as a protector of both economic development and social stability. The regime's repression of labor activism was therefore welcomed by many employers. As Price observes, economic elites feared "the red spectre" and associated organized labor movements with revolutionary instability. This concern became particularly acute in periods of economic crisis and urban unrest, when the possibility of renewed revolutionary mobilization appeared realistic. The relationship between the state and capitalist groups was reinforced through direct cooperation in major economic projects. Under Napoleon III, the state actively promoted infrastructure and financial modernization while relying heavily on private investors and business networks. Plessis emphasizes that the Empire created favorable conditions for the rise of banking and railway interests, which became closely connected to the political order established after the coup of 1851. Economic modernization thus strengthened the mutual dependence between authoritarian political institutions and capitalist development. At the same time, traditional landowning elites remained influential within the imperial coalition. Rather than being displaced by industrial capitalism, many conservative rural elites supported modernization so long as it did not threaten the existing political hierarchy. In this sense, the Second Empire represented not a conflict between aristocratic and capitalist interests, but a compromise between them against a common socialist threat. As Price remarks, support for the regime was often rooted less in ideological Bonapartism than in the shared desire to preserve social order and defend property. The weakening of the Empire in the late 1860s coincided with the growing politicization of the urban working class and the expansion of organized opposition movements. Liberalization reforms unintentionally opened greater political space for republican and socialist activism, undermining the authoritarian equilibrium on which the coalition had depended. Nevertheless, throughout much of its existence, the Second Empire successfully maintained cooperation between landowners and capitalist elites by combining economic modernization with political repression and by presenting itself as the principal barrier against socialism and revolution.

C. Russian Empire

Imperial Russia provides an important example of how industrialization can coexist with authoritarian political structures through an alliance between the ruling aristocracy and emerging capitalist groups. This alliance was shaped by two central forces: the state's provision of industrialization and the shared

perception of a growing socialist threat. As Martin Malia emphasizes, "no nation in history ever prepared its revolution longer or more self-consciously than Russia," underscoring the extent to which the possibility of revolution was embedded in elite thinking (see (Malia, 1961), p. 1). This persistent awareness influenced the strategic behavior of both the Tsarist state and economic actors. Industrialization was not simply an economic project, but a politically motivated response to the perceived need to stabilize the regime in the face of mounting social tensions. The development of capitalism in Russia occurred under conditions of strong state involvement. As Thomas C. Owen notes in his analysis of Russian enterprise, economic activity was deeply embedded in political structures, with entrepreneurs often relying on state support and protection. This dependence reduced incentives for political confrontation and fostered alignment with aristocratic interests. The social structure of Imperial Russia further reinforced this alignment. According to Boris Mironov, Russian society remained highly hierarchical, with weak forms of civic organization and limited capacity for collective action outside state structures. In such an environment, the bourgeoisie did not emerge as a unified political force capable of challenging the regime. Instead, economic modernization proceeded "from above," under the supervision of the state, which preserved the dominance of the aristocracy while incorporating capitalist development into its political framework (Mironov, 2000). At the same time, industrialization generated new social dynamics that intensified elite fears. The growth of the urban working class and the spread of socialist ideas created what contemporaries increasingly perceived as a revolutionary threat. As emphasized in studies of late imperial Russia by V. S. Diakin, the political system of the early twentieth century was characterized by "the disintegration of the existing order" and rising tensions between social groups (Diakin, 1988). Similarly, Avrekh highlights the fragility of the so-called June Third system, which attempted to stabilize the regime while containing political opposition. These developments created a convergence of interests between aristocrats and capitalists. For the former, industrialization was a means of strengthening the state and preventing external and internal threats. For the latter, cooperation with the regime provided access to resources, protection, and opportunities for profit, while also safeguarding them from the risks associated with social revolution (Avrekh, 1966). As Owen suggests, the Russian bourgeoisie was not a revolutionary class but rather one that adapted to existing political constraints, integrating itself into the structures of state power. Thus, the alliance between the Tsarist regime and capitalist groups can be understood as a rational response to both economic and political conditions. Industrialization, far from undermining the authoritarian system, became one of its key instruments. At the same time, the shared fear of socialism—long anticipated in Russian intellectual and political discourse—provided a powerful incentive for cooperation. In this sense, the Russian case supports the broader argument that external and internal threats can induce elites to promote economic development while maintaining political

control. The history of Imperial Russia therefore illustrates how an authoritarian regime can successfully mobilize capitalist development while preserving its political dominance, at least in the short to medium run. The alliance between aristocracy and capitalists, grounded in state-led industrialization and reinforced by the threat of revolution, was a central feature of this trajectory.

9 Conclusion

Industrialization was essential for the transition from Malthusian stagnation to a modern growth regime (Galor and Weil, 2000). However, the landowning elite initially restrained industrial development to maintain political stability and high land rents (Acemoglu and Robinson, 2012). 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 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.

In an extension of the baseline model, I introduce an additional policy dimension alongside redistribution. This policy can either preserve the status quo or promote industrialization—for example, by abolishing internal trade barriers, allowing the free mobility of labor, or protecting patent rights—and directly affects the capitalist's utility. When public investment and pro-industrial policy are complementary (to some extent), I show that public investment can commit the landowner to adopting a pro-industrial policy, provided that the landowner has a stake in industrialization, such as capital ownership. As in the baseline model, a sufficiently high level of public investment allows the landowner to secure the capitalist's support and thereby retain political power.

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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 $\lim_{I\to+\infty} \Delta^C(I) = -\infty$.

Because $\Delta^C(0) > 0$ (By Assumption 3), $\lim_{I\to+\infty} \Delta^C(I) = -\infty$, and $\Delta^C(I)$ is a continuous function, by the Intermediate Value Theorem, there exists $\tilde{I} > 0$ such that $\Delta^C(\tilde{I}) = 0$. 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 $\Delta^C(\tilde{I}) = 0$.

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

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 $\lim_{I\to+\infty} \frac{X(I)}{Z(I)} = +\infty$.

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

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 $\lim_{I\to+\infty} X(I) \geq X(0) = \lim_{I\to+\infty} X(0)$.

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

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

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 $\lim_{I\to+\infty} \frac{X(I)}{Z(I)} > 1$. 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 $\Delta^C(I) = ((1-q)\cdot\bar{p} - p(\mathcal{L}))\cdot f(I) + (1-q)\cdot m$.

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

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

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

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

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

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

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

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

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

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

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

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 $\Delta^C(\hat{I}) > 0$, $\lim_{I\to+\infty} \Delta^C(I) = -\infty$, and $\Delta^C(I)$ is a continuous function on $I \in [\hat{I}, +\infty)$, by the Intermediate Value Theorem, there exists $\tilde{I} > \hat{I}$ such that $\Delta^C(\tilde{I}) = 0$. 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 $U_2^L(I_2^*) = \sup_{\hat{I}\leq I<\tilde{I}} U_2^L$.

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:

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

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

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:

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

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

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:

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

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

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

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:

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

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

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

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.

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

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

[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.

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:

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

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

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

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.