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ECONOMIC BACKWARDNESS IN POLITICAL PERSPECTIVE

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ABSTRACT

Economic Backwardness in Political Perspective*

We construct a simple model where political elites may block technological and institutional development, because of a 'political replacement effect'. Innovations often erode elites' incumbency advantage, increasing the likelihood that they will be replaced. Fearing replacement, political elites are unwilling to initiate change, and may even block economic development. We show that elites are unlikely to block development when there is a high degree of political competition, or when they are highly entrenched. It is only when political competition is limited and also their power is threatened that elites will block development. We also show that such blocking is more likely to arise when political stakes are higher and that external threats may reduce the incentives to block. We argue that this model provides an interpretation for why Britain, Germany and the US industrialized during the nineteenth century, while the landed aristocracy in Russia and Austria-Hungary blocked development.

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I. Introduction

Government policies and institutions shape economic incentives, and via this channel, have a first-order impact on economic development. Why, then, do many societies adopt policies that discourage investment and maintain institutions that cause economic backwardness? Perhaps, politically powerful groups (elites) are not in favor of economic growth. But why? It would appear that economic growth would provide more resources for these groups to take over or tax, increasing their economic returns. So why don't powerful groups always support economic development?

In this paper, we develop a theory of inefficient government policies and institutions. All else equal, politically powerful groups would welcome superior institutions and technologies. But in practice all else is not equal, because superior institutions and technologies may reduce their political power, and make it more likely that they will be replaced. At the center of our theory is therefore the idea of *"a political replacement effect"*: changes in institutions or the introduction of new technologies often create turbulence, eroding the advantage of political incumbents. This makes politically powerful groups fear losing power and oppose economic and political change, even when such change will benefit society as a whole.

To understand the mechanism at work and its potential applications, consider a concrete example: industrialization in the nineteenth century. Bairoch (1982) estimates that between 1830 and 1913, world manufacturing output increased by a factor of 5 (see Table 1 Panel A). Nevertheless, this process was highly uneven across regions and countries. He also calculates that over the same period manufacturing output in developed countries (Europe and North America) increased by a factor of over 10, while it declined in the Third World. Among developed countries, there were also marked differences: while Britain and the U.S. adopted new technologies and industrialized rapidly, Russia, Austria-Hungary and Spain lagged behind. Why did these countries fail to adopt new technologies that would have increased their incomes?

These differences in performance motivated Gerschenkron's famous essay, *Economic Backwardness in Historical Perspective* (1962), which focused on how relatively backward economies lacking the economic prerequisites for industrialization could compensate in different ways, and assumed that there was no variation in the desire to industrialize. However, in later work Gerschenkron recognized that the desire to promote the institutions necessary for industrialization varied considerably across countries. Indeed, in the countries that lagged the most, rather than actively promoting industrialization, political elites opposed it. Gerschenkron argued that in the case of Austria-Hungary, the state not only failed to promote industrialization, but rather

> "economic progress began to be viewed with great suspicion and the railroads came to be regarded, not as welcome carriers of goods and persons, but as carriers of the dreaded revolution. Then the State clearly became an obstacle to the economic development of the country." (1970, p. 89).

So the problem of understanding why industrialization was rapid in some countries, while in others it did not get off the ground, is closely related to understanding why in some countries the state encouraged industrialization, while in others it did not. More explicitly: why did the state and the political elites in some societies not only fail to encourage industrialization but even go as far as blocking the introduction of new technologies, as well as of economic institutions necessary for industrialization, such as the production of well-functioning factor markets, property rights, and legal systems?[1]

Our answer emphasizes the *political replacement effect*:[2] political elites will block beneficial economic and institutional change when they are afraid that these changes will destabilize the existing system and make it more likely for them to lose political power and future rents. In the context of industrialization, the monarchy and landowning interests, opposed industrialization and the necessary institutional changes, precisely because these changes were likely to erode their political power. In fact, in most cases, the rise of markets and industrialization have been associated with a shift of political power away from traditional rulers and landowners towards industrial and commercial interests, and ultimately to popular interests and the masses. For example, in Russia the Tzar and political elites were initially strongly opposed to industrialization, or even to the introduction of railways. When industrialization in Russia finally got underway after the Crimean War, it brought social turbulence in urban centers, and political and social change, culminating

[1] Acemoglu, Johnson and Robinson (2001) present evidence that only countries with good institutions were able to benefit from the opportunity to industrialize during the nineteenth century.

[2] The intuition is similar to the well-known "replacement effect" in industrial organization, emphasized by Arrow (1962), whereby incumbent monopolists are less willing to innovate than entrants because they would be partially replacing their own rents. Here too, incumbents are less willing to innovate because they would be destroying part of their incumbency advantage and political rents. This motivates the use of the term "political replacement effect".

in the 1905 Revolution. This is the idea underlying our political replacement effect. Even though the political elites in Russia may have preferred industrialization if they could be sure of maintaining power and taxing the proceeds, in practice they did oppose it because they were afraid of losing their political power.

The presence of the political replacement effect implies that a Coase Theorem type of logic, maintaining that investments that increase the size of the social pie will always be carried out, does not apply. There is no (credible) way of compensating ex post the political elites who lose their power. So when they have power, these elites may want to prevent technological and institutional change, even though such change would increase the size of the social pie.

In addition to proposing a mechanism for why countries may fail to adopt superior technologies and institutions, our framework also gives a number of comparative static results that are useful in interpreting the historical evidence. We show that both political elites that are subject to competition and those that are highly entrenched are likely to adopt new technologies. With intense political competition, elites prefer to innovate, because otherwise they are likely to be replaced. With a high degree of entrenchment, incumbents are willing to innovate, because they are not afraid of losing political power. It is elites that are entrenched but still fear replacement that will block innovation. This non-monotonicity provides an interesting interpretation of the cross-country differences in industrialization. New technologies were rapidly adopted in the U.S. where there was a high degree of political competition, and in Britain and subsequently Germany where the political elites—the landed aristocracy— were sufficiently entrenched. In contrast, in Russia and Austria-Hungary, where the monarchy and the aristocracy controlled the political system, but feared replacement, they were firmly against industrialization. Instead, they continued to rely on the existing system of production, including the feudal relations between lords and serfs.

We will also show that economic change is more likely to be blocked when there are greater rents to political elites from staying in power. This suggests another factor contributing to stagnation in Russia and Austria-Hungary may have been the substantial rents obtained by the landed aristocracy from the more feudal labor relations in the agricultural sector of these countries. Rents were also influenced by the political institutions. At the dawn of the nineteenth century both Russia and Austria-Hungary were ruled by absolute monarchies who were unconstrained by representative political institutions. In the U.S. and Britain political institutions were very different. The U.S. constitution with its separation of powers, checks and balances, and distribution of authority between state and federal levels of government several restricted political rents. In Britain the absolute monarchy had been to a large extent emasculated by the Glorious Revolution of 1688 and had lost many prerogatives. Therefore, an important determinant of attitudes towards change will be the pre-existing political institutions: when these institutions limit political rents, elites will be more favorable towards change.[3]

The reasoning on the role of rents also suggests that differences in the level of human capital may be important in shaping the elites' attitudes towards industrialization; since human capital is complementary to industrial activity, a high level of human capital makes future gains from industrialization larger relative the rents from preserving the existing system, thus discouraging blocking by the elites.[4]

Finally, we show that external threats often make incumbents more pro-innovation, since falling behind technologically makes counties vulnerable to foreign invasion. This insight may explain why the Russian defeat in the Crimean war or the American blockade of Japan changed political elites' attitudes towards industrialization and modernization.

There is now a large literature on the political economy of growth. One strand, for example, Alesina and Rodrik (1994) and Persson and Tabellini (1994), emphasizes that high taxation reduces the incentives to invest. Another strand, for instance Lancaster (1973), Bardhan (1984), Tornell and Velasco (1992), Benhabib and Rustichini (1996), and Alesina and Perotti (1996), argues that non-cooperative distributional conflict discourages investment and growth.[5] Another strand, for example Olson (1996), argues that

[3] Hence, in some sense, our analysis attempts to explain why some countries developed Gerschenkron's (1962) economic prerequisites for industrialization, while others did not. In doing so, it emphasizes the importance of "institutional prerequisites," which encouraged economic and institutional change by reducing the rents that political elites would obtain by blocking change.

[4] Human capital differences could also matter through nonpolitical channels. More generally, although there are a variety of nonpolitical reasons for the differences in industrialization, our reading of the evidence, discussed in detail in Section VI, suggests that political factors were essential. This view supported by the notion that Russia and Austria-Hungary industrialized rapidly once the political barriers were removed or weakened, for example, following the Crimean war in Russia and the 1848 Revolution in Austria-Hungary.

[5] Both of these approaches could be adapted to generate predictions about technology adoption and institutional change. For example, failure to adopt institutions encouraging investment and new technologies in Russia or Austria-Hungary could be linked to higher inequality in these countries, leading to higher rates of taxation or political instability. Nevertheless, the comparative statics derived in this literature do not do a good job of capturing the essential elements of the nineteenth-century industrialization experience. First, income and capital tax rates were low in all countries and probably higher in Britain than Russia where the state had little fiscal base. Second, while Britain and the United States were

coordinated instititional changes are needed to promote development and this poses a collective action problem. However, our reading of the evidence suggests that when political elites wanted to promote institutonal change, such as in Russia after the defeat in the Crimean war and in Japan under the threat of Western domination, they could do so very effectively.

More related is the literature on interest group politics. This literature suggests that existing powerful interest groups may block the introduction of new technologies in order to protect their economic rents, and societies are able to make technological advances only if they can defeat such groups. In the context of development economics, this idea was first discussed by Kuznets (1968), developed at length by Olson (1982) and Mokyr (1990), and formalized by Krusell and Rios-Rull (1996) and Parente and Prescott (2000). Although the idea that monopolists, or other interest groups, may block technical change at first appears similar to the thesis in this paper, it is fundamentally different. We argue that what is important is not economic rents that will be destroyed by the introduction of new technologies, but the political power of the elites. After all, if the groups that have the political power to block change were to maintain their political power after the change is implemented, why wouldn't they be able to use the same power to redistribute some of the gains to themselves? This reasoning suggests that whether certain groups will lose economically or not is not as essential to their attitudes towards change as *whether their political power will be eroded*. This view is consistent with the fact that British landed aristocracy, which maintained its political power, supported industrialization despite its adverse effects on land values (see Section VI).

Finally, this paper relates to our previous research emphasizing the importance of political factors in economic development, e.g. Acemoglu and Robinson (2000a,b) and Robinson (1997). In particular, in Acemoglu and Robinson (2000a), we suggested the idea that the greater impediment to economic development was not groups whose economic interests were adversely affected by economic change, but those whose political power were threatened. This paper formalizes that idea and analyzes the interaction between political competition and the desire of political elites' to block innovation.[6]

probably the most stable countries politically, Germany experienced the 1848 revolutions as intensely as Austria-Hungary did.

[6] Chaudhry and Garner (2001a) incorporate the idea suggested in Acemoglu and Robinson (2000a) into a growth model. Bourguignion and Verdier (2000) is another related paper, since they analyze how political elite may want to prevent the masses from obtaining education, because educated individuals are more likely to vote. A more recent paper by Garner and Chaudhry (2001b) analyzes in detail a model of

It is also interesting to note in this context that our proposed theory reverses the standard view in Marxist social science and much of economics that economic forces (the substructure) shape political processes (the superstructure). While emphasizing the economic interests influencing political decisions, our theory is about political forces—concerns about political power—determining whether superior institutions and technologies will be adopted, and therefore whether beneficial economic change will take place.

The paper is organized as follows. Section II outlines our basic model and characterizes the optimal technology/institutions adoption decision. Section III looks at the decentralized equilibrium, and shows why political elites may not want to introduce superior technologies or institutions. It also establishes the non-monotonicity result that it will be elites that are partially entrenched, and fear replacement, that are more likely to resist change. In Section IV, we extend the model to include additional sources of rents for political elites as well as human capital differences. We show that when the political stakes are higher, new innovations are less likely to be adopted, while greater human capital makes innovation more likely. Section V shows how external threats might induce more positive attitudes towards economic change among political elites. In Section VI, we interpret the historical experience of European and Japanese industrialization through the lenses of our model, and discuss why attitudes towards innovation in hierarchical societies may have been adverse.

II. The Basic Model

We now discuss a simple model to illustrate the political mechanism preventing the introduction of superior technologies and institutions.

A. The Environment

Consider an infinite horizon economy in discrete time consisting of a group of citizens, with mass normalized to 1, an incumbent ruler, and an infinite stream of potential new rulers. All agents are infinitely lived, maximize the net present discounted value of their

political competition between countries, and shows how political competition can foster growth, and also how institutional reform in one country, which leads to innovation there, may create positive spillovers on a neighboring country that will feel threatened (see also Robinson, 1997, on this). Finally, a recent paper by Aghion, Alesina and Trebbi (2001) analyzes how the extent of entrenchment of politicians affects their willingness to undertake political reform.

income and discount the future with discount factor, β. While citizens are infinitely lived, an incumbent ruler may be replaced by a new ruler, and from then on receives no utility.

There is only one good in this economy, and each agent produces:

$$y_t = A_t,$$

where A_t is the state of "technology" available to the citizens at time t. A_t should be thought of as technology broadly construed, so that it also captures the nature of economic institutions critical to production. For example, a change in the enforcement of property rights such as the creation of new legal institutions, or the removal of regulations that prevent productive activities, or any kind of political and economic *reform* that encourages investment would correspond to an increase in A_t. In light of this, we will use the terms "innovate" and "adopt the new technology and "institutional change" interchangeably.

When a new technology is introduced or there is beneficial institutional change, A increases to αA, where $\alpha > 1$. The cost of adopting the new technology or initiating institutional change is normalized to 0. In addition, if there is political change and the incumbent ruler is replaced, this also affects the output potential of the economy as captured by A. In particular, when the incumbent does not adopt a new technology, the "cost of political change"—that is, the cost of replacing the incumbent—is zA, while this cost is $z'A$ when he introduces the new technology. Notice that this "cost" can be negative; it may be less costly to replace the incumbent ruler than keeping him in place, for example because he is "incompetent".

Therefore, more formally:

$$A_t = A_{t-1}\left((1-p_t)(1+(\alpha-1)x_t)) + p_t(1+(\alpha-1)\widehat{x}_t - x_t z' - (1-x_t)\, z)\right), \qquad (1)$$

where $x_t = 1$ or 0 denotes whether the new technology is introduced ($x_t = 1$) or not ($x_t = 0$) at time t by the incumbent ruler, while $\widehat{x}_t = 1$ or 0 refers to the innovation decision of a new ruler. Also, $p_t = 1$ denotes that the incumbent is replaced, while $p_t = 0$ applies when the incumbent is kept in place.[7]

When $x_t = 0$, the cost of replacing the ruler is z, and when $x_t = 1$, it is z'. This allows us to model the notion that costs of political change depend on whether the new

[7] Notice that if the incumbent is replaced, what matters is the innovation decision of the newcomer. So even when the incumbent has chosen $x_t = 1$, if the newcomer chooses $\widehat{x}_t = 0$, the new technology will not be introduced. This assumption is inconsequential, however, since we will see below that the newcomer will always choose $\widehat{x}_t = 1$.

technology has been adopted. When the new technology is not introduced, the position of the incumbent is relatively secure, and it will be more costly to replace him. When the new technology is adopted, there is political uncertainty and *turbulence*, and part of the advantages of the incumbent are eroded. As a result, the cost of replacing the incumbent may be lower.

More explicitly, we assume that z and z' are random variables, enabling stochastic changes in rulers along the equilibrium path. The distribution function of these two shocks differ: z is drawn from the distribution F^N and z' is drawn from F^I, which is first-order stochastically dominated by F^N, capturing the notion that the introduction of a new technology erodes part of the incumbency advantage of the initial ruler.

To simplify the algebra, we assume that F^I is uniform over $\left[\mu - \frac{1}{2}, \mu + \frac{1}{2}\right]$, while F^N is uniform over $\left[\gamma\mu - \frac{1}{2}, \gamma\mu + \frac{1}{2}\right]$, where $\gamma \geq 1$. In this formulation, μ is an inverse measure of the degree of political competition: when μ is low, incumbents have little advantage, and when μ is high, it is costly to replace the incumbent. Note that μ can be less than $\frac{1}{2}$, and in fact, we will focus much of the discussion on the case in which $\mu < \frac{1}{2}$, so that citizens sometimes replace rulers. The case of $\mu = 0$ is of particular interest, since it implies that there is no incumbency advantage, and z is symmetric around zero.

On the other hand, γ is a measure of how much the incumbency advantage is eroded by the introduction of a new technology: when $\gamma = 1$, the costs of replacing the ruler are identical irrespective of whether a new technology is introduced or not. A new entrant becomes the incumbent ruler in the following period after he takes control, and it will, in turn, be costly to replace him.

Citizens replace the ruler if a new ruler provides them with higher utility. This assumption is made for simplicity, and similar results are obtained if citizens' replacement decision translates into stochastic replacement of rulers (e.g., via revolution, coup, or simple shift of power). We assume that if an incumbent is replaced then whether or not innovation takes place in that period depends on what the new ruler does. Thus if the incumbent innovates but is replaced the new ruler can decide not to innovate and this implies that there is no innovation (though as we shall see along the equilibrium path a new ruler always innovates).

Finally, rulers levy a tax T on citizens. We assume that when the technology is A, citizens have access to a non-taxable informal technology that produces $(1-\tau)A$. This implies that it will never be optimal for rulers to impose a tax greater than τ.

It is useful to spell out the exact timing of events within the period.

1. The period starts with technology at A_t.
2. The incumbent decides whether to adopt the new technology, $x_t = 0$ or 1.
3. The stochastic costs of replacement, z_t or z'_t, are revealed.
4. Citizens decide whether to replace the ruler, p_t.
5. If they replace the ruler, a new ruler comes to power and decides whether to adopt the new technology $\widehat{x}_t = 0$ or 1.
6. The ruler in power decides the tax rate, T_t.

B. Social Planner's Solution

We start by characterizing the technology adoption and replacement decisions that would be taken by an output-maximizing social planner. This can be done by writing the end-of-period Bellman equation for the social planner, $S(A)$. As with all value functions, we use the convention that $S(A)$ refers to the end-of-period value function (after step 6 in the timing of events above). By standard arguments, this value function can be written as:

$$S(A) = A + \tag{2}$$

$$\beta\Big[x^S \int \left[\left(1 - p_I^S(z')\right) S(\alpha A) + p_I^S(z')\left(\widehat{x}^S S((\alpha - z')\, A) + (1 - \widehat{x}^S) S((1 - z')\, A)\right)\right] dF^I +$$

$$(1 - x^S) \int \left[\left(1 - p_N^S(z)\right) S(A) + p_N^S(z)\left(\widehat{x}^S S((\alpha - z)\, A) + (1 - \widehat{x}^S) S((1 - z)\, A)\right)\right] dF^N\Big]$$

where x^S denotes whether the social planner dictates that the incumbent adopts the new technology, while $\widehat{x}^S$ denotes the social planner's decision of whether to adopt the new technology when he replaces the incumbent with a new ruler. $p_I^S(z') \in \{0, 1\}$ denotes whether the planner decides to replace an incumbent who has innovated when the realization of the cost of replacement is z', while $p_N^S(z) \in \{0, 1\}$ is the decision to keep an incumbent who has not innovated as a function of the realization z.

Intuitively, when technology is given by A, the total output of the economy is A, and the continuation value depends on the innovation and the replacement decisions. If $x^S = 1$, the social planner induces the incumbent to adopt the new technology, and the social value when he is not replaced is $S(\alpha A)$. When the planner decides to replace the incumbent, there is a new ruler and the social planner decides if he will adopt the new technology, $\widehat{x}^S$. In this case, conditional on the cost realization, z', the social value is $S((\alpha - z')\,A)$ or $S((1 - z')\,A)$ depending on whether the new technology is adopted. Notice that if $\widehat{x}^S = 1$ and the newcomer innovates, this affects the output potential of the economy immediately, hence the term $(\alpha - z')\,A$. The second line of (2) is explained similarly following a decision by the planner not to innovate. The important point in this case is that the cost of replacement is drawn from the distribution F^N not from F^I.

By standard arguments, $S\,(A)$ is strictly increasing in A. This immediately implies that $S((\alpha - z')\,A) > S((1 - z')\,A)$ since $\alpha > 1$, so the planner will always choose $\widehat{x}^S = 1$. The same reasoning implies that the social planner would like to replace an incumbent who has innovated when $S((\alpha - z')\,A) > S(\alpha A)$, i.e., when $z' < 0$. Similarly, she would like to replace an incumbent who has not innovated when $S((\alpha - z)\,A) > S(A)$, i.e., when $z < \alpha - 1$. Substituting for these decision rules in (2), the decision to innovate or not boils down to a comparison of

$$\text{Value from innovating} = \left(\int_0^{\mu+\frac{1}{2}} S\,(\alpha A)\,dz'\right) + \left(\int_{\mu-\frac{1}{2}}^{0} S\,((\alpha - z')\,A)\,dz'\right)$$

and

$$\text{Value from not innovating} = \left(\int_{\alpha-1}^{\gamma\mu+\frac{1}{2}} S\,(A)\,dz\right) + \left(\int_{\gamma\mu-\frac{1}{2}}^{\alpha-1} S\,((\alpha - z)\,A)\,dz\right)$$

In the Appendix, we show that the first expression is always greater. Therefore, the social planner always innovates. Intuitively, the society receives two benefits from innovating: first, output is higher, and second the expected cost of replacing the incumbent is lower. Both of these benefits imply that the social planner always strictly prefers $x^S = 1$. For future reference, we state:

Proposition 1 The social planner always innovates, that is, $x^S = 1$.

III. Equilibrium

We now characterize the decentralized equilibrium of this game. We will limit attention to pure strategy Markov Perfect Equilibria (MPE) of this repeated game. The strategy of the incumbent in each stage game is simply a technology adoption decision, $x \in [0,1]$, and a tax rate $T \in [0,1]$ when in power, the strategy of a new entrant is also similarly, an action, $\widehat{x} \in \{0,1\}$ and a tax rate $\widehat{T}$. The strategy of the citizens consists of a replacement rule, $p(x,z,z') \in \{0,1\}$, with $p = 1$ corresponding to replacing the incumbent. The action of citizens is conditioned on x, because they move following the technology adoption decision of the incumbent. At this point, they observe z, which is relevant to their payoff, if $x = 0$, and z', if $x = 1$. An MPE of this game consists of a strategy combination $\left\{x, T, \widehat{x}, \widehat{T}, p(x,z,z')\right\}$, such that all these actions are best responses to each other for all values of the state A.

We will characterize the MPEs of this game by writing the appropriate Bellman equations. Let us denote the end-of-period value function of citizens by $V(A)$ (once again this is evaluated after step 6 in the timing of events), with A inclusive of the improvement due to technology adoption and the losses due to turbulence and political change during this period. With a similar reasoning to the social planner's problem we have

$$V(A) = A(1-T) + \tag{3}$$

$$\beta \left[x \int \left[(1 - p_I(z')) V(\alpha A) + p_I(z') \left(\widehat{x} V((\alpha - z') A) + (1 - \widehat{x}) V((1 - z') A) \right) \right] dF^I + \right.$$

$$\left. (1 - x) \int \left[(1 - p_N(z)) V(A) + p_N(z) \left(\widehat{x} V((\alpha - z) A) + (1 - \widehat{x}) V((1 - z) A) \right) \right] dF^N \right]$$

where $p_I(z')$ and $p_N(z)$ denote the decisions of the citizens to replace the incumbent as a function of his innovation decision and the cost realization. Intuitively, the citizens produce A and pay a tax of TA. The next two lines of (3) give the continuation value of the citizens. This depends on whether the incumbent innovates or not, $x = 1$ or $x = 0$, and on the realization of the cost of replacing the incumbent. For example, following $x = 1$, citizens observe z', and decide whether to keep the incumbent. If they do not replace the incumbent, $p_I(z') = 0$, then there is no cost, and the value to the citizens is $V(\alpha A)$. In contrast, if they decide $p_I(z') = 1$, that is, they replace the incumbent, then the value is $V((\alpha - z') A)$ when the newcomer innovates, and $V((1 - z') A)$ when he doesn't. The third line is explained similarly as the expected continuation value following a decision not to innovate by the incumbent.

The end-of-period value function for a ruler (again evaluated after step 6 in the timing of the game, so once he knows that he is in power) can be written as

$$W(A) = TA + \beta \left[x \int (1 - p_I(z'))\, W(\alpha A) dF^I + (1-x) \int (1 - p_N(z))\, W(A) dF^N \right]. \quad (4)$$

The ruler receives tax revenue of TA, and receives a continuation value which depends on his innovation decision x next period. This continuation value also depends on the draw z' or z, indirectly through the replacement decisions of the citizens, $p_I(z')$ and $p_N(z)$.

Standard arguments immediately imply that the value of the ruler is strictly increasing in T and A. Since, by construction, in an MPE the continuation value does not depend on T, the ruler will choose the maximum tax rate $T = \tau$.

Next, consider the innovation decision of a new ruler. Here, the decision boils down to the comparison of $W((1-z)\,A)$ and $W((\alpha - z)\,A)$. Now the strict monotonicity of (4) in A and the fact that $\alpha > 1$ imply that $\widehat{x} = 1$ is a dominant strategy for the entrants.

The citizens' decision of whether or not to replace the incumbent ruler is also simple. Again by standard arguments $V(A)$ is strictly increasing in A. Therefore, citizens will replace the incumbent ruler whenever $V(A) < V(A')$ where A is the output potential under the incumbent ruler and A' is the output potential under the newcomer. Now consider a ruler who has innovated and drawn a cost of replacement z'. If citizens keep him in power, they will receive $V(\alpha A)$. If they replace him, taking into account that the new ruler will innovate, their value is $V((\alpha - z')\,A)$. Then, their best response is:

$$p_I(z') = 0 \text{ if } z' \geq 0 \text{ and } p_I(z') = 1 \text{ if } z' < 0. \quad (5)$$

Next, following a decision not to innovate by the incumbent, citizens compare the value $V(A)$ from keeping the incumbent to the value of replacing the incumbent and having the new technology, $V((\alpha - z)\,A)$. So:[8]

$$p_N(z) = 0 \text{ if } z \geq \alpha - 1 \text{ and } p_N(z) = 0 \text{ if } z < \alpha - 1. \quad (6)$$

Finally, the incumbent will decide whether to innovate by comparing the continuation values. Using the decision rule of the citizens, the return to innovating is $\int_{\mu-\frac{1}{2}}^{\mu+\frac{1}{2}} (1 - p_I(z')) \cdot W(\alpha A) dF^I$, and the value to not innovating is given by the expression $\int_{\gamma\mu-\frac{1}{2}}^{\gamma\mu+\frac{1}{2}} (1 - p_N(z)) \cdot W(A) dF^N$. Now incorporating the decision rules (5) and (6), and

[8] Note that replacement rule of the citizen is identical to the one used by the social planner. This shows that the only source of inefficiency in the model stems from the innovation decision by the incumbent ruler.

exploiting the uniformity of the distribution function F^I, we obtain the value of innovating as

$$\text{Value from innovating} = \left[1 - F^I(0)\right] W(\alpha A) = P\left[\frac{1}{2} + \mu\right] W(\alpha A) \tag{7}$$

where the function P is defined as follows: $P[h] = 0$ if $h < 0$, $P[h] = h$ if $h \in [0,1]$, and $P[h] = 1$ if $h > 1$, making sure that the first term is a probability (i.e., it does not become negative or greater than 1). Similarly, the value to the ruler of not innovating is

$$\text{Value from not innovating} = \left[1 - F^N(\alpha - 1)\right] W(A) = P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right] W(A), \tag{8}$$

which differs from (7) for two reasons: the probability of replacement is different, and the value conditional on no-replacement is lower.

It is straightforward to see that if $P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right] < P\left[\frac{1}{2} + \mu\right]$, so that the probability of replacement is higher after no-innovation than innovation, the ruler will always innovate—by innovating, he is increasing both his chances of staying in power and his returns conditional on staying in power. Therefore, there will only be blocking of technological or institutional change when

$$P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right] > P\left[\frac{1}{2} + \mu\right], \tag{9}$$

i.e., when innovation, by creating "turbulence," increases the probability that the ruler will be replaced. For future reference, note that by the monotonicity and continuity of the function $P[.]$ there exists a $\bar{\gamma}$ such that (9) holds only when $\gamma > \bar{\gamma}$. Therefore, as long as $\gamma \leq \bar{\gamma}$, there will be no blocking of new technologies or institutional change.

To fully characterize the equilibrium, we now conjecture that both value functions are linear, $V(A) = v(x)A$ and $W(A) = w(x)A$. The parameters $v(x)$ and $w(x)$ are conditioned on x, since the exact form of the value function will depend on whether there is innovation or not.[9] Note however that $w(x)$ and $r(x)$ are simply parameters, independent of the state variable, A. It is straightforward to solve for these coefficients (see the Appendix). Here, the condition for the incumbent to innovate, that is, for (7) to be greater than (8), can be written simply as:

$$\begin{aligned} w(x)\,\alpha A P\left[\frac{1}{2} + \mu\right] &\geq w(x)\,A P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right] \\ &\Longleftrightarrow \\ \alpha P\left[\frac{1}{2} + \mu\right] &\geq P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right]. \end{aligned} \tag{10}$$

[9] More generally, one might want to write $v(x, \hat{x})$ and $w(x, \hat{x})$, but we suppress the second argument since in any MPE, we have $\hat{x} = 1$.

When will the incumbent adopt the new technology? First, consider the case $\mu = 0$, where there is no incumbency advantage (i.e., the cost of replacing the incumbent is symmetric around 0). In this case, there is "fierce" competition between the incumbent and the rival. Condition (10) then becomes $\alpha P\left[\frac{1}{2}\right] > P\left[\frac{1}{2} - (\alpha - 1)\right]$, which is always satisfied since $\alpha > 1$. Therefore, when $\mu = 0$, the incumbent will always innovate, i.e., $x = 1$. By continuity, for μ low enough, the incumbent will always innovate. Intuitively, when μ is low, because the rival is as good as the incumbent, citizens are very likely to replace an incumbent who does not innovate. As a result, the incumbent innovates in order to increase his chances of staying in power. The more general implication of this result is that incumbents facing fierce political competition, with little incumbency advantage, are likely to innovate because they realize that if they do not innovate they will be replaced.

Next, consider the polar opposite case where $\mu \geq 1/2$, that is, there is a very high degree of incumbency advantage. In this situation $P\left[\mu + \frac{1}{2}\right] = 1 \geq P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right]$, so there is no advantage from not innovating because the incumbent is highly *entrenched* and cannot lose power. This establishes that highly entrenched incumbents will also adopt the new technology.

The situation is different, however, for intermediate values of μ. Inspection of condition (10) shows that for μ small and γ large, incumbents will prefer not to adopt the new technology. This is because of the *political replacement effect* in the case where $\gamma > \bar{\gamma}$: the introduction of new technology increases the likelihood that the incumbent will be replaced, effectively eroding his future rents.[10] As a result, the incumbent may prefer not to innovate in order to increase the probability that he maintains power. The reasoning is similar to the replacement effect in industrial organization emphasized by Arrow (1962): incumbents are less willing to innovate than entrants since they will be partly replacing their own rents. Here this replacement refers to the rents that the incumbent is destroying by increasing the likelihood that he will be replaced.

To determine the parameter region where blocking happens, note that there can only be blocking when both $P\left[\frac{1}{2} + \mu\right]$ and $P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right]$ are between 0 and 1, hence respectively equal to $\frac{1}{2} + \mu$ and $\frac{1}{2} + \gamma\mu - (\alpha - 1)$. Then from (10), it is immediate that

[10] Notice that this is the opposite of the situation with $\mu = 0$ when the incumbent innovated in order to increase his chances of staying in power.

there will be blocking when

$$\gamma > \alpha + \frac{3}{2}\frac{\alpha - 1}{\mu}. \tag{11}$$

Hence as $\alpha \to 1$, provided that $\gamma > 1$, there will always be blocking. More generally, a lower gain from innovation, i.e., a lower α, makes blocking more likely.

It is also clear that a higher level of γ, i.e., higher erosion of the incumbency advantage, encourages blocking of technological and institutional change. This is intuitive: the only reason why incumbents block change is the fear of replacement. In addition, in (11) a higher μ makes blocking more likely. However, note that, as discussed above, the effect of μ on blocking is non-monotonic. As μ increases further, we reach the point where $P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right] = 1$, and then, further increases in μ make blocking less likely—and eventually when $P\left[\frac{1}{2} + \mu\right] = 1$, there will never be blocking.

Clearly, since the social planner always adopts new technologies, whenever the incumbent ruler decides not to adopt, there is inefficient blocking of beneficial technological and institutional change.

Finally, also note that condition (10) does not depend on A. Therefore, if an incumbent finds it profitable to block change, all future incumbents will also do so. There will still be increases in A, as incumbents are sometimes replaced and newcomers undertake innovations, but there will never be a transition to a political equilibrium with no blocking. This result will be relaxed in the extended model in the next section.

We now summarize the main results of this analysis:

Proposition 2 When μ is sufficiently small or large (political competition very high or very low), the elites will always innovate. For intermediate values of μ, economic change may be blocked.

As emphasized above, elites will block change because of the political replacement effect: in the region where blocking is beneficial for the incumbent ruler, the probability that he will be replaced increases when there is economic change. This implies that the incumbent ruler fails to fully internalize future increases in output, making him oppose change.

Perhaps the most interesting results is the non-monotonic relationship between political institutions, as captured by μ, and economic change. Political competition is often viewed as a guarantee for good political outcomes, and this view has motivated many constitutions to create a level playing field (e.g. Madison, 1788, and the U.S. Constitution). In our model, this corresponds to a low value of μ, ensuring that new technologies will be adopted, because citizens will remove incumbents who do not innovate. On the other hand, our mechanism also emphasizes the fear of losing political power as a barrier to innovation. So highly entrenched incumbents, i.e., high μ, will have little to fear from innovation, and are likely to adopt beneficial economic change. It is therefore rulers with intermediate values of μ, that is, those that are partially entrenched, but still fear replacement, that are likely to resist change.[11]

What does μ correspond to in practice? Since μ is the only measure of political competition in our model, it corresponds to both incumbency advantage and lack of political threats. For example, we think of a society like the U.S. in the nineteenth century with weak political elites tightly constrained by institutions and high levels of political participation as corresponding to low μ, while Germany and Britain where the landed aristocracy, through the House of Lords and the Coalition of Iron and Rye, were highly entrenched correspond to a high value of μ. Moreover, changes in domestic or foreign situations can correspond to changes in μ. For example, the defeat of Russia in the Crimean War is likely to have increased the political threat to the monarchy, consequently reducing μ. In Section VI, we discuss how these comparative static results, and this interpretation of incumbency advantage, help us interpret cross-country differences in the experience of industrialization in Europe and North America.

IV. Political Stakes and Development

So far we have considered a model in which the only benefit of staying in power was future tax revenues from the same technology that generated income for the citizens. There are often other sources of (pecuniary and nonpecuniary) rents for political elites, which will affect the political equilibrium by creating greater "stakes" from staying in power. This relates to an intuition dating back to Madison (1788) that emphasizes the benefits of having limited political stakes. We now introduce these additional sources of

[11] It is interesting at this point to note the parallel with the literature on the effect of product market competition on innovation. In this literature, low competition encourages innovation by increasing rents, while high competition might encourage innovation so that incumbents can "escape competition". Aghion, Harris, Howitt and Vickers (2001) show that the interplay of these two forces can lead to a non-monotonic effect of product market competition on innovation, which is similar to the non-monotonic effect of political competition on economic change emphasized here.

rents for political elites, enabling us to formalize this intuition: when rents from political power, "political stakes," are large, for example because of rents from land and natural resources, or because existing political institutions do not constrain extraction by rulers, political elites will be more likely to block development. We will also use this extended model to discuss the importance of human capital in affecting the political equilibrium, and show that high human capital will make blocking less likely.

We model these issues in a simple way by allowing income at date t to be $A_t h$ where h represents the exogenous stock of human capital. We assume that the structure of taxation is as before so that now the ruler gets tax income of $\tau A_t h$ and we additionally assume that a rent of R accrues to the ruler in each period. The two important assumptions here are: first, the political rent to the incumbent does not grow linearly with technology, A. This implies that a higher A makes the political rent less important. Second, human capital is more complementary to technology than to the political rent. Both of these assumptions are plausible in this context.

Let us now write the value function for the citizen, denoted $\widehat{V}(Ah)$,

$$\widehat{V}(Ah) = Ah(1-T) + \tag{12}$$

$$\beta\left[x\int\left[(1-p_I(z'))\widehat{V}(\alpha Ah) + p_I(z')\left(\widehat{x}\widehat{V}((\alpha-z')Ah)+(1-\widehat{x})\widehat{V}((1-z')Ah)\right)\right]dF^I + \right.$$

$$\left.(1-x)\int\left[(1-p_N(z))\widehat{V}(Ah) + p_N(z)\left(\widehat{x}\widehat{V}((\alpha-z)Ah)+(1-\widehat{x})\widehat{V}((1-z)Ah)\right)\right]dF^N\right]$$

Equation (12) is very similar to (3). The value for the incumbent ruler, $\widehat{W}(Ah,R)$, is

$$\begin{aligned}\widehat{W}(Ah,R) &= TAh + R \\ &+\beta\left[x\int(1-p_I(z'))\,\widehat{W}(\alpha Ah,R)dF^I + (1-x)\int(1-p_N(z))\,\widehat{W}(Ah,R)dF^N\right].\end{aligned}$$

whose interpretation is immediate from (4). A major difference from before is that whether blocking is preferred by the incumbent ruler will now depend on the value of A.

Again let us start with the decision of citizens. As before, $\widehat{V}(Ah)$ is strictly increasing, so the citizens will use the same replacement rules as before, (5) and (6). Then, with a similar reasoning, the value to the incumbent ruler of innovating and not innovating at time t are given by:

$$\text{Value from innovating} = \left[1-F^I(0)\right]\widehat{W}(\alpha A_t h,R) = P\left[\frac{1}{2}+\mu\right]\widehat{W}(\alpha A_t h,R) \tag{13}$$

and

$$\begin{aligned} \text{Value from not innovating} &= \left[1 - F^N(\alpha - 1)\right] \widehat{W}(A_t h, R) \\ &= P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right] \widehat{W}(A_t h, R), \end{aligned} \tag{14}$$

Notice that although, via the effect of A_t, the value functions, the $\widehat{W}$'s, depend on time, the probabilities of staying in power do not, since the decision rules of the citizens do not depend on time.

Next, again by standard arguments $\widehat{W}$ is strictly increasing in both of its arguments. This implies that if $\left[1 - F^I(0)\right] \widehat{W}(\alpha A_t h, R) > \left[1 - F^N(\alpha - 1)\right] \widehat{W}(A_t h, R)$, then it is also true that $\left[1 - F^I(0)\right] \widehat{W}(\alpha A' h, R) > \left[1 - F^N(\alpha - 1)\right] \widehat{W}(A' h, R)$, for all $A' \geq A_t$. Since innovations increase A_t, this implies that once an incumbent starts innovating, both that incumbent and all future incumbents will always innovate.

This implies that we can characterize the condition for innovation as follows: first determine the value function for the ruler under the hypothesis that there will always be innovations in the future, and then check whether the one-step ahead deviation of not innovating in this period is profitable. To do this, let us make the natural conjecture that $\widehat{V}(Ah) = \widehat{v}(x) Ah$ and $\widehat{W}(Ah, R) = \widehat{w}(x) Ah + \widehat{r}(x) R$, where we have again explicitly allowed the coefficients of these value functions to depend on whether there will be innovation in the future.

By a similar reasoning to that in Section III, the incumbent ruler innovates if

$$\begin{aligned} & P\left[\frac{1}{2} + \mu\right] (\widehat{w}(x=1) \alpha Ah + \widehat{r}(x=1) R) \\ \geq\ & P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right] (\widehat{w}(x=1) Ah + \widehat{r}(x=1) R), \end{aligned} \tag{15}$$

where $\widehat{w}(x=1)$ and $\widehat{r}(x=1)$ are the coefficients of the value functions when there will always the innovation in the future and are simple functions of the underlying parameters as shown in the Appendix.

Let us first focus on the main comparative statics of interest. As before, condition (15) can only be violated when $P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right] > P\left[\frac{1}{2} + \mu\right]$, that is, when innovation reduces the likelihood that the ruler will remain in power. Then, in this relevant area of the parameter space where blocking can occur, the coefficient of R on the right-hand side, $P\left[\frac{1}{2} + \gamma\mu - (\alpha - 1)\right]$, is greater than the corresponding coefficient on the left-hand side, $P\left[\frac{1}{2} + \mu\right]$, so an increase in R makes blocking more likely (i.e., it makes it less likely that

(15) holds). Conversely, an increase in h, the human capital of the labor force, makes blocking less likely. Intuitively, a higher level of R implies a greater loss of rents from relinquishing office, increasing the strength of the political replacement effect. In contrast, the higher level of h increases the gains from technology adoption relative to R, making technology adoption more likely.

More explicitly, we show in the Appendix that condition (15) implies that, as long as $P\left[\frac{1}{2}+\mu\right]\alpha - P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right] > 0$, the ruler will innovate at time t if

$$A_t \geq A^*\left(R/h\right) \equiv \frac{\left(P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]-P\left[\frac{1}{2}+\mu\right]\right)}{\left(P\left[\frac{1}{2}+\mu\right]\alpha-P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]\right)}\cdot\frac{1-\beta\alpha P\left[\frac{1}{2}+\mu\right]}{1-\beta P\left[\frac{1}{2}+\mu\right]}\cdot\frac{R}{\tau h}. \tag{16}$$

The inequality $P\left[\frac{1}{2}+\mu\right]\alpha - P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right] > 0$ is imposed because if it did not hold, the incumbent would never innovate irrespective of the value of A, so in this case we set $A^*\left(R/h\right)=\infty$. Condition (16) states that the incumbent will innovate if the current state of technology is greater than a threshold level A^*. The greater is R/h, the higher is this threshold level, implying that innovation is less likely (or will arrive later).

Next suppose, instead, that the incumbent would like to block innovation. Then as long as he remains in power $A_{t+1} = A_t$. This enables a simple characterization of the value functions, again using the natural linearity conjecture (see the Appendix). We then obtain that the incumbent will block if

$$\begin{aligned} &P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]\left(\widehat{w}\left(x=0\right)Ah+\widehat{r}\left(x=0\right)R\right)\geq \\ &P\left[\frac{1}{2}+\mu\right]\left(\widehat{w}\left(x=1\right)\alpha Ah+\widehat{r}\left(x=1\right)R\right), \end{aligned} \tag{17}$$

where the right-hand side features $\widehat{w}\left(x=1\right)$ and $\widehat{r}\left(x=1\right)$, since if the ruler finds it profitable to innovate this period, he will also do so in the future. The Appendix also shows that this condition will be satisfied if only if $A \leq A^*\left(R/h\right)$ as given by (16), i.e., only if A is lower than the critical threshold characterized above. On reflection, this result is not surprising since given the best responses of the citizens, the decision problem of the ruler is characterized by a standard dynamic programming problem, and has a unique solution.

Overall, the ruler will innovate when $A_t \geq A^*\left(R/h\right)$ and block whenever $A_t < A^*\left(R/h\right)$. This result has another interesting implication. In Section III, the innovation decision was independent of A, so an economy that had "adverse" parameters would always experience blocking. While there would still be some improvements in technology as incumbents were replaced, incumbents would always block change whenever they could. Here, since A_t tends to increase over time (even when there is blocking, because incumbents are being replaced and newcomers innovate), eventually A_t will reach the threshold $A^*(R/h)$ as long as $A^*(R/h) < \infty$, and then, the economy would no longer block innovations. Therefore, a possible development path implied by this analysis is as follows: first, incumbents block change, but as many of these incumbent rulers are replaced and some economic and political change takes place, the society eventually undergoes a *political transition*—it reaches the threshold where even incumbent rulers are no longer opposed to change. Of course, the arrival of such a political transition may be very slow.

Summarizing the main implication of this analysis:

Proposition 3 Political elites are more likely to block economic change when political rents, R, are high and human capital of the workforce, h, is low.

This proposition is important for our discussion below because it implies that elites are more likely to block change when political stakes, as captured by R, are greater. As a result, in this model we can think of two distinct roles of pre-existing political institutions: first, they determine μ, the degree of political competition, and affect the likelihood of economic change via this channel; and second, they affect the political stakes, R, and determine the gains to the elites from staying in power and their willingness to block development.

Finally, it is interesting to note that although in this discussion we have treated h as given, the same forces that determine whether incumbent rulers want to block change will also determine whether they want to invest in the human capital of the population. A greater human capital of the labor force is likely to increase output, but may make it easier for the masses to organize against the ruler, and hence may erode the incumbency advantage of the ruler. Therefore, the political replacement effect may also serve to discourage rulers from investing in human capital or even block initiatives to increase the human capital of the masses.

V. External Threats and Development

Political elites' attitudes towards industrialization changed dramatically in Russia after the defeat in the Crimean war and in Austria-Hungary after the 1848 Revolution.

Similarly, Japanese elites started the process of rapid industrialization after they felt threatened by the European powers and the United States.[12] One can also argue that the potential threat of communism was an important influence on the elites' attitudes towards development in South Korea and Taiwan. It therefore appears that external threats may be an important determinant of whether elites want to block technical and institutional change. In this section, we extend our model to incorporate this possibility.

To model these issues in the simplest possible way, suppose that at time t, rulers find out that there is a one-period external threat at $t+1$, which was unanticipated before. In particular, another country (the perpetrator) with technology B_t may invade. If an invasion takes place, the ruler is kicked out of power and gets zero utility from that point on. Whether this invasion will take place or not depends on the state of technology in two countries, and on a stochastic shock, q_t. If $q_t \phi B_t > A_t$, the perpetrator will successfully invade and if $q_t \phi B_t \leq A_t$, there will be no invasion. Hence $\phi \geq 0$ parameterizes the extent of the external threat: when ϕ is low, there will only be a limited threat. This formulation also captures the notion that an economy that produces more output will have an advantage in a conflict with a less productive economy.

For simplicity, suppose that there will never be an invasion threat again in the future, and assume that q_t is uniformly distributed on $[0,1]$. Suppose also that $B_t = \delta A_{t-1}$. This implies that there will be an invasion if

$$q_t > \frac{1 + x_t(\alpha - 1)}{\phi \delta},$$

where recall that x_t is the decision of the incumbent to innovate. Using the fact that q_t is uniform over $[0,1]$, and the same definition of the function $P[\cdot]$, we have the probability that the ruler will not be invaded at time t, conditional on x_t, as

$$P\left[\frac{1 + x_t(\alpha - 1)}{\phi \delta}\right].$$

The important point here is that the probability of invasion is higher when $x_t = 0$ because output is lower.

[12] Even China attempted a defensive modernization after its defeat in the Opium War of 1842 and subsequent humiliations at the hands of European powers. Chan (1978, p. 418) notes "the Chinese promotion of modern enterprise in the late nineteenth century was inspired by the political necessity of quickly achieving respectable national strength. This fundamental goal united government officials of various persuasions in a common commitment to industrialization."

Let us now return to the basic model of Sections II and III, with $R = 0$. The same reasoning as before immediately establishes that at time t the ruler will innovate if

$$\alpha P\left[\frac{1}{2}+\mu\right] P\left[\frac{\alpha}{\phi\delta}\right] \geq P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right] P\left[\frac{1}{\phi\delta}\right]. \tag{18}$$

This condition differs from the basic condition for innovation in Section III, (10), because of the probability of invasion. In particular, when $P\left[\frac{1}{\phi\delta}\right] \in (0,1)$, external threats make blocking less attractive, because a relatively backward technology increases the probability of foreign invasion. Therefore, the emergence of an external threat might induce innovation in a society that would otherwise block change. In fact, an increase in δ or ϕ will typically make blocking less likely.[13] For example, when $\delta \to 0$ or $\phi \to 0$, we have $P\left[\frac{1}{\phi\delta}\right] \to 1$, so the threat of invasion disappears and we are back to condition (10). For future reference, we state this result as a proposition:

Proposition 4 Political elites are less likely to block development when there is a severe external threat (high ϕ) and when the perpetrator is more developed (high δ).

The intuition for both comparative statics is straightforward. With a more powerful external threat or a more developed perpetrator, the ruler will be "forced" to allow innovation so as to reduce the likelihood of an invasion.

VI. Historical Evidence and Interpretation

We now use our analysis so far to provide an "interpretation" of the different industrialization experiences during the nineteenth century. As the data on output and industrial production from Maddison (1995) and Bairoch (1982) show (Tabel 1 Panels A and B) while some countries, including Britain, the United States, and Japan, industrialized rapidly, others, such as Russia, Spain and Austria-Hungary, lagged behind. Even Germany, though a famous example of rapid industrial catch-up, did not really take-off until after 1850. We provide historical evidence suggesting that the proximate cause of

[13] The mathematical reasoning is similar to that of the results before. Consider an increase in ϕ. This changes the left-hand side of (18) by $-\frac{\alpha}{\delta\phi^2}P\left[\frac{1}{2}+\mu\right]$, and the right-hand side by $-\frac{1}{\delta\phi^2}P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]$. Since at the point of indifference, i.e. when $\alpha P\left[\frac{1}{2}+\mu\right] P\left[1-\frac{\alpha}{\phi\delta}\right] = P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right] P\left[1-\frac{1}{\phi\delta}\right]$, we have $\alpha P\left[\frac{1}{2}+\mu\right] < P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]$, the left-hand side falls by less, and innovation becomes more attractive.

this divergence is that in some countries political elites did not want to introduce the economic institutions encouraging entrepreneurs to adopt new technology and innovate, and in fact, actively tried to block industrialization.[14] Our theory provides an interpretation for why there were such adverse attitudes toward change in some countries, and not in others. It suggests that the political elites—the landed aristocracy—in Britain and subsequently Germany did not strongly oppose industrialization and the associated institutional changes because they were sufficiently entrenched and political rents were relatively low. In Britain this was true throughout the nineteenth century, while in Germany it was not until the second half of the century that political elites forged the coalition that entrenched their political power. In turn, the high degree of political competition and low stakes from politics in the United States implied that the adoption of new technologies could not be blocked. We also suggest that external threats from the European powers and the United States were important in changing the attitudes of the Japanese elites towards industrialization and modernization, spurring rapid industrialization there.

In contrast, in Russia and Austria-Hungary, the political elites were powerful enough to block development, and because their political power was not totally secure, they feared technological and institutional change. We also suggest that because of the more feudal land/labor relations and the persistence of the absolutist monarchy into the nineteenth century, political stakes in Russia and Austria-Hungary were substantial for the landed aristocracy, encouraging them to oppose industrialization to protect their rents. Finally, we discuss briefly why elites in highly hierarchical societies such as China or the Ottoman Empire usually had adverse attitudes towards industrialization.

A. Britain

At the end of the eighteenth century the political system in Britain was controlled by a rich, primarily landowning aristocracy.[15] The British elites at the start of the next century faced an ongoing process of industrialization which, by creating new groups of wealthy businessmen and finally a powerful working class, forced the aristocracy to concede political power.

This process happened incrementally through the three Reform Acts, the first of

[14] See Acemoglu, Johnson and Robinson (2001) for econometric evidence supporting this interpretation.

[15] The seminal studies of aristocratic power in nineteenth century Britain are Guttsman (1963) and Thompson (1963).

which was in 1832, the others in 1867 and 1884. A crucial policy change was the 1846 repeal of the Corn Laws. While the extension of the franchise that was also introduced by these reforms was certainly fought for many years (for example, in the 1840s the Chartist movement was successfully undermined), the political elites in Britain did not actively oppose the processes set in force by the first industrial revolution.[16] Indeed, as Mokyr (1990, p.243) argues about Britain "the landowning elite, which controlled political power before 1850, contributed little to the industrial revolution in terms of technology or entrepreneurship. It did not, however, resist it."

British political elites were not always in support of industrialization. For example, Christopher Hill (1981) describes the attitude of the landed aristocracy to industrialization during the early seventeenth century as follows:

> "in general the official attitude to industrial advance was hostile, or at best indifferent. It was suspicious of social change and social mobility, of the rapid enrichment of capitalists, afraid of the fluctuations of the market and of unemployment, of vagabondage, and social unrest ....the Elizabethan Codes aimed at stabilizing the existing class structure, the location of industry and the flow of labor supply by granting privileges and by putting hindrances in the way of mobility and the freedom of contract."

However, the rise of parliament and the commercialization of British society during the following centuries overcame these forces and paved the way for industrialization. The Glorious Revolution of 1688, often emphasized as the final step in the rise of parliament over the monarchy (North and Weingast, 1989), also represented the final step in a much longer process of evolution (Clark, 1996). Not only were the political powers of the monarchy and traditional aristocracy relatively muted in Britain compared to other European countries, economic institutions were much more modernized. Feudalism and servile labor were almost completely gone and most of the landed elite had become commercial farmers (see Moore, 1966).

[16] See Rueschemeyer, Stephens and Stephens (1992) and Collier (1999) for overviews of political reform in Europe during this period. The battle over the extension of the franchise was more relevant for determining how much of the gains from industrialization would be redistributed to the poorer segments of the society, rather than over whether industrialization should proceed or not. See Acemoglu and Robinson (2000b).

Why were British elites, on balance, not opposed to economic and institutional development?[17] Three reasons, highlighted by our model, may have been important. First, the political settlement which had emerged from the Glorious Revolution meant that the landed aristocracy in Britain was politically entrenched. In particular, the House of Lords guaranteed the security of landed interests until the Liberal government of Asquith after 1906. Second, the transition from aristocratic to popular rule was a prolonged one. While relatively universal male suffrage came after 1867, aristocratic power was strong in government until well into the present century[18] (see Reid 1992). Therefore the British political elite, by adopting a strategy of gradual concessions, were able to control the political equilibrium and maintain power for at least a century following the onset of the political impact of industrialization. In terms of our model, both of these factors correspond to a high value of μ, reducing the opposition of existing elites towards institutional and technical change. In addition, the long history of Britain as a trading nation and mercantile power meant that many aristocrats had relatively diversified wealth,[19] and many of the feudal land relations had long disappeared. Therefore, the elites could benefit from industrialization, and had less to lose in terms of political rents. Moreover, the political institutions which emerged following the Glorious Revolution not only restricted predation by the monarchy against parliament, but also by parliament against commoners (Thompson, 1975). These institutional characteristics of British society further reduced political rents, R in our model, making the elites less likely to be oppose change.

B. Germany

Industrialization occurred in Germany in the context to the rise of the Prussian state within the German federation of states and the creation of the Empire in 1871. The resulting political institutions ensured the entrenchment of the elites, in particular the landed aristocracy, the Junkers. For example, the Junkers forged the coalition of 'Iron and Rye' with the rising industrial class to secure their economic interests. Gerschenkron

[17] In fact, they eventually lost their political power during the second half of the nineteenth century. So why did they not block development anticipating this outcome?

[18] It took until the start of the present century until parliament produced a prime minister that was not from a landed background (the Liberal, Asquith) and it was not until well into the 1920's with the rise of the Labour Party that a majority of Members of Parliament were not landed gentry.

[19] Saville (1994), for example, argues that this was important in sealing the compromise between the aristocracy and the rising industrial classes. The notion of 'gentlemanly capitalism' and the diversified economic interest of the British political elite is central to many modern interpretaions of British history, e.g. Cain and Hopkins (2000).

(1943, p. 49) describes this coalition as, "a compromise between modern industry and the feudal aristocratic groups in the country." And Eley (1984, p. 153-4) notes that

> "the option of the German bourgeoisie's leading fractions for a politics of accommodation with the landowning interests ... was fully compatible with the pursuit of bourgeois interests ... The bourgeoisie entered the agrarian alliance...as the best means of securing certain political goals."

However, before the 1848 revolution and the emergence of this coalition, the landed elites did not uniformly support industrialization. For example, Tracey (1989, p. 106) writes:

> "there was relatively little industrial development in the east, because of lack of natural resources and also as a result of deliberate opposition to industrialization by the Junkers and the Bund der Landwirte, who feared the spread of socialism and also did not want the Polish proletariat to participate in industrialization."

Tipton (1974, p. 962) argues that in the first half of the nineteenth century the political elites "adamantly opposed plans for eastern industrialization on the grounds that the danger of socialism would increase with the expansion of employment in factories" (see also his 1976 book). Trebilcock (1981, p. 76) makes similar arguments noting "the Prussian state...was attracted only to a particular type of industrial development, that with military utility. Outside this area, the authorities contributed little in the way of investment or encouragement to private entrepreneurs." Indeed, "they expressed hostility to major innovations in industry or transport, and they were notably suspicious of the railways at the outset." He continues that as late as the mid-century "the political preferences of the Junker groups definitely restricted the scope for economic advance."

Yet things began to change in the 1850's "a new alliance formed, combining authoritarianism with bourgeois elements, against the menace of peasant and proletariat. By modifying the vested interests of the previous four of five decades, it created a climate more favorable to industrial advance" (Trebilcock, 1981, p. 76). The threat from the rapidly industrializing Britain and France and from the 1848 wave of revolutions may have also been important in the change in the attitudes towards industrialization, adding some element of defensive modernization to the German case (see Hamerow, 1958).

Another factor facilitating the emergence of this more positive attitude towards change may have been that, despite the important role of the Junker elite, the political stakes were also relatively limited for the landed aristocracy. This was mostly because of the reforms induced by the Napoleonic wars. Blackbourn (1998, p. 71) notes that in the parts of Germany that they occupied, the French rule amounted to a "crash course in modernization that removed the institutions of the old regime, separated church and state, rebuilt the administrative bureaucracy on a new basis, and made possible the relatively untrammeled accumulation and disposition of property that is one hallmark of a modern civil society." Where the French did not rule, as in Prussia, their impact was to induce defensive reform and modernization (see Rosenberg, 1958). However, there is a consensus that these reforms did not have the revolutionary effects that they were once claimed to have had. Although the serfs were freed in Prussia in 1807, Trebilcock (1981, p. 34) notes "the small peasantry, immensely more numerous but holding only a fraction of the peasant land, the rural masses between the Elbe and the Vistula, had to wait until the 1850's and 1860's before the miraculous cloak of emancipation swept over them. " What is true is that labor relations were less feudal than in Russia or Austria-Hungary, though they were probably less modernized than in Britain.

Political reforms after the 1848 Revolution and the emergence of parliamentary institutions in Germany appear to have been strategically designed, as in Britain, to give a sufficient degree of representation to the Junker elites. For example, the legislature was bicameral with a federal council composed of delegates from the states (the Bundesrat) and a national elected parliament (the Reichstag). Prussia had 17 of the Bundesrat's 58 votes and "the conservative Prussian elite could essentially block proposed national legislation that was contrary to its interests (Berman, 2001, p. 439). After the 1870s, the Junkers were able to gain protection for their output, insulating themselves economically from the worst effects of industrialization—such as falling land rents. Therefore, in Germany the continued political power of the Junkers, once the coalition of Iron and Rye had been formed, allowed them to compensate for the adverse direct economic effects of industrialization. So in terms of our model, we can see the German case as one where, after the 1850s, the political elites were relatively entrenched, i.e., high μ, and the political stakes, R, were limited. This combination of elite entrenchment and low political rents made it unprofitable for the elites to block change. Rapid industrialization among its main rivals may have also contributed to the favorable attitudes towards industrialization in Germany.

C. The United States

In the British and German cases political elites were able to forge institutions and coalitions which consolidated their power. The United States embarked on rapid and very successful industrialization with very different political conditions. In particular, there is widespread agreement that the U.S. political institutions were highly representative and democratic. Both these representative institutions and the U.S. Constitution ensured a highly competitive political environment. These institutions and the ensuing political competition appear to have facilitated (or even caused?) industrialization economic involvement in the United States.

The relatively representative and democratic U.S. institutions evolved after 1607 and finally emerged following The War of Independence. The development of these institutions was most likely a consequence of the development of the U.S. as a settler colony with very low population density, therefore providing good opportunities for the poorer segments of the society. Galenson (1996) explains how early attempts to create oligarchic political institutions and restrict the access of settlers to land quickly disintegrated, mostly as a result of the very low population densities. Large land grants were made by Charles I to encourage settlers to move to the Colony, and in 1632 Maryland was given to the second Lord Baltimore (about 10 million acres). The charter also gave Baltimore "virtually complete legal authority over his territory, with the power to establish a government in whatever form he wished" (Galenson, p. 143). His idea was to attract tenants from Britain and set up a huge manorial system. This approach to colonization was not so different to the one employed by the Portuguese in Brazil. However, things were different in North America because:

> "the manorial organization of Baltimore's colony failed to materialize, as Maryland's history during the 17th century witnesses the gradual breaking down of rigid proprietary control ... The extreme labor shortage...allowed many early settlers to gain their economic independence from the manorial lords, and establish separate farms ... Thus just as in Virginia, in Maryland the colonial labor problem undermined the initial plans for a rigid social hierarchy, as Lord Baltimore's blueprints for a manorial society were largely swept

away and early Maryland became an open and fluid society, which offered considerable economic and social opportunity." (Galenson, 1996, p. 143).

The individual colonies were politically independent of one another, and though suffrage restrictions followed those in Britain, the far more equal pattern of landownership implied that a much higher proportion of white adult males could vote. On the eve of independence this proportion was between 50% to 80% while in Britain the corresponding figure was between 10% and 15% (Williamson, 1960 p. 38). The War of Independence did little to disrupt the social hierarchy in the United States, but the Southern planters not withstanding, there was no real landed aristocracy in the same way as there was in Europe. As argued originally by de Toqueville in 1835 in his *"Democracy in America,"* the relative lack of a landed elite and the relatively egalitarian distribution of assets appears to be a key part of the explanation for early democratization in the U.S. (see Engerman and Sokoloff, 2000, Keyssar, 2000). In the absence of an industrial proletariat and great disparities in the distribution of assets, and because white suffrage did not imply the extension of voting rights to blacks, the political elites had little to fear from enfranchisement. Most Northern States had universal white male suffrage by the 1820's and even Southern States had joined them by the late 1840's. As early as the 1828 Presidential election, 56% of the adult white males voted (Engerman and Sokoloff, 2000, Table 2).

Not only was wealth less concentrated in the United States, but also political institutions limiting the stakes from government by severely restricting the autonomy of politicians evolved rapidly. While the design of the Constitution in 1787 is the most famous example of this (in particular, the separation of powers and an elaborate system of checks and balances), the forces behind it date from an earlier period. Jones (1983, p. 62) notes that after the War of Independence, the individual States wrote their own Constitutions (under the Articles of Confederation) and the "deep suspicion of executive authority which was one of the legacies of the colonial past resulted in state governors being denied ... many of the powers enjoyed by their royal predecessors. Only in Massachusetts and New York was the governor given a veto; elsewhere his powers were narrowly restricted."

In an environment of relatively high and increasing enfranchisement and political institutions which institutionalized political competition and limited state authority intense political competition and the world's first real political parties emerged. After Washington's basically unopposed Presidencies of 1789-93 and 1793-1797, Jefferson turned the

Republican party into an electoral machine to win the Presidency from Adams in 1800.[20] After this, intense political competition between the Federalists and Republicans ensued.[21] Although these parties collapsed in the early 1820's they were succeeded by the Whigs and Democrats after the victory of Jackson in 1828. Political competition led to policies that voters wanted including the 1816 tariff introduced explicitly for protection, not just revenue, and from 1817 onwards, heavy subsidization of railways by both federal and state governments.

We therefore interpret the American experience as corresponding to a low value of μ in terms of our model. For a variety of reasons, some stemming from the evolution of the colony, some from the nature of the political settlement after independence, there was intense political competition in the United States with voters determining who was in power. This led to policies which promoted rather than impeded institutional change and industrialization. According to our model, in such a competitive political environment, political elites have to encourage innovation, and this was typically the case in the nineteenth-century United States.

D. Japan

Japan industrialized and modernized rapidly in the second half of the nineteenth century. Although the seeds of industrialization could be traced back to the Tokugawa era (e.g., Macpherson, 1987), rapid industrialization appears to have been related to the emergence of a serious external threat. The overwhelming British victory against the Chinese in the Opium War of 1842, the imposition of an "open door" to world trade on Japan by European powers and the United States, and perhaps most importantly, the arrival of the American fleet in Tokyo Bay in 1853 made it clear to the Japanese elites that they were facing a serious external threat.

Before the emergence of the external threat from the West, Japan was under the control of the Tokugawa shogunate which was a coalition of large landowning interests. Although Japan had been a relatively prosperous country since at least the fifteenth century, it was not always open to trade, innovation and foreign trade. For example, the

[20] In contrast, true political parties with national electioneering really only emerged in Britain after the Second Reform Act of 1867. Before this parties were very lose coalitions of members of parliament who did not campaign on a national platform at elections (see Cox, 1987).

[21] The parties initially emerged during the split over Hamilton's policies as Secretary of State under Washington. Aldrich (1995) provides a seminal modern analysis of the early party system in the United States.

elites did not welcome foreign missionaries, and foreign trade was seriously limited and controlled, or in the words of Macpherson (1987, p. 38), "... [they] ... virtually prohibited overseas trade". In terms of our model, this makes sense as a calculated conservatism to maximize the longevity of the regime. In fact the main aim of the Tokugawa shogunate was to bring peace and stability to Japan following an era of prolonged infighting and civil war, and many of the institutional changes needed to promote industry would have created turbulence and strengthened competing groups. The main threat to peace, stability and the Tokugawa regime was from the *daimyo* (the great lords), who were feudal lords with their own armies, and especially the *daimyo* at the outskirts of the shogunate posed a serious threat to the unity of Japan (e.g., Macpherson, 1987, p. 17-25).

This equilibrium was shattered by the emergence of the external threat from the West, culminating in the arrival of the American fleet in Tokyo Bay. These changes eventually lead to the Meiji Restoration of 1868. Although the Restoration installed the Meiji Emperor, this was purely symbolic, and the main aim was to "expel the barbarians," that is, the European traders, military and the diplomats. In fact, the important drive to industrialization had already started before the Restoration, as an explicit strategy of defensive modernization in response to the external threat. Curtin (2000, p. 163) describes this as follows:

> "The two sides were so similar that the brief but crucial fighting that ended the Tokugawa era was a struggle between competing military oligarchies seeking to control a new centralizing government, which would probably have sought to carry out similar policies, no matter which side won."

It is interesting that the drive for modernization in Japan took a special form, strengthening the centralized government and increasing the entrenchment of bureaucratic elites. In terms of our model, this can be viewed as a strategy to industrialize while also minimizing the probability of replacement, somewhat reminiscent to the industrialization experience in Britain and Germany where the non-industrial elites maintained their political power despite the process of industrialization. In Japan, the Restoration, despite its emphasis on Japanese traditions, quickly wiped out the powers of the *daimyo*, the main threat to the power of the centralized state. At the same time, much of industrial activity was delegated to a core group of wealthy families, known as the *Zaibatsu*, which was in close contact (under close supervision?) of the government, so the threat from economic change to the existing political regime was minimized. The choice of Japanese constitution also reflected the same desires. They adopted the Prussian constitution, which gave the appearance of representative government, but retained the oligarchy in control via the bicameral system with the upper house reserved largely for the ruling elite. The constitution also gave the military sweeping powers.

Overall, the Japanese experience can be interpreted as an example of defensive modernization and industrialization in response to an external threat, as emphasized in Section V, and the pattern of industrialization following the change of attitudes can be interpreted as an example of adopting technological institutional change, while strengthening the control of the oligarchy on centralized power.

E. Tzarist Russia

Russia provides stark contrast to the cases we have examined so far. During the reign of Nikolai I between 1825 and 1855 (in the wake of the Decembrist putsch) only one railway line was built in Russia.[22] Economic development was opposed since, as Mosse (1992) puts it "it was understood that industrial development might lead to social and political change." In a similar vein, Gregory (1991) argues:

> "Prior to the about face in the 1850's, the Russian state feared that industrialization and modernization would concentrate revolution minded workers in cities, railways would give them mobility, and education would create opposition to the monarchy."

It was only after the defeat in the Crimean War that Nikolai 's successor, Alexsandr II, initiated a large scale project of railway building and an attempt to modernize the economy (among other things, by introducing a western legal system, decentralizing government, and freeing the serfs). The reason appears to be that Alexsandr II, most probably correctly, perceived that Russia's technological inferiority left it vulnerable to foreign threat. Alexsandr's reforms led to rapid industrialization (Portal, 1965), supporting the notion that state policies before the Crimean War were important in blocking development. The sudden change of attitudes in the face of foreign threat is also consistent with the emphasis in Section V on external threats inducing innovation.

[22] Nikolai's long serving finance minister Count Krankin rejected proposals to build railway lines on the basis that they encouraged "frequent and useless travel, thus fostering the restless spirit of our age."

This period of industrialization also witnessed heightened political tensions, consistent with the view that times of rapid change destabilize the system (McDaniel, 1988, gives a detailed account of these events, see also Falkus, 1972, Mosse, 1958, and 1992, and Pipes, 1992).[23] Mosse (1992) argues:

> "early industrialization...resulted in an acceleration of change and an increased dynamism in a previously static society. Russia...was transformed from a backward (or underdeveloped) into a developing country. She had entered the railway age. Society experienced a gradual transformation. While the landed gentry was in a state of terminal decline, the bureaucracy recruited from various social strata, had begun to replace it as the ruling class. The liberal professions and the entrepreneurial bourgeoisie were gaining in numbers and importance. Early industrialization had created a small but growing proletariat. By the turn of the century, the social changes set in motion by perestroika were beginning to have an impact on public affairs."

The history of industrialization in nineteenth-century Russia therefore illustrates the contradictions that political elites faced in promoting innovation. Until the impetus of the Crimean War, industrialization was blocked. The defeat of the Crimean war is therefore the turning point in the attitudes of the Russian state to economic development.

Why was the Tzar so opposed to institutional and technological change in the period before the Crimean war? One possibility suggested by our analysis is the high level of the political rents, R, generated by the state of land/labor relations in Tzarist Russia. The feudal social structure in nineteenth-century Russia generated high rents for political elites, and implied that the landed aristocracy had few commercial interests, and was not associated with industrial groups. So the primary beneficiaries of industrialization would have been groups outside the landed aristocracy. Moreover, because land is relatively easy to expropriate, the elites had a lot to lose from political changes. These factors increased the political stakes for the elites, making them fear industrialization more than in Britain or Germany. Furthermore, the poor level of human capital of most of the workforce (see Lindert, 2000) also implied that the gains from industrialization were lower relative to land rents that the elites obtained under the *ancien regime*. Another important factor

[23] In fact, the burst of industrialization ended in the strike wave of 1902-1903 and, by creating a nascent industrial proletariat, laid the foundations for the 1905 revolution.

was the tight control of the state by the Tzar,[24] who had perhaps even more to lose from political transition.

F. The Habsburg Empire

In the nineteenth century, the Habsburg Empire was known as "Europe's China" or the "sick man on the Danube" (see Good 1984, 1991) and was generally regarded as having fallen far behind the other industrializing countries of Europe. Historians typically argue that this was what led to the weakness and disintegration of the empire during and after the First World War. The consensus view amongst historians now appears to be that the main explanation for the slow growth of Austria-Hungary in the nineteenth century is the opposition of the state. For instance Gross (1973) argues,

> "In domestic as well as foreign policy the *Vormärz* regime, from 1815 to 1848, was determined to prevent another French Revolution anywhere in Europe. From this principle Francis I derived not only his opposition to the growth of industry (and with it the Proletariat)...but his general reluctance to permit any change whatsoever."

The analysis of Fruedenberger (1967) is similar. He notes (p. 498-499)

> "In the 1790's fear of the French Revolution added a new dimension to government policy. High officials in the government, with the young Emperor Francis I in strong sympathy, felt that industrialization would create an industrial proletariat which to them was the carrier of revolutionary ideas and for that reason ....opposed not only large-scale enterprises but favored a policy that kept the population agrarian."

As with the Tzar, the Habsburg emperors opposed the building of railways and infrastructure and there was no attempt to develop an effective educational system (see Paulin, 1991, and Komlos, 1994). Blum (1943) pointed to the pre-modern institutional inheritance as the major blockage to industrialization arguing (p. 26) that

[24] No policy could be made without the Tzar's agreement and all government ministers were personally appointed by him. Here Russia was very different from the European countries, such as Britain, where the monarchy staged a long, carefully orchestrated withdrawal from political power. In line with this McDaniel (1991 p. 32) notes that "The struggle between kings and burghers so characteristic of much of western European history had few parallels in Russia."

> "these living forces of the traditional economic system were the greatest barrier to development. Their chief supporter was ... Emperor Francis. He knew that the advances in the techniques of production threatened the life of the old order of which he was so determined a protector. Because of his unique position as final arbiter of all proposals for change he could stem the flood for a time. Thus when plans for the construction of a steam railroad were put before him, he refused to give consent to their execution 'lest revolution might come into the country'."

The creation of the first railway line had to wait until Francis' death in 1835, yet even after that the government under Metternich kept to the same policies. It was the revolution of 1848 that perturbed this stasis. Eduard Marz places "the beginning of the industrial age in the 1850's ... when the Ancien regime ceased to exist" (quoted in Good, 1984, p.40-41, see also Blum, 1948). As in Russia after the Crimean, the response of the domestic elites was peasant emancipation and agrarian reform followed by a switch in economic policy towards a rather vigorous promotion of industry (see Eddie, 1989).

In addition, as in Russia, Austria-Hungarian elites received relatively high rents from unreformed feudal land/labor relations. Furthermore, the fact that they were landowners meant that they could be easily expropriated in the event of political transition.[25] Poor human capital (see Lindert, 2000) also again lowered the incentive to industrialize by increasing the importance of land rents relative to income from industrial activity.

G. Attitudes Towards Change in Hierarchical Societies

The above discussion shows that our framework provides an interesting interpretation of the differential industrialization experiences of Europe, the United States and Japan. At the heart of our framework is the idea that blocking of technical and institutional change will arise when elites can increase the likelihood that they remain in power by preventing change. This poses the question of why institutional and technical innovation was often blocked in highly hierarchical societies such as the Ottoman Empire and China. After all, weren't the elites highly entrenched in the societies? In fact, one of the most popular explanations for why these hierarchical societies stagnated, originally developed

[25] Another possibly important factor in the case of Austria-Hungary was the heterogeneity of the empire. The Austrian aristocracy thought that modernization would destroy the social glue which kept the empire together

by Wittfogel (1957), is that the elites were too entrenched for change to take place. If this interpretation is correct, it sheds doubt on the applicability of our framework to these societies, or may even be a challenge to the fundamental logic of our approach. However, we believe that this interpretation is not necessarily correct.

A full discussion of the experiences of the Ottoman Empire and China is beyond the scope of this paper. In this subsection, we will briefly point out that despite the hierarchical nature of the societies, the ruling elites were highly insecure, and there were many powerful groups opposed to change.

In the Ottoman case, although the Sultan was the ultimate ruler, many groups exerted significant control over him, and the history of the Ottoman Empire is full of deposed and beheaded Sultans. The main powerful groups, often opposed to change, included the *qadis* (the judges), led by the chief judge, *Seyl-ul-Islam*, who was the supreme religious authority with the power to depose the Sultan for a breach of religious law; the military, in particular the *janissaries*, who were recruited as children by force, purchase or as tribute, who were actively opposed to change during the latter centuries of the Empire; and the big landholders, the *ayan* (see, for example, Curtin, 2000, pp. 175-176, Zurcher, 1993, p. 13-21, or Lewis, 1968).

A number of attempts at modernization were crushed by these power centers. Perhaps the most notable is that of Sultan Selim III (1789-1807) who wanted to undertake military, fiscal and economic reform, and in 1792 and 1793, issued a set of regulations known as the New Order, *Nizam-i-Cedid*.[26] The New Order was immediately seen as a threat to the established groups, who mounted significant resistance, and in 1807, they joined forces and deposed Sultan Selim, with a *fetva* (religious opinion) from the *Seyl-ul-Islam* (see, for example, Zurcher, 1993, pp. 23-32). Selim's successor Muhammet II restarted the reforms in 1826, but only after further Ottoman defeats, and could succeeded because he was able to partially defeat the *janissaries*.

Therefore, this and other similar experiences from Ottoman history suggest that important institutional reforms often created turbulence and destabilize the power of the ruler. Perhaps one difference between the Ottoman experience and those of European countries is that the pre-industrial elites in the European context were afraid of losing their power to industrial interests. In contrast, the main concern of the Ottoman rulers

[26] Interestingly, in line with our approach, one of the main motivations of Sultan Selim was to strengthen the army because of external threat from the Ottomans' enemies, in particular Russia. This modernization required greater tax collection, which motivated the economic and fiscal reforms.

may have been a challenge from other politically powerful groups, such as the *ayan*, the *Seyl-ul-Islam* and the *janissaries,* who were likely to lose as a result of institutional change, and therefore effectively threatened to replace the rulers.

We know even less about the Chinese case. It is well known that during the Song dynasty until the takeover of the Ming in 1368, China led the world in technological creativity[27]. Also well known is that during the 15th century China turned inward. The most famous instance of this is the banning for almost 200 years of private trade abroad (Fairbank, 1992, pp. 137-140). After this period, there was technological regress. Although the population expanded massively with relatively unchanged living standards thanks to frontier expansion and agricultural intensification, China completely failed to industrialize or benefit from the adoption of Western technology. According to our theory, this could be because Chinese political elites were afraid of losing their power to the turbulence created by altering institutions in ways which would facilitate industry.

There certainly is consensus amongst sinologists that the institutional system in China was not conducive to modern capitalism. Brown (1979, p. 183) notes "in contrast to the West, private enterprise in China received little support from such institutions and ideologies as the 'sanctity' of private property, readily enforceable contracts, freedom of enterprise and laissez faire." The legal system functioned as a way of the government to control society and Fairbank (1992, p. 180) discusses "the official disregard for the rights of private property." Elsewhere Fairbank (1978, p. 13) states that "the state system produced no effective legal institutions to protect private property from official extractions or even seizure."

Why did China not move towards a set of institutions which would have promoted capitalism? This is a complex question surrounded by much controversy and recent revisionist accounts.[28] Nevertheless, our mechanism is one of the factors often stressed in the literature. Fairbank (1992, p. 186) argues that the lack of industrialization in nineteenth century China was due to reasons that were "social and political as well as economic," emphasizing "the rulers' concern always to maintain control." He also argues (1978, p. 6) that "The Ch'ing regime was mainly concerned with preserving the agrarian social order over which it presided, and from which it derived its main sustenance." Similarly, Jones (1988, p. 141) argues that the Chinese state "aimed at stability at the expense of

[27] Mokyr (1990, Chapter 9) gives a good overview of the many inventions made during the Song period.
[28] For example, Wong (1997) and Pomeranz (2000).

potentially productive change." Brown's evidence (1979, p. 197) leads to similar conclusions. Her research suggests that "The transfer of technology to China in the nineteenth century... was significantly impeded by the strength of the old regime and the traditional system of political economy. Foreigners were not allowed to engage in a number of important economic activities... the salt trade, the soy bean trade... mining and the construction of railroads. More importantly the government confined foreign enterprise to the treaty ports." She concludes, "China could have enjoyed a larger and growing use of foreign technology. To have done so would have required an entirely different attitude on the part of the government—one akin to that of the Japanese. But in China the old regime remained strong until 1895, and together with the traditional system of political economy that it supported, was the major impediment to the transfer of technology."[29]

Overall, historical evidence suggests that the failure of China to industrialize was intimately linked to the blocking of change by the political elites. There is also some evidence that the elites' attitudes were, at least in part, shaped by their concerns towards stability and their regime's continuity. In fact, contrary to some outside perceptions, the elites in these societies were not highly entrenched. Ottoman Sultans were often deposed and beheaded, and had to keep many different constituencies happy to maintain their power. The Manchu dynasty in China (also called the Qing or the Ch'ing) which ruled from 1644 to 1911 were outside conquerors and lacked the legitimacy of being Han Chinese. Moreover, they were faced with a persistent threat of domestic social disorder. One implication of their fragile position in society was that tax rates and government revenues were very low. Perkins (1967. p. 487) shows that government expenditure was probably only 1-2% of GDP with 3/4 of this being spent on the military. The state also engaged in extensive welfare schemes to keep social order, particularly the famous granary system (see Will and Wong, 1991) where vast quantities of grain were stored and distributed when harvests failed. This system was motivated by the desire to keep social order.

VII. Conclusion

In this paper, we constructed a simple model where political elites may block technological and institutional development, because of a "political replacement effect". Innovations often erode political elites' incumbency advantage, increasing the likelihood that

[29] See also Smith (1991, p. 313-318).

they will be replaced. Fearing replacement, political elites are unwilling to initiate economic and institutional change. We show that elites are unlikely to block developments when there is a high degree of political competition, or when they are highly entrenched. It is only when political competition is limited and also the elites' power is threatened that they will block development. We also show that such blocking is more likely to arise when political stakes are higher, and in the absence of external threats. We argue that this model provides an interpretation for why Britain and the U.S. industrialized first during the nineteenth century, while the monarchy and the landed aristocracy in Russia and Austria-Hungary blocked development.

VIII. Appendix

A. Proof that The Social Planner Always Innovates

It is clear that the value function of the social planner takes the form $S(A) = s\left(x^S\right)A$. In particular, using the fact that the planner always innovates with a new ruler, i.e., $\widehat{x}^S = 1$ and the replacement rules discussed in the text, we can write (2) as

$$
\begin{aligned}
s\left(x^S\right)A = A + & \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad (19)\\
& \beta\left[x^S\int_0^{\mu+\frac{1}{2}} s\left(x^S\right)\alpha A dz' + \int_{\mu-\frac{1}{2}}^{0} s\left(x^S\right)(\alpha - z')A dz' + \right.\\
& \left.(1-x^S)\int_{\alpha-1}^{\gamma\mu+\frac{1}{2}} s\left(x^S\right)A dz + \int_{\gamma\mu-\frac{1}{2}}^{\alpha-1} s\left(x^S\right)(\alpha - z)A dz\right],
\end{aligned}
$$

which solves for $s\left(x^S\right)$ as:

$$
s\left(x^S\right) = \frac{1}{1-\beta x^S\left(\alpha - \int_{\mu-\frac{1}{2}}^{0} z'dz'\right) - \beta\left(1-x^S\right)\left(\alpha - (\alpha-1)\int_{\alpha-1}^{\gamma\mu+\frac{1}{2}} dz - \int_{\gamma\mu-\frac{1}{2}}^{\alpha-1} zdz\right)}
$$

Now to determine x^S, we simply need to compare the second and the third lines of (19). Making use of the uniformity assumptions, the condition for the social planner to adopt the new technology can be written as

$$
\begin{aligned}
& s\alpha A\left(\int_0^{\mu+\frac{1}{2}} dz'\right) + sA\left(\int_{\mu-\frac{1}{2}}^{0}(\alpha - z')\,dz'\right)\\
\geq\ & sA\left(\int_{\alpha-1}^{\gamma\mu+\frac{1}{2}} dz\right) + sA\left(\int_{\gamma\mu-\frac{1}{2}}^{\alpha-1}(\alpha - z)\,dz\right).
\end{aligned}
$$

Rearranging and simplifying, we have $x^S = 1$ if and only if:

$$
\alpha - \int_{\mu-\frac{1}{2}}^{0} z'dz' \geq P\left[\frac{1}{2} + \gamma\mu - (\alpha-1)\right]\alpha + P\left[\frac{1}{2} - \gamma\mu + (\alpha-1)\right] - \int_{\gamma\mu-\frac{1}{2}}^{\alpha-1} zdz.
$$

Clearly $\alpha \geq P\left[\frac{1}{2} + \gamma\mu - (\alpha-1)\right]\alpha + P\left[\frac{1}{2} - \gamma\mu + (\alpha-1)\right]$ since the two probabilities must add to 1. Moreover,

$$
-\int_{\gamma\mu-\frac{1}{2}}^{\alpha-1} zdz = -\int_{\mu-\frac{1}{2}}^{0} zdz - \int_{\gamma\mu-\frac{1}{2}}^{\mu-\frac{1}{2}} zdz - \int_0^{\alpha-1} zdz < -\int_{\mu-\frac{1}{2}}^{0} zdz,
$$

which proves the claim.

B. Value Functions in Section III

Here for completeness, we solve for the value functions of the citizens and incumbent ruler in Section III. Using the conjecture, $V(A) = v(x)A$ and $\widehat{x} = 1$,

$$\begin{aligned} v(x)A &= A(1-\tau) + \\ &\quad \beta v(x) A \left[x \left(\alpha - \int_{\frac{1}{2}-\mu}^{0} z' dz' \right) + \right. \\ &\quad \left. (1-x) \left(\int_{\alpha-1}^{\frac{1}{2}+\gamma\mu} dz + \int_{\frac{1}{2}-\gamma\mu}^{\alpha-1} (\alpha - z)\, dz \right) \right] \end{aligned} \tag{20}$$

The undetermined constant is found to be

$$v(x) = \frac{(1-\tau)}{1 - \beta x \left(\alpha - \int_{\frac{1}{2}-\mu}^{0} z' dz' \right) - \beta (1-x) \left(\int_{\alpha-1}^{\frac{1}{2}+\gamma\mu} dz + \int_{\frac{1}{2}-\gamma\mu}^{\alpha-1} (\alpha - z)\, dz \right)}$$

For the ruler, the same type of argument leads to a value function,

$$w(x)A = \tau A + \beta w(x) A \left[x\alpha \int_{0}^{\frac{1}{2}+\mu} dz + (1-x) \int_{\alpha-1}^{\frac{1}{2}+\gamma\mu} dz \right]. \tag{21}$$

Hence,

$$w(x) = \frac{\tau}{1 - \beta \left(xP\left[\frac{1}{2}+\mu\right]\alpha + (1-x)P\left[\frac{1}{2}+\gamma\mu - (\alpha-1)\right] \right)}$$

C. Value Functions in Section IV

First consider the situation where there is always innovation in the future. Then, we have the following recursion defining $\widehat{w}(x=1)$ and $\widehat{r}(x=1)$:

$$\widehat{w}(x=1)Ah + \widehat{r}(x=1)R = \tau Ah + R + \beta \left(\widehat{w}(x=1)\alpha Ah + \widehat{r}(x=1)R \right) \int_{0}^{\frac{1}{2}+\mu} dz'.$$

The undetermined coefficients are obtained as:

$$\widehat{w}(x=1) = \frac{\tau}{1 - \beta\alpha P\left[\frac{1}{2}+\mu\right]}$$

and

$$\widehat{r}(x=1) = \frac{1}{1 - \beta P\left[\frac{1}{2}+\mu\right]}$$

Now using these expressions, condition (15) can be rewritten as:

$$P\left[\frac{1}{2}+\mu\right]\left(\frac{\tau\alpha Ah^{*}\left(R/h\right)}{1-\beta\alpha P\left[\frac{1}{2}+\mu\right]}+\frac{R}{1-\beta P\left[\frac{1}{2}+\mu\right]}\right)= \tag{22}$$
$$P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]\left(\frac{\tau Ah^{*}\left(R/h\right)}{1-\beta\alpha P\left[\frac{1}{2}+\mu\right]}+\frac{R}{1-\beta P\left[\frac{1}{2}+\mu\right]}\right),$$

which defines $A^{*}\left(R/h\right)$. This solves for the critical threshold of the state of technology as:

$$A^{*}\left(R/h\right)=\frac{\left(P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]-P\left[\frac{1}{2}+\mu\right]\right)}{\left(P\left[\frac{1}{2}+\mu\right]\alpha-P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]\right)}\cdot\frac{1-\beta\alpha P\left[\frac{1}{2}+\mu\right]}{1-\beta P\left[\frac{1}{2}+\mu\right]}\cdot\frac{R}{\tau h},$$

which is the expression in (16) in the text. Note that in (22) we must have $P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]>P\left[\frac{1}{2}+\mu\right]$ and $P\left[\frac{1}{2}+\mu\right]\alpha-P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]>0$—if the first inequality did not hold, the incumbent would strictly prefer to innovate, as discussed in the text, and if the second inequality did not hold, the incumbent would strictly prefer to block. These inequalities immediately imply that $A^{*}\left(R/h\right)$ is increasing in R/h as claimed in the text.

Next, consider the situation where a ruler does not innovate. Then the recursion for the value function can be written as

$$\widehat{w}\left(x=0\right)Ah+\widehat{r}\left(x=0\right)R=\tau Ah+R+\beta\left(\widehat{w}\left(x=0\right)Ah+\widehat{r}\left(x=0\right)R\right)\int_{\alpha-1}^{\frac{1}{2}+\gamma\mu}dz,$$

which is

$$\widehat{w}\left(x=0\right)=\frac{\tau}{1-\beta P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]}$$

and

$$\widehat{r}\left(x=0\right)=\frac{1}{1-\beta P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]}$$

Now using these expressions and condition (17), we have

$$P\left[\frac{1}{2}+\mu\right]\left(\frac{\tau\alpha Ah^{N}}{1-\beta\alpha P\left[\frac{1}{2}+\mu\right]}+\frac{R}{1-\beta P\left[\frac{1}{2}+\mu\right]}\right)= \tag{23}$$
$$P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]\left(\frac{\tau Ah^{N}}{1-\beta P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]}+\frac{R}{1-\beta P\left[\frac{1}{2}+\gamma\mu-(\alpha-1)\right]}\right)$$

which solves for $A^{N}=A^{*}\left(R/h\right)$, establishing the claim in the text that the incumbent ruler will block whenever $A_{t}<A^{*}\left(R/h\right)$, and innovate whenever $A_{t}\geq A^{*}\left(R/h\right)$.

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Table 1
Panel A: per-Capita Levels of Industrialization (UK 1900 is 100)[1]

	1750	1800	1860	1913
Austria-Hungary	7	7	11	32
France	9	9	20	59
Germany	8	8	15	85
Italy	8	8	10	26
Russia	6	6	8	20
Spain	7	7	11	22
United Kingdom	10	16	64	115
United States	4	9	21	126
Japan	7	7	7	20
China	8	6	4	3

Panel B: per-Capita GDP Levels[2]

	1820	1870	1900	1913
Austria	28	41	63	76
France	27	40	62	75
Germany	25	43	68	86
Italy	24	32	38	55
Russia	16	23	27	33
Spain	23	28	44	49
United Kingdom	38	71	100	110
United States	28	53	89	115
Japan	16	16	25	29
China	12	12	14	15

[1] Source Bairoch (1982).
[2] Source Maddison (1995). Maddison's data covers only Austria. Since Austria and Vienna was by far the richest part of the Empire these numbers severely overstate the prosperity of Austria-Hungary.