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The Ideological Roots of Institutional Change

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Abstract

Why do some societies fail to adopt more efficient institutions in response to changing economic conditions? And why are such failures often associated with a rise in traditional ideological beliefs? We propose an explanation that highlights the interplay—or lack thereof—between productivity shocks, institutions, and ideology. We conceptualize and formalize ideology as the process through which individuals use simplifying heuristics to make generalizations about the complex environment within which they operate. When productivity shocks occur, there is uncertainty regarding how new, more "appropriate" ideologies will interact with the new economic conditions. This uncertainty discourages investment in institutions *and* the cultural capital necessary to take advantage of new production possibilities, and accordingly, generates ideological movements that place a higher premium on traditional values. Historical analytic narratives support the theory, including Ottoman reform initiatives, the Japanese Tokugawa reforms and Meiji Restoration, and the Tongzhi Restoration in Qing China.

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1 Introduction

Why do some societies fail to adopt political or economic institutions that are commensurate with a changing technological and economic landscape? History is replete with instances of societies cognizant of, but failing to adopt, advanced market structures, legal codes, and organizational forms. For instance, Kuran (2011) notes that European commercial law was widely used and permitted in the Ottoman Empire, but only for European merchants. The various European legal codes permitted much more complex financial transactions than what was available to Ottoman merchants. Why did the Ottomans not adopt such obviously beneficial institutions? Likewise, the Chinese Qing Empire famously turned inward in the 17th and 18th centuries, just as contact with the West made it obvious to casual observers that Western organizational forms were far superior. In both cases, the stagnant society missed out on a transition to a more efficient economy. Given the stakes involved, why do institutional calcifications ever occur?

The answer most commonly given in the literature lays emphasis on a society's political economy: non-adoption occurs when it is in the interest of the politically powerful for it not to occur (North 1981, 1990; North, Wallis, and Weingast 2009; Acemoglu and Robinson 2012; Blaydes and Chaney 2013).[1] This view is rooted in North's (1990) idea that a society's *formal institutions*—those political, legal, social, and economic mechanisms that establish the formal "rules of the game" and the incentives faced by the players therein—are the key drivers of economic and political outcomes. The "formal institutions of political economy" view clearly explains many cases of non-adoption, and it is not the intention of this paper to undermine the importance of this view. Yet, there are numerous examples of institutional non-adoption despite adoption being consistent with the interests of powerful decision makers. For example, the anti-science movement in the U.S. has resulted in widespread climate change denial (and restrictions placed on federal funding of climate science) and the widespread use of textbooks challenging evolution. While there are certainly interests that gain from climate science denial (energy companies) and evolution denial (certain religious groups), the traditional political economy approach has a difficult time explaining why such views have become so widespread in the general population, especially since their appeal is growing despite improvements in science. A second example comes from contemporary Iraq and Egypt, where attempts to adopt or impose democratic institutions failed despite being in the interest of the politically powerful, who were in position to gain office via election. In each case, chaos dominated the post-election political and economic scene, threatening any chance of democratic institutions succeeding.

Moreover, the standard political economy explanation cannot account for the following curious stylized fact: the rejection of more efficient institutions against the backdrop of rapidly changing economic conditions

[1] This view is particularly prevalent in the related literature on technology non-adoption (Acemoglu and Robinson 2000, 2006; Chaudry and Garner 2007; Coşgel et al. 2012; Rubin 2017).

is frequently *coupled with traditional ideology* dominating discourse. By "ideology", we mean the shared cognitive rules or shortcuts that people within a society use to interpret the complex world around them (North 1981; Boyd and Richerson 1985, 2005; Henrich et al. 2001; Nunn 2012; Mokyr 2016; Greif and Mokyr 2016; Alston et al. 2016, Giuliano and Nunn 2016). Therefore, a "traditional ideology" is one in which a society interprets the world around them through the lens of traditional values that "worked well in the past," even if what made the society successful in the past is poorly understood. The U.S. anti-science movement provides a straight-forward example of such a traditional ideology. Other contemporary examples abound, including the widely expressed desire among some segments of the U.S. population to "return to the 1950s" and the ubiquitous Middle Eastern trope of "returning to the Golden Age of Islam."

Such traditional values are often incompatible with advanced technologies and institutions because they were formed when the technological and institutional environment was drastically different. In the Ottoman case, after it was clear that Western Europe had far surpassed the Empire, it was still true that "even the most intelligent and perceptive of Ottoman reformers at this time adhered to the basic premise that the Ottoman system was far superior to anything that the infidel might develop" (Shaw 1976, p. 175). Other examples include the famed "social decay" of the late Roman Empire, the inward turns of Qing China and Shogunate Japan in response to contact with Europe, and British unpreparedness for World War I. These examples are all reflective of societies built on ideologies associated with past glory but ill-suited for a much changed world.[2] Why do such traditionalist sociopolitical movements so often go hand-in-hand with institutional stagnation?

This paper presents a model that addresses these puzzles by *endogenizing* institutional change *and* ideological evolution. In doing so, the model gives structure to North's (1990) insight that formal institutions work in the intended manner only when complemented by a society's *informal institutions*. Such a framework, like the one laid out in great length by Greif (2006), acknowledges that social norms, beliefs, and informal organizations matter for economic development.[3] Importantly, it also suggests that formal political institutions are malleable, with the softer—and harder to measure—institutional determinants bearing on the formal rules of the game.

Our model indicates that the interplay between productivity shocks on the one hand and ideology on the other may well account for the causal channels through which a society's formal institutions evolve and come to impinge upon its economic development. Specifically, we employ an overlapping generations model where the economy's production technology is subject to exogenous productivity shocks. (Alternatively, one

[2] More generally, Boyd and Richerson (1985, p. 40) note that "historians, sociologists, and anthropologists have found a number of striking examples of cultural inertia, situations in which cultural ancestry is important in changed situations or where traditional cultural differences persist in similar environments."

[3] Informal institutions and culture have recently received renewed emphasis as a key contributor of England's industrialization. See, most importantly, Mokyr (2009, 2016), McCloskey (2010, 2016), and de la Croix, Doepke, and Mokyr (2016).

can entertain the notions that the society receives unexpected inflows of human capital via immigration or it is not on the technological frontier but, instead, is exposed to a new technology.)

In our model, ideological beliefs provide individuals the simplifying heuristics through which they comprehend the best they can the complex world around them.[4] Formally, we model ideology as a mapping from i) actual economic inputs and ii) actual institutions onto some value of "perceived" inputs and institutions. It is the "perceived" values that matter for labor productivity and actual output; a society that lacks the ideological capacity to employ advanced technologies or institutions will not be able to employ them to their full capacity.[5]

In addition to how we have defined ideology above, ideology differs from traditional factors of production (land, labor, and physical and human capital) in that more is not always better. For instance, consider a Westerner with 21st-century ideology being "dropped" into an environment with tribal institutions and ideologies. Despite the fact that her ideology is better suited for the more productive institutional settings of the West, tribal technologies and institutions would be foreign to her. Hence, tribe members would be more productive than her within the context of the tribal economy. Of course, she would be much more productive than tribe members if they were placed in a setting with Western institutions and ideologies.

In the model, ideological beliefs can update over generations to become better suited for the economic environment. The means through which ideology updates is intergenerational transmission; ideology is passed down from parent to child as in Boyd and Richerson (1985) or Bisin and Verdier (2001).[6] Parents can, at cost, provide their children with a new ideology that provides them with the means to equip themselves with the cognitive capacity to assess the production environment through a more objective lens (via, for example, education).[7] Our model extends on prevailing models of cultural transmission by formalizing the idea that while such an objective lens is more compatible with the post-productivity shock economy than the parents' own ideology, there is *uncertainty* associated with this new ideology, since it has never been employed in the current economic and institutional context.[8] Parents do not know how the new ideology maps economic

[4] We are not the first to view ideology in such a manner. We lay out in detail the literature and our formalization of ideological beliefs in Section 2.1.1.

[5] As it will become apparent when we present our model, our key contentions and findings permit the actual inputs of technology and institutions to affect TFP. For simplicity, we focus on the impact of technology and institutions on TFP via their affect on perceptions.

[6] In reality, ideology is also transmitted by one's peers, as well. Such transmission is one of the mechanisms employed by Bisin and Verdier (2001) and is seminal to the cultural transmission literature in anthropology (see, e.g., Boyd and Richerson 1985; Henrich 2001). We simplify the analysis by focusing on inter-generational cultural transmission. This comes with the benefit of making the intuition transparent, but the cost of missing intra-generational dynamics that may explain a lack of ideological change under some circumstances.

[7] Alternatively, the channel of ideological transmission could well be a public education system that is used to propagate a political regime's (potentially self-serving and preserving) ideological and political doctrines. In that case, schooling could be free but time spent at school would instill and propagate the existing state ideologies and political doctrines. In order to escape such indoctrination, parents would need to invest time or resources in a form of private education that would provide the offspring with the cognitive skills necessary to assess the technological and productive environment more objectively. We revisit this issue in the Appendix.

[8] In a related paper, Fernandez and Rodrik (1991) argue that the uncertainty associated with the distribution of gains and losses from reform can prevent reforms from happening even if they would be popular ex post. Although the source of uncertainty

inputs and institutions onto realized values. Sometimes they guess correctly, sometimes they overestimate, and sometimes they underestimate.[9]

Finally, there is a political ruler who maximizes tax revenue over the infinite planning horizon. This ruler can invest in improving the society's institutions to better accommodate technology, although institutional change is costly. Since we are interested in understanding why a society fails to adopt institutions *even when* it is in the interest of the powerful to encourage adoption, we assume that the ruler benefits from more efficient institutions.

The primary insight of our model is that there is an interplay between the uncertainty associated with new ideologies on the one hand and institutional evolution on the other. The degree of uncertainty associated with new ideologies can drive parents to emphasize the intergenerational transmission of their prevailing, traditional ideologies, which they know with certainty, at the expense of investing in a new cognitive framework for their children.[10] In turn, political rulers fail to adopt more efficient institutions even if—and despite the fact that—doing so would be a first-order economic improvement. Hence, both the existing (backward) state of economic development and the society's ideological beliefs would be unlikely to change even though a change in either ideology or institutions might trigger a positive response in the other. In other words, institutional conservatism is an *outcome*; it is not a root cause of failure to adopt more efficient institutions.[11]

This paper is not the first one in economics to suggest an interaction between culture and institutions.[12] Indeed, some recent papers that are particularly relevant to our hypothesis attempt to explain why culture persists in spite of changing economic circumstances. Giuliano and Nunn (2017) show that, consistent with the anthropology literature, societies tend to emphasize traditional values more in relatively stable and predictable environments. They find a negative correlation between *negative* economic shocks and traditional values both cross-sectionally and intertemporally. Our model suggests the complement to their argument, indicating that there is a positive correlation between traditional values and uncertainty related to *positive* economic shocks.[13] The recent theory paper most similar to ours is Bisin and Verdier (2017), who also

in our paper is different, the primary insight differentiating our paper is that we show how uncertainty associated with new ideologies retards institutional development.

[9] Note that such uncertainty would also arise in a model of horizontal cultural transmission.

[10] In order for conservative outcomes to arise, our model does not require parents valuing their own "identity" (as in Akerlof and Kranton [2000] or Bénabou and Tirole [2011]) and thus wanting to pass that identity onto their children. Nor does it require parents wanting to require a reputation for making the right choices (and thus choosing what worked for them in the past), as in Prendergast and Stole (1996). Indeed, an attractive feature of our model is that we find conditions under which "conservative" outcomes arise (with respect to ideology) despite parents having no preference for conservatism.

[11] For more on conservatism as an outcome of institutional environments, see Rubin (2011, 2017).

[12] For overviews of recent developments of various aspects of this literature, see Guiso et al. (2006), Nunn (2012), Spolaore and Wacziarg (2013), Algan and Cahuc (2013), Alesina and Giuliano (2015), and Gershman (2016).

[13] There are many other important works addressing cultural persistence in the face of changing economic and political circumstances. Examples include Putnam (1993), Greif (1994, 2006), Giuliano (2007), Guiso et al. (2008, 2016), Tabellini (2008, 2010), Greif and Tadelis (2010), Nunn and Wantchekon (2011), Gorodnichenko and Roland (2011, 2016), Voigtländer and Voth (2012), Greif, Iyigun and Sasson (2012), Greif and Iyigun (2013), Jha (2013), Alesina et al. (2013), Grosfeld et al. (2013), Alston et al. (2016), Becker et al. (2016), Buggle (2016), Greif and Tabellini (2017), Lowes et al. (2017), Nunn and de la Sierra (2017), and Karaja and Rubin (2017).

study the co-evolution of institutions and culture. They argue that culture and institutions may act as complements or substitutes. In the former (latter) case, the interaction of the two strengthens (weakens) the equilibrium patterns and institutions are more (less) likely to produce their desired effect. Acemoglu and Jackson (2016) investigate the coevolution of social norms and the enforcement of codified laws. They argue that laws which are in conflict with prevailing social norms may be counterproductive; it is only when such laws are gradually introduced that they are effective. Both Bisin and Verdier (2017) and Acemoglu and Jackson (2016) provide valuable insights into the co-evolution of institutions and culture. But one important aspect of this co-evolution which both papers fail to adequately address is why institutions fail to update in the face of changes which make the prevailing institutions and ideological beliefs obsolete.[14] This is hardly a trivial issue; failure to adopt modern institutions is a primary reason for the failure of laggard economies to converge with the leaders (North 1981; Acemoglu, Johnson, and Robinson 2001, 2005; Rodrik, Subramanian, and Trebbi 2004; Greif 2006; Kuran 2011; Acemoglu and Robinson 2012; Rubin 2017). Our paper addresses precisely this issue. Moreover, it is the first example of its kind to link the interplay among technologies, culture, and institutions on the one hand with sociopolitical movements that hinder or aid change on the other.

After we present our baseline theory, we turn to a discussion of three historical analytic narratives pertinent to our model. The first narrative is a historiography of the Ottoman Empire, where reformist movements spanned from clearly traditionalist, starting in the early-17th century and spanning through the 18th century, to the unabashedly modernizing Tanzimat Reform era during the second half of the 19th century. The second narrative addresses 18th-19th century Japan, ranging from the final century and a half of the Tokugawa Shogunate, when three reformist movements had clear and specific traditionalist goals, to the Meiji Restoration in the middle of the 19th century, which was driven in large part by an acknowledgment that the traditional organization of Japanese society was inadequate to deal with the modern challenges of adopting Western technologies and methods. The final narrative is a discussion of the Tongzhi Restoration in Qing China, which presents a particularly illuminating example of traditional values dominating discourse in response to foreign technological and institutional innovations.

The rest of our paper proceeds as follows. Section 2 lays out the model. Section 3 provides historical analytic narratives pertinent to our model, and Section 4 offers some concluding thoughts.

[14] The model in Bisin and Verdier (2017) has institutional design built into it. It therefore does not address how institutions and culture coevolve in response to a shock that changes the conditions under which the institutions were originally designed. An implication of Acemoglu and Jackson (2016) is that such a shock could be accounted for by gradual institutional change.

2 The Model

2.1 Setup

Consider an infinite-horizon, overlapping generations economy with one representative young agent, one representative old agent, and a Ruler (R) in each period.[15] Each agent lives for two periods (one as young and one as old) except for the Ruler, who is infinitely-lived.[16] Old agents are productive but young agents are not. Old agents have preferences over their own consumption and the consumption possibilities of their children, while the Ruler has preferences over current and future tax revenue.

Old agents are endowed with one unit of time, which they can only spend on labor ($\ell_t \in [0, 1]$). The output produced by their labor is $y_t = A_t \ell_t$, where A_t is a productivity parameter that we shall discuss in further detail below.

Individuals possess "ideological capital" which comes to bear on their labor productivity when they work in the second period. Ideological capital is transmitted from parents to their offspring via costly investment, a process which we shall motivate and discuss next.

2.1.1 Ideologies and Mechanisms of Intergenerational Transmission

Definitions & Functions A salient feature of ideology is that it helps individuals make generalizations about the complex environment within which they operate and about which they have incomplete knowledge. Accordingly, ideologies not only influence how individuals interpret their experiences, but also complement the factual information they possess. Henrich et al. (2001) provide evidence of this aspect of ideology, showing that participants in experimental games from various small-scale societies around the world act consistent with behaviors they employ in different (economic) settings. The most likely explanation for their findings is that being placed in new situations cues a response that has worked in other, more familiar situations—what we denote as ideology. Implicit in these assertions is the notion that ideologies may be economically useful; although the ideology which maximizes the economic "fitness" of a population may not always win out (Boyd and Richerson 2005; Henrich, Boyd, and Richerson 2008; Greif and Tadelis 2010). Indeed, the root of the idea that ideologies help to serve an economic purpose can be traced to Adam Smith, who recognized one form of ideology, religion, as a rational means for individuals to enhance their human capital (North 1981, p. 49; Iyigun, Mocan, and Owen 2001).

Naturally, the purpose of ideologies can be interpreted in different ways. For instance, one can subscribe

[15] There is no population growth in the model because our empirical applications are not affected by population growth. Interesting dynamics with respect to population growth could arise, but they do not alter the fundamental insights of the model.

[16] This formulation is consistent with a ruler who also lives two periods, but whose dynasty is in political control over the infinite time horizon and whose time discount factor is constant across generations.

to the view that ideologies are non-deductive sets of beliefs about "right" and "wrong," and that they serve a more normative approach to life rather than provide a general framework with which to make judgements about how things work (Henrich et al. 2001; Boyd and Richerson 2005). In presenting the model below, we adopt the notion that such a framework forms the basis of making positive judgements. Put another way, we argue that, while ideologies may help individuals form beliefs about what is "right" and what is "wrong," they do so within the context of some working hypotheses about their economic environment (Mokyr 2016; Greif and Mokyr 2016).

North (1981, p. 47) best summarizes the functional role of ideologies that we employ below: "Ideology is an economizing device by which individuals come to terms with their environment and are provided with a 'world view' so that the decision making process is simplified. [Ideology] is inextricably linked with moral and ethical judgments about the fairness of the world the individual perceives. This situation clearly implies a notion of possible alternatives. Individuals alter their ideological perspectives when their experiences are inconsistent with their ideology. In effect, they attempt to develop a new set of rationalizations that are a better 'fit' with their experiences."

Intergenerational Transmission In the spirit of the definitions above and, specifically, based on the way North defined ideology, we assume that an individual's ideological stock helps her to assess and form an opinion on the technology and institutions prevalent in the economy. Ideological interpretation is necessary because, without the simplifying heuristics that ideologies offer individuals, the technological and institutional environments in which they operate is too complex for full and neutral comprehension.

In particular, an ideology D^j, $j = O,\ N$ (for 'old' and 'new'), is a continuous mapping, $f : \mathbb{R}^2 \to \mathbb{R}^2$, such that

$$D^j(G_t,\, I_t) \ = \left\{\tilde{G}_t,\, \tilde{I}_t\right\} \ , \qquad j = O, N, \tag{1}$$

where G_t ($\in \mathbb{R}^+$) and I_t ($\in \mathbb{R}^+$) denote the prevailing states of technology and institutional efficacy in period t and $\tilde{G}_t$, $\tilde{I}_t$ are their inferred or "perceived" levels, respectively, by the individual who possesses the ideology D^j, $j = O, N$.[17]

In terms of the intergenerational transmission of ideologies, parents can pass on to their offspring an incumbent ideology, $D^O(G_t,\, I_t)$, at no cost. We refer to D^O as the "traditional" ideology, since it is the one associated with previous generations. With this traditional ideology, we have $D^O(G_t,\, I_t) = \{\alpha G_t,\, \alpha I_t\}$. More specifically, $D^O(G_t,\, I_t)$ is such that:

[17] One could imagine that ideology is continuous, rather than discrete as we have modeled it. Yet, Henrich and Boyd (2002) and Henrich, Boyd, and Richerson (2008) show that thinking of cultural evolution in discrete terms yields similar results while having the advantage of being much easier to conceptualize.

1. If there has been investment in the intergenerational transmission of ideologies at any time in the past and neither the technology nor the institutions have upgraded since then, we have $D^O(G_t,\ I_t) = \{G_t,\ I_t\}$, reflecting the assumption that $\alpha = 1$;

2. If the technology or institutions have updated in period t, then the traditional ideology yields $D^O(G_t, I_t) = \{\alpha G_t,\ \alpha I_t\}$ where $\alpha \leqslant 1$. This reflects the assumption that, without an update in ideologies, traditional ideologies may fall short of fully and without bias distilling the TFP impact of a new economic environment (i.e., $G_t,\ I_t$).

Alternatively, parents can choose to instill in their offspring an available but untested ideology, $D^N(G_t,\ I_t)$, at a cost of $zA_t,\ z > 0$. We might think of the cost, z, as investment in education or the opportunity cost of permitting one's child to socialize with their peers instead of working in the fields. Due to the fact that this new ideology is yet untested, it involves a risk/reward trade-off when it is first used. Specifically, with a new technology G_t or a new set of institutions I_t in place, we have:

$$D^N(G_t,\ I_t) \ = \begin{cases} \{G_t,\ I_t\} & \text{with probability } 1-2p \\ \{G_t+g,\ I_t+i\} & \text{with probability } p \\ \{G_t-g,\ I_t-i\} & \text{with probability } p \end{cases} . \tag{2}$$

Thus, the new ideology offers the potential to fully distill the actual TFP effects of the new technology and institutions *in expectation*, but it does so at the risk of undershooting and overshooting them with likelihood of p, $p \in [0, 0.5]$.[18]

2.1.2 Technology, Ideology and Labor Productivity

Labor productivity A_t derives from the prevailing state of technology, G_t, and institutional efficacy, I_t, as viewed through the ideological lens through which the individual interprets them. In particular,

$$A_t = \Omega[D^j(G_t,\ I_t)] \qquad j = O, N, \tag{3}$$

where the function $\Omega : \mathbb{R}^2 \to \mathbb{R}$ is strictly increasing and monotonic in both of its arguments.[19]

[18] As we already discussed in the introduction, the manner in which we formalize ideology entails that more is not always better, as is generally assumed of traditional factors of production. Revisiting the example we gave in the introduction, consider a Westerner with ideology D^O who is transplanted to a tribal economy with values of G_t and I_t she has never seen before. If she does not update her ideology, see will see G_t and I_t biased by α, whereas a native to the tribe would see G_t and I_t at their correct levels (i.e., $\alpha = 1$).

[19] As we noted previously, it is not essential that only "perceptions" of technology and institutions determine labor productivity

In terms of the state of technology, we assume that there is an incumbent technology in period t which has a TFP of G^O. We then assume that the economy is exposed to a new technology with a strictly higher TFP in period $t+1$. Specifically, we let $G_t = G^O$ and $G_{t+1} = G^N$, where $G^N \equiv \gamma G^O$, $\gamma > 1$.

Finally, institutional quality in period $t+1$, I_{t+1}, is determined by the Ruler's investment choices in a manner we shall discuss formally below. Informally, we assume that the Ruler chooses the socially optimal institutions, given ideological investment and the state of technology. We could consider alternative specifications in which the Ruler acts in the interest of a sociopolitical or economic class, as in some other conventional political economy models (e.g., Acemoglu and Robinson 2000). Such a model could also generate mechanisms through which institutions would not be upgraded even when it is economically efficient to do so. Yet, we aim to shed light on institutional and ideological dynamics when change is *in the interest* of the ruling elite. Thus, we choose a specification in which the socially efficient courses of action are aligned with the Ruler's interests.

2.2 The Equilibrium

2.2.1 A Benchmark without Ideologies

To highlight our paper's main contribution regarding the role of ideologies in institutional change, consider first a special case of our framework in which $\alpha = 1$. In this case, the incumbent ideology is always and maximally efficient in that $D^O(G_t, I_t) = \{G_t, I_t\}$. Hence, we effectively have $A_t = \Omega(G_t, I_t)$, and the Ruler's problem becomes much simplified, as we illustrate next.

The Ruler's Problem After observing the realization of $G_t = G^N$, the Ruler chooses institutions, I_t, to maximize lifetime tax revenue discounted at rate $\delta \in (0,1)$, minus the cost of maintaining institutions, $c(\cdot)$.[20] The cost of maintaining institutions is strictly increasing and convex in expenditures so that $c(0) = 0$, $c' > 0$, and $c'' > 0$. We assume there is some exogenously set tax rate, $\tau \in [0,1]$, which determines the portion of output the ruler receives.[21] The period t strategy set of the Ruler can therefore be written as $s_t^R = I_t \in \mathbb{R}^+$. The Ruler's utility is written:

$$U_t^R = \sum_{j=t}^{\infty} \delta^{j-t} E\left[\tau y_j - c(I_j) \,|s_j^o, s_j^R\right]. \tag{4}$$

and output. What is essential is that, besides the other more conventional determinants, "perceptions" of technology and institutions have some influence on labor productivity as well.

[20] Recall that we rule out technology non-adoption. In a setting in which political rulers or some vested interests can block new technologies, stagnation in technologies, institutions, and ideologies trivially and naturally occurs. Instead, our main focus is one in which technological change is the main driver of the evolution and the interplay between socially prevalent ideological beliefs and political institutions.

[21] The assumption that the tax rate is exogenous is not far-fetched if the model is applied to the pre-modern setting, where rulers had weak fiscal capacity and generally extracted the maximum amount possible subject to the constraint of weak fiscal institutions. Nevertheless, one can extend our model to endogenize the tax rates although doing so would not have a qualitative material impact on our key contentions.

In every period, the Ruler maximizes (4) by choosing, $\forall j \in [t, \infty]$, I_j, subject to $y_j = A_j \ell_j$ and A_j given by (3). Given that the incumbent ideology is "perfect" (in that $\alpha = 1$), old agents never choose to invest in updating the prevalent ideology, so that $D^j(G_t,\, I_t) = D^O(G_t,\, I_t) = \{G_t,\, I_t\}$ in every period t. On this basis, the Ruler's optimal behavior is implicitly defined by the following first-order condition:

$$\frac{\tau}{1-\delta}\frac{\partial E(A_t)}{\partial I_t} - c'\left(I_t\right) \leqslant\ 0, \tag{5}$$

where

$$\frac{\partial E(A_t)}{\partial I_t} = \Omega_2 \cdot D_2^O(G^N,\ I_t)\ , \tag{6}$$

where, due to the fact that $G^N \equiv \gamma G^O$ and the ideology in effect is "perfect", we have $\Omega_2 \cdot D_2^O(G^N, I_t) = \Omega_2(\gamma G^O, I_t)$.[22] On this basis, we can now readily show that the Ruler's optimal choice is to always upgrade institutions to keep pace with new technologies, so long as institutions and technology are complementary in the production process. Specifically, using the implicit function theorem, we have,

$$\frac{\partial I_t}{\partial \gamma}\ =\ -\frac{\tau\Omega_{21}}{1-\delta}\Bigg/\left(\frac{\tau\Omega_{22}}{1-\delta} - c''\right)\ . \tag{7}$$

Given that we assume $c'' > 0$ and $\Omega_{22} < 0$, equation (7) is unambiguously and strictly positive if institutions and technology are complements in TFP (i.e., $\Omega_{12} > 0$). Hence, we have a case in which, save for the classic arguments of how a variety of rent-seeking behavior on the part of the ruling class stifles "better" institutions, technological change would always spur institutions more amenable to economic productivity.

2.2.2 The Generalized Model

Now we illustrate how ideological beliefs come to impinge on the dynamics of institutional change. In our more general case where ideologies that are transmitted intergenerationally come to bear on labor productivity, the Ruler and Citizens both face uncertainty. In deciding whether to invest in "better" institutions, the Ruler grapples with the Citizen's choice of intergenerational ideological investment, and the latter takes into account whether the former will invest in institutions that are more conducive for labor productivity.

The Ruler's Problem The Ruler's problem is still specified as we exposited above with the exception that, here, ideological investments matter. Thus, equation (6) can no longer be simplified because the incumbent ideology no longer helps to perfectly observe technology and institutions after the shock (and hence $\alpha \leq 1$). The Ruler takes as given the ideological decision of the Citizen (i.e., $D^j(G_t,\, I_t)$, $j = O, N$), and chooses

[22] This reflects the fact that, in this case, $D_2^O = 1$.

institutional investment on the basis of the following first-order conditions, which are slightly amended versions of (5) and (6):

$$\frac{\tau}{1-\delta}\frac{\partial E(A_t)}{\partial I_t} - c'\left(I_t\right) \leqslant\ 0, \tag{8}$$

where

$$\frac{\partial E(A_t)}{\partial I_t} = E\left[\Omega_2 \cdot D_2^j(G^N,\ I_t)\right] \qquad j\ =\ O,\ N\ . \tag{9}$$

The Citizens' Problem Simultaneous with the institutional choice of the Ruler, old agents decide their level of consumption and whether they will invest in the transmission of new ideological beliefs to their offspring. They do so by maximizing their utility from their own consumption and the consumption possibilities of their children, subject to $zA_t 1_N + c_t \leq (1-\tau)\, y_t$, where zA_t, $z > 0$, represents the pecuniary cost of transmitting the untested, new ideology $D^N(G_t,\ I_t)$ to one's offspring and 1_N is an indicator function that switches on when the Citizen invests in the new ideology.[23] The old citizen's choices are conditional on the prevailing states of technology (G_t), institutions (I_t), and the tax rate (τ). The period t strategy set of the old agent is therefore denoted $s_t^o = (1_N, c_t) \in \{0,1\} \times \mathbb{R}^+$. Old agents are altruistic, placing weight $\lambda \in \mathbb{R}^+$ on the consumption possibilities of their children (i.e., $(1-\tau)\, A_{t+1}$). Assuming log utility, the utility of the old agent is written:

$$U_t^o = \log\left(c_t\right) + \lambda \log[(1-\tau)\, E(A_{t+1})]\ . \tag{10}$$

The citizen maximizes (10) by choosing c_t and whether to invest in D^N for its child, subject to $zA_t 1_N + c_t \leq (1-\tau)\, y_t$.

Intra-Temporal Equilibrium The intra-temporal equilibrium of such an economy is one in which each player takes the optimal choices of the other as given and decides on her optimal allocations. This involves an intra-temporal equilibrium where the optimal choices of the Ruler and the Citizen are consistent with each other (in that, the behavior each takes as given in deciding their optimal choices is the optimal response of the other agent).

Accordingly, the Ruler calculates two optimal investment choices I_t based on the first-order conditions we described above (which are evaluated conditionally at $D^O(G_t,\ I_t)$ and $D^N(G_t,\ I_t)$, respectively). Her optimal level of institutional investment, I_t, is then given by the value that yields the maximum value of (4).

[23] Formally, the old agent chooses a level of labor, ℓ_t, to supply as well. Since we ignore utility from leisure, there is no choice but to provide labor with one's time. Thus, we drop this formality and embed the optimal labor choice into the decision problem, as a result of which we have $\ell_t = 1$.

Specifically, the two levels of investment possible in equilibrium are implicitly defined by $I_t^*[D^O(G_t, I_t^*)]$ and $I_t^{**}[D^N(G_t, I_t^{**})]$.

Turning to the Citizen's problem, all we need to determine is her indirect utility function evaluated at $D^O(G_t, I_t^*)$ and $D^N(G_t, I_t^{**})$, with her optimal choice being defined by:

.

$$V_t^o = \max \left\{ \begin{array}{c} \log\left((1-\tau)\, A_t\right) + \lambda \log\left(1-\tau\right) \Omega[D^O(G^N,\, I_{t+1}^*)], \\ \\ \log\left((1-\tau-z)\, A_t\right) + \lambda \log\left(1-\tau\right) \Omega[D^N(G^N,\, I_{t+1}^{**})] \end{array} \right\}. \tag{11}$$

Now consider the fact that there is a new technology employed in period $t+1$ such that $G^N = \gamma G^O$. In this case, equation (11) yields:

$$V_t^o = \max \left\{ \begin{array}{c} \log\left((1-\tau)\, A_t\right) + \lambda \log\left(1-\tau\right) \Omega(\alpha\gamma G^O,\, \alpha I_{t+1}^*), \\ \\ \log\left((1-\tau-z)\, A_t\right) + \lambda \left[\begin{array}{c} (1-2p) \log\left(1-\tau\right) \Omega(\gamma G^O,\, I_{t+1}^{**}) \\ \\ +p \log\left(1-\tau\right) \Omega(\gamma G^O + g,\, I_{t+1}^{**} + i) \\ \\ +p \log\left(1-\tau\right) \Omega(\gamma G^O - g,\, I_{t+1}^{**} - i) \end{array} \right] \end{array} \right\}. \tag{12}$$

Predictions We can now illustrate the key contentions of our paper. First, consider how the risk associated with new ideology, p, affects ideological updating in periods following a shock. As p approaches zero, an ideological update strictly dominates a traditionalist response for relatively small α. To see this, first observe that, as p and z approach zero and α approaches one, I_{t+1}^* approaches I_{t+1}^{**}. Then, the two arguments on the RHS of equation (12) become strictly equal. One can then see that there are unique pairs of $z > 0$ and $\alpha < 1$ such that the two arguments of (12) remain strictly equal. Thus, for some $z > 0$, there exists $\alpha < 1$ that would make the switch to the new ideology unambiguously optimal. As a corollary, the smaller is α, the more likely it is that parents will choose to instill in their children the new and untested ideology.

By a related argument, the higher is the risk associated with the new and untested ideology, p, the higher is the likelihood that parents stick with the traditional ideology, despite the changing production environment and the new technology in effect. To see this, one simply has to note that the payoff of the new ideology strictly decreases in p so long as $\Omega_{11} < 0$.

Moreover, the equilibrium level of institutions chosen by the ruler, I_{t+1}^* or I_{t+1}^{**}, is decreasing in p. This results for two reasons. First, as p increases, the parameter space over which the agent chooses D^N is

decreasing. Since the returns to the ruler are greater when the agent transmits ideology D^N than they are when the agent transmits the traditional ideology, an increase in p weakly decreases the ruler's optimal institutional choice. Second, the ruler faces a probabilistic set of outcomes associated with the new ideology. Like the agent, the payoff to the ruler of the new ideology strictly decreases in p so long as $\Omega_{11} < 0$. We summarize these insights in the following proposition (for complete proofs of the following two propositions, see Appendix A).

Proposition 1 *Both the optimal level of institutions (I^*_{t+1} or I^{**}_{t+1}) and the parameter space over which the agent chooses the updated ideology (D^N) are weakly decreasing in p, ceteris paribus.*

Next, we turn to comparative statics with respect to the size of the shock, γ. First consider how the size of the shock affects ideological updating in periods following a shock. It follows directly from (12) that the new ideology becomes unambiguously more attractive as γ increases, so long as $\alpha < 1$. Thus, it must be the case that, when α is relatively small so that the prevailing, traditional ideology is fairly ineffective in mapping onto labor productivity from new technologies and institutions, the parameter space over which the agent chooses the new ideology is increasing in γ. It likewise follows that the ruler's institutional choice is increasing in γ. To see this, note that the agent is more likely to choose the productivity-enhancing ideology at higher levels of γ and, in any case, Ω is increasing in γ regardless of the agent's choice. Combined, these insights yield the following proposition.

Proposition 2 *When α is sufficiently small, both the optimal level of institutions (I^*_{t+1} or I^{**}_{t+1}) and the parameter space over which the agent chooses the updated ideology (D^N) are weakly increasing in γ, ceteris paribus.*

Finally, we represent graphically our key insights with a 2×2 figure (see Figure 1). The two propositions indicate that whether ideology updates in equilibrium is dependent on p and γ, ceteris paribus. When the size of the shock (γ) is small, ideology is unlikely to update regardless of the uncertainty associated with updating. As the size of the shock grows, ideology is still likely to remain traditional when uncertainty (p) is large.

Interpreting this figure further, consider the case where α is small, meaning (by definition) that the traditional ideology returns low levels of G and I. In this case, a shock will lead to a small amount of institutional change if ideology remains traditional and a large amount of institutional change if ideology updates. Moreover, institutional change will have little effect on outcomes if ideology remains traditional, since the mapping from actual institutions to outcomes (via D^O) greatly reduces the effectiveness of institutions. As seen in Figure 1, it follows that when p is large, a large shock (i.e., high γ) may lead to some institutional

change *without ideological change*. We keep this insight in mind as we turn to a series of analytic narratives on which the model sheds light and vice versa.

3 Historical Evidence

In this section, we support the insights of the model with three historical analytical narratives. Each of these narratives highlights the ideological and institutional reaction of non-Western societies when first confronted with Western technologies. These are precisely the conditions examined by the model. Western technologies and organizational forms offered massive productivity improvements when first introduced, yet they also carried immense uncertainty regarding how they would "fit" the existing ideological base upon which non-Western societies were built. The narratives cover the Ottoman Empire's evolving political and institutional responses to a rapidly industrializing Europe, the rapid industrialization and modernization of the Japanese economy during the Meiji era, following conservative reform episodes during the Tokugawa Shogunate, and the inward turn of Qing China during the Tongzhi Restoration.

3.1 The Ottoman Empire

It was by no means obvious in the 16th century that the Ottoman Empire would eventually fall behind its Western European rivals. Territorially, the Empire expanded throughout the century and eventually ruled most of the North African coast, the Arabian Peninsula, the Balkan Peninsula, and the Middle East. Indeed, the Ottomans repeatedly threatened the great powers of central and southern Europe—Spain, Venice, and the Holy Roman Empire.

Yet, by the end of the 17th century, the Ottomans had clearly fallen behind. Even prior to the Industrial Revolution, this reversal of fortune was especially apparent with respect to technology (Mokyr 1990). The Ottomans were hardly unaware that the tables began to turn in the seventeenth century; they were in close contact with the West when profound economic changes were beginning to take shape in Europe. As early as the first part of the seventeenth century, the Ottomans seem to have caught on rather quickly that the world was rapidly changing. The prototype reformist sultan was Osman II, whose reign lasted from 1618 to 1622. He was followed by Sultan Murad IV (r. 1623–40) and the exceptional era of Grand Vizier Mehmed Köprülü (r. 1656–83), who both followed up with reforms of their own.

In our model, productivity shocks, γ, are much more likely to result in improved institutions to accommodate such changes when individuals (or most of society) decide to update their prevailing ideologies in response to the shock. Yet, ideology only updates if the uncertainty (p) associated with new and heretofore unused ideology is sufficiently small. When uncertainty is large, ideology regarding the appropriateness of

the "new economy" to the society's resource base will not update, and there will be little incentive for the ruling elite to update institutions. As we will argue below, the latter insight provides an explanation for the initial Ottoman reaction to Western advancements and, in particular, why the early reformist sultans advocated conservative reforms.

Ottoman rulers clearly recognized that change was occurring in the West. Yet, their operating premise was the inferiority of anything Western—an ideology that was justifiable in the sixteenth century context in which it emerged. The "traditionalist reform period" of the seventeenth and eighteenth centuries was built on this ideal of Ottoman superiority (Shaw 1976, p. 175). Contemporary observers viewed Ottoman failure vis-à-vis the West as a failure to apply the techniques and organizational forms employed under the glorious reign of Süleyman the Magnificent (r. 1520-66), a period often viewed as the apex of Ottoman power. In other words, reform could only be achieved by returning to the "traditional" way of doing things.[24]

The traditionalist reform period of the seventeenth and eighteenth centuries was characterized by an entire class of Ottoman political observers commenting on the decline of the empire, focusing primarily on deviations from the norms of Süleyman's reign (Howard 1988; Dale 2010). One influential pre-cursor of these observers was Mustafa Ali (1541-1600), who wrote a history of the empire during a time of Ottoman expansion—i.e., before it was obvious that the empire had fallen behind leading European powers. Ali's treatise is characteristic of what would become the genre. It laments the "rising corruption, disruption of the military, the declining power of viziers, the loss of authority of the madrasa-trained intellectual elite, ... economic problems, and the pernicious influence of the harem" (Dale 2010, p. 270). If the sultan and his administrators could just return to the pious and honest rule of Süleyman and his predecessors, Ottoman decline would be arrested.[25]

The most important and skilled writer on Ottoman stagnation was Koçi Beg, an intimate advisor of Sultan Murad IV (r. 1623-40). Koçi Beg's most important contributions to the reform literature included a treatise for Sultan Murad IV in 1630 and a description of Ottoman institutions and terminology for Sultan Ibrahim in 1640 (Howard 1988, p. 64; Lewis 1973, p. 203-7). Throughout his writings—many of which were used extensively by later writers of the genre—the concept of a past "Golden Age" under Süleyman is a dominant theme (or, the "imagined perfection" of the era before Süleyman, as denoted by Colin Imber

[24] In our model, the ruler does not have an ideology (although we extend the model in the Appendix to permit the ruler to have an "optimal ideology"). Yet, according to the model, the ruler must assess the prevailing ideology when choosing institutions. As we attempt to make clear throughout the narratives, Ottoman, Japanese, and Chinese rulers were not necessarily acting in accordance with their own ideologies, but in accordance with the prevailing ideologies of the citiizenry as transmitted to them via trusted advisors and reformers.

[25] Along these same lines, Lewis (2002, p. 45) notes how traditional Ottoman reforms emphasized a return to cultural and ideological roots: "The final answers given by traditional writers to the older formulation of the question [why did the West leap ahead?] were always 'let us go back to our roots, to the good old ways, to the true faith, to the word of the God.' With that of course there was always the assumption that if things are going badly, we were being punished by God for having abandoned the true path."

[2016]). It was under Süleyman that administrative practices reached their ideal, but this ideal was long past: "It is a long time since the high-chambered household of the lofty Sultanate (may it remain under the protection of eternal grace) was served by solicitous, well-intentioned, worthy ulema and by obedient, self-effacing, willing slaves. Today the state of affairs having changed, and evil, upheaval, sedition, and dissension having passed all bounds, I have sought occasion to observe the causes and reasons of these changes, and bring them to the Imperial and august ear" (quoted in Lewis 1973, p. 203). In this view, it was the laziness of the sultan, the debasement of the Grand Vizier, the bloating of the Janissaries, and the venality of the judges—all practices far removed from the glories of the "imagined perfection" of the past—that were at fault for Ottoman decline (Lewis 1973, p. 204-6).

Koçi Beg's writings were characteristic of the entire "traditionalist reform" genre, with its emphasis on traditional ideology (Dale 2010, p. 272).[26] Yet these writings were also optimistic, noting that a return to the past was all that was needed to bring back lost glory: "The enemies of the faith, seeing the good order and stability ... will say, in helpless fear and envy: 'The House of Osman lay for sixty years in neglectful sleep, but now they are wide-awake, and have begun to make good the shortcomings of past days'" (quoted in Lewis 1973, p. 207).

Simply put, it was not obvious to the Ottomans of the time that European institutions were superior to Ottoman ones, particularly those put in place during the Ottoman rise to power. The ideology through which the Ottomans viewed European advances made it impossible to adopt these advances in any meaningful way, since they clashed with the ideological belief of Ottoman superiority. Indeed, there was genuine uncertainty whether European productivity improvements would work in a society that deemed them inferior. If it were just a matter of transplanting institutions independent of ideology, this would have been straight-forward enough. But ideological beliefs centered on the superiority of Ottoman institutions were slow to update. In the process, Ottoman institutions fell behind. This is a classic case of the "traditionalist equilibrium" we describe in the model. In the face of a vastly changing world, Ottoman beliefs in their own superiority failed to change and, as a consequence, Ottoman institutions failed to accommodate institutional and technological advances.

The failure of the *tımar* system provides an excellent example of the interaction between antiquated institutions and traditionalist ideological beliefs. At the height of Ottoman power in the fifteenth and early sixteenth centuries, the sultan derived two-thirds to three quarters of his revenue through the *tımar* system, a military lease contract whereby the provincial cavalry collected agricultural taxes directly from the peasantry

[26] For instance, an anonymous treatise entitled *Kitāb-i Müstetāb* from about 1620 argues that the Ottomans were successful from the founding of the dynasty until the reign of Murād III (1574-1595) because they followed Shari'a (Islamic law) and kanun (secular law) and had just administration. The author contrasts that situation with the present, where decline versus the West had already commenced (Howard 1988, p. 71). For many more examples, see Lewis (1973, ch. 15), Howard (1988), and Dale (2010, p. 270-287).

as remuneration for their military services to the state. The *tımar* system was similar to the tax collection system of feudal Europe, where local feudal lords controlled revenues in return for military service. But as Ottoman expansion ceased and the sultan was no longer able to provide new *tımar*s to the military elite, the system began to fail and the central government received less tax revenue (İnalcık 1973, ch. 13; Hourani 1991, ch.13; Coşgel and Miceli 2005). To address this revenue shortfall, the state eventually (in 1695) sought larger short-term payouts in return for lifetime tax farms under an institution known as the *malikane* system. But this system failed, too, as tax farmers passed down their farms to their heirs instead of returning them to the state, and some tax farmers stopped sending in revenues altogether (Pamuk 2004; Balla and Johnson 2009).

The Ottoman failure to extract revenue stands in stark contrast to what the leading European economies were able to achieve. The sixteenth and seventeenth centuries were precisely the period when the leading European powers built large fiscal apparatuses and sovereign debt markets. They achieved this via institutions that constrained rulers and centralized tax collection (North and Weingast 1989; Dincecco 2009). As a result, a nation as small as the Dutch Republic was able to collect 42.5% more taxes than the Ottoman Empire by the 1650s despite having less than one tenth of its population. In per capita terms, the Dutch collected over 15 times the revenue of the Ottomans, and the Spanish, French, Venetians, and English all collected at least five times the per-capita revenue of the Ottomans (Karaman and Pamuk 2010, 2013).

How did Ottoman advisors and intellectuals respond to the decline of the *tımar* system? Instead of looking to Europe for solutions—and clearly certain European polities had found better institutional solutions to tax collection—Ottoman writers placed blame on corruption within the *tımar* system (Howard 1988, pp. 59-73). If only the Ottomans could employ the system like it was used at the height of Ottoman power under Süleyman (and before), decline could be arrested. It was corruption and nepotism among *tımar* holders, not the *tımar* institution itself, that required mending. This is typical of the "traditional equilibrium" described in the model. The prevailing Ottoman ideology was founded upon the belief that Ottoman institutions and technologies were superior to those of the West. Clearly, by this point in time, this ideology was obsolete. In the terms of the model, this traditional ideology had a low α—that is, the perceived value of Western technology and institutions was much lower than their actual value. What was needed was the recognition that Western technology and institutions were more advanced than Ottoman ones, something that the prevailing Ottoman ideology failed to provide.

It was only after the Ottoman-Europe disparity became sufficiently large and obvious that the Ottomans accepted the superiority of European institutions and technology. Historians date the beginning of the Ottomans' decline to the Peace of Karlowitz signed between the Holy League and the Ottomans in 1699. With that treaty, the Ottomans ceded most of Hungary, Transylvania, and Slovenia to Austria; Podolia to

Poland; and most of Dalmatia to Venice. Karlowitz also marked the ushering in of the second-generation Ottoman reforms (Shaw 1976, p. 225). The reforms, for the first time, recognized that an appropriate response to European advancements was only achievable by discovering what Europe had done to pull ahead in the first place and to emulate it. Even then, there was an attempt to keep technology and ideology transfers confined to the military and national defense realms (Lewis 2002, p. 81). The fact that military reforms took precedence over others helped subordinate the hurdles of cultural and religious beliefs, but it did not ensure the successful implementation of the necessary reforms, as the empire was slow to adapt and it held the view that the fundamentals of its own military organization were superior to the West (Imber 2002, p. 284).

It was not until the 19th century unveiling of the *Tanzimat Decree* by Sultan Abdülmecid I (1839) that the Ottomans began to adopt Western institutions. These reforms rejected traditional ideology. They were heavily influenced by European ideas—including the superiority of parliamentary democracy as a political system and the Enlightenment's emphasis on rationality and education—with the intent to effectuate a fundamental change from the old system based on theocratic principles to that of a modern state. This turnabout is explicable in the context of the model. As the size of the "shock" (γ) increases, there is a greater benefit of investing in new ideologies better-suited for the new economy. When γ is sufficiently large, as it almost certainly was in the mid-nineteenth century Ottoman Empire, investments in new ideology will be made even if there is significant uncertainty regarding the impact of this new ideology.

The culmination of this ideological change was the Tanzimat Decree: the earliest constitutional document in any Muslim country. The decree culminated with the establishment of the first ever House of Parliament in the Muslim world, the Meclisi Mebusan, in 1876 (Kinross, 1979, p. 474). It encompassed a series of reforms promulgated in the Ottoman Empire between 1839 and 1876 under the reigns of the sultans Abdülmecid I (r. 1839-61) and Abdülaziz I (r. 1861-76). Many of the key provisions of the Tanzimat reforms were set forth in the *Hatt-ı Şerif of Gülhane* (1839). This document called for the establishment of new institutions that would guarantee security of life, property, and honor to all subjects of the empire regardless of their religion or race. It also authorized the development of a standardized system of taxation to eliminate abuses and established fairer methods of military conscription and training. The promises of equality for non-Muslims (mainly Christians and Jews) living in the empire were not always carried out, but the balance of the changes provided for in the Noble Edict, along with other reform measures, were implemented principally under the leadership of Mustafa Reşid Paşa, who served six terms as grand vizier. The reforms included institutional adoption from across Europe, such as the development of a new secular school system, the reorganization of the army based on the Prussian conscript system, the creation of provincial representative assemblies, and the introduction of new codes of commercial and criminal law, which were largely modeled after those

of France. These laws were administered by newly established state courts independent of the *ulemā*, the Islamic religious council.

But these reforms came too late. By the late 19th century, the Ottoman Empire was known as the "sick man of Europe", and its remnants were carved up by the victors of the First World War. What was a once powerful empire fell behind and could not catch up—not because it was incapable of adopting Western institutions, but because for too long the ideological beliefs of its people were incompatible with the adoption of Western techniques.

3.2 The Road to Modern Japan

Eighteenth and nineteenth century Japan, which witnessed the decline and fall of the Tokugawa Shogun followed by the Meiji Restoration, is another relevant case that highlights the key dynamics of our hypothesis. In particular, the last few decades of the Tokugawa era were exemplified by a number of reformist movements, almost all of which had a traditionalist spirit in the sense we defined above. By contrast, the Meiji Restoration was an initiative aimed at transforming Japanese society, economy, and institutions based on an acknowledgment of Western superiority.

The reform attempts during the Tokugawa Shogunate began in the early eighteenth century with those undertaken during the Kyōhō era. These reforms were primarily a response to political economy disruptions associated with the rise of urban commercialism (Jensen 2000, pp. 238-9). Their most prominent features included renovations in the educational system and the intellectual realm based on the orthodoxy of Chi Hsi Confucianism. Later, during the waning decades of the Tokugawa era, a new set of reforms known as the "Tenpō reforms" enacted ad hoc emergency responses to a series of natural disasters that widened Japanese sociopolitical rifts. These, too, aimed to reform education with a heavy emphasis on the traditional Confucian teachings and discipline (Jansen 2000, pp. 243, 248).

The common thread connecting Samurai discontent and social criticism toward the demise of the Tokugawa Shogunate was a fundamentally traditionalist outlook based on Confucian principles. Early interactions with Western powers, even when they revealed direct or indirect evidence of the superiority of their technologies and institutional organizations, were met with some degree of existential denial (Duus 1976). As a result, the practical reforms undertaken by the Tokugawa regime were heavily influenced by attempts to restore traditional Japanese morality, spirituality, and philosophies guided by conventional Confucian ideas. Much like the Ottoman reformers discussed in the previous section, Tokugawa reformers believed that traditionalist morals and political standards were correct in spite of an obviously changing world. What went wrong, according to this idea, was the failure of society to live up to these traditionalist standard (Duus 1976,

p. 53). Few critics called for an overthrow of the old system. They instead blamed the people empowered by the traditionalist system for not living up to its standards.

By stark contrast, the Meiji Restoration was a wholesale reform initiative based on an acknowledgment that the traditional social, political, and economic organization of Japanese society was inadequate to deal with the modern challenges of adopting Western technologies and methods of production. Based on our hypothesis, it was driven by an eventual recognition that Western technologies and institutional organizations involved a degree of superiority that was significantly more advanced than those in Japan and, thus, that their adoption at the expense of Japanese traditional ways were worth the uncertainty regarding how they would clash with Japanese ideology. To put things in the context of our model, the size of the shock (γ) associated with Western technologies was, by the middle of the 19th century, significant and apparently large enough relative to the uncertainty associated with updated ideology (p) that the Japanese were willing to adopt Western methods. And it is this new and progressive ideology, which acknowledged Western technological and institutional superiority, that formed the basis of the subsequent institutional reforms that were enacted.

The most obvious Japanese weaknesses relative to the West were in the realm of military and economics. The Meiji government feared—not without reason—that these weaknesses would make them easy prey for an enterprising Western power (Allen 1981, pp. 32, 33). Consequently, the Meiji regime adopted Western methods in both war and industry. Among the most important of the economic reforms was an abolition of the old regime's restrictions on freedom of movement and enterprise. Such restrictions served the agrarian Tokugawa regime well, but they were completely unsuitable for an industrial economy. Other socio-economic reforms included an active industrial policy funded, in large part, by a more efficient tax collection system made possible by the greater powers of the centralized government, and the introduction of a system of universal education. The changes to political institutions were equally revolutionary. Political authority and power were consolidated with the central government, and the reformers enacted a conscription law as the basis of the modern Japanese military, paving the way for the eventual fall of the samurai (Duus 1976, pp. 76-86; Allen, 1981, p. 2). More generally, the Imperial Oath of 1868 committed the new government to "convocation of an assembly and 'public discussion' on matters of state, unity of 'all cases high and low' in promoting the national welfare, abandonment of 'absurd customs of olden times' and conformity to the 'principles of international justice' and an effort at 'seeking knowledge from all over the world.'" (Duus 1976, p. 74-75).

The transformative nature of the Meiji Restoration was best manifested in the degree to which the intellectual elites began to study and analyze the ways of the West. Beginning in the 1850s, Japanese writers were increasingly sent abroad to study in the West. Many more learned about the West by studying books. These writers and scholars emerged as the intellectual elite in the 1860s and 1870s, replacing those versed

in the Confucian style. It was this group that would produce the translations and original works that would ultimately disseminate knowledge of the West to the educated classes (Duus 1976, p. 87). This is a straightforward and important example of the type of ideological updates and transformations we describe in the model. By sending their children to Europe for education, members of the Japanese elite exposed their children to both Western techniques *and* the Western ideologies that enabled these techniques to function.

An important feature of Japanese history over the relevant time span is the changing function and effect of education on social and institutional reforms. In particular, the education system was used explicitly as the medium through which the Confucian philosophy (ideology, in our parlance) was intergenerationally transmitted during the Tokugawa period, when the reforms had a clear traditionalist bend. This traditionalism was exemplified by Sadanobu, a daimyō (feudal lord) and prominent reformer during the Tokugawa era. Sadanobu was most famous for his financial reforms, enacted as part of the "Kansei prohibition". The prohibition forbade dissident teachings; only the teachings of Chu Hsi Confucianism were permitted under this law. The "'Novel doctrines' of recent times, he decreed, threatened the order of the realm; there was to be a 'return' to a central doctrine." (Jensen 2000, p. 43).

By contrast, one of the most significant achievements of the Meiji era was the expansion and changing content of formal education and its interplay with other Meiji transformations in the institutional and economic realms. The introduction of universal education based on both the general and the technical was widely accepted. Education increasingly played a role in Meiji government policy, with the government spending more on education as a share of national income than many of the Western powers (Allen 1981, pp. 2, 3).

In short, the Japanese case conforms well to two different equilibria emanating from the model. When first confronted with rising urban commercialism and Western economic and military aggression—both of which were associated with significant uncertainty regarding how they would "fit" with prevailing Japanese ideology—the Japanese response was overwhelmingly traditionalist. It was recognized that reforms were needed, but the traditionalist bent of these reforms was typical of an equilibrium in which institutions and ideologies change little in the face of a productivity shock carrying a high level of uncertainty. On the contrary, once it was clear just how large the shock was, the benefits of ideological updating overwhelmed the negative consequences associated with high uncertainty. In turn, a "virtuous cycle" emerged where ideological updating encouraged institutional change, which triggered further ideological updating, and so forth.

3.3 Qing China

As our final historically relevant case, we consider Qing China (1644-1912), which presents a particularly illuminating example of a traditionalist response to foreign technological and institutional innovations. Prior to the Qing, it was not obvious that the West had pulled ahead economically and technologically. Indeed, prior to the fifteenth century, China far surpassed Europe in technological capability. In this period, the transfer of technologies overwhelmingly flowed from East to West—inventions such as paper, the compass, printing, gunpowder, iron plow, blast furnace, water clock, crossbow, and trebuchet were made in China centuries before their adoption in Europe (Mokyr 1990). However, by the dawn of the sixteenth century, numerous Western European technologies surpassed that of China. The observation led Mokyr (1990, p. 209) to argue that "the greatest enigma in the history of technology is the failure of China to sustain its technological supremacy." Chinese time-measuring technologies, ocean shipping, and block printing (as opposed to movable type) are examples of technologies in which China had reigned supreme for centuries but fell behind Europe by 1500 C.E. In spite of China's head start in knowledge of explosives, European military technology was far superior to anything found in China by the dawn of the sixteenth century (Needham 1986). When the Portuguese reached China's shores in 1514, the superiority of European muskets and cannons was apparent to all, and the Chinese rapidly adopted these weapons (Cipolla 1965; Hacker 1977).

In the face of two contemporaneous crises—the rapid decimation of Chinese forces by the British in the First Opium War (1839-42) and numerous internal revolts, with the Taiping Rebellion (1851-1864) being the most bloody and dangerous to the regime's future—the Qing realized the need to modernize their economy and military. Revenues were too low to contain further rebellion (Ma and Rubin 2017), while the Qing faced an existential crisis of European domination that was temporarily relieved by their acquiescing to humiliating trade deals that gave Westerners extraordinary commercial powers within China. The adoption of Western institutions would have offered a solution to China's relative stagnation; politically constrained rulers, like those of the leading European powers, could have raised much more tax revenue and issued sovereign debt, while opening up markets and reducing the arbitrary powers of government officials would have encouraged the adoption of more efficient techniques and technologies (Ma and Rubin 2017).

In the terms of our model, the productivity shock (γ) faced by the Qing was large, but it only would have translated into productivity gains if institutions and ideologies more commensurate with the "new economy" were adopted. But it was also highly uncertain how such new ideologies would have interacted with previously established Chinese institutions—ones that had served generations of Chinese rulers very well in the past.

The most important of these institutions was the bureaucracy, with its grounding in Confucian ideals.

Bureaucrats were the primary tax collectors, dispensers of law and order, chief instruments of peasantry control, and legitimators of the state. The bureaucracy was by nature a traditionalist group, as it was tasked with providing stability rather than technological or economic improvement (Fei 1953; Wright 1957, p. 60-63; Chesneaux and Needham 1964, p. 593; Cipolla 1965; Mokyr 1990, p. 235-37). The ideal Confucian political system was based on an ethic of enduring value, one that would work just as well in one epoch as another (Wright 1957, p. 2). This is precisely the type of traditionalism we have in mind in our description of "traditionalist ideology."

The Qing responded to the mid-nineteenth century crises with a set of policies known as the "Tongzhi Restoration" (1862-74), a period in which modernizing policies were enacted. These policies were implemented via the old, conservative bureaucratic institutions, led by scholars steeped in conservative Confucian ideology (Wright 1957). Instead of adopting Western governance, fiscal, or tax-collecting institutions, the Qing—much like the Tokugawa era reformers in Japan—attempted to apply practical or rational Western knowledge without adopting the Western ideologies and institutions that made this knowledge useful in the first place. For example, in order to deal with diplomacy with the European powers, the Qing government simply grafted a modern foreign relation office onto the bureaucracy, rather than removing the bureaucracy from foreign relations altogether (Wright 1957, p. 8).[27] Instead of seeking knowledge of the technological revolution occurring in Europe, the Chinese elites remained engrossed in preparing for the civil service exams based on knowledge of Chinese classics (Ma 2004). Chinese "borrowing" of Western know-how and technology but not ideology or institutions is summarized by the famous formula: "Chinese learning as the basis; Western learning for practical use" (Wright 1957, p. 1).

A key element of the Restorations was the so-called "Self-Strengthening Movement", which discouraged private enterprise, disparaged commerce and foreign trade, emphasized agriculture above all other forms of economic activity, encouraged frugality, and discouraged investment in infrastructure in favor of "traditional" handicrafts (Wright 1957, ch. 8-9). As a result, private modern industry had no legal status in China until the 20th century (Brown 1979; Ma 2004). These policies in turn resulted in the loss of leadership in one of China's most important industries, sericulture (silk production) to Japan, whose Meiji government implemented Western reforms strongly encouraging private enterprise (despite its negative effects on traditional manufacturers) and important infrastructure such as the telegraph (Ma 2005). Those directing the Self-Strengthening Movement displayed little interest in supplying modern public goods or supporting private initiatives. They were even opposed to private efforts to build public goods such as railroads or inland steam shipping (Ma 2004, p. 374).

[27] It should be noted that the introduction of a modern foreign relations office was one of the most successful endeavors of the era, as it resulted in numerous accomplished diplomats and better foreign relations for China (Wright 1957, p. 8).

The Qing responses to Western advancement and its own internal troubles is a particularly straightforward example of what we mean by a "traditionalist equilibrium". In the face of a rapidly changing world—a world that was obviously much more efficient than the world of previous Chinese glory—the Qing refrained from adopting the ideologies and institutions that were responsible for Western economic success. The uncertainty related to whether Western ideological beliefs were more suitable than the prevailing Chinese ideological beliefs, which were steeped in a Confucian ethic that was often inconsistent with Western ideals, discouraged the Qing from adopting Western advancements despite very clear evidence that they were more efficient. It was only after China's failure to modernize became all the more obvious during the Sino-Japanese War (1894-95) that the failure of the empire's bureaucrats and leaders to grasp the obvious became inevitable: China had fallen behind. After all, the Westernizing Meiji reforms that Japan had recently undertaken clearly enabled their humiliating victory over China. In this context, the Chinese finally considered major institutional changes. By then, however, it was too late; the Qing dynasty was on its last legs and would collapse in 1912.[28]

4 Conclusion

In this paper, we propose a theoretical framework that seeks to explain the failure of societies to adopt beneficial institutions—even when adoption entails undeniable efficiency gains *and* is in the interest of the politically powerful—and why these failures so often coincide with a rise in traditionalist ideology.

Our model emphasizes the role that *ideological beliefs* play in this process. According to our model, economic fundamentals and institutions translate into output via a society's ideology—how people employ simplifying heuristics to comprehend the best they can the complex world around them. Ideologies can and do evolve in response to a changing world, but ideological change carries with it significant *uncertainty*. When one does not know how those new simplifying heuristics associated with new ideologies will interact with her economic and institutional environment, she may refrain from updating her (or her children's)

[28] Viewed from the comparative perspective of our model, the stark differences in the Japanese and Chinese experiences discussed above are highly illuminating. In particular, one could be puzzled by the relatively rapid ideological adjustments undertaken in Japan, followed by fairly radical and successful institutional reforms, versus the much more muted, delayed, and unsuccessful responses in China. There is a developed literature on the China-Japan divergence; see Koyama, Moriguchi, and Sng (2017) for insights and citations. On the one hand, there exists a body of literature in comparative economic development that argues that Chinese social institutions were built upon and supported conservative decision-making. For example, Greif et al. (2012, 2013) and Greif and Tabellini (2017) advance the idea that the Chinese clan system was heavily controlled by family elders. Coupled with the sizable literature and empirical evidence on increasing risk aversion with age (Einav and Cohen 2007; Graham, Harvey, and Puri 2013; Halek and Eisenhauer 2001; Riley and Chow 1992), such papers argue that Chinese clans were slow to change. If true, this would also account for the comparative differences in ideological change in China versus Japan, even if the risk involved with new ideology adoption and benefits of new Western technologies were perceived to be identical in both countries. Yet, one could also easily interpret these differences in the light of our model. For Chinese clan leaders, appealing to old ideologies worked well for them and they had for centuries. Hence, the risk (p) associated with new (Western) ideologies was significant. The same could be said of the Japanese shoguns, which is why their ideology remained conservative. But, when the shoguns lost political power, those who replaced them had much less to lose from appealing to a different (Western) ideology (i.e., p was lower). It is likely that both interpretations are valid, and we choose not to dismiss one in favor of the other.

ideology. This in turn discourages institutional change, since the full benefits of new institutions will not be realized.

The insights provided by the model and three analytic narratives (on Ottoman, Japanese, and Chinese reform initiatives) provide an explanation for why institutional reforms by themselves have historically not been the elixir of economic development. Our insights suggest that institutional reforms will not likely achieve their desired results unless they are associated with an update in ideology that is more suitable for the changing economic environment. In each of the three cases we study, the societies' long-standing ideological beliefs were impediments to meaningful institutional reforms. When these societies were exposed to more sophisticated and advanced technologies, early reform attempts were fundamentally traditionalist in nature.

These insights have implications for various 21st-century efforts to impose democratic or economic institutions on societies whose ideologies are not equipped to handle them. For instance, attempts at instilling democracy in formerly autocratic states in the Middle East (e.g., Iraq and Egypt) ended in dysfunction. Likewise, Russia experienced massive corruption when implementing capitalist reforms following the fall of communism. In these examples, societies that were culturally unready for massive institutional change were unable to adopt the intended changes in a functional manner.

More generally, this insight suggests that the "exogenous" imposition of institutional or economic reforms is unlikely to work unless the society is on an ideological path to implementing those reforms anyway. In other words, unless institutional reforms come on the back of transformations in a society's prevalent ideologies (commensurate with the new technological and institutional realities), they are likely to have neither a meaningful nor a lasting impact. Not only might reforms implemented in the absence of the appropriate cultural capital fail to succeed, but they might also encourage traditionalist movements to take hold, making future reforms all the more difficult to implement. Well-intentioned efforts to improve economic or political institutions in the developing world may therefore backfire, while putting in place cultural hurdles that make future improvements all the less likely.

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A Proofs

A.1 Proof of Proposition 1

Let

$$V_t^o(G^O) \equiv \log\left((1-\tau)\,A_t\right) + \lambda \log\left(1-\tau\right)\Omega(\alpha\gamma G^O, \alpha I_{t+1}^*)\ , \tag{A.1}$$

and, let

$$V_t^o(G^N) \equiv \log\left((1-\tau-z)\,A_t\right) + \lambda \left[\begin{array}{c} (1-2p)\log\left(1-\tau\right)\Omega(\gamma G^O,\, I_{t+1}^{**}) \\ \\ +p\log\left(1-\tau\right)\Omega(\gamma G^O + g,\, I_{t+1}^{**} + i) \\ \\ +p\log\left(1-\tau\right)\Omega(\gamma G^O - g,\, I_{t+1}^{**} - i) \end{array}\right]\ . \tag{A.2}$$

Denoting $V_t^o(G^O) - V_t^o(G^N) = \Delta V$ and provided that $\Omega(0,\, \alpha I_{t+1}^*) = \Omega(\alpha\gamma G^O,\, 0) = 0$, we then have

$$\lim_{\alpha\to 0} \Delta V \ < \ 0\ , \qquad \text{and} \qquad \lim_{\alpha\to 1} \Delta V \ > \ 0\ . \tag{A.3}$$

and,

$$\frac{\partial \Delta V}{\partial \alpha} \ = \ \frac{\gamma G^O \lambda \Omega_1(\alpha\gamma G^O, \alpha I_{t+1}^*)}{\Omega(\alpha\gamma G^O, \alpha I_{t+1}^*)} \ > \ 0\ ,$$

$$\frac{\partial \Delta V}{\partial z} \ = \ -\ \frac{A_t}{(1-\tau-z)\,A_t} \ < \ 0\ , \tag{A.4}$$

$$\frac{\partial \Delta V}{\partial p} \ = \ \lambda\left[2\log\Omega(\gamma G^O,\, I_{t+1}^{**}) - \log\Omega(\gamma G^O + g,\, I_{t+1}^{**} + i) - \log\Omega(\gamma G^O - g,\, I_{t+1}^{**} - i)\right] \ > \ 0\ .$$

According to (A.3) and (A.4), ΔV is continuous and strictly increasing in α. Thus, for any given level of p, $z \in (0,\, 1)$, $\exists\ \tilde{\alpha} \in (0,\, 1)$ such that $\Delta V = 0$. Combined with the fact that $\partial \Delta V/\partial p > 0$, we establish that, for any combination of α, $z \in (0,\, 1)$, increases in p make it more likely that $\Delta V > 0$.

A.2 Proof of Proposition 2

First, note that

$$\frac{\partial \Delta V}{\partial \gamma} \;=\; \begin{cases} \frac{\alpha G^O \lambda \Omega_1(\alpha\gamma G^O, \alpha I^*_{t+1})}{\Omega(\alpha\gamma G^O, \alpha I^*_{t+1})} \\ \\ -\left[\frac{(1-2p) G^O \lambda \Omega_1(\gamma G^O, I^*_{t+1})}{\Omega(\gamma G^O, I^*_{t+1})} + \frac{p G^O \lambda \Omega_1(\gamma G^O + g, I^*_{t+1}+i)}{\Omega(\gamma G^O + g, I^*_{t+1}+i)} + \frac{p G^O \lambda \Omega_1(\gamma G^O - g, I^*_{t+1}-i)}{\Omega(\gamma G^O - g, I^*_{t+1}-i)}\right] \end{cases}, \tag{A.5}$$

where, $\forall\ p,\ z \in (0,\ 1)$, we can easily verify that

$$\lim_{\alpha \to 0} \frac{\partial \Delta V}{\partial \gamma} \;<\; 0\ . \tag{A.6}$$

On this basis, we conclude that, when α is sufficiently small so that $\partial \Delta V / \partial \gamma < 0$, it is more likely that citizens choose D^N over D^O. The first part of the proposition then directly follows from the observations that, for D^j, $j = O,\ N$, $\partial \Omega / \partial \gamma = \Omega_1 > 0 \wedge \Omega_{12} > 0$. Consequently, $\partial E(A_t)/\partial I_t$ in (9) is strictly increasing in γ, as a result of which the optimal institutional investments, I^*_{t+1} and I^{**}_{t+1}, are both increasing in γ as well.

B Extensions: The Ruler's Optimal Ideology

B.1 Dynamics with Ruler having a Preferred Ideology

Thus far, we constructed the model to show a "lower bound scenario" under which a traditional ideology can persist in spite of changing economic circumstances. According to our formulation, the ruler has incentive to maximize the welfare of the citizenry and adjust institutions accordingly. Hence, rulers consider the positive effect of their institutional choice on the society's prevalent ideology. However, if the role of ideology is to help individuals make generalizations about the complex environment within which they operate, it is easy to imagine the ruler having an optimal ideology, $D^R(G_t,\ I_t) = \left\{G_t,\ I^R\right\}$, which lends it political legitimacy and justifies its rule. Under this conceptualization, the Ruler desires that the technology is fully perceived without bias with respect to its TFP impact,[29] but institutions are perceived in a manner that benefits the ruler. For example, a despot may want its citizens to view institutions as working well even when they are not. Historical examples of ideologies that attempt to legitimate rule in such a manner include the "divine right of kings" doctrine employed by the English Stuart dynasty and Louis XIV of France, the Mandate of Heaven claimed by numerous Chinese emperors, or various Islamic doctrines supporting rulers who "act consistent with the faith" (Greif and Rubin 2015; Ma and Rubin 2017; Rubin 2017).

[29] This assumption is not necessary for results to hold, but it permits us to focus on the relationship between the Ruler's ideology and institutions, the latter of which the Ruler can affect.

We consider a minimal alteration to the Ruler's utility function. In this version of the model, the further the deviation in the society's perceived institutions from the Ruler's optimal perceived institutions (I^R) the lower the Ruler's survival probability. We therefore interpret D^R as the ideological basis for legitimacy in the Ruler's society (Greif and Rubin 2015), with any deviations from D^R undermining the Ruler's legitimacy (and hence its capacity to stay in power). We operationalize this update to the model by having the Ruler maximize:

$$U_t^R = \sum_{j=t}^{\infty} \left[\delta \frac{1}{1 + \left(\tilde{I}_t - I^R \right)^2} \right]^{j-t} E \left[\tau y_j - c\left(I_j\right) | s_j^o, s_j^R \right]. \tag{B.1}$$

In other words, when $D_t^o = D^R$, (B.1) is the same as the Ruler's utility function laid out previously in equation (4). As D_t^o diverges from D^R—and hence $\tilde{I}_t$ diverges from I^R—the probability that the Ruler stays in power decreases. Note that deviations in either direction decrease the Ruler's survival probability. This is consistent with the idea, for instance, that the type of ideology that legitimates a democratically elected leader would not work to legitimate a tribal leader, while the tribal ideology that legitimates the leader would be useless in a democracy.

The Ruler's optimal set of institutions, denoted $I_t'^*$ and $I_t'^{**}$, is augmented from those derived in Section 2.2.2, while the decision-making calculus of the old agent is the same as in Section 2.2.2. $I_t'^*$ and $I_t'^{**}$ differ from I_t^* and I_t^{**} in that the Ruler chooses a level of I_t that pulls institutions closer to I^R. For any set of parameters which imply that $\tilde{I}_t > I^R$ in the model presented in Section 2.2.2, the ruler chooses a weakly lower value of I_t in the present model. Meanwhile, for any set of parameters which imply that $\tilde{I}_t < I^R$ in the model presented in Section 2.2.2, the ruler chooses a higher value of I_t.

More importantly, the equilibrium reaction to the technology shock with be different under the present specification. When $\tilde{I}_t < I^R$ the Ruler responds to a shock by choosing more advanced institutions than it did under the specification presented in Section 2.2.2. Hence, there is a smaller part of the parameter space over which the traditional ideology persists. In the more common case, where $\tilde{I}_t > I^R$, the Ruler responds to a shock by choosing less advanced institutions than it did under the specification presented in Section 2. Hence, there is a larger part of the parameter space over which the traditional ideology persists following the shock.

On the one hand, this result should not be surprising; if the Ruler has incentive to discourage (encourage) ideological updating, changes in ideology should occur less (more) in equilibrium. But the mechanism through which this occurs is not obvious. Our model suggests a mechanism: the complementarity between institutions—which the Ruler affects—and ideology. In this specification, the Ruler has the capacity to

indirectly affect ideology through its choice of institutions. In what follows, we tease out the implications of the model when the Ruler can *directly* affect ideology via public education.

B.2 Dynamics with Schooling as the Indoctrination Medium

An additional corollary of our extended model is the debilitating impact of new technologies on the stability of political regimes that rely on some specific ideology and an indoctrination apparatus designed to nourish such ideology. In our context, new technologies do not destabilize political regimes because they enable more efficient communication and coordination among the citizenry.[30] They do so because improved technology increases the return to updating ideology, which makes it costlier for rulers to ensure that the prevalent ideologies do not stray too much from those that legitimize their rule.

In both Japan and the waning years of the Ottoman Empire, there is historical evidence and ample anecdotal references that the functions and objectives of the public education systems were transformed as well. Moreover, as we discussed in Sections 3.2 and 3.3 above, the Japanese and Chinese education systems were used explicitly as the medium through which the Confucian philosophy and its manifest ideologies indoctrinated the younger generations during the Tokugawa reforms and Tongzhi Restoration, both of which were inherently conservative (Jansen 2000, p. 243; Wright 1957). However, in the Japanese case, the subsequent Meiji era was very clearly and consistently characterized as one in which the expansion in and the changing content of formal education was the primary driver of other fundamental Meiji transformations in the institutional and economic realms (Allen 1981, pp. 2-3; Duus 1967, p. 89).

As for the late Ottoman era and the early Turkish Republic, the role of education as an indoctrination medium (relative to a scientific education medium) is only slightly more muddled. The traditional Ottoman educational system centered around "the elementary mosque schools (*mekteps*), which gave rudimentary religious education to the masses, and the higher institutions of learning (*medreses*), which trained new members of the *ulema* [Islamic theological scholars] as well as others entering the Ruling Class" Shaw (pp. 132-33). After *The Royal Tanzimat Decree* of 1839 which, as we discussed above, aimed to progressively reform Ottoman society and institutions along Western cleavages, the educational system was intended to be reoriented toward an objective scientific emphasis. To that end, the General Education Regulation of 1869 (*Maarif-I Umumiye Nizamnamesi*) announced that primary education would be compulsory and free for all citizens (Gők 2007). This objective did not materialize before the empire disintegrated, however, and Ottoman education continued to harbor elements of religious and political indoctrination in deliberate attempts to protect and strengthen the crumbling empire. For instance, Sultan Abdűlhamit strengthened

[30] For the role of social media on the Arab Spring, see for example, Howard et al. (2011) and Howard and Hussain (2012). For an historical example of new technology destabilizing the existing political and religious regime, see Rubin (2014).

the bureaucracy and invested heavily in education, covering the Empire in a network of secondary schools, but new European learning was always combined with religious instruction (Mango 1999, pp. 15-16).

Only after the establishment of the Turkish Republic in 1923 was a major step taken toward universal secular education. With the 1924 Law on Unification of Education, the Turkish government established a national secular education system, fashioned on the Western European model, which brought under central control all scientific and educational institutions, while putting an end to all kinds of religious educational and training institutions (Gők 2007). To be sure, Turkish education maintained a heavy dose of nationalist indoctrination put in the service of the young republic, as primary and secondary education textbooks were diligently and carefully crafted to unify a friendly narrative on Turkish nationalism, culture, and history. Nevertheless, literacy rates, which were as low as ten percent, doubled within a decade, continuing to increase at a rapid clip thereafter. The secular, uniform, and mandatory education laws helped to advance women's educational attainment and social freedoms at levels theretofore unseen in a Muslim society (Mango 1999, pp. 494, 533, 535).

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C Figures

Figure 1: Ideological Change in the $p \times \gamma$ Space