Wealth Distribution, Lobbying, and Industrialization: Theory and Evidence*

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Abstract

This paper develops a model of lobbying over industrialization policies and tests its predictions against the data on public petitions to the British Parliament and the US Congress in the 17-19 centuries. Our theory integrates the endogenous political struggle over pro-growth policies into the standard two-sector model of industrialization, and predicts that the intensity of lobbying over industrialization policies follows a hump-shaped dynamical path. This prediction is consistent with the data on industrialization-related petitions both in Britain and in the US. Moreover, the model predicts that places with historically more concentrated capital ownership are more successful in lobbying for pro-growth reforms. The opposite holds for the concentration of land ownership. We find support for these predictions in (i) data on petitions, (ii) counterfactual simulations, and (iii) historical examples from the 19th century Prussia and from the Middle East.

Keywords: political economy, industrialization, wealth distribution, lobbying, growth

JEL codes: D72, D74, N10, O14, O41, O43

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1 Introduction

A large part of contemporary variation in living standards can be traced back to differential timing of transition from stagnation to growth\(^1\). Progressive reforms, such as mass education (Galor et al. (2009)), infrastructure investments (Bogart (2018)), and free trade (e.g., the Corn Laws repeal, Schonhardt-Bailey (1991) and Heblich et al. (2022)) were crucial for the takeoff, as they precipitated productivity growth in the modern sector and pulled labor out of agriculture with lagging productivity, Restuccia et al. (2008). However, both historically and nowadays, industrializing economies tend not to be fully democratic. The passage of crucial reforms and policies depended on the relative wealth and lobbying efforts of various elite groups, such as landowners, merchants, and industrialists. Surprisingly, there is relatively little understanding of (i) the interplay between the dynamics of political lobbying and the process of structural change\(^2\); and (ii) the effects of wealth distribution within and between the groups of elites on political support for reforms. This paper addresses these gaps.

We model the dynamics of political struggle over modern-sector reforms during the process of structural change, and ask how historical concentration of capital and land wealth affects the pace of such reforms. Our theoretical framework uses a simple two-sector growth model with wealth inequality and augments it with a micro-founded contest over public policy in the spirit of Esteban and Ray (2011) and Nitzan and Ueda (2014). Traditional sector employs land and labor, while modern sector employs capital and labor. A reform/policy can boost modern-sector productivity, thereby increasing capital incomes and pulling labor from agriculture. Landowners, however, loose their rents if a reform passes, which generates a scope for political struggle over reforms. Whether a productivity-enhancing reform passes depends on the outcome of the lobbying process in each period. Individuals can allocate part of their incomes for political lobbying to increase the probability of their desired policy - 'reform' or 'status-quo'. Such political lobbying was widespread historically\(^3\).

\(^1\)The ratio of incomes per capita in rich to poor countries is about 20:1 nowadays in comparison to 3:1 at the end of the 18th century. Mokyr (1992), Pomeranz (2000), Galor and Weil (2000), Hansen and Prescott (2002), Allen (2009), Galor (2011) discuss the role of growth take-offs in generating these income differences and provide an overview of the mechanisms behind the "Great Divergence".

\(^2\)A review by Herrendorf et al. (2014) does not mention the dynamics of political barriers and lobbying over M-sector policies. Literature pioneered by Acemoglu and Robinson (2000b) and Lizzeri and Persico (2004) focuses on democratic transitions, and mostly disregards economic reforms under the elitist/oligarchic parliaments, as well as their interplay with the process of structural change.

\(^3\)Mokyr (1992), Mokyr and Nye (2007), Galor et al. (2009), Bogart (2018), Becker and Hornung (2020), Gershman et al. (2022) provide many examples of political struggles over crucial reforms and institutions. One of the most famous examples is the "Anti-Corn Law League" in Britain in the middle of the 19th century:
Our model links the dynamics of political lobbying for/against the modern-sector reforms with the process of structural change and predicts that the intensity of political lobbying follows a hump-shaped path. At the early stages of industrialization, when capital to land ratio is low, M-sector supporters lack incentives and abilities to push for reforms. As the share of the M-sector grows, political stakes and incentives to fight for reforms increase, as does the opposition from landowners. When the T-sector contracts and landowners accumulate enough capital, political struggle declines.

To test how well our model matches historical data on lobbying and structural change, we use newly collected data on petitions to the British Parliament from the Parliamentary Papers database and Huzzey and Miller (2020), as well as data on historical income concentration from social tables, Allen (2019). We calibrate the model to the British economy from 1690 (right after the Glorious Revolution, which vastly increased the policy-making importance of the Parliament) onward, and demonstrate that our model-based dynamics of political lobbying matches closely the data of public petitions to the British Parliament in the 18-19 centuries. To the best of our knowledge, this is the first paper to capture the joint dynamics of political lobbying, structural change, and inequality between social classes. Using data on petitions to the US Congress, we verify that industrialization-related petitions in the US also follow the predicted hump-shaped path.

Our second key contribution is to explain why pro-growth reforms received more support in some places than in others. We study theoretically how distribution of capital and land wealth affects individual lobbying incentives, and compare lobbying intensity and the pace of reforms under different profiles of wealth distribution. The model predicts that at the earlier stages of industrialization, a higher concentration of capital ownership increases lobbying for pro-growth reforms, and thus speeds up development. At the later stages, the result reverses.

The intuition behind this result is a combination of the collective action mechanism in the context of lobbying for public policies, and non-convexity of the contribution schedule. At the onset of industrialization, if capital ownership is dispersed, all capitalists will lack incentives and abilities to actively lobby for development. Additionally, severe free-riding problem constrains the overall support for reforms. At this stage, redistributing capital from small capitalists to big capitalists increases lobbying efforts of the latter, while the former remain free-riders. The overall lobbying for reforms goes up. At the later stages, however, big industrial interests funded the League and lobbied for the repeal of the Corn Laws, while big landowners opposed this policy change. Schonhardt-Bailey (1991) provides a detailed analysis of contributions to the Anti-Corn Law League, and Miller (2012) looks specifically into public petitioning, which was one of the key means of political lobbying by the League.
when the capital-to-land ratio grows, the odds of reform supporters improve, and smaller capitalists join the lobbying process, the result reverses. A higher concentration of capital at the top decreases the contribution of smaller capitalists to a larger extent, and overall, reform supporters are less likely to prevail.

Importantly, a higher concentration of land ownership has a negative effect on reforms (in line with Galor et al. (2009) and Cinnirella and Hornung (2016)), suggesting that it is important to distinguish between the type of asset (land or capital) and the stage of industrialization when discussing the effects of inequality on development. Moreover, the model reveals that between-group inequality in capital ownership has distinct effects from the within-group inequality. Namely, at the early stages of industrialization, reforms slow down if a higher share of the aggregate capital belongs to landowners. The reason is that landowners’ incentives to participate in political lobbying are mostly unaffected by additional capital, while the lobbying incentives and abilities of early capitalists drop significantly.

To test these predictions, we combine data on petitions to the US Congress (Blackhawk et al. (2021)) with data on local firm size distributions from the 1860 manufacturing census of the US and data on landownership concentration from Galor et al. (2009). In states with a higher concentration of capital ownership, merchants, industrialists and other M-sector agents lobby more actively for passing important policies and reforms. In contrast, places with more concentrated land show less intense lobbying for progressive reforms. We also conduct a series of counterfactual simulations, changing the fundamentals that affect the capital concentration. Simulations reveal that lower concentration of capital slows down reforms, and fails to account for the historical patterns of political struggle and industrialization.

Finally, to support our theoretical predictions regarding the role of capital concentration, we rely on two historical case studies. First, we bring recent evidence on the 19th century Prussia, where, as shown in Becker and Hornung (2020), the support for pro-growth reforms in 1867-1903 was more likely to come from the constituencies with higher wealth inequality and with larger-scale industry. Second, we look into the ‘broad picture’ comparison of capital distribution and pro-growth lobbying efforts between the Middle East and Western Europe. In the former, Islamic laws prevented the concentration of mercantile and industrial

\[4\] Moreover, we allow for (otherwise endogenously evolving) wealth distribution to change because of an external shock, such as trade gains, and demonstrate how it affects the dynamics of reforms and industrialization.

\[5\] Recent evidence from public goods provision in the 19th century Prussia in Krieger (2020), as well as the effect of historical capital concentration on the abolition of serfdom in Ashraf et al. (2020) further corroborate the logic of our model.
wealth at the early stages of development (Kuran (2012)), thereby limiting the abilities of dispersed capitalists to lobby against and overpower the biggest landowners, as argued in Pamuk (2004, 2009). As a result, important reforms were delayed, and the Middle East fell behind, despite being far ahead of Europe up until the 14-15 centuries.

Contribution to the literature

Our paper contributes to several strands of research in the political economy of long-run development. This literature has long emphasized the importance of private interests that can operate against pro-growth reforms and block important policies and institutional changes, see Krusell and Rios-Rull (1996), Acemoglu and Robinson (2000a), Lizzeri and Persico (2004), Llavador and Oxoby (2005), Bertocchi (2006), Galor et al. (2009), Seim and Parente (2013), Desmet and Parente (2014), Bogart (2018), Becker and Hornung (2020), Gershman et al. (2022). We contribute to this literature in three ways.

First, our focus is on the endogenous political lobbying, which corresponds the best to the periods of 18-19 century in countries like Britain, Prussia, and the US, which were not yet complete democracies, and when most of the crucial reforms happened, see Bogart and Richardson (2010), Bogart (2018), Becker and Hornung (2020), Krieger (2020), and Gershman et al. (2022). Most of the previous literature, however, has either focused on the transition between the autocracy and democracy (Acemoglu and Robinson (2000a), Lizzeri and Persico (2004)), or assumed a veto power or a democratic process (Galor et al. (2009), Bertocchi (2006)). Our main contribution here is to integrate the dynamics of political lobbying into the broader process of industrialization and structural change, and match the historical data on lobbying in Britain.

Second, we add to the debate about the role of inequality in the process of long-run development. The link between inequality and growth has been explored at least since Kuznets (1955), with most of the early evidence (Benabou (1996)) pointing at the negative effects of inequality. Galor and Zeira (1993) and Galor and Moav (2004), however, show that capital concentration can be beneficial at the early stages of development, before human capital becomes the key driver of growth. Adamopoulos (2008), Galor et al. (2009), Rajan and Ramcharan (2011), Cinnirella and Hornung (2016), and Goni (2023) showed that concentration of land ownership has a particularly negative effect on development, mainly via delayed education and pro-growth reforms. The reason is that larger landowners hold on

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6The seminal early contributions of North and Weingast (1989) and Jones (2001), among others, emphasize that good institutions and policies were necessary to make entrepreneurship, innovation, and capital accumulation in the modern sector profitable.
for longer to their preferred policies. Importantly, however, the role of land was decreasing, while the role of capital was increasing in the process of structural change. Our paper focuses on the concentration of capital ownership, and shows that the political economy effects of wealth concentration depend on (i) the type of asset (land or capital), (ii) the stage of industrialization, and (iii) the within/between group dimension of wealth distribution.

Finally, our theoretical framework integrates a micro-founded public policy contest over reforms into the otherwise standard two-sector model of industrialization with heterogeneous agents. To the best of our knowledge, our paper is the first one linking the research on asymmetric public policy contests (Nti (1999), Esteban and Ray (2001), Stein (2002), Epstein and Nitzan (2006), Baik (2008), Esteban and Ray (2011), Nitzan and Ueda (2014)) to the literature on structural change and growth.

The remainder of the paper is organized as follows. Section 2 describes historical regularities on lobbying, as proxied by data on petitions in Britain and USA. Section 3 describes the structure and assumptions of our model. Section 4 solves for the inter-period political and economic equilibrium, and derives our main theoretical predictions. Section 5 calibrates the model to British data and provides numerical simulations of the model’s dynamics. Section 6 tests the importance of historical capital concentration using counterfactual simulations, historical cases, and empirical evidence. Section 7 concludes.

2 Data and patterns on historical lobbying

2.1 Public petitions and lobbying in Britain: background

To the best of our knowledge, there has been only limited evidence (Huzzey and Miller (2020)) and theory linking the dynamics of historical lobbying over the M-sector reforms to the better-studied processes of structural change and inequality dynamics. Part of the reason is the lack of data on historical lobbying. To address this gap, we build measures of historical lobbying intensity broken down by topic, year, and petitioner, using recently available data on petitioning to the British parliament from 1764 to 1918, and to the US Congress from 1789 to 1949. But is petitioning activity a good proxy for historical lobbying?

As is well established by now (e.g., North and Weingast (1989)), the Glorious Revolution of 1688 was a key event that significantly increased the role of the British Parliament in

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7In the contemporary context, lobbying in the US was linked to trade policies and to firm size distribution across sectors, Bombardini (2008) and Bombardini and Trebbi (2012), finding that greater firm size concentration tends to increase lobbying.
political and economic reforms. However, the political system remained far from democratic and franchise highly limited up until well into the 20th century, see Figure A1. Under the limited voting franchise, petitioning the parliament was one of the key ways of exerting political pressure in the post-Glorious Revolution Era, Loft (2019) and Huzzey and Miller (2020). The British Parliament History website summarizes the point (emphasis is ours):

"By the 18th century, people used their Members of Parliament to raise their problems and concerns with those powerful enough to make changes. ... The most common way people tried to influence Parliament was to present MPs with petitions. They often demanded changes in the law and could be presented by individuals, whole communities or organised groups. ... The number of petitions and those participating grew rapidly from the end of the 18th century. In 1839 13,657 public petitions were presented on more than 90 different subjects with a total of over 4.5 million signatures."

Many petitions in this period were directly related to the struggle between the supporters of modern-sector development (merchants, industrialists, etc.) and its opponents (mainly landowners). One of the clearest examples related to the political struggle we study comes from petitioning surrounding the Corn Laws in the mid-19th century. Miller (2012) shows that petitions against the Repeal were coming mostly from landowners and agriculturalists in places like Lincolnshire, eastern counties, parts of Yorkshire, and other agricultural strongholds. After eventually losing in 1846, these groups petitioned for agricultural relief. In contrast, petitioner for the Repeal often came from manufacturers (textiles and other industries) and workers located in the North West (especially Lancashire), West Midlands, West Riding of Yorkshire and other regions with concentrated industry. Moreover, the Anti-Corn Law League spent large sums of money collecting petitions in the years 1839-1943. Many local subsidiaries of the League were established and helped lobbying for the Repeal. Similar stories apply for the petitioning from textiles, engineering, and mining industries against the old Navigation Laws in 1849.

Another important examples included lobbying by the National Education League for the expansion of elementary schooling exempt from religious influence. The opposing force
was National Educational Union of Manchester, where Conservative and Anglican members lobbied against such reforms. The struggle resulted in the passage of the Elementary Education Act of 1870. The Balfour act of 1902 abolished school boards and stimulated secondary schooling, Galor and Moav (2006). From the traditional sector, landowners petitioned and demanded enclosures to increase their rent, Bogart and Richardson (2011). From the 1860s and 1870s onward, farmers and larger entities, such as the Farmers’ Alliance, petitioned for greater farmers’ rights and compensations for improvements of the landholdings, resulting in the Agricultural Holdings Act of 1883. In the infrastructure sphere, construction of canals was crucial for industrialization, and yet fiercely contested topic, where modern-sector interests lobbied for, and landowners against the local Canal Acts and Navigation Acts.11 Collecting signatures and delivering petitions to the Parliament was costly: it often involved demonstrations and agitations, printing, and integration into broader campaigns. Many of the contested infrastructure bills were expensive, with an (extreme) example of the Great Northern Railway Bill of 1845-46 costing £590,355 on Parliamentary expenses alone. How effective were petitions in changing public policy outcomes? Aidt and Franck (2019) show that in the process of political struggles over key reforms in the 19th century Britain, MPs votes were most strongly affected by lobbying efforts, as opposed to violent political uprisings and riots. Constituency-level intensity of reform agitation efforts and public petitioning for the reform strongly increased the probability that a local MP supports the Great Reform Act. Moreover, Huzzey and Miller (2020) argue that large petitions presented in the Parliament also posed a potential threat, because of many international precedents when unsatisfied petitioners resorted to protests and violence. Loft (2019) further notes that numbers of signatures, references to petitioners’ skills, etc. were efficient ways of conveying local knowledge of companies and individuals to the parliament, persuading it to listen.

2.2 Dynamics of petitions in Britain

Our simplest measure of lobbying surrounding the reforms is based on the intensity of public petitions to the British parliament from 1764 to 1918. Data on petitions comes from the Parliamentary Papers database for the years 1833 to 1918, while data for 1764-1832 was kindly shared by Prof. Henry Miller. We focus on petitions related to topics most relevant Education League began its campaign for free, compulsory and non-religious education for all children. The views expressed by industrialists that mass education was vital to the nation’s ability to maintain its lead in manufacture carried considerable weight in Parliament. A Bill which met many, but not all, of the League’s wishes was drafted and introduced by W. E. Forster, and quickly passed.9

11See the description of related acts here
for the political struggle we analyze - the one between the opponents and proponents of the modern-sector productivity growth. Thus, we select petition topics such as infrastructure, education, trade and duties, navigation, and technological progress.

To have a clear picture on the dynamics of petitioning overall, we first document the dynamics of petitions on all topics on Figure 1.

![Figure 1: Dynamics of lobbying expenditures (petitions) relative to GDP, based on the historical data from Britain. Averages over 20-year periods.](image)

To measure expenditures on petitioning we take the estimate of cost per one petition from Huzzey and Miller (2020): approx. 20 pounds in 1845 (based on the Corn Laws related petitions by the Anti-Corn Law League). We then take the time series on historical GDP of Britain and calculate total costs of petitions relative to GDP, averaged over 20-year bins, starting from 1761-1780, the first period with data on petitions. Figure 1 shows the dynamics of this measure of lobbying intensity, revealing a very clear inverted-U shape pattern. At the peak of the political struggle in the mid-19 century, about 0.04-0.05% of GDP was going into this form of political lobbying. For comparison, lobbying expenditures in contemporary USA fluctuate at around 0.02% of GDP.

Not all petitions, however, were clearly related to the topics of industrial or commercial development. For example, many petitions were related to issues of alcohol consumption.

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12The Anti-Corn Law League spent 1037 pounds on raising petitions from December 1845 to July 1846. We extrapolate this amount to the whole year 1846 and take into account the number of petitions related to the Corn Laws this year, arriving at the cost per petition of 20 pounds.
church, wars, pensions, law (including the enfranchisement), etc. While these topics could be linked to the "M-sector" broadly defined, we focus on more directly related topics: industry and trade, infrastructure, education, and related. In the Parliamentary Papers Database, we conduct a keyword analysis of all petition topics, and select those topics that contain any of the pre-selected words (such as "merchant", "school", "education", "road", "rail", "canal", "bank", "factory", and so on). Figure 2a illustrates the dynamics of petitions on selected topics from 1780 (when data on topics is first available) onward. Clearly both the number and the costs as a share in GDP follow the hump-shaped path. Moreover, 2b shows that the share of selected topics in overall petitioning also rapidly declines towards the end of the 19th - early 20th century. In section 5, we examine to what extent our model can match this dynamics of political struggle over the key reforms.

![Figure 2a: Number of petitions and costs to GDP](image)

(a) Number of petitions and costs to GDP

![Figure 2b: Share of selected topics](image)

(b) Share of selected topics

Figure 2: Dynamics of lobbying expenditures (selected topics).

Does the behavior of specific lobbying topics correspond well to the passage of important reforms? On Figure 3, we illustrate the dynamics of petitions for 2 selected topics, infrastructure and education. As one can clearly see, petitioning on infrastructure (canals, river navigation, roads and railroads, etc.) kick in in the early 19th century, and reach peak in the 2nd half of the century, before eventually subsiding. In contrast, petitions related to education start much later, and peak in the 2nd half of the 19th, and early 20th century, when demand for major reforms was growing.

It is important to note that the decline in petitioning in the 20th century was partly
associated with the extension of the franchise. Moreover, other lobbying tools were becoming more widespread. Because of this, we do not attempt to explain the dynamics of lobbying in the 20th century, and acknowledge that the means of lobbying and the incentives to participate in it changed with the franchise extension. However, our measures of lobbying are highly relevant at least until the end of the 19th century, before major extensions of the franchise happened in Britain.

2.3 Dynamics of petitions in the US: key topics and petitioners

In addition to more aggregate data from Britain we use a finer, petition-level database from the US, as made available by Blackhawk et al. (2021). The advantage of this dataset is that it allows distinguishing very detailed topics and subtopics of petitions as well as the occupations of (a subset of) petitioners. The dataset covers a universe of petitions (537123 in total) submitted to the Congress from 1789 to 1949.

On Figure 4, we show the breakdown of petitions by broad topics. We focus on petitions related to the following topics: (i) Agriculture, (ii) Civil Rights / Slavery, (iii) Economic / Tax / Trade Policy, (iv) Education / Arts, (v) Infrastructure / Transportation, and (vi) Regulation of domestic commerce. The analysis of specific "prayers" (demands/requests made in the text of the petition) confirms that these topics are highly relevant to the struggle over the M-sector productivity.\footnote{Examples of prayers include things like improving navigation, imposing or amending trade duties,
Figure 4: Broad topics of petitions in the US.

Figure 5 shows the dynamics of petitioning in the US, taking into account specific topics as explained above. First, Figure 5a plots the total number of petitions and petitioning per capita for each of the 20-year intervals, showing the intensity of petitioning peaks in the mid-19th century, and declines massively by the early-to-mid 20th century, similar to the patterns observed in Britain. Importantly, as shown on Figure 5b, the share of petitions related to the selected topics also peaks in the mid-19th century, and declines from there on. This suggests that the eventual decline of lobbying over the M-sector policies corresponds to the contraction of the T-sector, and thus changing economic incentives of special interest groups, and is not driven by the overall decline of petitioning as a technology.

Finally, we explore who submits petitions and how the intensity of petitioning from the M-sector supporters depends on local distribution of capital and land wealth. First, we calculate the share of petitions coming from the main M-sector actors: traders, merchants, industrialists, bankers, businessmen, insurance companies, and so on. Second, we calculate the measure of capital concentration (Gini) at the state level, using data from the manufacturing census of 1860. Galor et al. (2009) provide the measure of land concentration.

Figure 6 plots the conditional correlations between the petitioning activity of the main M-sector agents and our measures of the underlying wealth concentration. Controls include improvements of lighthouses, bankruptcy system, and so on.

It is important to note that the majority of petitions do not have a clearly defined occupation or identity of the petitioner, hence a relatively small share throughout.
Figure 5: Dynamics of petitions in the US, by 20-year intervals

(a) Aggregate and per capita, all topics
(b) Share of selected topics

Figure 6: Share of petitions submitted by the M-sector agents in 1860-1880 vs. capital and land inequality, controlling for average capital stock and GDP per capita.
GDP per capita and average stock of capital in a state. As one can clearly see, petitioning from the M-sector actors tends to be significantly more intense in states with a higher concentration of capital ownership, and with a lower concentration of land ownership.

In what follows we build a model that integrates the micro-founded lobbying game into the standard two-sector growth model to explain both (i) the dynamics of petitioning/lobbying over time, and (ii) the variation in lobbying intensity depending on the underlying distribution of capital and land wealth.

3 The model set-up

In this section, we present a two-sector growth model with the overlapping generations (OLG) population structure, and heterogeneous wealth endowments. The two sectors are traditional (T), with land and labor as production inputs, and modern (M), where production involves capital and labor inputs. The population is divided into two classes: landowners and capitalists, and there is an initial inequality in the distribution of assets (capital and land). The main novelty is that we introduce an endogenous political struggle over whether a reform increasing productivity of the M-sector is allowed to pass. Below we describe each part of the model and our key assumptions in more detail.

3.1 Population and endowments

Total population, which we assume constant over time\(^\text{15}\), is divided into two classes: landowners (\(A\)) and capitalists (\(C\)). There are \(N_l\) landowners. Capitalists are further subdivided into two groups of \(N_b\) big and \(N_s\) small capitalists. The initial amount of capital, \(K_0\), is distributed between the landowning elite and the landless capitalists, so that \(\kappa_0\) is the share of initial capital stock that belongs to capitalists, and \((1 - \kappa_0)\) is the share belonging to landowners. Within-group distribution of capital wealth is governed by parameter \(\theta_t\) that stands for the share of \(\kappa_t \cdot K_t\) that belongs to big capitalists, so the individual endowment in this group at time \(t\) is \(\frac{\theta_t \cdot \kappa_t \cdot K_t}{N_b}\), while in the group of small capitalists, individual wealth is \(\frac{(1 - \theta_t) \cdot \kappa_t \cdot K_t}{N_s}\).

Since the main focus of our model is the distribution of capital, we assume that all land belongs to landowners, and they are equally endowed with both types of wealth\(^\text{16}\) every

\(^{15}\text{Endogenous fertility like in Galor and Weil (2000) or Voigtländer and Voth (2006) would not qualitatively alter our main results regarding the interplay of wealth inequality and political struggle over reforms.}

\(^{16}\text{None of the main result would change if we allow capitalists to own some land, as long as landowners own a large enough share of the total endowment. In the dynamic simulations of the model, we allocate}
landowner owns \((1 - \kappa_t)K_t/N_t\) of capital and \(T/N_t\) of land at time \(t\). Land endowments are fixed over time and are non-tradable, so within a lineage of landowners, land is inherited from one generation to another without any changes in size. Heldring et al. (2021) state that until the end of 19th century selling land was not common in Britain\(^{17}\). Thus, \(T_t = T = \text{const}\), and \(T_i = T^i = \text{const}\) for any \(i \in \Lambda\). Land, labor, and capital are employed in the two production sectors of the economy.

### 3.2 Production and factor incomes

The economy consists of two sectors, traditional \((T)\) and modern \((M)\). Traditional sector employs land \(T\) and labor \(L_T\), and operates using the following Cobb-Douglas technology:

\[
Y_{T,t} = A_{T,t} T^\alpha L_T^{1-\alpha}, \tag{1}
\]

where \(A_{T,t}\) is the \(T\)-sector productivity. Modern sector employs physical capital \(K\) and labor \(L_M\), and has productivity level \(A_{M,t}\). With a Cobb-Douglas technology we have:

\[
Y_{M,t} = A_{M,t} K^\alpha L_M^{1-\alpha}. \tag{2}
\]

The aggregate product of the economy is \(Y_t = Y_{M,t} + Y_{T,t}\), and goods produced in the two sectors are perfect substitutes in consumption\(^{18}\). In this single-good economy, the final good can be consumed, saved in the form of a bequest to an offspring, or invested in political lobbying for (or against) the \(M\)-sector reforms.

Following Bertocchi (2006) and Acemoglu and Robinson (2008), we assume that landowners appropriate a fraction \(\phi\) of the traditional sector output, while their peasants get an average of what is left, i.e. \(w_{T,t} = (1 - \phi)Y_{T,t}/L_T = (1 - \phi)A_{T,t}(T/L_T)^\alpha\). Moreover, we can represent the total rent of the landowners, \(\phi Y_{T,t}\) as \(\phi A_{T,t}(L_T/T)^{1-\alpha}\), which is shared equally among landowners. Finally, we make a substitution \(\phi = (\alpha + \tau(1-\alpha))\) and get the some of the land to capitalists to better match the historical data.

\(^{17}\)For the analysis of endogenous land inheritance system see, for example, Bertocchi (2006), where landowners choose between primogeniture and land partition among children. Landowners chose to bequeath the entire amount of land to a single offspring at the early stages of development because large estates were the source of political power. In our paper we abstract from endogenous land inheritance since our prime focus is on the distribution of capital and its effects.

\(^{18}\)Thereby, we focus on supply-driven forces of industrialization, the so-called ‘labor pull’ from the traditional sector, and abstract from demand-driven forces of industrialization, the so-called ‘labor push’ out of the traditional sector. As shown in Alvarez-Cuadrado and Poschke (2011), labor pull was more important at the earlier stages of industrialization, up until 1920s.
following factor incomes for the unit of labor and land:

\[ w_{T,t} = (1 - \tau)(1 - \alpha)A_{T,t}(T/L_{T,t})^\alpha, \quad (3) \]

\[ \rho_t = (1 + \tau(1 - \alpha)/\alpha)A_{T,t}(L_{T,t}/T)^{1-\alpha}, \quad (4) \]

where \( \tau \geq 0 \) represents the relative bargaining power of the landowners versus their peasants\(^{19}\) and the deviation of factor incomes from competitive ones. The land income of each landowner is proportional to the size of the landholding and equals \( T^i\rho_t \).

We assume a competitive labor market structure in the modern sector\(^{20}\), so the factor incomes for the unit of labor and capital are the following:

\[ w_{M,t} = (1 - \alpha)A_{M,t}(K_t/L_{M,t})^\alpha, \quad (5) \]

\[ R_t = \alpha A_{M,t}(L_{M,t}/K_t)^{1-\alpha}. \quad (6) \]

Therefore, the total capital income (profit) is given by \( K_tR_t \), which is shared among all capital owners proportionally to their capital stocks: each individual gets \( k^iR_t \).\(^{21}\)

We assume that workers are perfectly mobile between the two sectors\(^{22}\), so in the equilibrium, wages of the T- and M-sectors are the same. For simplicity, we also assume that all individuals supply their labor, so both landowners and landless agents receive wage incomes. As is common in the OLG models, capital fully depreciates between periods.

\(^{19}\)The conflict between peasants and landowners is beyond the scope of this paper, so we treat this admittedly endogenous institutional variable as exogenous. Alternatively, one could consider \( \tau \) as chosen by the elite to maximize their land rents, \( \rho_t \) in each period. In such a case, chosen \( \tau^* \) would balance the benefits from a higher expropriation rate against the costs of losing workers to the modern sector. It is easy to show that \( \tau^* \) would be a decreasing function of the aggregate capital, and at the limit, it would tend to zero. This more intricate structure would not affect our main results.

\(^{20}\)An alternative interpretation of \( \tau \) is a measure of relative labor exploitation, as factor prices in the modern sector were not competitive historically, and labor exploitation was common in both sectors.

\(^{21}\)A similar formulation for capitalists’ profits is derived in Aidt et al. (2010), but the authors allow each capitalist to have their own firm, instead of using an aggregate production function. Because of the perfect labor mobility and constant returns to scale in both sectors, this reformulation results in the same factor incomes as in \((3)-(6)\).

\(^{22}\)If we allow landowners to restrict labor mobility (e.g., serfdom), the main political economy mechanics of the model would not change. An additional TFP increase in the M-sector would create more demand for new labor there, and landowners would need to increase (costly) coercion or pay higher wages to retain workers. Thus, landowners would remain in the opposition to the M-sector growth, at least at the beginning.
3.3 Individual preferences and budget constraints

Individuals live for two periods, and value consumption and bequest to their children. In the first period of their lives, individuals do not take any economic or political decisions, and simply receive their capital and land bequests, $b_i$ and $T_i$. Capital bequests are invested in the modern sector and become productive capital in the next period, i.e., $k_i = b_{i-1}^t$.

The second period of life is divided into two sub-periods: before political struggle (indexed by 1) and after political struggle (indexed by 2). In the first sub-period, all individuals inelastically supply their factors of production to the market, and after production takes place, they receive their factor incomes. Individuals then maximize their lifetime utility. The lifetime utility function is:

$$U(c_{i,1}^t, c_{i,2}^t, b_i^t) = (1 - \beta) \cdot \ln(c_{i,1}^t) + \beta \cdot ((1 - \eta) \cdot \ln(c_{i,2}^t) + \eta \cdot \ln(b_i^t))$$  \hspace{1cm} (7)

In the first sub-period, individuals allocate their incomes, $I_{i,1}^t = w_{i,1} + k_i^1 R_{i,1} + T_i^s \rho_{i,1}$, between consumption and investments in lobbying, so $I_{i,1}^t = c_{i,1}^t + e_i^t$ is the budget constraint of the first sub-period. $e_i^t$ is investment in lobbying, which increases the probability of the preferred policy outcome: the advancement of the modern sector productivity or the status-quo policy (to be explained below). The outcome of this political struggle affects individuals’ incomes in the subsequent sub-period.

In the second sub-period, one of the policy outcomes is realized, and individuals supply their production factors once again and receive their factor incomes for the second time. Capital does not depreciate between the two sub-periods. Thus, the second period incomes are given by $I_{i,2}^t = w_{i,2} + k_i^2 R_{i,2} + T_i^s \rho_{i,2}$. Individuals optimally allocate their second sub-period incomes between consumption and bequest: $I_{i,2}^t = c_{i,2}^t + b_i^t$.

This utility function implies that in the second sub-period, optimal consumption is given by $c_{i,2}^t = (1 - \eta) \cdot I_{i,2}^t$, and optimal bequest is given by $b_i^t = \eta \cdot I_{i,2}^t$. Thus, the indirect utility of the second sub-period is given by $\ln(I_{i,2}^t) + \bar{\eta}$, where $\bar{\eta}$ is a constant. This allows us to simplify the subsequent analysis by looking instead of (7) at the indirect utility function of individual $i$ after the second sub-period optimization is taken into account:

$$V^i(c_{i,1}^t, e_i^t) = \max_{c_{i,1}^t + e_i^t = I_{i,1}^t} \ (1 - \beta) \cdot \ln(c_{i,1}^t) + \beta \cdot (\ln(I_{i,2}^t) + \bar{\eta})$$ \hspace{1cm} (8)

While the first sub-period incomes are exogenous for individuals born in period $t$, the second sub-period incomes, $I_{i,2}^t$, depend on the (uncertain) outcome of the political struggle: reform or status-quo in the modern sector. We now describe how we model lobbying.
3.4 Modern sector policies and lobbying

In each period, there is a potential to advance productivity $A_{M,t}$ of the $M$-sector via a reform or policy. We think of changes in $A_{M,t}$ as reflecting any reform/policy/institutional changes that makes the $M$-sector more productive: property rights protection, infrastructure investment, mass education, new industrial technologies, etc., see also Llavador and Oxoby (2005) and Seim and Parente (2013) for a similar approach. Each individual has an opportunity to invest in political lobbying to affect the probability of preferred policy outcome.

More formally, the outcome of political struggle is a realization of a reform ($R$) policy or a status-quo ($S$) policy. In the case of a reform, modern-sector productivity improves $\gamma_R$ times, while in the case of a status-quo, it improves only $\gamma_S$ times, and $\gamma_R > \gamma_S \geq 1$. Therefore, the dynamics of productivity in the modern sector is given by

$$A_{M,t} = \begin{cases} 
\gamma_R \cdot A_{M,t-1} & \text{if } R \text{ (probability } p_{R,t}) \\
\gamma_S \cdot A_{M,t-1} & \text{if } S \text{ (probability } 1 - p_{R,t}). 
\end{cases}$$

(9)

We also assume that there exists a productivity spillover from the modern-sector to the traditional sector, such that $A_{T,t} = \zeta \cdot A_{M,t-1}$ with $0 \leq \zeta \leq 1$.

Thus, in the case of a status-quo policy in period $t$, we get $a_t = A_{M,t}/A_{T,t} = \gamma_S$, and in the case of a reform, we get $a_t = \gamma_R$. Relative productivity $a_t$ affects factor incomes in both sectors, due to (i) the direct productivity effect, and (ii) the reallocation of labor effect. As a result, individual incomes depend on the outcome of the political struggle via the realization of $a_t$. Due to opposing interests regarding labor movements between sectors and regarding factor prices, an entire population can be partitioned into two groups, those in favor and those against the M-sector reforms.

Optimal behavior requires each agent to consider how their investment in political lobbying, $e^i_t$, affects the probability of reform policy, $p_{R,t}$, being realized. We model the process of political struggle over the public policy following the literature on public policy contests, see Tullock (1980), Baik (2008), Esteban and Ray (2011), Nitzan and Ueda (2014).

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23 In the static version of the model, we do not open the black box of TFP. In our dynamic simulations, we account for the fact that potential for the M-sector TFP growth was increasing with the M-sector employment and human capital accumulation, see Brunt and Garcia-Peñalosa (2021) and Cervellati et al. (2022).

24 This is supported by Mokyr (1992), among others. Moreover, the productivity gain in the $M$-sector can be thought of as a gain relative to that in the $T$-sector. Generally, having an independent reform over the T-sector productivity (think of enclosure acts, etc.) would not qualitatively affect our main results.

25 An alternative way to model political lobbying is via the Grossman and Helpman’s (1994) "Protection for Sale" framework, augmented with heterogeneity within groups, as in Bombardini (2008). It is easy to show
Specifically, the probability \( p_{R,t} \) that the reform happens is determined by the standard logit contest success function (CSF), with efforts of individual members of one interest group being perfect substitutes:

\[
p_R = \frac{\left( \sum e^i_R \right) / \left( \sum e^i_R + \sum e^j_S \right)}{E_R / E} = \frac{E_R}{E},
\]

(10)

where we intentionally suppress time subscripts for the sake of tractability. We denote by \( E_R = \sum e^i_R \) the combined political lobbying of reform supporters and by \( E_S = \sum e^j_S \) the combined political lobbying of status-quo supporters. The overall lobbying expenditures are given by \( E = E_R + E_S \).\(^{26}\)

Lobbying effort is chosen non-cooperatively. Each individual, by choosing his political contribution \( e^i \), takes into account that a larger total contribution of his interest group increases the chances of his preferred policy being realized. However, as is evident from (10), group-level contribution is effectively a "club good", and a standard free-riding incentives will affect individual lobbying efforts.

Denote by \( I^i_{2,R} \) the second sub-period income under reform policy, and by \( I^i_{2,S} \) the second sub-period income under status-quo policy. Then we define \( \Delta^i_R = ln(I^i_{2,R}) - ln(I^i_{2,S}) \) as the utility gain for individual \( i \) from the reform policy. \( \Delta^i_R > 0 \) for reform supporters and \( \Delta^i_R < 0 \) for status-quo supporters. Combining this definition of gains from reform policy with (10) and the state-dependent utility function in (8), the individual expected utility maximization problem boils down to

\[
\max \left\{ c^i \geq 0, e^i \geq 0 \right\} \mathbb{E}V(c^i, e^i) = (1 - \beta) \cdot ln(c^i) + \beta \cdot p_R(e^i) \cdot \Delta^i_R + \ln(I^i_{2,S})
\]

subject to \( c^i + e^i = I^i_1 \)

\[(P)\]

where the last term in (P) is just a constant not affecting the maximization problem. Thus, each individual chooses \( c^i \) and \( e^i \) to balance off the gains from an increase in the probability of his preferred policy against the costs of forgone consumption. To sum up, the timing of events is the following:

1. Generation born in period \( t \) receives capital \( b^i_t \) and land \( T^i \) bequests. Capital bequest is invested to become productive capital in period \( t + 1 \), so \( k^i_{t+1} = b^i_t \).

\(^{26}\)In defining the CSF, we also need to add to equation (10) what happens if both groups contribute zero. In this case we assume, as is standard in the literature, that \( p_R(0,0) = 1/2 \), which guarantees that there will be no zero-effort equilibria as long as there are groups with opposing political interests.
2. In the first sub-period of the second \((t + 1)\) period of life, individuals supply land, capital, and labor they own to the market. Production takes place, and all individuals receive their factor incomes.

3. At the end of the first sub-period, individuals optimally allocate their factor incomes between political lobbying and consumption.

4. Public policy contest is resolved: either the reform policy or the status-quo policy is realized, affecting productivity and the allocation of labor in the second sub-period.

5. In the second sub-period, production takes place (with potentially updated relative productivity level and labor supply), and individuals receive their factor incomes again.

6. Individuals optimally allocate their second sub-period incomes between consumption and bequest to their offspring, born in period \(t + 1\), and the process repeats.

4 Intra-period equilibrium and comparative statics

In this section, we first describe the intra-period economic equilibrium period, for a given policy outcome. Then we characterize Nash Equilibrium of the non-cooperative political lobbying game that determines the policy outcome. Finally, we analyze how a change in within- and between-group distribution of capital affects the pace of M-sector reforms and the intensity of political lobbying.

4.1 Labor market clearing and factor prices

The labor market clears when \(w_{T,t} = w_{M,t}\), which comes from the fact that labor is perfectly mobile between two sectors. Using the labor demand from equations (3) and (5), labor supply \(L_{T,t} + L_{M,t} = N\), together with the labor market clearing condition, we derive the equilibrium number of workers employed in the modern sector:

\[
L^*_{M,t} = \frac{N}{1 + (T/K_t) \cdot ((1 - \tau)/a_t)^{1/\alpha}},
\]

where \(a_t = A_{M,t}/A_{T,t}\) after the realization of one of the two policies, reforms or status-quo. A higher relative productivity of the M-sector pushes wages up and attracts more workers until wages equalize at a new, higher level.

Using (11) and (3)-(6), we get the equilibrium factor prices \(w_t^* = w_t(L^*_{M,t})\), \(R_t^* = R_t(L^*_{M,t})\), and \(\rho_t^* = \rho_t(L^*_{M,t})\). It is straightforward to see that a higher \(A_{M,t}\) increases \(R_t^*\) and \(w_t^*\)
by enhancing productivity directly and also attracting more labor to the modern sector. However, it also lowers $\rho^*_t$, since land and labor are complements in the traditional sector. This consideration reflects the nature of political conflict: why landowners may oppose the M-sector reforms (if they don’t own large enough stocks of capital), while landless individuals support them\footnote{While $\rho^*_t$ decreases following the productivity gain in the M-sector in period $t$, $\rho^*_{t+1}$ increases due to an inter-sectoral productivity spillover. In our model, individuals are myopic towards such longer-run effects because they only live for two periods, and do not take any decision in the 1st period. However, even with more long-run oriented landowners, our main results would not change qualitatively because future gains would be weighted down as compared to current losses (time discounting and/or imperfect altruism towards the offspring, plus the spillover coefficient is below one). Moreover, a higher $A_{\text{M},t}$ today empowers capitalists in the future political struggles, increasing landowners’ incentives to support status-quo today.} Moreover, it is clear that $(w^*_t)_{K_t} > 0$, $(R^*_t)_{K_t} < 0$, and $(\rho^*_t)_{K_t} < 0$. Below we focus on intra-period equilibrium and drop the $^*$ symbol for the sake of exposition.

4.2 Individual policy preferences

Individual policy preferences regarding the reform vs. status-quo policy in the M-sector are based on how an increase in $A_{\text{M},t}$ affects individual incomes. The incomes are given by $I^i_t = w^i_t + k^i_t \cdot R^i_t + T^i_t \cdot \rho^i_t$, and since $T^i = 0$ for landless individuals, all of them support reform policy because it increases wages and returns to capital. However, landowners may either support or oppose modern sector reforms, depending on the amount of land and capital they own, and on the current factor prices.

Denote by $w^R$, $R^R$, and $\rho^R$ the equilibrium factor prices under the reform policy, while $w^S$, $R^S$, and $\rho^S$ will stand for equilibrium factor prices under the status-quo policy. Then $\Delta w = w^R - w^S > 0$, $\Delta R = R^R - R^S > 0$, and $\Delta \rho = \rho^S - \rho^R > 0$ are the changes in factor prices, and $\Delta I = I^R - I^S = \Delta w + k^i_t \cdot \Delta R - T^i \cdot \Delta \rho$ is a change in income going from the status quo to the reform policy state. With this we formulate the following proposition.

Proposition 1 (Policy preferences and gains from policy change).

For given $K_t$, $T$, $\alpha$, $\beta$, $\gamma_R$, $\gamma_S$, and $\tau$, the following statements are true:

1. **Policy preferences of capitalists and landowners.** All landless individuals support reform policy. I.e., $\Delta^i_R > 0$ for all capitalists, as $\Delta I > 0$ for this group.

   Landowners support reform policy when $k^i_t \cdot \Delta R + \Delta w \geq T^i_t \cdot \Delta \rho$. I.e., $\Delta^i_R > 0$ for landowners only when their gains in profits and wages surpass their losses from land.
2. **Individual wealth and gains from policy change.** A higher $k_i$ increases the gains from the $M$-sector reform policy, while a higher $T_i$ decreases the gains from the $M$-sector reform policy, i.e., $(\Delta^i_R)'_{k_i} > 0$, and $(\Delta^i_R)'_{T_i} < 0$. Moreover, $(\Delta^i_R)''_{k_i} < 0$, and $(\Delta^i_S)''_{T_i} < 0$, i.e., the strength of support for a reform (status-quo) policy is concave in the individual amount of capital (land).

3. **The end of political struggle.** There exists a threshold level of aggregate capital $\bar{K}$, such that for all $K_t \geq \bar{K}$, all individuals support reform policy, i.e., $\forall i : \Delta^i_R \geq 0$. Therefore, there is no political struggle, and $p_R = 1$ when $K_t \geq \bar{K}$.

**Proof.** See Appendix C

A larger individual capital ownership increases support for reform policy because an increase in the $M$-sector productivity increases profits, and this effect is proportional to $k_i$ (part 2). However, an individual owning both capital and land wins from industrialization as a capital owner but loses as a landowner. The relative endowment of capital and land, as well as their factor prices, determines the landowners’ attitudes towards reforms (part 1). However, as the aggregate capital stock grows sufficiently large, labor is pulled out of agriculture, and traditional sector becomes smaller. When the aggregate capital-to-land ratio increases above a certain threshold, incomes from the traditional sector play such a minor role in landowners’ portfolios that they switch to reform policy supporters (part 3).

4.3 **Political Struggle and its Outcomes**

In this section, we define and analyze the Nash equilibrium (NE) in a non-cooperative public policy contest game. Using the CSF from (10) and expected utility maximization problem defined in (P), we arrive at the following best response function for the amount of $e^i_R$ invested into lobbying for reforms.

$$e^i_R = \begin{cases} I^i - \frac{1}{\beta} \cdot \frac{E}{1-p_R} \cdot \frac{1}{\Delta_R} & \text{if } I^i \cdot \Delta^i_R > \frac{1}{\beta} \cdot \frac{E}{1-p_R} \\ 0 & \text{otherwise} \end{cases}$$  

(12)

A similar optimization problem is solved for status-quo policy supporters, with a symmetric best response function. Figure 7 illustrates the best response function for reform

\[\text{We have assumed for simplicity that landowners are identical to each other in terms of their land endowments. However, we can consider a more general case whereby their land (and hence capital) endowments can differ. In this case, the pool of reform policy supporters consists of all capitalists and a subset of landowners. Bigger landowners support the status-quo policy for longer in the course of industrialization.}\]
Figure 7: Individual contribution schedule w.r.t. capital

supporters. First, note that non-zero schedule of $e^i_R$ is increasing and concave in individual capital stock. This is based on the fact that individual’s contribution to the political struggle is increasing in own income (linearly) and gains from a reform policy (non-linearly), see part 2 of Proposition 1. Second, smaller capitalists, with $I^i \cdot \Delta^i_R \leq \frac{1-\beta}{\beta} \cdot \frac{E}{1-p_R}$ (which simplifies to $k^i < \bar{k}$) have an optimal contribution of zero. So, small capitalists are free-riders for some parameter values and lobbying investments of other players.

Moreover, a more intense overall lobbying $E$ makes any individual contribution to the contest less important, which lowers $e^i_R$. In a similar vein, there is a standard free-rider effect: if all other members of one’s own group increase they total contribution, $p_R$ becomes higher, and the individual incentives to contribute go down. Note, however, that both $E$ and $p_R$ are endogenous and will constitute a Nash Equilibrium of this game. These properties of the best response will be very important for our main comparative statics results regarding the distribution of capital.

Since the best response $e^i_R$ depends only on the aggregate values of choices of other players and on exogenous parameters, this lobbying game can be analyzed as an "aggregative game", which permits the use of a convenient approach to solution of such games called the "share function approach", see Cornes and Hartley (2005). In order to solve for the NE, we need to aggregate individual best responses for both sides of the contest. The total investment in political struggle by reform policy supporters is then given by

$$E_R = \sum_{i \in R_+} (I^i - \frac{1-\beta}{\beta} \cdot \frac{E}{1-p_R} \cdot \frac{1}{\Delta^i_R}),$$

where the $R_+$ is the group of reform supporters for whom the participation constraint from (12) is satisfied. If we divide the total group investment $E_R$ in political struggle by the
overall contest intensity $E$, we get the so-called ‘share function’:

$$s_R = E_R/E = \frac{\sum_{i \in R_+} \left( I_i - \frac{1-\beta}{\beta} \cdot \frac{E_{1-i} - \beta \cdot E_{1-i} \cdot \Delta_i}{E} \right)}{E}. \tag{13}$$

Using the share functions for both the supporters and the opponents of a reform policy, we can define and characterize the Nash equilibrium of the political struggle game. Define by $\Omega$ the list of all exogenous parameters for a given time period (wealth endowments, aggregate macroeconomic variables, preference parameters, etc.), i.e., $\Omega = \{K, T, A_M, \gamma_R, \gamma_S, N_l, N_b, N_s, \tau, \alpha, \beta, \theta, \kappa\}$.

**Definition 1** (Share functions and Nash equilibrium in the political contest).

Let $s_Z(E, \Omega)$ for $Z \in \{R, S\}$ from (13) be a share function of group $Z$ that satisfies the following properties:

1. $s_Z$ is continuous w.r.t. $E > 0$.
2. $s_Z$ is strictly decreasing in $E$.
3. $\lim_{E \rightarrow 0} s_Z(E) = 1$, and $\lim_{E \rightarrow \infty} s_Z(E) = 0$

Then, there exists a unique level of total contest intensity $E^*$ satisfying $s_R(E^*, \Omega) + s_S(E^*, \Omega) = 1$ that is a Nash Equilibrium of the game. The equilibrium probability of reform policy is given by $p^*_R = s^*_R(E^*, \Omega)$. For each group, the equilibrium level of total investment in a contest is given by $E^*_Z = E^* \cdot s_Z(E^*, \Omega)$.

It is straightforward to verify that the share function from (13) satisfies all the three properties in Definition 1. Using Properties 1 and 2, it’s also easy to prove the existence and uniqueness of the NE (see also Nitzan and Ueda (2014) for similar existence and uniqueness proofs). We relegate the details of solving for the NE of this game to Appendix B.

With three classes of individuals in the economy, we can have two types of NE. In the first type of NE, only the big capitalists participate in lobbying, while the small capitalists are free-riders (the participation constraint from (12) is not satisfied for their relatively low $k^i$).

In the second type of NE, both groups of capitalists contribute to the political struggle.\footnote{It is important to note that allocations with (i) both sides of the conflict contributing zeros, or (ii) neither of the two capitalists groups participating, or (iii) with landowners not participating, can not be an equilibrium. This is easily proven by acknowledging that in a zero total effort case (case (i)), every individual has an incentive to contribute $\varepsilon > 0$ to change the probability of his desired policy from 1/2 to 1. Next, consider case (iii) when status-quo supporters do not participate, i.e., $E_S = 0$. Then, for any $E_R > 0$, we have $p_R = 1$, so the participation constraint from (12) for the group of reform supporters will not hold, and we are back to (0,0) case, which is impossible. Case (ii) is rejected analogously to case (iii).}
Below we analyze how the distribution of wealth within and between social classes affects the equilibrium probability of reforms and the intensity of the overall lobbying efforts.

### 4.4 Distribution of wealth and the pace of reforms

Recall from section 3.1 that population of the economy is partitioned into three groups, smaller capitalists, bigger capitalists, and landowners. We take the size of each group as fixed, and ask how changes in the distribution of capital between smaller and bigger capitalists, i.e., a change in $\theta_t$, affects the probability of reform policy in that period.

**Proposition 2** (The effect of capital distribution between small and big capitalists).

For relatively low (high) levels of the aggregate capital-to-land ratio, a marginal transfer of capital from smaller capitalists to bigger capitalists increases (decreases) the chances for reform policy. Thus, if $K_t \leq (>\Phi$ then $\partial p^R_t \partial \theta_t \geq (<)0$, where $\Phi$ is a function of $\Omega_{-K}$ (all exogenous variables except capital stock).

**Proof.** See Appendix C

The intuition behind this result is based on a combination of several mechanisms. First, consider Figure 7 and individual best response from (12). At the earlier stages of industrialization, capital ownership of smaller capitalists is very low, which means their incomes and gains from the reform policy are low as well. Thus, smaller capitalists remain non-contributors, and only bigger capitalists participate in lobbying for reforms. In such a case, redistributing capital from smaller to bigger capitalists (an increase in $\theta_t$) means transferring capital away from non-contributors and towards contributors. Thus, the combined stakes in the game for those who actually participate in lobbying increases (see Proposition 1), and so does the equilibrium probability of passing a reform. Therefore, at the earlier stages of the process, a more concentrated capital ownership creates a group with enough incentives and abilities to actively lobby for the modern sector development.

At the later stages, when the economy accumulates more capital, and land rents decline, both smaller and bigger capitalists may find it optimal to participate in lobbying. When both groups participate, redistributing capital from smaller to bigger capitalists decreases

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30The lack of concentrated capital at the earlier stages of industrialization, as we argue in Section 6, is something that prevented dispersed merchants and capital owners in the Middle East from efficiently opposing the established elite.
the combined gains from policy change\[^{31}\] hence more concentrated capital decreases the probability of reform policy at later stages of the process.

Figures below illustrate several possible equilibria in this game and the workings of proposition 3. Figure 8 shows\[^{32}\] that all three groups (including the small capitalists) participate in lobbying only if the concentration of capital in the hands of big capitalists is relatively small. Otherwise, when capital concentration is high, only bigger capitalists lobby, while smaller capitalists free-ride. From Figure 9 we see that for low levels of industrialization (on the horizontal axis), a higher \(\theta\) (on the vertical axis) increases the probability of reform policy\[^{33}\]. However, at the later stages of industrialization, when all three groups participate in lobbying, the result reverses, and a transfer of capital to big capitalists decreases the chances of reform policy - this can be seen as a change in the slope of the level curve from negative to positive in the lower-right part of the graph.

Next we describe the effects of a change in \(\kappa_t\), the share of total capital wealth that belongs to the group of landless agents. Such a between-class reallocation of capital affects gains from policy change and incomes of both supporters and opponents of reforms. Certain events, like the Atlantic trade or the Eastern trade (see Acemoglu et al.\(^{(2005)}\)), have put a lot of merchant wealth and capital into the hands of landless agents in some places, but into the hands of landowners in other places. While the theoretically the effects of a change in \(\kappa_t\) are often ambiguous and depend on many other parameters, the following proposition summarizes the consequences of such a between-group reallocation of wealth for early periods of the industrialization.

**Proposition 3** (Distribution of capital between landowners and landless, and probability of reform policy).

For relatively low levels of the aggregate capital \(K_t\), a larger \(\kappa_t\) (more capital ownership by the landless groups) increases \(p^*_R\). Moreover, larger \(\kappa_t\) shifts the preferences of landowners

\[^{31}\]As per Proposition 1, individual gains is a concave function of individual capital. Thus, an increase in the incentives of bigger capitalists to invest in political lobbying does not compensate for a decrease in the incentives of smaller capitalists.

\[^{32}\]In this example, parameters are chosen for illustrative purposes. There are three groups: 1 landowner, 1 big capitalist, and 18 small capitalists. The share of labor in the manufacturing is 0.5. For a given share of labor in the manufacturing aggregate capital and productivity levels are such that the labor market clears, and the economy is in the steady state for a constant level of technology (\(K_{t+1} = K_t\) and \(A_M = A_T = A\), see more details in section 4). Other parameters are the following: \(\eta = 0.14\), \(\beta = 0.95\), \(\alpha = 1/3\), \(\gamma_R = 1.56\), \(\gamma_S = 1.056\), \(\tau = 0.3\), \(T = 1\), \(\kappa = 0.25\).

\[^{33}\]Here we use the same set of parameters: \(\eta = 0.14\), \(\beta = 0.95\), \(\alpha = 1/3\), \(\gamma_R = 1.56\), \(\gamma_S = 1.056\), \(\tau = 0.3\), \(T = 1\), and \(\kappa = 0.25\).
Figure 8: Participation in lobbying: all three groups participate (yellow); only big capitalists and landowners participate (green); no political struggle (blue)

Figure 9: Probability of reforms for different levels of employment in modern sector and different levels of $\theta$
towards status-quo, which increases the level of aggregate capital $\bar{K}$ necessary for political conflict to end. Thus, $\frac{\partial p^*_R}{\partial \kappa} > 0$ and $\frac{\partial \bar{K}}{\partial \kappa} > 0$ for low $K_t$.

Proof. See Appendix C

The logic behind Proposition 3 is straightforward. An increase in $\kappa_t$ means that both incomes and gains from reform policy increase for capitalists, which makes them to invest more in political lobbying. Moreover, incomes of landowners decrease (as they own less capital), while their interest in maintaining status-quo becomes even stronger (as their share in the modern sector becomes smaller). Overall, the income effect dominates the gains from status-quo effect for landowners, and together with more capable group of reform supporters, it increases chances for reforms. However, since landowners loose capital, they maintain their opposition to reforms even when the aggregate stock of capital grows larger. Thus, this short-run effect of capital redistribution makes conflict last longer, other things equal. However, this does not take into account the dynamic effects of a higher $p_R$ - that we are going to discuss in the next section.

Both between- and within-group inequality results described above speak to the short-run consequences, i.e., changes in the probability of passing an M-sector reform in the period immediately after a change in the distribution of wealth. However, there are also longer-run implications of these changes in wealth distribution. Namely, an increase in the probability of reforms in any given period $t$, also increases the pace of capital accumulation and labor migration in the long-run, which leads to the accumulated (long-run) effect of one-time change in wealth distribution. As we show in more detail in the section 6, the combination of the short-run and long-run effects is what produces divergence between trajectories of economies with higher and lower concentration of capital at the initial stages of industrialization.

So far, we have analyzed the effects of capital concentration on the probability of reforms in the M-sector. However, the other important variable is the intensity of political struggle itself. Our next proposition characterizes the overall intensity of political struggle $E^*$, and describes how it depends on the distribution of capital wealth.

**Proposition 4** (The intensity of political struggle). The NE intensity of the political struggle $E^*$ has the following properties:

- $E^*$ is increasing in the incomes of contributors from any side of the struggle, i.e., $\frac{\partial E^*_Z}{\partial I_i} > 0$, for $Z \in \{R, S\}$
- $E^*$ is increasing in the gains from reforms of contributors from any side of the struggle, i.e., $\frac{\partial E^*_Z}{\partial \Delta x_i} > 0$, for $Z \in \{R, S\}$
\( E^* \) is increasing in capital wealth inequality among landless agents \( \theta_t \) if and only if \( p_R \) is increasing in \( \theta_t \), i.e., \( \frac{\partial E^*}{\partial \theta_t} > 0 \iff \frac{\partial p_R^*}{\partial \theta_t} > 0 \)

**Proof.** See Appendix C

Other things equal, higher incomes and gains from reform/stats-quo policy increases individuals’ incentives and abilities to lobby for preferred policy outcomes\(^{34}\), thereby increasing the overall lobbying intensity \( E^* \). The fact that \( E^* \) is increasing in incomes and stakes of both capitalists and landowners, together with the structural change away from the T-sector, generates a hump-shaped dynamics of lobbying intensity. Incomes and policy gains of capitalists increase over time, while landowners’ gains from status-quo first increase and then decline with the accumulation of capital and migration of labor away from agriculture.

Moreover, any change in the distribution of capital that increases the probability of reform policy higher also increases the overall intensity of conflict in that time period. The reason is that the probability or reforms increases precisely because of a higher combined resources that the group of reform supporters invests in a struggle. In the following section we will discuss the dynamic implications of this result and those that we have discussed above.

## 5 Model Dynamics: Calibration and Simulations

In this section, we first describe the dynamics of our main macroeconomic variables, and then proceed to calibrate the model, using the historical data from Britain for the years 1688-1920 and parameter estimates from the previous literature. We also show that our model predicts quite well the dynamics of political struggle in the post-Glorious Revolution era. We simulate the model dynamics and conduct counterfactual exercises to illustrate the role of capital concentration in the process of political struggle and the pace of reforms. In Appendix D, we simulate a more complex version of the model with human capital and endogenous potential TFP growth in the modern sector. Both versions of the model are well calibrated and capture the main features of the historical data.

### 5.1 Model dynamics

Aggregating over individual incomes, we get the following capital accumulation equation:

\[
K_{t+1} = \eta \cdot Y_{t,2} = \eta \cdot (A_{T,t}^\alpha L_{T,t,2}^{1-\alpha} + A_{M,t,2} K_{t}^\alpha L_{M,t,2}^{1-\alpha}),
\]

\(^{34}\)Higher incomes make it easier to forgone consumption and invest in lobbying, while higher gain from preferred policy acts as a return on investment in lobbying.
where \(Y_{t,2}\) - the level of total output at the period \(t\), sub-period 2 (after the political contest and its realization), \(A_{M,t,2}\) - the level of technology in the modern period at period \(t\), sub-period 2, and \(L_{T,t,2}, L_{M,t,2}\) - the employment in traditional and modern sector correspondingly at period \(t\), sub-period 2. As the amount of capital is constant within a period, we do not distinguish between the capital in the first and second sub-periods. As previously, the level of employment in the traditional sector is

\[L_{T,t,j} = 1 - L_{M,t,j},\]  

(15)

which is true for both subperiods \(j = 1, 2\), and the expected rate of technological progress in the modern sector is equal to \(E(A_{M,t+1,2}/A_{M,t,1}) = \gamma_S + p_{R,t}(\gamma_R - \gamma_S)\), where the probability of reform policy, \(p_{R,t}\), is determined in Definition 1, and \(\gamma_R > \gamma_S \geq 1\). Since \(A_{M,t+1,1} = A_{M,t,2}\), for every sub-period \(j = 1, 2\)

\[E(A_{M,t+1,j}) = A_{M,t,j} \cdot (\gamma_S + p_{R,t}(\gamma_R - \gamma_S))\]  

(16)

Productivity dynamics in the traditional sector is given by

\[A_{T,t} = \zeta \cdot A_{M,t-1,2},\]  

(17)

where \(A_{T,t}\) is productivity of the traditional sector in both sub-periods, and \(0 \leq \zeta \leq 1\).

It is important to note that in our simulations, we focus on a deterministic trajectory of the economy that for each period takes the expected pace of technological progress as given in (16). The alternative would be to retain stochastic nature of productivity increase in each period and estimate the confidence intervals for where the economy could be in each period, given the value of \(p_{R,t}\) and the history of previous outcomes of the stochastic reform process. We decided to stick to the former option for the sake of tractability and to focus on the effects of wealth concentration.

**Definition 2** (Intertemporal political-economic equilibrium).

A sequence of \((K_t, L_{M,t,1}, L_{M,t,2}, L_{T,t,1}, L_{T,t,2}, A_{M,t,1}, A_{M,t,2}, A_{T,t}, w_{t,1}, w_{t,2}, R_{t,1}, R_{t,2}, \rho_{t,1}, \rho_{t,2}, e^i_{R,t}, e^i_{S,t}, k^i_{t,1}, k^i_{t,2}, I^i_{t,1}, I^i_{t,2})\) is the intertemporal equilibrium of the model, if for a given values of \((K_0, k^i_0, A_{M,0}, A_{T,0}, T^i)\), the dynamics of physical capital is determined from the dynamic equation (14), the dynamics of technology is determined from the equations (16), (17), the dynamics of individual levels of capital is determined from the equation \(k^i_{t+1} = \eta I^i_{t,2}\), the dynamics of investment in contest is determined from the optimization problem (P). Moreover, labor market clearing conditions hold, factor prices are determined from (4), (5), (6), and \(p_R\) satisfies (10).
Let us focus initially on the case, when the technological level is constant over time, 
\( A_{t,M} = A_{t,T} = A = \text{const} \) for any \( t \). That is possible, if \( p_R = 0 \) and \( \gamma_S = 1 \). The dynamic equation \( 14 \) for a constant level of technology is the following

\[
K_{t+1} = \eta Y_{t,2} = \eta A (T^\alpha L_{T,t,2}^{1-\alpha} + K_t^{\alpha L_{M,t,2}^{1-\alpha}}), 
\]

(18)

By substituting the equilibrium level of employment from \( 11 \), we get

\[
K_{t+1} = \eta A L^{1-\alpha}(T(1-\tau)(1-\alpha)/\alpha + K_t) / (T(1-\tau)^{1/\alpha} + K_t)^{1-\alpha},
\]

(19)

Below we assume that \( \tau < \alpha \), that is the share of wages, expropriated by landowners, is not very high. This is a technical assumption, that guarantees that for any level of \( K_t \), \( K'_{t+1}(K_t) > 0 \). As we show in the Appendix it is a sufficient (but not necessary) condition for the existence of the unique steady state.

**Proposition 5. Conditional steady state.**

1. For a given level of technology \( A_{M,t,1} = A_{M,t,2} = A_{T,t} = A \), for any initial level of \( K_0 \) the capital dynamics converge to the steady state level \( K^* \).
2. The steady state level \( K^* \) is an increasing function of the level of technology, \( A \).

**Proof.** See Appendix C

From the previous analysis, factor prices and employment levels are also constant in the conditional steady-state given the level of \( K^* \) and \( A_{t,M} = A_{t,T} = A = \text{const} \).

The level of the steady-state capital depends positively on the level of productivity, so the long-run dynamics of income per capita is driven entirely by the increases in productivity. An increase in \( p_R \) boosts productivity growth in the modern sector, pulls workers from the traditional to the modern sector, intensifies the accumulation of physical capital, and eventually increases output per capita.

For the dynamics of our model, it is crucial to distinguish between the two periods of industrialization, as defined in Proposition 1: conflictual and consensual. The economy starts in the conflictual period, when the supporters and the opponents of M-sector reforms coexist. These two groups invest in political struggle, \( p_R \) remains between 0 and 1, and so the pace of technological progress is below its potential.

Once the economy accumulates a sufficient amount of physical capital, the preferences of the traditional landowning elite switch towards reform policy, and the economy enters the consensual period of industrialization. In this period, there is no political struggle over M-sector reforms, \( p_R = 1 \) and the technological progress rate in the modern sector
attains the maximum level, $\gamma_R$. In the limit, the share of employment in the traditional sector tends to 0, and the economy behaves like a standard Solow-Swan growth model with a constant rate of technological progress.

### 5.2 Model calibration

In this section we calibrate the model using parameter estimates from the previous literature and data from the Industrial Revolution era in Britain. As our model is the OLG model, one period is equal to 20 years in our quantitative exercises. The model contains 10 time-invariant sets of parameters characterizing the production function ($\alpha$), the utility function ($\beta, \eta$), properties of the technological progress ($\gamma_R, \gamma_S$), distortions in the labour markets ($\tau$), the composition of social classes ($N_l, N_r, N_s$) and the distribution of land ($T$). Moreover, there are several parameters that describe the initial state of the economy ($A_{0,M}, A_{0,T}, K(0)$), and the initial distribution of wealth ($\kappa_0, \theta_0$).

**Production function and market distortions** We take into account the average share of labor incomes in total output for the period 1688-1867 from [Allen (2019)] to get the estimate for $1 - \alpha = 0.57$. Moreover, there was no upward or downward trend in the share of labour incomes in GDP in 1688-1900, during the periods of major structural transformation. We thus take $\tau = 0$, which means that market distortions in agricultural and modern sectors were roughly the same. $\tau = 0$ implies that the share of labour incomes in GDP remains constant in our model.

**Bequests and capital accumulation** Propensity to bequest and thus the speed of capital accumulation in our model is determined by $\eta$. Due to the neoclassical properties of the simple growth model that we use, any initial differences in capital distribution within the landless agents disappear within a few periods. Thus, in the baseline version of the model we introduced above, there is no persistent (only initial) inequality in capital between the big and the small capitalists.

This outcome of the model contradicts the empirical evidence from the social tables, suggesting that the relative incomes of big and small capitalists diverged during the period of industrialization ([Allen (2019)]). There are several ways to generate persistent differences in capital distribution within the landless agents. Motivated by the theory and evidence in

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35One way would be to adjust the institutions in the model, and assume that there is a fixed cost to capital accumulation, thereby ensuring that initial differences have persistent effects, like in [Galor and Zeira (1993)]. Another way could be to assume that returns differ across skill or other groups. Finally, one could assume that utility fundamentals differ.
Doepke and Zilibotti (2008), who model differences in patience and work ethic across social classes, we assume there are differences in preference parameters across groups of individuals. Namely, in our calibration, we assume that big and small capitalists have different propensity to bequest, i.e., different \( \eta \) parameters: bigger capitalists bequest a larger share of their incomes. But how large should the differences be to match the historical data?

We calibrate the savings rate across social classes to match the historical data on inequality from social tables, and on the aggregate savings rate. As documented by Crafts (1985) and later by Broadberry and de Pleijt (2021), the investment rate rose drastically from the onset on the Industrial Revolution. According to Crafts (1985), the investment rate increased from 4% in 1760 to 11.4% in 1820. Broadberry and de Pleijt (2021) showed that the investment to GDP ratio increased from 3.3% in 1760 to 10.2% in 1860. To match the historical dynamics of the aggregate investment rate, we assume that landowners and small capitalists have \( \eta = 0.08 \), which is consistent with pre-industrial level of investment rates. For big capitalists, we assume that \( \eta = 0.4 \), which is consistent with the average level of investment rates in the modern period for 1970-2021 (WDI). As incomes of the group with a higher saving rate increase faster than incomes of other groups, the aggregate savings rate increases over time in our model. In our simulations we show that with these parameter values, the dynamics of inequality produced by the model matches data from social tables quite well (except for the period right after the Glorious Revolution).

For simplicity, we also assume that agents value equally the first and second sub-periods, so that \( \beta = 0.5 \).

The composition of social classes According to Allen (2019) big landowners (aristocracy) represented about 1.5% of population in Britain in the age of the Industrial Revolution and so \( N_l/N = 0.015 \). Allen (2019) documented that during the years 1688-1880 the share of the class of bourgeoisie including large-scale capitalists, bankers, merchants, lawyers, high officials and investors grew more than two-fold. Since we focus on within-class distribution of capital, and in the model the share of each group is fixed, we take the average for years.

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36 We take into account that there are two sub-periods with the amount of production \( Y_{1,t} \) and \( Y_{2,t} \) within each of periods. As bequest is formed only from incomes in the second sub-period, \( eta = 0.08 \) implies that the amount of bequest is about 4% of total income during the period.

37 Another way to account for the fact that investment rates were increasing over time is to use the Stone-Geary preferences with a subsistence constraint. With the Stone-Geary utility, the dynamic effect of capital concentration would be amplified: an increase in the capital share owned by bigger capitalists would increase their capital investment, so in the next periods, their offspring are even more interested in lobbying. Smaller capitalists, however, would lack capital for longer, and hence lack incentives to invest in political lobbying until a later point in the process of industrialization.
1688-1867, which gives us $N_b/N = 0.05$.

**Distribution of land** In order to capture the dynamics of inequality between social classes during the Industrial Revolution, we take into account the fact that not all of the land belonged to the rich elite in the pre-industrial era. Allen (2019) estimates that big landowners earned 66% of land rent in 1688. In our calibration, landowners own 66% of the land, while the rest is equally distributed among other groups. This assumption improves the fit of model-based inequality measures to the data from social tables.

Importantly, most of the land belonging to big landowners was non-tradable until the XX century. Thus, we fix the amount of land for each of groups of the population and focus on the initial distribution of land before the major reforms. We focus on changes and effects of capital distribution and therefore abstract in the baseline calibrations from the historical shocks to the distribution of land.

**Technological progress** To match the modern era ($L_m \to N$) long-run growth rate of 2 percent (Crafts and Harley (1992)), we set the productivity increase in the modern sector when a reform passes to $1.26^{[39]}$ and normalize $\gamma_S$ to 1.

**Initial endowments of capital and technology** We begin our simulation in the year 1690, right after the Glorious Revolution - a crucial moment that marked a sharp increase of the role of the British Parliament in political decision making. In the year 1688, according to Wallis et al. (2018), about 31% of employees in England worked in industry, while 53% worked in agriculture. The rest were employed in the tertiary sector.

As in Voigtländer and Voth (2006), we abstract from the tertiary sector, as this labor is harder to clearly allocate to either T- or M-sector in our model. As a measure modern sector employment share we take the ratio of industrial labor to the combined employment in agriculture and industry. After taking into account lower employment in industry in Wales and Scotland, we fix the initial share of workers employed in the modern sector at 35%. This is a larger estimate than suggested by Crafts (1985), but consistent with more recent evidence in Shaw-Taylor and Wrigley (2014) who showed that earlier works were underestimating the degree of industrialization at the beginning of the 18th century.

We pick the initial levels of capital and productivity, $K(0)$ and $A(0)$, to match the

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38 According to Heldring et al. (2021), in the year 1407, aristocracy, gentry, church and crown owned 80% of cultivated land in Britain. By 1688, the share of land, owned by small owners increased from 20% to 25-33%.

39 From the production function $dY/Y = dA_M/A_M + \alpha dK/K + (1 - \alpha)dL_M/L_M$, in the modern growth regime, when $L_M \to L$, $dL_M = 0$, and on the balanced growth path $dK/K = dY/Y$. Hence $dA/A = dY/Y \ast (1 - \alpha)$. 

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historical data on the share of workers in the modern sector.

5.3 Model simulations: basic results

We now proceed to the results of our model’s simulations. On Figure 10, we compare the dynamics of the M-sector employment predicted by our model to the historical data from Britain. As a first exercise, we simulate a model without political barriers to reforms, so that reforms boosting M-sector productivity happen each period after Glorious Revolution with probability 1. This case is depicted on Figure 10a, which shows that such a case widely misses the data, predicting a much faster industrialization compared to what actually happened historically. Thus, a standard two-sector model without the political economy side of reforms does not capture the dynamics of industrialization well enough.

In contrast, on Figure A3, we show our baseline simulations from the full model, with potential to block M-sector reforms and corresponding political struggle. The model fits the data on structural transformation from traditional to the modern sector very closely. Moreover, the figure shows the model-based probability of reforms in the course of industrialization. As capital accumulates, and incomes, as well as gains from reforms of capitalists increase relative to the incentives of landowners to maintain the status-quo, the probability of passing a reform increases. Once the economy reaches the consensual period (and landowners no longer oppose reforms), probability of reforms equals one. The model-based measure of reform intensity closely resembles the data on the annual number of Acts passed by the British Parliament, as documented in Bogart and Richardson (2010).

We now turn to the dynamics of factor shares and inequality. Figure 11 depicts the dynamics of factor income shares (rent and profits) in the simulated model and in the data. The model matches the Industrial Revolution data very closely: the share of land rent in total incomes steadily decreases down to small levels, and the share of capital income increases.

Figure 12 depicts the dynamics of income inequality across social groups and compares dynamics of the model to the data from social tables. The model fits well the steady decline of relative incomes of big landowners in XVIII-XIX century due to the rise of the modern sector. It also matches the increase of the relative incomes of big capitalists (merchants, industrialists) in XIX century. Higher saving rates (\(\eta\)) and rising interest rate (\(R\)) (due to the technological progress) contribute to the transition from an agricultural society with a

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40 Initial levels of individual capital, \(K_{i,0} = \eta_i I_{2,i,0}\), also correspond to the conditional steady state.

41 The version of such a model where the pace of productivity increases with the share of labor employed in the M-sector (externality effect) also fails to fit the dynamics of industrialization and other data.
Figure 10: M-sector employment and probability of reforms (model and data), with and without political barriers to reforms

(a) Model without political barriers \((P_R = 1)\) \hspace{1cm} (b) Model with political barriers and lobbying

Figure 11: Dynamics of rent and profits as shares of total income
rich landowning elite to the industrial society with the bourgeoisie (big industrialists and merchants) being the new elite. The model does not fit the very first period, where the data comes from the social tables of 1688 - the year of the Glorious Revolution.

Figure 12: Incomes of landowners and big capitalists, relative to the average incomes

Changes in factor shares and income levels are crucial in determining individuals’ incentives to invest in political lobbying. Figure 13 describes the dynamics of gains ($\Delta^i$) from a reform policy for each of the three groups. After a certain point in time, $\Delta_L$ becomes positive, which means that landowners switch to reform supporters due to increased individual capital to land ratio. After that period the pace of productivity growth in the modern sector is not constrained politically (the probability of a passing a reform equals one) and attains its maximum level.

The preferences of landowners regarding the reform policy are non-monotonic because of two competing effects. On the one hand, as industrialization accelerates, land rent incomes become more sensitive to increases in the M-sector productivity, so the landowners’ incentives to block reforms increase. On the other hand, landowners’ stakes in the modern sector increase over time, as does the size of the modern sector. These two aggregate channels combined affect the landowners’ (and capitalists’) gains from their preferred policy.

Importantly for our main argument, in the early periods of industrialization, the incentives of big capitalists to lobby for reforms are much larger than that of small capitalists. Since the inequality in incomes between rich and poor capitalist is rising during the transition, in our calibration only two groups (landowners and big capitalists) invest into political

\[42\text{There are also incentives coming from own incomes, as well as capital stocks, where the wealth distribution becomes crucial. We focus on the roles of inequality in the next subsection.} \]
Turning to the dynamics of the lobbying intensity, Figure 14 depicts the dynamics of lobbying investments of landowners, $E_1$, big capitalists, $E_2$, and their combined lobbying investments, $E$. The model thus predicts a very clear hump-shaped dynamics of lobbying surrounding industrialization reforms. The hump-shaped dynamics of political struggle intensity is generated by the fact that (i) the opposing interest groups invest in a political struggle more resources when their incomes and their gains from preferred policy are higher, and (ii) the incomes and gains change non-monotonously for capitalists and landowners. In
the earliest periods of industrialization, when capital-to-land ratio is small, stakes of both landowners and capitalists are low (as land rents hardly react to the initial small reallocations of labor to the M-sector), and there is no intense political struggle. Lobbying is also negligible in the late stages of industrialization, when the traditional sector contracts sharply as workers migrate to industry, and the richest landowners become more interested in industrialization. In between, however, the intensity of political struggle attains its maximum levels, when both supporters and opponents of reforms have a lot to gain from their preferred policies, and when capitalists accumulate sufficient incomes to oppose the established elite.

Figure 15: Lobbying expenditures over GDP, model and data

Our model-based measure of political struggle is in units of income, so to compare the model-based lobbying intensity to that in the historical data on public petitions, we express total lobbying expenditures as a share of GDP. Figure 14 depicts the historical expenditures on petitions in % of GDP together with the intensity of political struggle over GDP from the model, $E/Y$. One can clearly see a very close quantitative match, especially in the most intense periods of the mid-19th century. The current calibration of the model results in a slightly later end of the struggle between landowners and capitalists, as compared to the data, as well as an earlier intensification. It is important to note, however, that public petitions were just one of the technologies of political pressure, most prevalent in the 19th century. This technology was largely absent in the 17 and early 18 century, right after the defeat of the absolutist monarchy. In the 20th century, in contrast, democratic processes become more mature, which meant a decline of petitions as a political tool.
6 Capital concentration, lobbying, and reforms

6.1 The role of capital concentration: simulations

We now proceed to explore the effects of capital concentration within the group of capitalists on the pace of reforms and the intensity of political struggle. To quantitatively assess the effect of capital concentration on the probability of reforms, we compare the baseline distribution of capital considered above to an alternative distribution, in which there is less inequality between big and small capitalists. Namely, in the alternative scenario, big capitalists have a smaller bequest rate, \( \eta_R = 0.3 \), while small capitalists have a slightly larger bequest rate, which keeps the aggregate saving rate same, but reduces the concentration of capital wealth at the top.

Figure 16 depicts the dynamics of modern-sector employment, the pace of reforms, and the intensity of lobbying for the baseline and the alternative (less concentrated) capital distribution. Clearly, when the distribution of capital is less skewed, pro-growth reforms and industrialization happen much slower than when big capitalists own a larger share of capital (consistent with historical data from British social tables). Moreover, the period of active political struggle between the T- and the M-sector interests begins and ends later when capital is less concentrated, consistent with the anecdotal evidence we discuss below.

The reason is that big capitalists have lower individual incomes and lower gains from a reform policy at any stage of the process, which also lowers their lobbying efforts. Small capitalists gain additional capital and income, but due to the free rider problem, they do not participate in lobbying. Thus, the combined lobbying efforts of capitalists are smaller than in the baseline scenario, despite the fact that the aggregate level of capital and the aggregate savings rate for this group remain the same.

6.2 Case studies

To further support our model’s predictions regarding the role of capital concentration in creating fertile ground for historical lobbying for reforms, we present two case studies. The first case focuses on the 19th century Prussia and discusses micro-level evidence on how inequality in capital distribution mapped into policy outcomes at the county level. The second case focuses on the historical difference in capital concentration between Europe and the Middle East and shows how highly dispersed capital ownership in the Middle East prevented the emerging capitalists from successfully lobbying for progressive reforms.
Figure 16: M-sector employment, probability of reforms, and lobbying intensity under two capital distributions: $\eta_b = 0.4$ and $\eta_b = 0.3$, and same aggregate savings.
6.2.1 Concentrated capital and support for reforms in 19th-century Prussia

The process of industrialization and political struggle in 19th century Prussia provides clear micro-level evidence supporting our theory. Several recent papers credibly demonstrate how the distribution of wealth affected the political process and public policy outcomes in the non-democratic system of 19th century Prussia - the so-called ‘three-class franchise’[^43] which ensured that political decisions at the local level are affected mostly by the wealthy elites, both landowning and landless.

Recent empirical findings by Becker and Hornung (2020) support one of the main results of our theoretical model. Namely, the authors demonstrate that the support for pro-growth reforms in the period of rapid industrialization (1867-1903) in Prussia was more likely to come from the constituencies with higher ‘vote inequality’ - a measure that reflected wealth inequality at the time. Importantly, this empirical regularity holds even after accounting for landownership inequality, which was shown before to itself be predictive of a negative propensity for reforms, see Galor et al. (2009) and Cinnirella and Hornung (2016). Moreover, the link between political support for industrialization and wealth inequality was stronger in constituencies with large-scale industry, aligning these findings with our model even further. Thus, a higher concentration of industrial wealth in a constituency predicted MPs voting for progressive modern-sector policies.

Additionally, as is shown in Krieger (2020), landless elites often held a much stronger interest in providing various public goods, such as health infrastructure. In particular, the author finds that the county-level provision of health-promoting public goods in late 19-century Prussia was increasing in the share of important political office positions held by landless elites as compared to landowning elites. Landless elites had higher economic benefits from improving the health of workers in more crowded, disease-prone environments. Thus, where the political power of the landless elites was greater, reforms and policies necessary for industrialization were more likely to pass.

However, it was not always the case that big capitalists and big landowners had directly opposite preferences regarding reforms and policies. As Mares and Queralt (2020) have recently demonstrated, both big landowners and big capitalists in the late 19th century Prussia were in favor of the introduction of the income tax. Income tax was supposed to shift the relative tax burden from land towards previously mostly non-taxed industrial

[^43]: A political system under which individual votes cast for members of the parliament were weighted according to the amount of taxes individuals pay. Voters were grouped into three classes based on their tax payments.
incomes and liberal professions. Thus, economically, landed elites were in favor of this change, while capitalists were against, which aligns well with our model. However, because income tax was increasing the political power of the highest taxpayers (due to the three-class franchise system in Prussia), both big capitalists and big landowners were gaining from it politically. While this mechanism is not explicitly built-in in our model, we still capture the link between incomes of various groups and their political power: incomes of both landowners and capitalists directly affect their political power in the lobbying process, see equation (13).

6.2.2 Dispersed capital and failed reforms in the Middle East

It is now well-established (Kuran (2012) and Bosker et al. (2013)) that the Middle East was ahead of Western Europe economically up until at least 14th century. However, from the 15th century onward, Western Europe was rapidly catching up and eventually overtaking the Middle East in urbanization and incomes per capita. There is a large literature trying to understand the reasons for this divergence (Kuran (2018) provides a review). Lagging reforms that had a potential to boost modern-sector productivity is considered to be one of the main reasons for the long period of stagnation in the Middle East. For example, as shown in Cosgel et al. (2012), the printing press technology was blocked by the elites in the Middle East for nearly 3 centuries. Pamuk (2009) argues that merchants and modern-sector producers in the Middle East were not able to overcome the opposition of the elites and push for the necessary policy change. But why were these groups not strong enough, given how more urbanized and developed the Middle East was in the Middle Ages?

Our theory argues that not only the level, but the distribution of capital is crucial for the political support for the modern-sector reforms. At the earlier stages of industrialization, a higher concentration of capital wealth among the landless (merchants, industrialists) increases the chances for their success in lobbying for progressive reforms. As emphasized by Kuran (2004, 2012), several arguably exogenous features of the Islamic law assured that capital wealth remained dispersed, and enterprises small. According to our model, this highly dispersed distribution of capital wealth in the Islamic commerce and industry could have prevented the accumulation of sufficient lobbying efforts against the traditional elites, and hence hindered industrial development.

A key feature of the Islamic law that prevented higher concentration of capital was related to inheritance laws. Specifically, inheritance laws required any property or estate
to be divided among all close and distant relatives, including both men and women. Another important feature was the absence of “corporation” as a legal institution – a form of property ownership distinct from a collection of individuals that form a joint venture. Under these conditions, incentives to pool large capital stocks together remained low. As shown by Kuran (2012), in 17th-century Istanbul, around 80 percent of all partnerships involved only two people, while “enterprises” with more than 5 or more persons were very rare.

Pamuk (2004, 2009) emphasizes more specifically the lack of political and economic power in the hands of merchants and producers, comparing it to much greater political power of central bureaucracy - who also owned most of the land in the Middle East. Although Pamuk does not explicitly link low political pressure from the emerging capitalists to highly dispersed capital ownership, the author stresses the inability of merchants and producers to oppose the interests of the landowning state in blocking technological and institutional reforms necessary for development.

This anecdotal evidence illustrates one of the main predictions of our model: pro-growth policies and reforms in the M-sector are much less likely to be supported by sufficient lobbying effort when the concentration of capital ownership is low at the early stages of development. While the overall amount of capital in the Middle East was not so low (especially in the form of waqfs), and many industrial technologies were already available for import from the West, the actual industrialization was often blocked (see, e.g., the case of the printed press (Cosgel et al. (2012)) by the landed elite. Recent more detailed evidence from Spain presented in Cinnirella et al. (2023) shows further that places subjected to Muslim institutions had significantly weaker merchant classes, inhibiting early industrial development and education.

Lafi (2010) explicitly studies petitioning activity of special interest groups in late Ottoman Empire (focusing on Tunis province), and shows that while petitioning was overall quite prevalent in this period, it was mostly coming from artisans and workers, and their guilds, in the non-mechanized industries, facing the threat of automation and competition from Europe. Lafi (2011) notices that petitions were common in the pre-20th century Ottoman Empire, but rarely were coming from merchants or industrial groups. Baldwin (2012) also

in the hands of the commercial elite.

45The institution of a “waqf” – basically, a shelter for private wealth under the risks of confiscation by the state - was another reason why private capital wealth remained scattered. Waqfs led to a massive outflow of private wealth, Bazzi et al. (2018) and Cansunar and Kuran (2019), and although funds in waqfs were used to finance public goods (like mosques and schools), the immobility of these funds constrained their use for private investment or political lobbying. Depending on the region of the Middle East, from 15 to 50 percent of all estate was accumulated in waqfs, Kuran (2013).
suggests that petitions to the Sultan in the 17-19 centuries were more often addressing local, non-economic issues, rather than struggles between sectoral interest groups.

7 Conclusion

In this paper, we explored the interplay between inequality, political lobbying over reforms, and industrialization. Our model integrated a standard two-sector growth model with a micro-founded political struggle over modern sector reforms. A crucial feature of the industrialization era - political lobbying between the supporters and opponents of modern-sector development - emerges and resolves endogenously, driven by the relative incentives of special interest groups to invest in lobbying. The first key contribution of the paper is thus to integrate the dynamics of historical lobbying into the better known processes of capital accumulation, structural change, and wealth distribution. The model predicts that the intensity of political lobbying follows a hump-shaped dynamic path, which quantitatively matches very closely the observed public petitions to the British Parliament and the US Congress over the period from the late 17th to the early 20th century.

Our second contribution concerns the effects of historical capital and land concentration on the pace of progressive reforms and industrialization. In our model, the initial distributions of capital and land, as well as their evolution over time, determine the abilities and incentives of individuals in this political struggle. The key prediction of our model is that historically higher concentration of capital increases the chances of successful lobbying for modern sector reforms. Higher concentration of capital alleviates the free-rider problem, and increases the incentives and abilities of bigger capitalists to lobby for development, while smaller capitalists are not yet ready to participate in the political process. The opposite holds for the concentration of land ownership. These key predictions of our model are validated using (i) new data on petitions to the US Congress, (ii) simulations of the model calibrated to the British data, as well as (iii) recent evidence from Prussia and the Middle East.

Overall, this paper makes two arguments in the discussion of the inequality-growth relationship in historical perspective. First, one needs to take into account the crucial distinction between the impact of land and capital inequalities on the outcomes of political struggle and, hence, growth during the stage of industrialization. During the period of active political struggle between the landowners and capitalists, any attempt to generate a link between overall inequality and development might be misleading. Moreover, given the changing relative importance of these two assets in the overall wealth, one may expect a change in the
effect of the overall wealth inequality on growth when capital replaces land as a primary source of wealth. Second, the paper argues that it is important to distinguish between the within- and between-group inequalities in the distribution of capital. The two components have different effects, depending on the stage of industrialization. We hope that future research will bring more empirical evidence on how various dimensions of wealth concentration might have affected political struggle and growth historically.
References


Appendix

A. Additional Figures and Tables

Figure A1: Voting rights extensions in Britain (after the Great Reform Act of 1832)

Figure A2: Parliamentary Acts in Britain after the Glorious Revolution. Source: Bogart and Richardson (2010)
B. Solving for the Nash Equilibrium

Using

\[ c_R^i = \begin{cases} 
I^i - \frac{1-\beta}{\beta} \cdot \frac{E}{1-p_R} \cdot \frac{1}{\Delta_R} & \text{if } I^i \cdot \Delta_R > \frac{1-\beta}{\beta} \cdot \frac{E}{1-p_R} \\
0 & \text{otherwise.}
\end{cases} \]  

(20)

and

\[ s_R(E, p_R) = \frac{E_R}{E} = \frac{\sum_{i \in R} (I^i - \frac{1-\beta}{\beta} \cdot \frac{E}{1-p_R} \cdot \frac{1}{\Delta_R})}{E} \]  

we can easily solve for \( s_R(E) \), taking into account that \( p_R = s_R(E) \). If we denote \( \sum_{i \in Z} I^i \) as the sum of incomes over contributors from group \( Z = \{R, S\} \), i.e., those with \( I^i \cdot \Delta_Z > \frac{1-\beta}{\beta} \cdot \frac{E}{1-p_Z} \), and denote \( \sum_{i \in Z} \frac{1}{\Delta_Z} \) as the sum over the same set of participants as above. With these notations, we obtain

\[ s_R(E) = 1/2 + \frac{\sum_{i \in R} I^i}{2E} - \sqrt{\left(1 - \frac{\sum_{i \in R} I^i}{E}\right)^2 + 4 \cdot \frac{1-\beta}{\beta} \cdot \sum_{i \in R} \frac{1}{\Delta_R}} \]  

(21)

and the analogous expression for \( s_S(E) \).

\( E^* \) is defined to be a unique Nash Equilibrium in this political contest game if an only if \( s_R(E^*) + s_S(E^*) = 1 \). We use this equilibrium condition together with (22) to get the following expression that defines \( E^* \):

\[ \sum_{i \in R} I^i \frac{E}{E} - \sqrt{\left(1 - \frac{\sum_{i \in R} I^i}{E}\right)^2 + 4 \cdot \frac{1-\beta}{\beta} \cdot \sum_{i \in R} \frac{1}{\Delta_R}} + \sum_{i \in S} I^i \frac{E}{E} - \sqrt{\left(1 - \frac{\sum_{i \in S} I^i}{E}\right)^2 + 4 \cdot \frac{1-\beta}{\beta} \cdot \sum_{i \in S} \frac{1}{\Delta_S}} = 0 \]  

(23)

It is easy to prove (see properties of \( s_Z(E) \) from Definition 1) that the solution to (23) is unique. Once \( E^* \) is known, we use equation (22) to find the equilibrium probability of reform policy as \( p_R^* = s_R(E^*) \) at any given distribution of capital and land, and any given period in time.

It’s important to remember that individual participation condition from equation (20) itself depends on the equilibrium conflict intensity \( E^* \) and equilibrium probability of reform \( p_R^* \). Since in our simplified set-up, there are only two groups of capitalists and one group of landowners, with all agents identical to each other within those groups, we need to consider only two cases: (i) when all agents from the group of bigger capitalists participate, and all smaller capitalists are complete free-riders, and (ii) when all agents from both groups of capitalists participate.
C. Proofs

Proof of Proposition 1

Part 1

Recall that $\Delta_R^i = \ln(I^i_{2,R}) - \ln(I^i_{2,S})$. Consider inequality $\Delta_R^i \geq 0$ for $i \in \Lambda$. This inequality simplifies to $I^i_{2,R} \geq I^i_{2,S}$, which further simplifies to $w_{2,R} + k^iR_{2,R} + T^i\rho_{2,R} > w_{2,S} + k^iR_{2,S} + T^i\rho_{2,S}$, and finally we arrive at:

$$k^i \cdot \Delta R + \Delta w \geq T^i \cdot \Delta \rho,$$

which is the condition for landowner to support reform policy. Note that $\Delta w = w^R - w^S > 0$, which follows from (3), (5), and (11); $\Delta R = R^R - R^S > 0$, which follows from (6) and (11); and $\Delta \rho = \rho^S - \rho^R > 0$, which follows from (4) and (11).

Part 2

From the inequality we need to prove, $(\Delta_R^i)_{k^i} > 0$, it is easy to arrive at it’s equivalent: $I^i_{2,R}/I^i_{2,S} < R^i_{2,R}/R^i_{2,S}$. Denote this inequality by (*). The RHS in (*) is always larger than 1. Hence, if agent $i$ supports status-quo, i.e. $I^i_{2,R} < I^i_{2,S}$, then the LHS in (*) is less than 1, and so $(\Delta_R^i)_{k^i} > 0$ is always true for $i$. Otherwise, if agent $i$ supports reform policy, i.e. $I^i_{R} > I^i_{S}$, then we need to solve for $I^i_{R}/I^i_{S} < R^i_{R}/R^i_{S}$ explicitly. Inequality (*) simplifies to $T^i > (w^R R^R - w^S R^R)/(\rho^S R^R - \rho^R R^R)$, where the denominator is definitely larger than zero (since $\rho^S > \rho^R$ and $R^R > R^S$), while the numerator is definitely less than zero (it follows from the fact that $w^R/w^S < R^R/R^S$, i.e., wages do not grow as fast as capital incomes after the reform policy is realized. Hence, $T^i > (w^R R^R - w^S R^R)/(\rho^S R^R - \rho^R R^R)$ is always true. Therefore, we have proven that $(\Delta_R^i)_{k^i} > 0$. Inequality $(\Delta_R^i)_{T^i} < 0$ can be proved along the same way.

In order to establish the signs of the second derivatives, first note that $(\Delta_R^i)_{k^i} = (R^i_k/I^i_R - R^i_S/I^i_S)$. Therefore, $(\Delta_R^i)_{k^i} < 0$ simplifies to $(w^R R^R - w^S R^R) + T^i \cdot (\rho^R R^R - \rho^S R^S) < 0$. Expression in the first brackets is negative since capital gains increase faster with the M-sector productivity growth than wages do. Expression in the second brackets is negative because $\rho^R < \rho^S$, while $R^R > R^S$. In the same way, we establish that $(\Delta_R^i)_{T^i} < 0$.

Part 3

Even ignoring (for now) the fact that $k^i$ is a function of $K_{t-1}$, it is easy to show (using (3)-(6) and (11)) that $(\Delta R)_K < 0$ and $(\Delta w)_K > 0$, so as the economy accumulates aggregate capital stock, the difference between returns to capital between reform and status-quo
outcomes are getting smaller, while that for wages is getting larger. Moreover, \((\Delta \rho)'_K \geq 0\) if \(K \leq \tilde{K}\), but \((\Delta \rho)'_K < 0\) if \(K > \tilde{K}\) (thus, the difference in returns to land between status-quo and reform outcomes is hump-shaped in \(K\)).

Using continuity of all the functions involved, the signs of derivatives above, and the limits \(\lim_{K \to \infty} \Delta \rho = 0\), \(\lim_{K \to \infty} \Delta R = 0\), \(\lim_{K \to \infty} \Delta w > 0\), and \(\lim_{K \to \infty} \Delta \rho/\Delta R = 0\) one can easily verify, using the Intermediate Value Theorem, that there exists a threshold \(\bar{K}\), such that for \(K \geq \bar{K}\), inequality \(k^i \geq T^i \cdot \Delta \rho/\Delta R - \Delta w/\Delta R\) will hold for all \(i\), so all initial status-quo supporters switch their preferences to reform policy after \(K \geq \bar{K}\).

The fact that with the accumulation of capital \(K_t\) even the biggest landowners become reform supporters is even more straightforward if we acknowledge that \(k^i_t\) is increasing with capital accumulation. In order to derive a specific functional form for \(\bar{K}\) we would need to take this dynamic relationship into account.

**Proof of Proposition 2**

We proceed with the proof in two main steps. First, we consider two types of NE, (i) with only the group of bigger capitalists participating in the political struggle (i.e., when the participation condition does not hold for the group of smaller capitalists), and (ii) with both groups of capitalists participating in conflict. We establish that in the first type of equilibrium, redistributing capital from smaller to bigger capitalists increases \(p_R\), while the same type of redistribution in the second type of equilibrium decreases \(p_R\). Second, we show that for aggregate capital \(K_t \leq \Phi\), we have the first type of equilibrium, while for \(K_t > \Phi\) we have the second type of equilibrium. We also describe the properties of the \(\Phi\) function.

**Step 1**

The following Lemma adapted from Nitzan and Ueda (2014) will be very useful for proving this proposition.

**Lemma 1.** Given the definition and properties of the share function \(s_Z(E, \Omega)\) from Definition 1, and any initial equilibrium level of political struggle intensity \(E^*\), any change in the exogenous parameters in \(\Omega\) that results in new vector of parameters \(\Omega_{\text{new}}\) and increases \(s_Z(E^*, \Omega)\) (and does not affect the share function of the other group)\(^{46}\) will increase equilibrium \(p_Z\). Thus, \(p_Z^{**} = s_Z(E^{**}, \Omega_{\text{new}}) > p_Z^* = s_Z(E^*, \Omega)\). Moreover, \(E^{**}(\Omega_{\text{new}}) > E^*(\Omega)\).

**Proof.** See Nitzan and Ueda (2014), and replace the reference to 'stake vectors' with \(\Omega\), as the result applies more broadly to a change in any parameter exogenous from the viewpoint.

\(^{46}\)We will return to a more complicated case when a change in parameters from \(\Omega\) affects both share functions (of reform supporters and of status-quo supporters) later, when proving Proposition 3.
of an individual within a given period. Our new condition that a change in parameters from \( \Omega \) affects the share function of only one group is important, but does not affects the proof (as in Nitzan and Ueda (2014) the proof is designed for this specific case).

Lemma 1 is very intuitive, as any increase in parameters that for a given level of contest intensity \( E^* \) increases the share of lobbying efforts that come from group \( Z \), would also increase the probability of this group winning at a new equilibrium. The reason is that if a group spends more, it’s share increases, and a new equilibrium total effort must also increase to ensure that \( \sum s_Z = 1 \). Thus, since \( s_Z \) is decreasing in \( E \), in a new equilibrium, the share function of the second group goes down, which ensures it’s winning probability becomes lower.

Now we can apply Lemma 1 to complete the first step Proposition 2 proof. Namely, consider a change in \( \theta_t \). A change in \( \theta_t \) redistributes capital wealth between capitalists, and as \( \theta_t \) increases, \( k_b \) increases, while \( k_s \) decreases, which means that incomes \( I_b \) and stakes in conflict \( \Delta_b \) increase, while \( I_s \) and \( \Delta_s \) decrease. To determine the direction of the effect of \( \theta_t \) on \( p^*_R \) it is sufficient to determine \( \frac{\partial s_R (E, \Omega)}{\partial \theta_t} \) - see Lemma 1.

Consider first an equilibrium \( E^*_1(\Omega) \) such that only a group of bigger capitalists participates in political lobbying, so the following system of inequalities must be satisfied:

\[
\begin{align*}
    I_b \cdot \Delta_b^i &> \frac{1-\beta}{\beta} \cdot \frac{E^*_1}{1-p^*_{R,1}} \\
    I_s \cdot \Delta_s^i &\leq \frac{1-\beta}{\beta} \cdot \frac{E^*_1}{1-p^*_{R,1}}
\end{align*}
\]  

(25)

In this case, after substituting \( \sum_{i \in R} I^i \) for \( N_b \cdot I_b \), and \( \sum_{i \in R} \frac{1}{\Delta_i^R} \) for \( \frac{N_b}{\Delta_b} \), it is straightforward to see from (22) (Appendix B) that an increase in \( \theta_t \) increases \( p^*_R \). The reason is that \( \frac{\partial s_R (E^*_1)}{\partial \Delta_b} > 0 \) and \( \frac{\partial s_R (E^*_1)}{\partial I_b} > 0 \) (to see the latter one needs to consider two cases, \( E^*_1 > I_b \cdot N_b \) and \( E^*_1 \leq I_b \cdot N_b \), and verify that in both cases the sign of the derivative is unambiguous), and hence Lemma 1 guarantees that for the equilibrium with only the bigger capitalists participating, \( \frac{\partial p^*_{R,1}}{\partial \theta_t} > 0 \).

Next, consider an equilibrium \( E^*_2(\Omega) \) such that both groups of capitalists participate in political lobbying, so the following system of inequalities must be satisfied:

\[
\begin{align*}
    I_b \cdot \Delta_b^i &> \frac{1-\beta}{\beta} \cdot \frac{E^*_2}{1-p^*_{R,2}} \\
    I_s \cdot \Delta_s^i &> \frac{1-\beta}{\beta} \cdot \frac{E^*_2}{1-p^*_{R,2}}
\end{align*}
\]  

(26)
In this case, a redistribution of capital does not affect the combined incomes of all individuals supporting reform policy, i.e., \( \frac{\partial (N_b \cdot I_b + N_s \cdot I_s)}{\partial \theta_t} = 0 \). However, due to the fact that individual gains from preferred policy \( \Delta_i \) are concave in individual capital \( k_i \), \( \forall i \) (see Proposition 1), we have \( \frac{\partial (N_b \cdot \Delta_b + N_s \cdot \Delta_s)}{\partial \theta_t} > 0 \). Thus, again from (22), we can see that \( \frac{\partial p^*(E^*_2)}{\partial \theta_t} < 0 \), and hence Lemma 1 guarantees that for the equilibrium with both groups of capitalists participating, \( \frac{\partial \nu_{b,2}}{\partial \theta_t} < 0 \).

Step 2

The second step is to establish how the type of equilibrium (whether only the bigger capitalists, or both groups, participate) depends on the set of exogenous parameters and dynamic variables \( \Omega \). We are especially interested in the effect of \( K_t \).

First, note that both \( I_b, I_s \) and \( \Delta_b, \Delta_s \) are increasing in \( K_t \). This can be seen from the definition of \( \Delta^i \) and the fact that individual capital \( k_b = \frac{\theta \kappa K_t N_b}{k_s = (1-\theta) \kappa K_t N_b} \), which allows one to express \( \Delta^i \) in terms of \( Y_{M,t} \). It is a simple differentiation from there.

As is evident from (25) and (26), the LHS in both systems, both inequalities, are increasing in \( K_t \) without bound. The RHS, however, is always smaller than the LHS for bigger capitalists, as we know that bigger capitalists always participate in the contest. Moreover, we know that as \( K_t \) approaches \( \bar{K} \), \( E^* \) goes to zero, and \( p^*_R \) goes to one. Thus, using L’Hopital’s Rule, one can verify that for \( K_t \geq \Phi \), the RHS of systems (25) and (26) goes to zero. Thus, we have the type of NE with both groups participating, as system (26) is always satisfied for \( K_t \geq \Phi \).

Proof of Proposition 3

As we can see from the definition of \( s_Z(E,\Omega) \) given in Definition 1 and (13), a change in \( \kappa_t \) affects both \( s_R \), and \( S_S \), so we cannot directly apply Lemma 1 to prove how \( \kappa_t \) affects \( p^*_R \). Instead, we prove that \( (s_R - s_S)'_\kappa > 0 \) for small \( K_t \), which then allows us to see that for small \( K_t \), \( \frac{\partial p^*_R}{\partial \kappa} > 0 \).

First, note that \( \partial I_R/\partial \kappa > 0 \), while \( \partial I_S/\partial \kappa < 0 \), so because of inter-class redistribution of capital away from landowners, their incomes fell, while incomes of landless agents rise.

Second, compare \( \partial \Delta_R/\partial \kappa \) to \( \partial \Delta_S/\partial \kappa \). It is easy to show that gains of both reformers and status-quo supporters increase in \( \kappa \), i.e., \( \partial \Delta_Z/\partial \kappa > 0 \) for \( Z \in R, S \). However, for small values of \( K_t/T \), the \( \lim_{K_t/T \to 0} (\partial \Delta_R/\partial \kappa - \partial \Delta_S/\partial \kappa) > 0 \), i.e., for small values of \( K_t/T \), gains of reform supporters increase faster than that of status-quo supporters, when the latter lose some capital to the former.

Together, the two results above imply that \( (s_R - s_S)'_\kappa > 0 \), which in terms implies that for small \( K_t/T \), \( \frac{\partial p^*_R}{\partial \kappa} > 0 \).
Proof of Proposition 4

Proposition 4 is easily proved using Lemma 1 and Proposition 2, step 1.

Part 1

Higher incomes $I_Z^i$ increase $s_Z(E^*, \Omega)$, which means that (see Lemma 1) new equilibrium $E^{**}$ will be higher.

Part 2

Higher gains from preferred policy $\Delta_Z^i$ increase $s_Z(E^*, \Omega)$, which means that (see Lemma 1) new equilibrium $E^{**}$ will be higher.

Part 3

Again, from Lemma 1 and Proposition 2, as long as $\theta_t$ increases $p^*_R$, Lemma 1 guarantees that $\theta_t$ also increases $E^*$, and vice versa.

Proof of Proposition 5

First, we prove that from the equation (18) it follows that $K'_{t+1}(K_t) > 0$ for all $K_t \geq 0$.

By taking the derivative of the equation (18) of $K_t$, we get

$$K'_{t+1}(K_t) = ((K_t + T(1-\tau)^{1/\alpha})^{1-\alpha} - (1-\alpha)(K_t + T(1-\tau)^{1/\alpha})^{-\alpha}(K_t + T(1-\tau)^{(1-\alpha)/\alpha}) / ((K_t + T(1-\tau)^{1/\alpha})^{2-2\alpha})$$

(27)

The derivative $K'_{t+1}(K_t)$ is positive only if

$$((K_t + T(1-\tau)^{1/\alpha})^{1-\alpha} - (1-\alpha)(K_t + T(1-\tau)^{1/\alpha})^{-\alpha}(K_t + T(1-\tau)^{(1-\alpha)/\alpha}) > 0$$

(28)

Rearranging the items, we get the following condition

$$((K_t + T(1-\tau)^{1/\alpha}) - (1-\alpha)(K_t + T(1-\tau)^{(1-\alpha)/\alpha}) > 0$$

(29)

or

$$\alpha K_t + T(1-\tau)^{1/\alpha}(1- (1-\alpha))(1-\tau) > 0$$

(30)

For $\tau < \alpha$ this equation always holds and so, $K'_{t+1}(K_t) > 0$ for all $K_t \geq 0$.

By differentiating (27), we get

$$K''_{t+1}(K_t) = ((K_t + T(1-\tau)^{1/\alpha})^{1-2\alpha} - 2(2\alpha - 2 + (\alpha - 2)(K_t + T(1-\tau)^{1/\alpha}) / (K_t + T(1-\tau)^{1/\alpha}))$$

(31)

As $\alpha < 1$, $K''_{t+1}(K_t)$ for all $K_t$. Moreover, if $K_t$ tends to infinity, $K'_{t+1}(K_t)$ tends to zero.

Therefore, there is a unique steady state, for which $K_{t+1} = K_t = K^*$. 

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This steady state is globally stable, only if $K_{t+1}'(K^*) < 1$.

From (27) in the steady state

$$K_{t+1}'(K^*) = \left(\frac{K^*/(K^* + T(1 - \tau)(1-\alpha)/\alpha)}{(1 - \alpha)(K^*/(K^* + T(1 - \tau)^{1/\alpha})}\right)$$

(32)

It follows that for any $K^*$, $K_{t+1}'(K^*) < 1$ and so, the steady state is globally stable.

Moreover, as $(K_{t+1}'(K_t))'(A_t) > 0$ the rise in the level of technology increases the steady state level of capital.

**D. The model with human capital and endogenous TFP growth**

In this section, we extend our model to show that our results hold with more realistic modelling of TFP growth and the role of human capital. In our baseline model, the reform policy (which includes education reforms) leads to the acceleration of the M-sector TFP growth, stimulating structural change. However, the potential increase of M-sector TFP is considered to be exogenous and fixed at a relatively high level (based on contemporary TFP growth rates). Thus, the role of reforms and them being often blocked at the early stages of structural change can lead to the overestimation of the role of political economy factors that we model. Moreover, we do not model directly the evolution of human capital and its effect on output and TFP. However, Galor and Weil (2000) and subsequent studies in the unified growth theory show that human capital plays a key role in transition from stagnation to growth. In this part of the paper, we extend the model in two major ways.

First, we take into account the role of human capital as a driver of productivity growth and structural change. All agents are endowed with $h(t)$ units of human capital, which may be employed in the modern sector, such that

$$Y_{M,t} = A_{M,t} K_{M,t} H_{M,t}$$

where $H_{M,t} = h(t) \cdot L_{M,t}$, and $h(t) = 0.13 \cdot s$. The number of years of schooling, $s$, evolves exogenously in our model and as shown in Lee and Lee (2016), accelerates in the 2nd half of the 19th and early 20th century in Britain. The Mincer return to education is taken from

47A more complex version of the model would have taken into account the fact that years of schooling themselves are a product of supply of schooling by the government and demand for education from the population. Thus, part of an increase in schooling in the end of the 19th - early 20th century reflects the passage of necessary reforms under the pressure from the interest groups, see also Galor and Moav (2006); Galor et al. (2009). However, we already have an effect of special interest groups on the passage of the TFP-increasing reform, and human capital already plays a role here by increasing the demand for reforms and by increasing the size of the potential TFP boost.
Caselli (2005) for the time periods before education accelerates in the 2nd half of the 20th century. In equilibrium, wages equalize across sectors, so an increase in the stock of human capital speeds up the outflow of workers from the traditional to the modern sector.

Second, we assume that the rate of potential TFP growth (if not blocked) depends on the market size (in our model, the level of employment in the modern sector) and on the level of education. Specifically, we assume that

\[ \gamma_R(t) = 1 + 0.26 \cdot \left[ \frac{L_m(t)}{L} \right] (1 + \frac{h(t)}{h_{MAX}})^{0.9}, \]

where in the modern growth regime the potential growth rate attains the same maximum level 1.26 as in the baseline model. This specification resembles the ones used in Lagerlof (2006) and Cervellati et al. (2022), among others.

The process of model calibration closely resembles the one described in the main part of the paper. Below we show the main results of simulations with this more realistic version of the model. Figure A3 shows the dynamics of model-based measure of M-sector employment, along with the actual data on employment\(^{48}\). The match is very close. The pace of reforms co-evolves closely with structural change, as before, and matches well the acceleration from Bogart and Richardson (2010), see Figure A2.

Figure A3: Model with human capital

Figure A4 shows an updated dynamics of income inequality, looking at the ratios of incomes of landowners to the average, and big capitalists to the average. The model slightly

\(^{48}\)For robustness, and to make sure that we properly capture the role of skilled sectors, we also use alternative data on the dynamics of employment in the modern sector from CAMPOP, available here https://www.campop.geog.cam.ac.uk/research/projects/occupationalstructure/. We consider services as part of the modern sector (noting that part of the services labor was servants, etc., in agriculture).
overestimates incomes of landowners, but does a decent job capturing the historical concentration of incomes in the hands of bigger capitalists, as well as their rise to dominance at the end of the 19th century.

Figure A4: Incomes of landowners and big capitalists, relative to the average incomes

Figure A5 depicts the model-based dynamics of lobbying intensity by participants groups, and in the aggregate. As before, the aggregate intensity of political struggle over the M- vs. T-sector reforms reaches its peak at the end of the 19th century, which is consistent with the data.

Figure A5: Lobbying expenditures: $E$ - overall lobbying intensity; $E_1$ - lobbying expenditures of landowners; $E_2$ - lobbying expenditures of capitalists