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MODELING INEFFICIENT INSTITUTIONS

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ABSTRACT

Why do inefficient – non-growth enhancing – institutions emerge and persist? This paper develops a simple framework to provide some answers to this question. Political institutions determine the allocation of political power, and economic institutions determine the framework for policy-making and place constraints on various policies. Groups with political power, the elite, choose policies to increase their income and to directly or indirectly transfer resources from the rest of society to themselves. The baseline model encompasses various distinct sources of inefficient policies, including revenue extraction, factor price manipulation and political consolidation. Namely, the elite may pursue inefficient policies to extract revenue from other groups, to reduce their demand for factors, thus indirectly benefiting from changes in factor prices, and to impoverish other groups competing for political power. The elite''s preference over inefficient policies translates into inefficient economic institutions. Institutions that can restrict inefficient policies will in general not emerge, and the elite may manipulate economic institutions in order to further increase their income or facilitate rent extraction. The exception is when there are commitment (holdup) problems, so that equilibrium taxes and regulations are worse than the elite would like them to be from an ex ante point of view. In this case, economic institutions that provide additional security of property rights to other groups can be useful. The paper concludes by providing a framework for the analysis of institutional change and institutional persistence.

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1 Introduction

Many economists and social scientists have recently emphasized the importance of government policies, economic, political and legal institutions, and more broadly, the organization of society.[1] There is also mounting evidence that various institutional features are indeed important for economic growth.[2] Nevertheless, despite important theoretical advances, we still lack an organizational framework to analyze the determinants of institutions.[3] In particular, if institutions matter (so much) for economic performance, why do societies choose or end up with institutions that do not maximize economic growth or aggregate economic welfare? This paper discusses potential answers to this question.

The main focus is on modeling the emergence and persistence of inefficient institutions, meaning institutions that do not maximize the growth potential of a society.[4] The purpose of the paper is not to provide a survey but to construct a relatively simple unified model that illustrates both various issues already raised in the existing literature and a number of new mechanisms that appear to be important in understanding inefficient institutions.

To understand why inefficient institutions emerge and persist, we first need to understand: (i) what type of equilibrium policies and allocations emerge within different institutional frameworks; (ii) the preferences of different individuals and groups over these policies and allocations. This will enable us to derive *induced preferences* over institutions. Inefficient institutions will emerge and persist, in turn, when groups that prefer the inefficient (non-growth enhancing) policies that these institutions generate are sufficiently powerful,

[1]For general discussions, see North and Thomas (1973), Jones (1981), North (1981), Olson (1982), North and Weingast (1989), Eggertsson (2005), Dixit (2004), and Acemoglu et al. (2005).

[2]See, among others, the empirical evidence in Knack and Keefer (1995), Mauro (1995), Barro (1999), Hall and Jones (1999), Acemoglu et al. (2001, 2002) or Persson (2005).

[3]Austen-Smith and Banks (1999) and Persson and Tabellini (2000) are excellent introductions to recent advances in political economy.

[4]A potentially weaker definition of "inefficiency" would be Pareto inefficiency, whereby a set of institutions would be Pareto inefficient if a different set of institutions would make everybody better off. This definition, though important for certain theoretical analyses, is too weak in the context of political economy discussions, since one set of institutions may enrich a particular narrow social group, while causing stagnation or low growth for the society at large, and we may wish to refer to this set of institutions as "inefficient".

and when other social arrangements that compensate these powerful groups, while reaching more efficient allocations, cannot be found.

In this paper, I provide one example of such an approach. I start with a simple baseline model, which is then enriched to discuss a number of mechanisms that lead to the emergence and persistence of inefficient policies and institutions. The model includes three groups: workers, elite producers and non-elite (middle class) producers. The latter two groups have access to investment opportunities with varying degrees of productivity. The key policies in the model are taxes imposed on producers.[5] There are two different institutional dimensions. The first is political institutions, which govern the allocation of *de jure* power in society.[6] This power determines, for example, which groups (or individuals) have control over fiscal policies. To start with, I suppose that the elite have de jure political power.[7] Economic institutions, on the other hand, relate to the constraints and rules governing economic interactions. They include, among other things, enforcement of property rights, entry barriers, regulation of technology, and the set of contracts that can be enforced.[8] In the model, restrictions on expropriation, taxation and redistribution, or the ability to regulate technology, correspond to economic institutions.

The model is first used to highlight various sources of inefficiencies in policies:

1. *Revenue extraction:* the group in power—the elite—will set high taxes on middle class producers in order to extract resources from them. These taxes are distortionary. This

[5]This should be interpreted as an example standing for many other forms of distortionary ways of transferring resources from one group to another. These include simple violations of property rights (as, for example, when land tenure is removed or assets are expropriated from certain groups), entry barriers (used to indirectly transfer resources from more efficient to less efficient producers or to manipulate factor prices as we will see below), or other distortionary policies, for example, the use of marketing boards in order to depress the prices paid for certain agricultural products (e.g., see Bates (1981), a classic analysis of the use of marketing boards in Ghana and Zambia)

[6]See Acemoglu and Robinson (2006a) and Acemoglu et al. (2005) for the distinction between de jure and de facto political power.

[7]Throughout I retain the assumption that political and economic groups coincide, thus all members of "the elite" will have the same preferences over economic policies and will somehow be able to coordinate their policy actions. In practice who "the elite" are is a key question, on which I am remaining agnostic in this paper (though the model will illustrate that the productivity of the elite has an important effect on the efficiency of equilibria).

[8]Naturally, the distinction between economic and political institutions is somewhat arbitrary. For example, restrictions on taxes and expropriation are interpreted as "economic institutions" here, though they clearly require limits on the political power of certain groups.

source of inefficiency results from the absence of non-distortionary taxes, which implies that the distribution of resources cannot be decoupled from efficient production.[9]

2. *Factor price manipulation:* the group in power may want to tax middle class producers in order to reduce the prices of the factors they use in production. This inefficiency arises because the elite and middle class producers compete for factors (here labor). By taxing middle class producers, the elite ensure lower factor prices and thus higher profits for themselves.[10]

3. *Political consolidation:* to the extent that the political power of the middle class depends on their economic resources, greater middle class profits reduce the elite's political power and endanger their future rents. The elite will then want to tax the middle class in order to impoverish them and consolidate their political power.[11]

Although all three inefficiencies in policies arise because of the desire of the elite to extract rents from the rest of the society, the analysis reveals that of the three sources of inefficiency, the revenue extraction is typically the least harmful, since, in order to extract revenues, the elite need to ensure that the middle class undertakes efficient investments. In contrast, the factor price manipulation and political consolidation mechanisms encourage the elite to directly impoverish the middle class. An interesting comparative static result is that greater state capacity shifts the balance towards the revenue extraction mechanism, and thus, by allowing the elite to extract resources more efficiently from other groups, may

[9]Many models in the literature emphasize the revenue extraction mechanism. See, among others, Grossman (1991), Grossman and Kim (1995), McGuire and Olson (1996). The costs of redistributive taxation in models of democracy are also related (e.g., Romer (1975), Roberts (1977), Meltzer and Richard (1981)). See also Besley and Coate (1998) for a discussion of inefficient redistribution because of limits on fiscal instruments.

[10]This mechanism is most closely related to Acemoglu (2003a), where incumbents may impose entry barriers in order to affect factor prices. It is also related to models in which there is a conflict between agricultural and capitalist producers, or between users of old and new technologies, for example, Krusell and Rios-Rull (1996), Parente and Prescott (1999), Bourguignon and Verdier (2000), Nugent and Robinson (2002), Galor et al. (2003), and Sonin (2003). The discussion of the taxation policies and migration and occupational controls towards blacks in South Africa in Feinstein (2005) provide a clear example of the factor price manipulation mechanism.

[11]The mechanism of political consolidation is most closely related to Acemoglu and Robinson (2000a, 2006b), where a ruler may block technological change in order to increase the probability of staying in power. In that model, the reason why technological change may threaten the ruler is that it erodes its incumbency advantage. See also Robinson (2001), Rajan and Zingales (2000) and Bueno de Mesquita et al. (2003). Empirical evidence related to the political consolidation mechanism from various historical contexts is discussed in Acemoglu and Robinson (2000a).

improve the allocation of resources.

Additional inefficiencies arise when there are "commitment problems" on the part of the elites, in the sense that they may renege on policy promises once key investments are made. Following the literature on organizational economics, I refer to this as a *holdup problem*. With holdup, taxes are typically higher and more distortionary. Holdup problems, in turn, are likely to be important, for example, when the relevant investment decisions are long-term, so that a range of policies will be decided after these investments are undertaken.

The inefficiencies in policies translate into inefficient institutions. Institutions determine the framework for policy determination, and economic institutions determine both the limits of various redistributive policies and other rules and regulations that affect the economic transactions and productivity of producers. In the context of the simple model here, I associate economic institutions with two features: limits on taxation and redistribution, and regulation on the technology used by middle class producers.[12] The same forces that lead to inefficient policies imply that there will be reasons for the elite to choose inefficient economic institutions. In particular, they may not want to guarantee enforcement of property rights for middle class producers or they may prefer to block technology adoption by middle class producers. Holdup problems, which imply equilibrium taxes even higher than those preferred by the elite, create a possible exception, and may encourage the elite to use economic institutions to place credible limits on their own future policies (taxes). This suggests that economic institutions that restrict future policies may be more likely to arise in economies in which there are more longer-term investments and thus more room for holdup.

The model also sheds light on the conditions under which economic institutions discourage or block technology adoption. If the source of inefficiencies in policies is revenue extraction, the elite always wish to encourage the adoption of the most productive technologies by the middle class. However, when the source of inefficiencies in policies is factor price manipulation or political consolidation, the elite may want to *block* the adoption of

[12] More generally, these correspond to various rules and arrangements that put constraints on fiscal and regulatory policies of governments, and shape the set of contracts and technology choices available to firms.

more efficient technologies, or at the very least, they would choose not to invest in activities that would increase the productivity of middle class producers. This again reiterates that when the factor price manipulation and political consolidation mechanisms are at work, significantly more inefficient outcomes can emerge.[13]

While economic institutions regulate fiscal policies and technology choices, political institutions govern the process of collective decision-making in society. In the baseline model, the elite have *de jure political power*, which means that they have the formal right to make policy choices and influence economic decisions. To understand the inefficiencies in the institutional framework, we need to investigate *the induced preferences* of different groups over institutions. In the context of political institutions, this means asking whether the elite wish to change the institutional structure towards a more equal distribution of political power. The same forces that make the elite choose inefficient policies also imply that the answer to this question is no. Consequently, despite the inefficiencies that follow, the institutional structure with elite control tends to persist.

The framework also enables me to discuss issues of appropriate and inappropriate institutions. Concentrating political power in the hands of the elite may have limited costs (may even be "efficient"), if the elite are sufficiently productive (more productive than the middle class). However, a change in the productivity of the elite relative to the middle class could make a different distribution of political power more beneficial. In this case, existing institutions, which may have previously functioned relatively well, become inappropriate to the new economic environment.[14] Yet there is no guarantee that there will be a change in institutions in response to the change in environment.

Finally, I present a framework for analyzing changes in political institutions.[15] Political institutions regulate the allocation of de jure political power, as in the example of

[13]The framework in this paper is applied to the inefficiency of institutions in an open economy setting in Segura-Cayuela (2006).

[14]How a given set of institutions that may first increase but then retard economic growth is also discussed in Acemoglu (2003a) and Acemoglu et al. (2003).

[15]This framework builds on my previous work with James Robinson, but applies these ideas to the environment considered here which contains richer economic interactions. See in particular Acemoglu and Robinson (2000b, 2001, 2006a).

constitutions or elections determining the party in government. There is more to political power than this type of de jure power, however. Certain groups may be able to disrupt the existing system, for example, by solving their collective action problem and undertaking demonstrations, unrest, protests, revolutions or military action. Each group may therefore possess *de facto political power* even when excluded from de jure political power. In this context, middle class producers, even though they have no formal say in a dictatorship or an oligarchic society, may sometimes have sufficient de facto political power to change the system or at least to demand some concessions from the elite. Under these circumstances, changes in political institutions may emerge as an equilibrium outcome. They are useful as a way of committing to future allocations, because, by affecting the distribution of de jure political power in the future, they shape future policies and economic allocations. Such a commitment may be necessary when the current elite need to make concessions in response to a shift in the distribution of de facto political power and when their ability to make concessions within a given political system is limited. Consequently, changes in political institutions take place when the elite are forced to respond to temporary changes in de facto political power by changing the political system (and thus the distribution of de jure political power in the future). The analysis also shows that changes in political institutions are less likely when *political stakes* are higher, because, in this case, the elite will fight and use repression to defend the existing regime. Rents from the natural resources or land tend to increase political stakes and thus contribute to institutional persistence. Interestingly, state capacity, which makes redistribution more efficient, also increases political stakes and may create dynamic costs by increasing the longevity of the dictatorship of the elite.

The rest of the paper is organized as follows. Section 2 presents the basic economic model and characterizes the equilibrium for a given sequence of policies. The rest of the paper investigates how these policies are determined. Section 3 analyzes the revenue extraction, factor price manipulation and political consolidation mechanisms, and also discusses holdup problems and distortions in the process of technology adoption. Section 4 analyzes the emergence of inefficient economic institutions, while Section 5 discusses emergence and persistence of inefficient political institutions. Section 6 presents a model of endogenous institutional change and institutional persistence. Section 7 concludes.

2 Baseline Model

2.1 Environment

Consider an infinite horizon economy populated by a continuum $1+\theta_e+\theta_m$ of risk neutral agents, each with a discount factor equal to $\beta<1$. There is a unique non-storable final good denoted by y. The expected utility of agent j at time 0 is given by:

$$U_0^j=\mathbb{E}_0\sum_{t=0}^{\infty}\beta^t c_t^j, \tag{1}$$

where $c_t^j\in\mathbb{R}$ denotes the consumption of agent j at time t and $\mathbb{E}_t$ is the expectations operator conditional on information available at time t.

Agents are in three groups. The first are workers, whose only action in the model is to supply their labor inelastically. There is a total mass 1 of workers. The second is the elite, denoted by e, who initially hold political power in this society. There is a total of θ^e elites. Finally, there are θ^m "middle class" agents, denoted by m. The sets of elite and middle class producers are denoted by S^e and S^m respectively. With a slight abuse of notation, I will use j to denote either individual or group.

Each member of the elite and middle class has access to production opportunities, represented by the production function

$$y_t^j=\frac{1}{1-\alpha}(A_t^j)^{\alpha}(k_t^j)^{1-\alpha}(l_t^j)^{\alpha}, \tag{2}$$

where k denotes capital and l labor. Capital is assumed to depreciate fully after use. The Cobb-Douglas form is adopted for simplicity.

The key difference between the two groups is in their productivity. To start with, let us assume that the productivity of each elite agent is A^e in each period, and that of each middle class agent is A^m. Productivity of the two groups differs, for example, because they are engaged in different economic activities (e.g., agriculture versus manufacturing, old versus new industries, etc.), or because they have different human capital or talent.

On the policy side, there are activity-specific tax rates on production, τ^e and τ^m, which are constrained to be nonnegative, i.e., $\tau^e \geq 0$ and $\tau^m \geq 0$. There are no other fiscal instruments (in particular, no lump-sum non-distortionary taxes). In addition there is a total income (rent) of R from natural resources. The proceeds of taxes and revenues from natural resources can be redistributed as nonnegative lump-sum transfers targeted towards each group, $T^w \geq 0$, $T^m \geq 0$ and $T^e \geq 0$.[16]

Let us also introduce a parameter $\phi \in [0, 1]$, which measures how much of the tax revenue can be redistributed. This parameter, therefore, measures "state capacity," i.e., the ability of the states to penetrate and regulate the production relations in society (though it does so in a highly "reduced-form" way). When $\phi = 0$, state capacity is limited all tax revenue gets lost, whereas when $\phi = 1$ we can think of a society with substantial state capacity that is able to raise taxes and redistribute the proceeds as transfers. The government budget constraint is

$$T_t^w + \theta^m T_t^m + \theta^e T_t^e \leq \phi \int_{j \in S^e \cup S^m} \tau_t^j y_t^j dj + R. \tag{3}$$

Let us also assume that there is a maximum scale for each firm, so that $l_t^j \leq \lambda$ for all j and t. This prevents the most productive agents in the economy from employing the entire labor force. Since only workers can be employed, the labor market clearing condition is

$$\int_{j \in S^e \cup S^m} l_t^j dj \leq 1, \tag{4}$$

with equality corresponding to full employment. Since $l_t^j \leq \lambda$, (4) implies that if

$$\theta^e + \theta^m \leq \frac{1}{\lambda}, \tag{ES}$$

there can never be full employment. Consequently, depending on whether Condition (ES) holds, there will be excess demand or excess supply of labor in this economy. Throughout,

[16] The assumption that taxes and transfers are nonnegative are standard in the literature (which, naturally, does not make them innocuous). The non-negativity of transfers will play an important role in the analysis by forcing redistributive policies to be distortionary. Although this structure of fiscal instruments can be motivated as restrictions imposed by "economic institutions", the most compelling reason for assuming this structure is that it is a tractable reduced-form formulation, which captures potential inefficiencies that will arise because of informational problems in richer settings (e.g., Mirrlees (1971)).

I assume that

$$\theta^e \leq \frac{1}{\lambda} \text{ and } \theta^m \leq \frac{1}{\lambda}, \tag{A1}$$

which ensures that neither of the two groups will create excess demand for labor by itself. Assumption (A1) is adopted only for convenience and simplifies the notation (by reducing the number of cases that need to be studied).

2.2 Economic Equilibrium

I first characterize the economic equilibrium for a given sequence of taxes, $\{\tau_t^e, \tau_t^m\}_{t=0,1,\ldots,\infty}$ (the transfers do not affect the economic equilibrium). An *economic equilibrium* is defined as a sequence of wages $\{w_t\}_{t=0,1,\ldots,\infty}$, and investment and employment levels for all producers, $\left\{\left[k_t^j, l_t^j\right]_{j\in S^e\cup S^m}\right\}_{t=0,1,\ldots,\infty}$ such that given $\{\tau_t^e, \tau_t^m\}_{t=0,1,\ldots,\infty}$ and $\{w_t\}_{t=0,1,\ldots,\infty}$, all producers choose their investment and employment optimally and the labor market clears.

Each producer (firm) takes wages, denoted by w_t, as given. Finally, given the absence of adjustment costs and full depreciation of capital, firms simply maximize current net profits. Consequently, the optimization problem of each firm can be written as

$$\max_{k_t^j, l_t^j} \frac{1-\tau_t^j}{1-\alpha}(A^j)^\alpha (k_t^j)^{1-\alpha}\left(l_t^j\right)^\alpha - w_t l_t^j - k_t^j,$$

where $j \in S^e \cup S^m$. This maximization yields

$$k_t^j = (1-\tau_t^j)^{1/\alpha} A^j l_t^j, \text{ and} \tag{5}$$

$$l_t^j \begin{cases} = 0 & \text{if } w_t > \frac{\alpha}{1-\alpha}(1-\tau_t^j)^{1/\alpha} A^j \\ \in [0,\lambda] & \text{if } w_t = \frac{\alpha}{1-\alpha}(1-\tau_t^j)^{1/\alpha} A^j \\ = \lambda & \text{if } w_t < \frac{\alpha}{1-\alpha}(1-\tau_t^j)^{1/\alpha} A^j \end{cases}. \tag{6}$$

A number of points are worth noting. First, in equation (6), the expression $\alpha(1-\tau_t^j)^{1/\alpha}A^j/(1-\alpha)$ is the net marginal product of a worker employed by a producer of group j. If the wage is above this amount, this producer would not employ any workers, and if it is below, he or she would prefer to hire as many workers as possible (i.e., up to the maximum, λ). Second, equation (5) highlights the source of potential inefficiency in this economy. Producers invest in physical capital but only receive a fraction $(1-\tau_t^j)$ of the revenues. Therefore, taxes discourage investments, creating potential inefficiencies.

Combining (6) with (4), equilibrium wages are obtained as follows:

(i) If Condition (ES) holds, there is excess supply of labor and $w_t = 0$.

(ii) If Condition (ES) does not hold, then there is "excess demand" for labor and the equilibrium wage is

$$w_t = \min\left\langle \frac{\alpha}{1-\alpha}(1-\tau_t^e)^{1/\alpha}A^e, \frac{\alpha}{1-\alpha}(1-\tau_t^m)^{1/\alpha}A^m \right\rangle. \tag{7}$$

The form of the equilibrium wage is intuitive. Labor demand comes from two groups, the elite and middle class producers, and when condition (ES) does not hold, their total labor demand exceeds available labor supply, so the market clearing wage will be the minimum of their net marginal product.

One interesting feature, which will be used below, is that when Condition (ES) does not hold, the equilibrium wage is equal to the net productivity of one of the two groups of producers, so either the elite or the middle class will make zero profits in equilibrium.

Finally, equilibrium level of aggregate output is

$$Y_t = \frac{1}{1-\alpha}(1-\tau_t^e)^{(1-\alpha)/\alpha}A^e \int_{j\in S^e} l_t^j dj + \frac{1}{1-\alpha}(1-\tau_t^m)^{(1-\alpha)/\alpha}A^m \int_{j\in S^m} l_t^j dj + R. \tag{8}$$

The equilibrium is summarized in the following proposition (proof in the text):

Proposition 1 Suppose Assumption (A1) holds. Then for a given sequence of taxes $\{\tau_t^e, \tau_t^m\}_{t=0,1,...,\infty}$, the equilibrium takes the following form: if Condition (ES) holds, then $w_t = 0$, and if Condition (ES) does not hold, then w_t is given by (7). Given the wage sequence, factor demands are given by (5) and (6), and aggregate output is given by (8).

3 Inefficient Policies

Now I use the above economic environment to illustrate a number of distinct sources of inefficient policies. In this section, political institutions correspond to "the dictatorship of the elite" in the sense that they allow the elite to decide the policies, so the focus will be on the elite's desired policies. The main (potentially inefficient) policy will be a tax on middle class producers, though more generally, this could correspond to expropriation, corruption or entry barriers. As discussed in the introduction, there will be three mechanisms leading to inefficient policies; (1) Resource Extraction; (2) Factor Price Manipulation; and (3) Political Consolidation.

To illustrate each mechanism in the simplest possible way, I will focus on a subset of the parameter space and abstract from other interactions. Throughout, I assume that there is an upper bound on taxation, so that $\tau_t^m \leq \bar{\tau}$ and $\tau_t^e \leq \bar{\tau}$, where $\bar{\tau} \leq 1$. This limit can be institutional, or may arise because of the ability of producers to hide their output or shift into informal production.

The timing of events within each period is as follows: *first*, taxes are set; *then,* investments are made. This removes an additional source of inefficiency related to the holdup problem whereby groups in power may seize all of the output of other agents in the economy once it has been produced. Holdup will be discussed below.

To start with, I focus on Markov Perfect Equilibria (MPE) of this economy, where strategies are only dependent on payoff-relevant variables. In this context, this means that strategies are independent of past taxes and investments (since there is full depreciation). In the dictatorship of the elite, policies will be chosen to maximize the elite's utility. Hence, a *political equilibrium* is given by a sequence of policies $\{\tau_t^e, \tau_t^m, T_t^w, T_t^m, T_t^e\}_{t=0,1,\dots,\infty}$ (satisfying (3)) which maximizes the elite's utility, taking the economic equilibrium as a function of the sequence of policies as given.

More specifically, substituting (5) into (2), we obtain elite consumption as

$$c_t^e = \left[\frac{\alpha}{1-\alpha}(1-\tau_t^e)^{1/\alpha} A^e - w_t\right] l_t^e + T_t^e, \tag{9}$$

with w_t given by (7). This expression follows immediately by recalling that the first term in square brackets is the after-tax profits per worker, while the second term is the equilibrium wage. Total per elite consumption is given by their profits plus the lump sum transfer they receive. Then the political equilibrium, starting at time $t = 0$, is simply given by a sequence of $\{\tau_t^e, \tau_t^m, T_t^w, T_t^m, T_t^e\}_{t=0,1,\dots,\infty}$ that satisfies (3) and maximizes the discounted utility of the elite, $\sum_{t=0}^{\infty} \beta^t c_t^e$.

The determination of the political equilibrium is simplified further by the fact that in the MPE with full capital depreciation, this problem is simply equivalent to maximizing (9). We now characterize this political equilibrium under a number of different scenarios.

3.1 Revenue Extraction

To highlight this mechanism, suppose that Condition (ES) holds, so wages are constant at zero. This removes any effect of taxation on factor prices. In this case, from (6), we also have $l_t^j = \lambda$ for all producers. Also assume that $\phi > 0$ (for example, $\phi = 1$).

It is straightforward to see that the elite will never tax themselves, so $\tau_t^e = 0$, and will redistribute all of the government revenues to themselves, so $T_t^w = T_t^m = 0$. Consequently taxes will be set in order to maximize tax revenue, given by

$$\text{Revenue}_t = \frac{\phi}{1-\alpha}\tau_t^m(1-\tau_t^m)^{(1-\alpha)/\alpha}A^m\lambda\theta^m + R \tag{10}$$

at time t, facedownwhere the first term is obtained by substituting for $l_t^m = \lambda$ and for (5) into (2) and multiplying it by τ_t^m, and taking into account that there are θ^m middle class producers and a fraction ϕ of tax revenues can be redistributed. The second term is simply the revenues from natural resources. It is clear that tax revenues are maximized by $\tau_t^m = \alpha$. In other words, this is the tax rate that puts the elite at the peak of their Laffer curve. In contrast, output maximization would require $\tau_t^m = 0$. However, the output-maximizing tax rate is not an equilibrium because, despite the distortions, the elite would prefer a higher tax rate to increase their own consumption.

At the root of this inefficiency is a limit on the tax instruments available to the elite.[17] If they could impose lump-sum taxes that would not distort investment, these would be preferable. Inefficient policies here result from the redistributive desires of the elite coupled with the absence of lump-sum taxes.

It is also interesting to note that as α increases, the extent of distortions are reduced, since there are greater diminishing returns to capital and investment will not decline much

[17]See the discussion in footnote 16 and the further analysis and discussion in Besley and Coate (1998).

in response to taxes.[18]

Even though $\tau_t^m = \alpha$ is the most preferred tax for the elite, the exogenous limit on taxation may become binding, so the equilibrium tax is

$$\tau_t^m = \tau^{RE} \equiv \min\{\alpha, \bar{\tau}\} \tag{11}$$

for all t. In this case, equilibrium taxes depend only on the production technology (in particular, how distortionary taxes are) and on the exogenous limit on taxation. For example, as α decreases and the production function becomes more linear in capital, equilibrium taxes decline.

This discussion is summarized in the following proposition (proof in the text):

Proposition 2 Suppose Assumption (A1) and Condition (ES) hold and $\phi > 0$, then the unique political equilibrium features $\tau_t^m = \tau^{RE} \equiv \min\{\alpha, \bar{\tau}\}$ for all t.

3.2 Factor Price Manipulation

I now investigate how inefficient policies can arise in order to manipulate factor prices. To highlight this mechanism in the simplest possible way, let us first assume that $\phi = 0$ so that there are no direct benefits from taxation for the elite. There are indirect benefits, however, because of the effect of taxes on factor prices, which will be present as long as the equilibrium wage is positive. For this reason, I now suppose that Condition (ES) does not hold, so that equilibrium wage is given by (7).

Inspection of (7) and (9) then immediately reveals that the elite prefer high taxes in order to reduce the labor demand from the middle class, and thus wages, as much as possible. The desired tax rate for the elite is thus $\tau_t^m = 1$. Given constraints on taxation, the equilibrium tax is $\tau_t^m = \tau^{FPM} \equiv \bar{\tau}$ for all t. We therefore have (proof in the text):

Proposition 3 Suppose Assumption (A1) holds, Condition (ES) does not hold, and $\phi = 0$, then the unique political equilibrium features $\tau_t^m = \tau^{FPM} \equiv \bar{\tau}$ for all t.

[18] More explicitly, (5) implies that $\partial^2 \ln k_t^j / \partial \tau_t^j \partial \alpha = 1 / \left(\alpha^2 \left(1 - \tau_t^j \right) \right) > 0$.

This result suggests that the factor price manipulation mechanism generally leads to higher taxes than the pure revenue extraction mechanism. This is because, with the factor price manipulation mechanism, the objective of the elite is to reduce the profitability of the middle class as much as possible, whereas for revenue extraction, the elite would like the middle class to invest and generate revenues. It is also worth noting that, differently from the pure revenue extraction case, the tax policy of the elite is not only extracting resources from the middle class, but it is also doing so indirectly from the workers, whose wages are being reduced because of the tax policy.

The role of $\phi = 0$ also needs to be emphasized. Taxing the middle class at the highest rate is clearly inefficient. Why is there not a more efficient way of transferring resources to the elite? The answer relates to the limited fiscal instruments available to the elite (recall the discussion in footnote 16). In particular, $\phi = 0$ implies that they cannot use taxes at all to extract revenues from the middle class, so they are forced to use inefficient means of increasing their consumption, by directly impoverishing the middle class. In the next subsection, I discuss how the factor price manipulation mechanism works in the presence of an instrument that can directly raise revenue from the middle class. This will illustrate that the absence of any means of transferring resources from the middle class to the elite is not essential for the factor price manipulation mechanism (though the absence of non-distortionary lump-sum taxes is naturally important).

3.3 Revenue Extraction and Factor Price Manipulation Combined

I now combine the two effects isolated in the previous two subsections. By itself the factor price manipulation effect led to the extreme result that the tax on the middle class should be as high as possible. Revenue extraction, though typically another motive for imposing taxes on the middle class, will serve to reduce the power of the factor price manipulation effect. The reason is that high taxes also reduce the revenues extracted by the elite (moving the economy *beyond the peak* of the Laffer curve), and are costly to the elite.

To characterize the equilibrium in this case again necessitates the maximization of (9).

This is simply the same as maximizing transfers minus wage bill for each elite producer. As before, transfers are obtained from (10), while wages are given by (7). When Condition (ES) holds and there is excess supply of labor, wages are equal to zero, and we obtain the same results as in the case of pure resource extraction.

The interesting case is the one where (ES) does not hold, so that wages are not equal to zero, and are given by the minimum of the two expressions in (7). Incorporating the fact that the elite will not tax themselves and will redistribute all the revenues to themselves, the maximization problem can be written as

$$\max_{\tau_t^m} \left[\frac{\alpha}{1-\alpha} A^e - w_t \right] l_t^e + \frac{1}{\theta^e} \left[\frac{\phi}{1-\alpha} \tau_t^m (1-\tau_t^m)^{(1-\alpha)/\alpha} A^m l_t^m \theta^m + R \right], \tag{12}$$

subject to (7) and

$$\theta^e l_t^e + \theta^m l_t^m = 1, \text{ and} \tag{13}$$

$$l_t^m = \lambda \text{ if } \quad (1-\tau_t^m)^{1/\alpha} A^m \geq A^e. \tag{14}$$

The first term in (12) is the elite's net revenues and the second term is the transfer they receive. Equation (13) is the market clearing constraint, while (14) ensures that middle class producers employ as much labor as they wish provided that their net productivity is greater than those of elite producers.

The solution to this problem can take two different forms depending on whether (14) holds in the solution. If it does, then $w = \alpha A^e / (1-\alpha)$, and elite producers make zero profits and their only income is derived from transfers. Intuitively, this corresponds to the case where the elite prefer to let the middle class producers undertake all of the profitable activities and maximize tax revenues. If, on the other hand, (14) does not hold, then the elite generate revenues both from their own production and from taxing the middle class producers. In this case $w = \alpha(1-\tau^m)^{1/\alpha} A^m / (1-\alpha)$. Rather than provide a full taxonomy, I impose the following assumption:

$$A^e \geq \phi(1-\alpha)^{(1-\alpha)/\alpha} A^m \frac{\theta^m}{\theta^e}, \tag{A2}$$

which ensures that the solution will always take the latter form (i.e., (14) does not hold). Intuitively, this condition makes sure that the productivity gap between the middle class and elite producers is not so large as to make it attractive for the elite to make zero profits themselves (recall that $\phi(1-\alpha)^{(1-\alpha)/\alpha} < 1$, so if $\theta^e = \theta^m$ and $A^e = A^m$, this condition is always satisfied).[19]

Consequently, when (A2) holds, we have $w_t = \alpha(1-\tau_t^m)^{1/\alpha} A^m \ \tau_t^m / (1-\alpha)$, and the elite's problem simply boils down to choosing τ_t^m to maximize

$$\frac{1}{\theta^e}\left[\frac{\phi}{1-\alpha}\tau_t^m(1-\tau_t^m)^{(1-\alpha)/\alpha} A^m l^m \theta^m + R\right] - \frac{\alpha}{1-\alpha}(1-\tau_t^m)^{1/\alpha} A^m \lambda, \qquad (15)$$

where I have used the fact that all elite producers will employ λ employees, and from (13), $l_m = (1-\lambda\theta^e)/\theta^m$.

The maximization of (15) gives

$$\frac{\tau_t^m}{1-\tau_t^m} = \kappa(\lambda, \theta^e, \alpha, \phi) \equiv \frac{\alpha}{1-\alpha}\left(1 + \frac{\lambda\theta^e}{(1-\lambda\theta^e)\phi}\right).$$

The first interesting feature is that $\kappa(\lambda, \theta^e, \alpha, \phi)$ is always less than ∞. This implies that τ_t^m is always less than 1, which is the desired tax rate in the case of pure factor price manipulation. Moreover, $\kappa(\lambda, \theta^e, \alpha, \phi)$ is strictly greater than $\alpha/(1-\alpha)$, so that τ_t^m is always greater than α, the desired tax rate with pure resource extraction. Therefore, the factor price manipulation motive always increases taxes above the pure revenue maximizing level (beyond the peak of the Laffer curve), while the revenue maximization motive reduces taxes relative to the pure factor price manipulation case. Naturally, if this level of tax is greater than $\bar{\tau}$, the equilibrium tax will be $\bar{\tau}$, i.e.,

$$\tau_t^m = \tau^{COM} \equiv \min\left\{\frac{\kappa(\lambda, \theta^e, \alpha, \phi)}{1+\kappa(\lambda, \theta^e, \alpha, \phi)}, \bar{\tau}\right\}. \qquad (16)$$

It is also interesting to look at the comparative statics of this tax rate. First, as ϕ increases, taxation becomes more beneficial (generates greater revenues), but τ^{COM} declines.

[19] To see why this condition is sufficient for (14) not to hold, first use (13) (and drop the R term, which plays no role here) to write the objective of an elite agent as $(\alpha A^e/(1-\alpha) - w)\, l^e + \phi\tau^m(1-\tau^m)^{(1-\alpha)/\alpha} A^m (1-l^e)/(1-\alpha)\theta^e$. The maximum of this expression when (14) holds is $U^1 = \phi\alpha(1-\alpha)^{(1-\alpha)/\alpha} A^m\theta^m\lambda/(1-\alpha)\theta^e$. When it does not hold, let the value be $\max_{\tau^m} U^2(\tau^m)$. Note that when $\tau^m = 1$, we have $w = 0$ and $U^2(\tau^m = 1) = \alpha A^e\lambda/(1-\alpha)$, so when Assumption (A2) holds

$$\max_{\tau^m} U^2(\tau^m) > U^2(\tau^m = 1) = \alpha A^e\lambda/(1-\alpha) \geq U^1,$$

establishing that (A2) is sufficient for the elite to prefer a tax policy that yields positive profits for them.

This might at first appear paradoxical, since one may have expected that as taxation becomes less costly, taxes should increase. Intuition for this result follows from the observation that an increase in ϕ raises the importance of revenue extraction, and as commented above, in this case, revenue extraction is a force towards lower taxes (it makes it more costly for the elite to move beyond the peak of the Laffer curve). Since the parameter ϕ is related, among other things, to state capacity, this comparative static result suggests that higher state capacity will translate into lower taxes, because greater state capacity enables the elite to extract revenues from the middle class through taxation, without directly impoverishing them. In other words, greater state capacity enables more efficient forms of resource extraction by the groups holding political power.[20]

Second, as θ^e increases and the number of elite producers increases, taxes also increase. The reason for this effect is again the interplay between the revenue extraction and factor price manipulation mechanisms. When there are more elite producers, reducing factor prices becomes more important relative to gathering tax revenue. One interesting implication of this discussion is that when the factor price manipulation effect is more important, there will typically be greater inefficiencies. Finally, an increase in α raises taxes for exactly the same reason as above; taxes create fewer distortions and this increases the revenue-maximizing tax rate.

Once again summarizing the analysis (proof in the text):

Proposition 4 Suppose Assumptions (A1) and (A2) hold, Condition (ES) does not hold, and $\phi > 0$. Then the unique political equilibrium features $\tau_t^m = \tau^{COM}$ as given by (16) for all t. Equilibrium taxes are increasing in θ^e and α and decreasing in ϕ.

3.4 Political Consolidation

I now discuss another reason for inefficient taxation, the desire of the elite to preserve their political power. This mechanism has been absent so far, since the elite were assumed to always remain in power. To illustrate it, the model needs to be modified to allow

[20] This is a very different argument for why greater state capacity may be good for economic outcomes than the standard view, for example, espoused in Evans (1995).

for endogenous switches of power. Institutional change will be discussed in greater detail later. For now, let us assume that there is a probability p_t in period t that political power permanently shifts from the elite to the middle class. Once they come to power, the middle class will pursue a policy that maximizes their own utility. When this probability is exogenous, the previous analysis still applies. Interesting economic interactions arise when this probability is endogenous. Here I will use a simple (reduced-form) model to illustrate the trade-offs and assume that this probability is a function of the income level of the middle class agents, in particular

$$p_t = p\left(\theta^m c_t^m\right) \in [0,1], \tag{17}$$

where I have used the fact that income is equal to consumption.[21] Let us assume that p is continuous and differentiable with $p' > 0$, which captures the fact that when the middle class producers are richer, they have greater de facto political power. This reduced-form formulation might capture a variety of mechanisms. For example, when the middle class are richer, they may be more successful in solving their collective action problems or they may increase their military power.

This modification implies that the fiscal policy that maximizes current consumption may no longer be optimal. To investigate this issue we now write the utility of elite agents recursively, and denote it by $V^e(E)$ when they are in power and by $V^e(M)$ when the middle class is in power. Naturally, we have

$$V^e(E) = \max_{\tau_t^m} \left\{ \begin{array}{c} \left[\frac{\alpha}{1-\alpha}A^e - w_t\right] l_t^e + \frac{1}{\theta^e}\left[\frac{\phi}{1-\alpha}\tau_t^m (1-\tau_t^m)^{(1-\alpha)/\alpha} A^m l_t^m \theta^m + R\right] \\ +\beta\left[(1-p_t)V^e(E) + p_t V^e(M)\right] \end{array} \right\}$$

subject to (7), (13), (14) and (17), with $p_t = p\left(\frac{\alpha}{1-\alpha}(1-\tau_t^m)^{1/\alpha} A^m l_t^m \theta^m - w_t l_t^m \theta^m\right)$. I wrote $V^e(E)$ and $V^e(M)$ not as functions of time, since the structure of the problem makes it clear that these values will be constant in equilibrium.

The first observation is that if the solution to the static problem involves $c_t^m = 0$, then the same fiscal policy is optimal despite the risk of losing power. This implies that, as long as Condition (ES) does not hold and (A2) holds, the political consolidation mechanism does

[21] Alternatively, one can assume, with qualitatively identical results, that it is the income of the middle class relative to that of the elite that matters for political power.

not add an additional motive for inefficient taxation.

To see the role of the political consolidation mechanism, suppose instead that Condition (ES) holds. In this case, $w_t = 0$ and the optimal static policy is $\tau_t^m = \tau^{RE} \equiv \min\{\alpha, \bar{\tau}\}$ as discussed above and implies positive profits and consumption for middle class agents. The dynamic maximization problem then becomes

$$V^e(E) = \max_{\tau_t^m} \left\{ \begin{array}{c} \frac{\alpha}{1-\alpha} A^e \lambda + \frac{1}{\theta^e} \left[\frac{\phi}{1-\alpha} \tau_t^m (1-\tau_t^m)^{(1-\alpha)/\alpha} A^m \lambda \theta^m + R \right] \\ +\beta \left[V^e(E) - p\left(\frac{\alpha}{1-\alpha} (1-\tau_t^m)^{1/\alpha} A^m \theta^m \lambda \right) \left(V^e(E) - V^e(M) \right) \right] \end{array} \right\}. \quad (18)$$

The first-order condition for an interior solution can be expressed as

$$\phi - \phi \frac{1-\alpha}{\alpha} \frac{\tau_t^m}{1-\tau_t^m} + \beta \theta^e p' \left(\frac{\alpha}{1-\alpha} (1-\tau_t^m)^{1/\alpha} A^m \theta^m \lambda \right) \left(V^e(E) - V^e(M) \right) = 0.$$

It is clear that when $p'(\cdot) = 0$, we obtain $\tau_t^m = \tau^{RE} \equiv \min\{\alpha, \bar{\tau}\}$ as above. However, when $p'(\cdot) > 0$, $\tau_t^m = \tau^{PC} > \tau^{RE} \equiv \min\{\alpha, \bar{\tau}\}$ as long as $V^e(E) - V^e(M) > 0$. That $V^e(E) - V^e(M) > 0$ is the case is immediate since when the middle class are in power, they get to tax the elite and receive all of the transfers.[22]

Intuitively, as with the factor price manipulation mechanism, the elite tax *beyond the peak* of the Laffer curve, yet now not to increase their revenues*, but to consolidate their political power*. These high taxes reduce the income of the middle class and their political power. Consequently, there is a higher probability that the elite remain in power in the future, enjoying the benefits of controlling the fiscal policy.[23]

An interesting comparative static is that as R increases, the gap between $V^e(E)$ and $V^e(M)$ increases, and the tax that the elite sets increases as well. Intuitively, the party in power receives the revenues from natural resources, R. When R increases, the elite become more willing to sacrifice tax revenue (by overtaxing the middle class) in order to increase the probability of remaining in power, because remaining in power has now become more valuable. This contrasts with the results so far where R had no effect on taxes. More interestingly, a higher ϕ, i.e., greater state capacity, also increases the gap between $V^e(E)$

[22]More specifically, $V^e(E)$ is given as the solution to (18), while the expression for $V^e(M)$ is given by equation (24) in Section 6.

[23]This result is similar to that in Acemoglu and Robinson (2006b) where a ruling elite may want to block beneficial technological change in order to increase the probability of political survival.

and $V^e(M)$ (because this enables the group in power to raise more tax revenues) and thus implies a higher tax rate on the middle class. Intuitively, when there is no political competition, greater state capacity, by allowing more efficient forms of transfers, improves the allocation of resources. But in the presence of political competition, by increasing the *political stakes*, it leads to greater conflict and more distortionary policies.

Summarizing this discussion (proof in the text):

Proposition 5 Consider the economy with political replacement. Suppose also that Assumption (A1) and Condition (ES) hold and $\phi > 0$, then the political equilibrium features $\tau_t^m = \tau^{PC} > \tau^{RE}$ for all t. This tax rate is increasing in R and ϕ.

3.5 Subgame Perfect Versus Markov Perfect Equilibria

I have so far focused on Markov perfect equilibria (MPE). In general, such a focus can be restrictive. In this case, however, it can be proved that subgame perfect equilibria (SPE) coincide with the MPE. This will not be true in the next subsection, so it is useful to briefly discuss why it is the case here.

MPE are a subset of the SPE. Loosely speaking, SPEs that are not Markovian will be supported by some type of "history-dependent punishment strategies". If there is no room for such history dependence, SPEs will coincide with the MPEs.

In the models analyzed so far, such punishment strategies are not possible even in the SPE. Intuitively, each individual is infinitesimal and makes its economic decisions to maximize profits. Therefore, (5) and (6) determine the factor demands uniquely in any equilibrium. Given the factor demands, the payoffs from various policy sequences are also uniquely pinned down. This means that the returns to various strategies for the elite are *independent of history*. Consequently, there cannot be any SPEs other than the MPE characterized above. Therefore, we have:[24]

[24] A formal proof of this proposition requires additional notation, so I only provide a sketch in this footnote. *A history* is defined as the complete list of actions up to a certain point in the game. Let $\mathcal{H}^{t-1}$ denote the set of all possible histories of play up to $t-1$, and denote a particular history by $h^{t-1} \in \mathcal{H}^{t-1}$. The essence of the proof is that, since each producer is infinitesimal, they will always choose their factor commands according to (5) and (6) at the time t for all $h^{t-1} \in \mathcal{H}^{t-1}$. This implies that the maximization

Proposition 6 The MPEs characterized in Propositions 2-5 are the unique SPEs.

3.6 Lack of Commitment—Holdup

The models discussed so far featured full commitment to taxes by the elites. Using a term from organizational economics, this corresponds to the situation without any "*holdup*". Holdup (lack of commitment to taxes or policies) changes the qualitative implications of the model; if expropriation (or taxation) happens after investments, revenues generated by investments can be *ex post* captured by others. These types of holdup problems are likely to arise when the key investments are long-term, so that various policies will be determined and implemented after these investments are made (and sunk).

The problem with holdup is that the elite will be unable to commit to a particular tax rate before middle class producers undertake their investments (taxes will be set after investments). This lack of commitment will generally increase the amount of taxation and inefficiency. To illustrate this possibility, I consider the same model as above, but change the timing of events such that first individual producers undertake their investments and then the elite set taxes. The economic equilibrium is unchanged, and in particular, (5) and (6) still determine factor demands, with the only difference that τ^m and τ^e now refer to "expected" taxes. Naturally, in equilibrium expected and actual taxes coincide.

What is different is the calculus of the elite in setting taxes. Previously, they took into account that higher taxes would discourage investment. Since, now, taxes are set after investment decisions, this effect is absent. As a result, in the MPE, the elite will always want to tax at the maximum rate, so in all cases, there is a unique MPE where $\tau_t^m = \tau^{HP} \equiv \bar{\tau}$ for all t. This establishes (proof in the text):

Proposition 7 With holdup, there is a unique political equilibrium with $\tau_t^m = \tau^{HP} \equiv \bar{\tau}$ for all t.

It is clear that this holdup equilibrium is more inefficient than the equilibria characterized above. For example, imagine a situation in which Condition (ES) holds so that with the

problem of the elite is independent of history and establishes the result.

original timing of events (without holdup), the equilibrium tax rate is $\tau_t^m = \alpha$. Consider the extreme case where $\bar{\tau} = 1$. Now without holdup, $\tau_t^m = \alpha$ and there is positive economic activity by the middle class producers. In contrast, with holdup, the equilibrium tax is $\tau_t^m = 1$ and the middle class stop producing. This is naturally very costly for the elite as well since they lose all their tax revenues.

In this model, it is no longer true that the MPE is the only SPE, since there is room for an implicit agreement between different groups whereby the elite (credibly) promise a different tax rate than $\bar{\tau}$. To illustrate this, consider the example where Condition (ES) holds and $\bar{\tau} = 1$. Recall that the history of the game is the complete set of actions taken up to that point (recall footnote 24). In the MPE, the elite raise no tax revenue from the middle class producers. Instead, consider the following trigger-strategy combination: the elite always set $\tau^m = \alpha$ and the middle class producers invest according to (5) with $\tau^m = \alpha$ as long as the history consists of $\tau^m = \alpha$ and investments have been consistent with (5). If there is any other action in the history, the elite set $\tau^m = 1$ and the middle class producers invest zero.[25] With this strategy profile, the elite raise a tax revenue of $\phi\alpha(1-\alpha)^{(1-\alpha)/\alpha} A^m \lambda \theta^m / (1-\alpha)$ in every period, and receive transfers worth

$$\frac{\phi}{(1-\beta)(1-\alpha)} \alpha (1-\alpha)^{(1-\alpha)/\alpha} A^m \lambda \theta^m. \tag{19}$$

If, in contrast, they deviate at any point, the most profitable deviation for them is to set $\tau^m = 1$, and they will raise

$$\frac{\phi}{1-\alpha} (1-\alpha)^{(1-\alpha)/\alpha} A^m \lambda \theta^m. \tag{20}$$

The trigger-strategy profile will be an equilibrium as long as (19) is greater than or equal to (20), which requires $\beta \geq 1 - \alpha$. Therefore we have (proof in the text):[26]

[25] More formally, let history $\hat{h}^{t-1}$be such that $\tau_s^m = \alpha$ for all $s \leq t-1$ and $k_s^j = (1-\alpha)^{1/\alpha} A^m$ for all $j \in S^m$ and all $s \leq t-1$. Then, the trigger strategy profile in question is as follows: if $h^{t-1} = \hat{h}^{t-1}$ $\tau_t^m = \alpha$ and $k_t^j = (1-\alpha)^{1/\alpha} A^m$, and if $h^{t-1} \neq \hat{h}^{t-1}$, then $\tau_t^m = 1$ and $k_t^j = 0$.

[26] Some authors, for example, Greif (1994), also view differences between the MPE and the SPE as corresponding to "institutional differences," since different equilibria create different incentives for individual agents (and are supported by different "beliefs"). I find it more transparent to reserve the term "institutions" for arrangements that determine the economic or political rules of the game (i.e., limits on fiscal policies or distribution of political power) rather than using this term also for the equilibria that arise for a given set of rules.

Proposition 8 Consider the holdup game, and suppose that Assumption (A1) and Condition (ES) hold and $\bar{\tau} = 1$. Then for $\beta \geq 1 - \alpha$, there exists a subgame perfect equilibrium where $\tau_t^m = \alpha$ for all t.

An important implication of this result is that in societies where there are greater holdup problems, for example, because typical investments involve longer horizons, there is room for coordinating on a subgame perfect equilibrium supported by an implicit agreement (trigger strategy profile) between the elite and the rest of the society.

3.7 Technology Adoption and Holdup

Suppose now that taxes are set before investments, so the source of holdup in the previous subsection is absent. Instead, suppose that at time $t = 0$ before any economic decisions or policy choices are made, middle class agents can invest to increase their productivity. In particular, suppose that there is a cost $\Gamma(A^m)$ of investing in productivity A^m. The function Γ is non-negative, continuously differentiable and convex. This investment is made once and the resulting productivity A^m applies forever after.[27]

Once investments in technology are made, the game proceeds as before. Since investments in technology are sunk after date $t = 0$, the equilibrium allocations are the same as in Propositions 2-5 above. Another interesting question is whether, if they could, the elite would prefer to commit to a tax rate sequence at time $t = 0$.

The analysis of this case follows closely that of the baseline model, and I simply state the results (without proofs to save space):

Proposition 9 Consider the game with technology adoption and suppose that Assumption (A1) holds, Condition (ES) does not hold, and $\phi = 0$, then the unique political equilibrium features $\tau_t^m = \tau^{FPM} \equiv \bar{\tau}$ for all t. Moreover, if the elite could commit to a tax sequence at time $t = 0$, then they would still choose $\tau_t^m = \tau^{FPM} \equiv \bar{\tau}$.

[27] The fact that technology choices are made once, or at any rate, more infrequently, partly distinguishes them from the investments in k, which are made in every period.

That this is the unique MPE is quite straightforward. It is also intuitive that it is the unique SPE. In fact, the elite would choose exactly this tax rate even if they could commit at time $t = 0$. The reason is as follows: in the case of pure factor price manipulation, the only objective of the elite is to reduce the middle class' labor demand, so they have no interest in increasing the productivity of middle class producers.

For contrast, let us next consider the pure revenue extraction case with Condition (ES) satisfied. Once again, the MPE is identical to before. As a result, the first-order condition for an interior solution to the middle class producers' technology choice is:

$$\Gamma'(A^m) = \frac{1}{1-\beta}\frac{\alpha}{1-\alpha}(1-\tau^m)^{1/\alpha} \tag{21}$$

where τ^m is the constant tax rate that they will face in all future periods. In the pure revenue extraction case, recall that the equilibrium is $\tau^m = \tau^{RE} \equiv \min\{\alpha, \bar{\tau}\}$. With the same arguments as before, this is also the unique SPE. Once the middle class producers have made their technology decisions, there is no history-dependent action left, and it is impossible to create history-dependent punishment strategies to support a tax rate different than the static optimum for the elite.[28] Nevertheless, this is not necessarily the allocation that the elite prefer. If the elite could commit to a tax rate sequence at time $t = 0$, they would choose lower taxes. To illustrate this, suppose that they can commit to a constant tax rate (it is straightforward to show that they will in fact choose a constant tax rate even without this restriction, but this restriction saves on notation). Therefore, the optimization problem of the elite is to maximize tax revenues taking the relationship between taxes and technology as in (21) as given. In other words, they will solve: $\max \phi\tau^m(1-\tau^m)^{(1-\alpha)/\alpha}A^m\lambda\theta^m/(1-\alpha)$ subject to (21). The constraint (21) incorporates the fact that (expected) taxes affect technology choice.

The first-order condition for an interior solution can be expressed as

$$A^m - \frac{1-\alpha}{\alpha}\frac{\tau^m}{1-\tau^m}A^m + \tau^m\frac{dA^m}{d\tau^m} = 0$$

[28] The fact that each middle class producer is infinitesimal is important here. Otherwise, it would be possible to create a strategy profile where middle class producers would collectively deviate from (5).

where $dA^m/d\tau^m$ takes into account the effect of future taxes on technology choice at time $t = 0$. This expression can be obtained from (21) as:

$$\frac{dA^m}{d\tau^m} = -\frac{1}{1-\beta}\frac{1}{1-\alpha}\frac{(1-\tau^m)^{(1-\alpha)/\alpha}}{\Gamma''(A^m)} < 0.$$

This implies that the solution to this maximization problem satisfies $\tau^m = \tau^{TA} < \tau^{RE} \equiv \min\{\alpha, \bar{\tau}\}$. If they could, the elite would like to commit to a lower tax rate in the future in order to encourage the middle class producers to undertake technological improvements. Their inability to commit to such a tax policy leads to greater inefficiency than in the case without technology adoption. Summarizing this discussion (proof in the text):

Proposition 10 Consider the game with technology adoption, and suppose that Assumption (A1) and Condition (ES) hold and $\phi > 0$, then the unique political equilibrium features $\tau_t^m = \tau^{RE} \equiv \min\{\alpha, \bar{\tau}\}$ for all t. If the elite could commit to a tax policy at time $t = 0$, they would prefer to commit to $\tau^{TA} < \tau^{RE}$.

An important feature is that in contrast to the pure holdup problem where SPE could prevent the additional inefficiency (when $\beta \geq 1-\alpha$, recall Proposition 8), with the technology adoption game, the inefficiency survives the SPE. The reason is that, since middle class producers invest only once at the beginning, there is no possibility of using history-dependent punishment strategies. This illustrates the limits of implicit agreements to keep tax rates low. Such agreements not only require a high discount factor ($\beta \geq 1-\alpha$), but also frequent investments by the middle class, so that there is a credible threat against the elite if they deviate from the promised policies. When such implicit agreements fail to prevent the most inefficient policies, there is greater need for economic institutions to play the role of placing limits on future policies.

4 Inefficient Economic Institutions

The previous analysis shows how inefficient policies emerge out of the desire of the elite, which possesses political power, to redistribute resources towards themselves. I now discuss the implications of these mechanisms for inefficient institutions. Since the elite prefer to implement inefficient policies to transfer resources from the rest of the society (the middle class and the workers) to themselves, they will also prefer inefficient economic institutions that enable and support these inefficient policies.

To illustrate the main economic interactions, I consider two prototypical economic institutions: (1) *Security of property rights;* there may be constitutional or other limits on the extent of redistributive taxation and/or other policies that reduce profitability of producers' investments. In terms of the model above, we can think of this as determining the level of $\bar{\tau}$.[29] (2) *Regulation of technology*, which concerns direct or indirect factors affecting the productivity of producers, in particular middle class producers.

As pointed out in the introduction, the main role of institutions is to provide the framework for the determination of policies, and consequently, preferences over institutions are derived from preferences over policies and economic allocations. Bearing this in mind, let us now discuss the determination of economic institutions in the model presented here. To simplify the discussion, for the rest of the analysis, and in particular, throughout this section, I focus on MPE.

4.1 Security of Property Rights

The environment is the same as in the previous section, with the only difference that at time $t = 0$, before any decisions are taken, the elite can reduce $\bar{\tau}$, say from $\bar{\tau}^H$ to some level in the interval $[0, \bar{\tau}^H]$, thus creating an upper bound on taxes and providing greater security of property rights to the middle class. The key question is whether the elite would like to do so, i.e., whether they prefer $\bar{\tau} = \bar{\tau}^H$ or $\bar{\tau} < \bar{\tau}^H$

The next three propositions answer this question:

Proposition 11 Without holdup and technology adoption, the elite prefer $\bar{\tau} = \bar{\tau}^H$.

The proof of this result is immediate, since without holdup or technology adoption,

[29]A difficult question, which is being sidestepped here, is how such upper bounds on taxes or security of property rights are enforced while the distribution of political power remains unchanged. For this reason, as noted above, limits on taxes may be considered to be related to political institutions as much as to economic institutions.

putting further restrictions on the taxes can only reduce the elite's utility. This proposition implies that if economic institutions are decided by the elite (which is the natural benchmark since they are the group with political power), they will in general choose not to provide additional security of property rights to other producers. Therefore, the underlying economic institutions will support the inefficient policies discussed above.

The results are different when there are holdup concerns. To illustrate this, suppose that the timing of taxation decision is after the investment decisions (so that there is the holdup problem), and consider the case with revenue extraction and factor price manipulation combined. In this case, the elite would like to commit to a lower tax rate than $\bar{\tau}^H$ in order to encourage the middle class to undertake greater investments, and this creates a useful role for economic institutions (to limit future taxes):

Proposition 12 Consider the game with holdup and suppose Assumptions (A1) and (A2) hold, Condition (ES) does not hold, and $\phi > 0$, then as long as τ^{COM} given by (16) is less than $\bar{\tau}^H$, the elite prefer $\bar{\tau} = \tau^{COM}$.

The proof is again immediate. While τ^{COM} maximizes the elite's utility, in the presence of holdup the MPE involves $\tau = \bar{\tau}^H$, and the elite can benefit by using economic institutions to manipulate equilibrium taxes.

This result shows that the elite may provide additional property rights protection to producers in the presence of holdup problems. The reason is that because of holdup, equilibrium taxes are too high even relative to those that the elite would prefer. By manipulating economic institutions, the elite may approach their desired policy (in fact, it can exactly commit to the tax rate that maximizes their utility).

Finally, for similar reasons, in the economy with technology adoption discussed above, the elite will again prefer to change economic institutions to restrict future taxes:

Proposition 13 Consider the game with holdup and technology adoption, and suppose that Assumption (A1) and Condition (ES) hold and $\phi > 0$, then as long as $\tau^{TA} < \bar{\tau}^H$, the elite prefer $\bar{\tau} = \tau^{TA}$.

As before, when we look at SPE, with pure holdup, there may not be a need for changing economic institutions, since credible implicit promises might play the same role (as long as $\beta \geq 1 - \alpha$ as shown in Proposition 8). However, parallel to the results above, in the technology adoption game, SPE and MPE coincide, so a change in economic institutions is necessary for a credible commitment to a low tax rate (here τ^{TA}).

4.2 Regulation of Technology

Economic institutions may also affect the environment for technology adoption or more directly the technology choices of producers. For example, by providing infrastructure or protection of intellectual property rights, a society may improve the technology available to its producers. Conversely, the elite may want to *block*, i.e., take active actions against, the technological improvements of the middle class.[30] Therefore the question is: do the elite have an interest in increasing the productivity of the middle class as much as possible?

Consider the baseline model. Suppose that there exists a government policy $g \in \{0, 1\}$, which influences only the productivity of middle class producers, i.e., $A^m = A^m(g)$, with $A^m(1) > A^m(0)$. Assume that the choice of g is made at $t = 0$ before any other decisions, and has no other influence on payoffs (and in particular, it imposes no costs on the elite). Will the elite always choose $g = 1$, increasing the middle class producers' productivity, or will they try to block technology adoption by the middle class?

When the only mechanism at work is revenue extraction, the answer is that the elite would like the middle class to have the best technology:

Proposition 14 Suppose Assumption (A1) and Condition (ES) hold and $\phi > 0$, then $w = 0$ and the the elite always choose $g = 1$.

The proof follows immediately since $g = 1$ increases the tax revenues and has no other effect on the elite's consumption. Consequently, in this case, the elite would like the produc-

[30] The decision to "block" technology adoption may also be considered a "policy" rather than an "economic institution". The reason why it may be closer to economic institutions is that it influences the set of options available to economic agents, and is plausibly slower to change than certain fiscal policies, such as taxes or government spending. See Acemoglu and Robinson (2006b) for a more detailed discussion of the elite's incentives to block technology.

ers to be as productive as possible, so that they generate greater tax revenues. Intuitively, there is no competition between the elite and the middle class (either in factor markets or in the political arena), and when the middle class is more productive, the elite generate greater tax revenues.

The situation is different when the elite wish to manipulate factor prices:

Proposition 15 *Suppose Assumption (A1) holds, Condition (ES) does not hold, $\phi = 0$, and $\bar{\tau} < 1$, then the elite choose $g = 0$.*

Once again the proof of this proposition is straightforward. With $\bar{\tau} < 1$, labor demand from the middle class is high enough to generate positive equilibrium wages. Since $\phi = 0$, taxes raise no revenues for the elite, and their only objective is to reduce the labor demand from the middle class and wages as much as possible. This makes $g = 0$ the preferred policy for the elite. Consequently, the factor price manipulation mechanism suggests that, when it is within their power, the elite will choose economic institutions so as to reduce the productivity of competing (middle class) producers.

The next proposition shows that a similar effect is in operation when the political power of the elite is in contention (proof omitted).

Proposition 16 *Consider the economy with political replacement. Suppose also that Assumption (A1) and Condition (ES) hold and $\phi = 0$, then the elite prefer $g = 0$.*

In this case, the elite cannot raise any taxes from the middle class since $\phi = 0$. But differently from the previous proposition, there are no labor market interactions, since there is excess labor supply and wages are equal to zero. Nevertheless, the elite would like the profits from middle class producers to be as low as possible so as to consolidate their political power. They achieve this by creating an environment that reduces the productivity of middle class producers.

Overall, this section has demonstrated how the elite's preferences over policies, and in particular their desire to set inefficient policies, translate into preferences over inefficient—non-growth enhancing—economic institutions. When there are no holdup problems, introducing economic institutions that limit taxation or put other constraints on policies provides no benefits to the elite. However, when the elite are unable to commit to future taxes (because of holdup problems), equilibrium taxes may be too high even from the viewpoint of the elite, and in this case, using economic institutions to manipulate future taxes may be beneficial. Similarly, the analysis reveals that the elite may want to use economic institutions to discourage productivity improvements by the middle class. Interestingly, this never happens when the main mechanism leading to inefficient policies is revenue extraction. Instead, when factor price manipulation and political consolidation effects are present, the elite may want to discourage or block technological improvements by the middle class.

5 Inefficient Political Institutions

The above analysis characterized the equilibrium under "the dictatorship of the elite," a set of political institutions that gave all political power to the elite producers. An alternative is to have "the dictatorship of the middle class," i.e., a system in which the middle class makes the key policy decisions (this could also be a democratic regime with the middle class as the decisive voters). Finally, another possibility is democracy in which there is voting over different policy combinations. If $\theta^e + \theta^m < 1$, then the majority are the workers, and they will pursue policies to maximize their own income.[31]

I now briefly discuss the possibility of a switch from the dictatorship of the elite to one of these two alternative regimes. It is clear that whether the dictatorship of the elite or that of middle class is more efficient depends on the relative numbers and productivities of the two groups, and whether elite control or democracy is more efficient depends on policies in democracy. Hence, this section will first characterize the equilibrium under these alternative political institutions. Moreover, for part of the analysis in this subsection, I simplify the discussion by assuming that

$$\theta^m = \theta^e < \frac{1}{2}, \tag{A3}$$

so that the number of middle class and elite producers is the same, and they are in the

[31] More generally, we could consider various different political institutions as represented by social welfare functions giving different weights to the elite, the middle class and the workers (see, for example, the Appendix to Chapter 4 in Acemoglu and Robinson (2006a).

minority relative to workers.[32]

5.1 Dictatorship of the Middle Class

With the dictatorship of the middle class, the political equilibrium is identical to the dictatorship of the elite, with the roles reversed. To avoid repetition, I will not provide a full analysis. Instead, let me focus on the case, combining revenue extraction and factor price manipulation. The analog of Assumption (A2) is:

$$A^m \geq \phi(1-\alpha)^{(1-\alpha)/\alpha} A^e \frac{\theta^e}{\theta^m}. \tag{A4}$$

Given this assumption, a similar proposition to that above immediately follows; the middle class will tax the elite and will redistribute the proceeds to themselves, i.e., $T_t^w = T_t^e = 0$, and moreover, the same analysis as above gives their most preferred tax rate as

$$\tau_t^e = \tilde{\tau}^{COM} \equiv \min \left\{ \frac{\kappa\left(\lambda, \theta^m, \alpha, \phi\right)}{1+\kappa\left(\lambda, \theta^m, \alpha, \phi\right)}, \bar{\tau} \right\}. \tag{22}$$

Proposition 17 Suppose Assumptions (A1) and (A3) hold, Condition (ES) does not hold, and $\phi > 0$, then the unique political equilibrium with middle class control features $\tau_t^e = \tilde{\tau}^{COM}$ as given by (22) for all t.

Comparing this equilibrium to the equilibrium under the dictatorship of the elite, it is apparent that the elite equilibrium will be more efficient when A^e and θ^e are large relative to A^m and θ^m, and the middle class equilibrium will be more efficient when the opposite is the case.

Proposition 18 Suppose Assumptions (A1)-(A4) hold, then aggregate output is higher with the dictatorship of the elite than the dictatorship of the middle class if $A^e > A^m$ and it is higher under the dictatorship of the middle class if $A^m > A^e$.

Intuitively, the group in power imposes taxes on the other group (and since $\theta^m = \theta^e$, these taxes are equal) and not on themselves, so aggregate output is higher when the group with greater productivity is in power and is spared from distortionary taxation.

[32] Otherwise, there is no median voter and the analysis of political equilibrium requires further assumptions about parties and political procedures.

5.2 Democracy

Under Assumption (A4), workers are in the majority in democracy, and have the power to tax the elite and the middle class to redistribute themselves. More specifically, each worker's consumption is $c_t^w = w_t + T_t^w$, with w_t given by (7), so that workers care about equilibrium wages and transfers. Workers will then choose the sequence of policies $\{\tau_t^e, \tau_t^m, T_t^w, T_t^m, T_t^e\}_{t=0,1,\dots,\infty}$ that satisfy (3) to maximize $\sum_{t=0}^{\infty} \beta^t c_t^w$.

It is straightforward to see that the workers will always set $T_t^m = T_t^e = 0$. Substituting for the transfers from (3), we obtain that democracy will solve the following maximization problem to determine policies:

$$\max_{\tau_t^e, \tau_t^m} w_t + \frac{\phi}{1-\alpha}\left[\tau_t^m (1-\tau_t^m)^{(1-\alpha)/\alpha} A^m l^m \theta^m + \tau_t^e (1-\tau_t^e)^{(1-\alpha)/\alpha} A^e l^e \theta^e\right] + R$$

with w_t given by (7).

As before, when Condition (ES) holds, taxes have no effect on wages, so the workers will tax at the revenue maximizing rate, similar to the case of revenue extraction for the elite above. This result is stated in the next proposition (proof omitted):

Proposition 19 Suppose Assumption (A1) and Condition (ES) hold and $\phi > 0$, then the unique political equilibrium with democracy features $\tau_t^m = \tau_t^e = \tau^{RE} \equiv \min\{\alpha, \bar{\tau}\}$.

Therefore, in this case democracy is more inefficient than both middle class and elite control, since it imposes taxes on both groups.[33] The same is not the case, however, when Condition (ES) does not hold and wages are positive. In this case, workers realize that by taxing the marginal group they are reducing their own wages. In fact, taxes always reduce wages more than the revenue they generate because of their distortionary effects.[34]

[33] Naturally, in this case we may expect workers to ultimately become entrepreneurs, and this extreme inefficiency to be ameliorated. See Acemoglu (2003a).

[34] To see this, suppose there is only one group with productivity A. With a tax rate of τ, the wage is $\alpha(1-\tau)^{1/\alpha} A/(1-\alpha)$, and in addition there is per worker transfer equal to $\phi\tau(1-\tau)^{(1-\alpha)/\alpha} A/(1-\alpha) + R$, so the total consumption of a worker is $\tilde{c}_t^w = (1-\tau)^{(1-\alpha)/\alpha} A\left[\alpha(1-\tau) + \phi\tau\right]/(1-\alpha) + R$. The derivative of this expression with respect to τ is

$$-\frac{1}{1-\alpha}(1-\tau)^{(1-2\alpha)/\alpha} A\left[\frac{\phi-\alpha}{\alpha}\tau - (1-\phi)\right],$$

which is always negative, implying that $\tilde{c}_t^w$ is maximized at $\tau = 0$, establishing the claim.

As a result, workers will only tax the group with the higher marginal productivity. More specifically, for example, if $A^m > A^e$, we will have $\tau_t^e = 0$, and τ_t^m will be such that $(1-\tau_t^m)^{1/\alpha} A^m = A^e$ or $\tau_t^m = \alpha$ and $(1-\alpha)^{1/\alpha} A^m \geq A^e$. Therefore, we have:

Proposition 20 Suppose Assumption (A1) and (A4) hold and Condition (ES) does not hold. Then in the unique political equilibrium with democracy, if $A^m > A^e$, we will have $\tau_t^e = 0$, and $\tau_t^m = \tau^{Dm}$ will be such that $(1-\tau^{Dm})^{1/\alpha} A^m = A^e$ or $\tau^{Dm} = \alpha$ and $(1-\alpha)^{1/\alpha} A^m \geq A^e$. If $A^m < A^e$, we will have $\tau_t^m = 0$, and $\tau_t^e = \tau^{De}$ will be such that $(1-\tau^{De})^{1/\alpha} A^e = A^m$ or $\tau^{De} = \alpha$ and $(1-\alpha)^{1/\alpha} A^e \geq A^e$.

Most of the proof of this proposition follows directly from the analysis so far. The only part that is not obvious is that workers prefer to set zero taxes on the less productive group, and this is proved in Appendix A (included in the working paper version). The intuition for this is that wages are determined by the marginal productivity of the less productive of the two entrepreneurial groups, and positive taxes on this group will reduce wages by more than the gain in tax revenues (by a similar argument as in footnote 34).

The most interesting implication of this proposition comes from the comparison of the case with and without excess supply. While in the presence of excess labor supply, democracy taxes both groups of producers and consequently generates more inefficiency than the dictatorship of the elite or the middle class, when there is no excess supply, it is in general less distortionary than the dictatorship of the middle class or the elite. The intuition is that when Condition (ES) does not hold, workers understand that high taxes will depress wages and are therefore less willing to use distortionary taxes.[35]

5.3 Inefficiency of Political Institutions and Inappropriate Institutions

Consider a society where Assumption (A4) is satisfied and $A^e < A^m$ so that middle class control is more productive (i.e., generates greater output). Despite this, the elite will have

[35] This is similar to the reasons why workers (democracy) are less in favor of entry barriers than oligarchic societies (see Acemoglu (2003a)). Another reason for democracy to be more efficient, emphasized in Acemoglu (2003a), is that policies that differentially affect the productivity of different groups will lead to a misallocation of talent.

no incentive, without some type of compensation, to relinquish their power to the middle class. In this case, political institutions that lead to more inefficient policies will persist even though alternative political institutions leading to better outcomes exist.

One possibility is a Coasian deal between the elite and the middle class. For example, perhaps the elite can relinquish political power and get compensated in return. However, such deals are in general not possible. To discuss why (and why not), let us distinguish between two alternative approaches.

First, the elite may relinquish power in return for a promise of future transfers. This type of solution will run into two difficulties. (i) such promises will not be credible, and once they have political power, the middle class will have no incentive to keep on making such transfers.[36] (ii) since there are no other, less distortionary, fiscal instruments, to compensate the elite, the middle class will have to impose similar taxes on itself, so that the alternative political institutions will not be as efficient in the first place.[37]

Second, the elite may relinquish power in return for a lump-sum transfer from the middle class. Such a solution is also not possible in general, since the net present value of the benefit of holding political power often exceeds any transfer that can be made. Consequently, the desire of the elite to implement inefficient policies also implies that they support political institutions that enable them to pursue these policies. Thus, in the same way as preferences over inefficient policies translate into preferences over inefficient economic institutions, they also lead to preferences towards inefficient political institutions. I will discuss how political institutions can change from the "ground-up" in Section 6 below.

Another interesting question is whether a given set of economic institutions might be "appropriate" for a while, but then become "inappropriate" and costly for economic activity later. This question might be motivated, for example, by the contrast of the Northeastern United States and the Caribbean colonies between the 17th and 19th centuries. The Caribbean colonies were clear examples of societies controlled by a narrow elite, with po-

[36]See Acemoglu (2003b).

[37]The exception is when there are holdup problems and manipulating economic institutions was not sufficient to deal with them. In this case, there can be significant gains from changing political institutions.

litical power in the monopoly of plantation owners, and few rights for the slaves that made up the majority of the population.[38] In contrast, Northeastern United States developed as a settler colony, approximating a democratic society with significant political power in the hands of smallholders and a broader set of producers.[39] While in both the 17th and 18th centuries, the Caribbean societies were among the richest places in the world, and almost certainly richer and more productive than the Northeastern United States,[40] starting in the late 18th century, they lagged behind the United States and many other more democratic societies, which took advantage of new investment opportunities, particularly in industry and commerce.[41] This raises the question as to whether the same political and economic institutions that encouraged the planters to invest and generate high output in the 17th and early 18th centuries then became a barrier to further growth.

The baseline model used above suggests a simple explanation along these lines. Imagine an economy in which the elite are in power, Condition (ES) does not hold, ϕ is small, A^e is relatively high and A^m is relatively small to start with. The above analysis shows that the elite will choose a high tax rate on the middle class. Nevertheless, output will be relatively high, because the elite will undertake the right investments themselves, and the distortion on the middle class will be relatively small since A^m is small.

Consequently, the dictatorship of the elite may generate greater income per capita than an alternative society under the dictatorship of the middle class. This is reminiscent of the planter elite controlling the economy in the Caribbean.

However, if at some point the environment changes so that A^m increases substantially relative to A^e, the situation changes radically. The elite, still in power, will continue to impose high taxes on the middle class, but now these policies have become very costly because they distort the investments of the more productive group. Another society where

[38]See, for example, Beckford (1972) and Dunn (1972).

[39]See, for example, Keyssar (2000).

[40]Although the wealth of the Caribbean undoubtedly owed much to the world value of its main produce, sugar, Caribbean societies were nonetheless able to achieve these levels of productivity because the planters had good incentive to invest in the production, processing and export of sugar. See Eltis (1995) and Engerman and Sokoloff (1997).

[41]See, for example, Acemoglu et al. (2002) or Engerman and Sokoloff (1997).

the middle class have political power will now generate significantly greater output.

This simple example illustrates how institutions that were initially "appropriate" (i.e., that did not generate much distortion or may have even encouraged growth) later caused the society to fall substantially behind other economies.

6 Institutional Change and Persistence

To develop a better understanding for why inefficient institutions emerge and persist, we need an equilibrium model of institutional change. I now briefly discuss such a model.[42]

It is first useful to draw a distinction between de jure and de facto political power. De jure political power is determined by political institutions. In the baseline model, de jure political power is in the hands of the elite, since the political institutions give them the right to set taxes and determine the economic institutions. De facto political power, which comes from other sources, did not feature so far in the model (except in the discussion of political consolidation). The simplest example of de facto political power is when a group manages to organize itself and poses a military challenge to an existing regime or threatens it with a revolution. I will conceptualize institutional change as resulting from the interplay of de jure and de facto political power.

Imagine a society described by the baseline model above where de jure political power is initially in the hands of the elite. In each period, with probability q the middle class solve the collective action problem among its members and gather sufficient de facto political power to overthrow the existing regime and to monopolize political power (establish a dictatorship of the middle class). However, violently overthrowing the existing regime is still costly, and in particular, each middle class agent incurs a cost of ψ in the process. Moreover, in the process, the elite are harmed substantially. In particular, I assume that following a violent overthrow, the elite receive zero utility.

Let us assume that the dictatorship of the middle class, if established, is an absorbing state and once the middle class comes to power, there will never be any further institutional

[42]The model here heavily builds on my previous work with James Robinson. See in particular Acemoglu and Robinson (2000b, 2001, 2006a).

change. With probability $1-q$, the middle class has no de facto political power. Also denote the state at time t by the tuple (P_t, s_t), where $P_t \in \{E, M\}$ denotes whether the elite or the middle class are in control, and $s_t \in \{H, L\}$ denotes the level of threat (high or low) against the regime controlled by the elite.

When the middle class amass de facto political power, the elite need to respond in some way, since letting the middle class overthrow the existing regime is excessively costly for them. The elite can respond in three different ways: (i) they can make temporary concessions, such as reducing taxes on the middle class, etc.; (ii) they can give up power; (iii) they can use repression, which is costly, but manages to prevent the regime from falling to the middle class. I assume that repression costs μ for the elite as a whole.

Throughout this section, I focus on MPE. In a MPE, strategies are only a function of the state s_t, so when $s_t = L$, the elite will set the policies that maximize their utility, which were characterized above. So the interesting actions take place in the state $s_t = H$. Moreover, to simplify the discussion, I assume throughout that Condition (ES) is satisfied, so that the main motive for inefficient policy is revenue extraction.

Let us first calculate the value of a middle class agent when the middle class is in power. Since Condition (ES) is satisfied, the above analysis shows that they will not tax themselves, set a tax of $\tau^e = \tau^{RE}$ on the elite in every period, and redistribute all the revenue to themselves. To write the resulting value function, let us introduce the following notation: $\mathcal{T}^j(\tau) \equiv \phi\tau(1-\tau)^{(1-\alpha)/\alpha} A^j \theta^j \lambda/(1-\alpha)$ as the tax revenue raised from group j at the tax rate τ, and $\pi^j(\tau) \equiv \alpha(1-\tau)^{1/\alpha} A^j \lambda/(1-\alpha)$ as the profit of a producer in group j facing the tax rate τ. Then, using M to indicate a value function under the dictatorship of the middle class, we have

$$V^m(M) = \frac{\pi^m(0) + \left(\mathcal{T}^e\left(\tau^{RE}\right) + R\right)/\theta^m}{1-\beta}, \tag{23}$$

where τ^{RE} is given by (11). The first term in the numerator is their own revenues, $\alpha A^m \lambda/(1-\alpha)$, and the second is the distribution from the revenue obtained by taxing the elite and from natural resources. The term $1-\beta$ provides the net present discounted value of this stream of revenues. Similarly, the value of an elite producer in this case is

$$V^e(M) = \frac{\pi^e\left(\tau^{RE}\right)}{1-\beta}. \tag{24}$$

What about the dictatorship of the elite? Let us write this value recursively starting in the no threat state:

$$V^m(E,L) = \pi^m\left(\tau^{RE}\right) + \beta(1-q)V^m(E,L) + \beta q V^m(E,H). \tag{25}$$

This expression incorporates the fact that, in the MPE, during periods of low threat, the elite will follow their most preferred policy, $\tau^m = \tau^{RE}$ and $T^m = 0$. The low threat state recurs with probability $1-q$. What happens when $s_t = H$? As noted above, there are three possibilities. Let us first start by investigating whether the elite can prevent a switch of political power by making concessions in the high threat state. For this purpose, let us denote the highest possible value to the middle class under the dictatorship of the elite by $\bar{V}^m(E,H)$. Then, the condition for concessions within the given political regime to prevent action by the middle class is simply

$$\bar{V}^m(E,H) \geq V^m(M) - \psi, \tag{26}$$

where recall that ψ is the cost of regime change for the middle class. When this constraint holds, the elite could make sufficient concessions to keep the middle class happy within the existing regime.

Therefore, to determine whether concessions within the dictatorship of the elite will be sufficient to satisfy the middle class, we simply need to calculate $\bar{V}^m(E,H)$. Note that the best concession that the elite can do is to adopt a policy that is most favorable for the middle class, i.e., $\tau^m = 0$, $\tau^e = \tau^{RE}$, and $T^m = \left(\mathcal{T}^e\left(\tau^{RE}\right) + R\right)/\theta^m$. Therefore,

$$\bar{V}^m(E,H) = \pi^m(0) + \left(\mathcal{T}^e\left(\tau^{RE}\right) + R\right)/\theta^m + \beta(1-q)\bar{V}^m(E,L) + \beta q \bar{V}^m(E,H) \tag{27}$$

where $\bar{V}^m(E,L)$ is given by expression (25), with $\bar{V}^m(E,H)$ replacing $V^m(E,H)$ on the right hand side. Combining (27) and (25), we obtain:

$$\bar{V}^m(E,H) = \frac{\beta(1-q)\pi^m\left(\tau^{RE}\right) + (1-\beta(1-q))\left[\pi^m(0) + \left(\mathcal{T}^e\left(\tau^{RE}\right) + R\right)/\theta^m\right]}{(1-\beta)} \tag{28}$$

This is the maximum credible utility that the elite can promise the middle class within the existing regime. The reason why they cannot give them greater utility is because of commitment problems. As (28) makes it clear, the elite transfer resources to the middle class only in the state $s_t = H$. Even if they promise to make further transfers or not tax them in the state $s_t = L$, these promises will not be credible (they cannot commit to them), and in the MPE, when the state $s_t = L$ arrives, the elite will choose their most preferred policy of taxing the middle class and transferring the resources to themselves.[43]

If given this expression, (26) is satisfied, then the elite can prevent a violent overthrow by making concessions within the existing regime. Nevertheless, the elite may not necessarily prefer such concessions. To investigate this issue, we first need to determine the exact concessions that the elite will make. They will clearly not follow the most preferable policy for the middle class, since this will give more than sufficient utility to prevent an overthrow. Instead, the elite will choose a policy combination $\left(\hat{\tau}^m, \hat{\tau}^e, \hat{T}^m, \hat{T}^e\right)$ such that $V^m(E, H) = V^m(M) - \psi$, i.e., they will make the middle class just indifferent between overthrowing the regime or accepting the concessions. The value of such concessions to the elite is, by similar arguments, given by:

$$\hat{V}^e(E,H) = \frac{\beta(1-q)\left(\pi^e(0) + \left(\mathcal{T}^m\left(\tau^{RE}\right) + R\right)/\theta^e\right) + (1-\beta(1-q))\left[\pi^e(\hat{\tau}^e) + \hat{T}^e\right]}{(1-\beta)} \tag{29}$$

Whether the elite will make these concessions or not then depends on the values of other options available to them. Another alternative is the use of repression whenever there is a threat from the middle class. Such repression is always effective, so the only cost of this strategy for the elite is the cost they incur in the use of repression, μ. Denote $V^e(O, s_t)$ the value function to the elite it uses repression and the state is s_t. By standard arguments, we can obtain this value by writing the following standard recursive formulae: $V^e(O,H) = \pi^e(0) + \left(\mathcal{T}^m\left(\tau^{RE}\right) + R\right)/\theta^m - \mu + \beta(1-q)V^e(O,L) + \beta q V^e(O,H)$ and $V^e(O,L) = \pi^e(0) + \left(\mathcal{T}^m\left(\tau^{RE}\right) + R\right)/\theta^m + \beta(1-q)V^e(O,L) + \beta q V^e(O,H)$. These two

[43]If instead of the MPE, we consider the SPE, the elite can promise a greater value to the middle class, but again there will be limits to this; once the state $s_t = L$ arrives, the elite will have an incentive to renege on their promises. See Acemoglu and Robinson (2006a) for an analysis of the SPE in a related game.

expressions incorporate the fact that, when using the repression strategy, the elite will always choose their most for preferred policy combination, and will use repression when $s_t = H$ to defend their regime. Combining these two equations, we obtain:

$$V^e(O,H) = \frac{\pi^e(0) + \left(\mathcal{T}^m\left(\tau^{RE}\right) + R\right)/\theta^m - (1-\beta(1-q))\mu}{1-\beta}. \tag{30}$$

Consequently, for the elite to prefer concessions, it needs to be the case that $\hat{V}^e(E,H) \geq V^e(O,H)$.

Finally, the third alternative for the elite is to allow regime change, and obtain $V^e(M)$ as given by (24).[44] Evidently, $V^e(M)$ is less than $\hat{V}^e(E,H)$, since in the latter case they only make concessions (in fact limited concessions) with probability q. Therefore, regime change will only happen when (26) does not hold. In addition, for similar reasons, for regime change to take place, we need $V^e(M) \geq V^e(O,H)$. Note that all of the values here are simple functions of parameters, so comparing these values essentially amounts to comparing nonlinear functions of the underlying parameters.

Putting all these pieces together and assuming for convenience that when indifferent the elite opt against repression, we obtain the following proposition:

Proposition 21 Consider the above environment with potential regime change and suppose that Condition (ES) holds. Then there are three different types of political equilibria:

1. If (26) holds and $\hat{V}^e(E,H) \geq V^e(O,H)$, in the unique equilibrium the regime always remains the dictatorship of the elite. When $s_t = L$, the elite set their most preferred policy of $\tau^m = \tau^{RE}$, $\tau^e = 0$ and $T^m = 0$, and when $s_t = H$, the elite make concessions sufficient to ensure $\hat{V}^m(E,H) = V^m(M) - \psi$, i.e., they adopt the policy $\left(\hat{\tau}^m, \hat{\tau}^e, \hat{T}^m, \hat{T}^e\right)$.

2. If (26) holds but $\hat{V}^e(E,H) < V^e(O,H)$, or if (26) does not hold and $V^e(M) < V^e(O,H)$, then the regime always remains the dictatorship of the elite. The elite always set their most preferred policy of $\tau^m = \tau^{RE}$, $\tau^e = 0$ and $T^m = 0$, and when $s_t = H$, they use repression against the middle class.

[44] By construction, this is always better for the middle class than a violent overthrow, since they do not have to incur the cost ψ.

3. If (26) does not hold and $V^e(M) \geq V^e(O, H)$, then there is equilibrium institutional change. When $s_t = L$, the elite set their most preferred policy of $\tau^m = \tau^{RE}$, $\tau^e = 0$ and $T^m = 0$, and when $s_t = H$, the elite voluntarily pass political control to the middle class.

This proposition illustrates how various different institutional equilibria can arise. The most interesting case is 3, where there is equilibrium institutional change as a result of the elite voluntarily relinquishing political control. Why would the elite give up their dictatorship? The reason is the de facto political power of the middle class, which threatens the elite with a violent overthrow—an outcome worse than the dictatorship of the middle class. The elite then prevent such a violent overthrow by changing political institutions to transfer de jure political power to the middle class. This transfer exploits the role of political institutions as a commitment device (a commitment to a different distribution of de jure political power), and acts as a credible promise of future policies that favor the middle class (the promise is credible, since institutional change gives de jure political power and thus the right to set fiscal policy in the future to the middle class).

This discussion highlights that institutional change has two requirements: (i) that concessions within the existing regime are not sufficient to appease the middle class; (ii) that repression is sufficiently costly for the elites to accept regime change.

The comparative statics of regime change are also interesting. First, when repression is more costly, i.e., μ is higher, institutional change is more likely. Moreover:

$$V^e(O, H) - V^e(M) = \frac{\pi^e(0) - \pi^e\left(\tau^{RE}\right) + \left(\mathcal{T}^m\left(\tau^{RE}\right) + R\right)/\theta^m - (1 - \beta(1-q))\,\mu}{1-\beta}$$

is increasing in R and ϕ. This implies that when R is high, so that there are greater rents from natural resources, $V^e(M) \geq V^e(O, H)$ becomes less likely, and the elite now prefer to use repression rather than allowing institutional change. Similarly, greater ϕ, which corresponds to greater state capacity, has the same impact on institutional equilibrium, since greater state capacity enables greater tax revenues in the future. This implies that, as already suggested by the results in subsection 3.4, greater state capacity, which typically leads to less distortionary policies, also increases political stakes and makes the use of repression by the elite the more likely. Nevertheless, increases in R or ϕ do not make institutional change unambiguously less likely, since they also make (26) more likely to be violated, making it more difficult for the elite to use concessions to appease the middle class.[45] Therefore, when the trade-off for the elite is between repression and institutional change, greater R and ϕ make repression more likely, while when the trade-off is between concessions and institutional change, they may encourage institutional change.[46]

This analysis also illustrates the conditions for institutional persistence. Persistence is the natural course of things and something unusual, the success of the middle class in solving their collective action problem and amassing de facto political power, creates the platform for institutional change. However, even the possibility of collective action by the middle class is not sufficient, since the elite can use costly methods to defend the existing regime. Therefore, institutions will be more persistent when the elite are unwilling to give up the right to determine policies in the future, which will in turn be the case when there is significant distributional conflict between the elite and the middle class, for example because tax revenues are important (i.e., high ϕ) or because rents from natural resources, R, are high. Therefore, a set of political institutions will persist when political stakes are high, i.e., when alternative institutional arrangements are costly for those who currently hold political power and have the means to use force to maintain the existing political institutions.

The model also suggests the possibility of interesting interactions between economic forces and institutional equilibria. The first is an interaction between economic and political institutions. Suppose that economic institutions impose a low $\bar{\tau}$. This implies that control of fiscal policy will generate only limited gains, reducing political stakes, and the elite will have less reason to use repression in order to defend the existing regime. Consequently, institutional persistence might be more of an issue in societies where economic institutions

[45] In particular, (26) can be written as:

$$\bar{V}^m(E,H) - V^m(M) + \psi = \beta(1-q)\left[\pi^m\left(\tau^{RE}\right) - \left(\pi^m(0) + \left(\mathcal{T}^e\left(\tau^{RE}\right) + R\right)/\theta^m\right)\right]/(1-\beta) + \psi \geq 0$$

and increases in R and ϕ make this constraint less likely to hold.

[46] This is similar to the non-monotonic effect of inequality on democratization in Acemoglu and Robinson (2006a).

enable those with political power to capture greater rents.[47]

When the ability of the middle class to solve their collective action problem is endogenous (as in the model used above to illustrate the political consolidation effect), there will be a further interaction between economics and politics. In particular, suppose that the probability q that the middle class will be able to pose an effective threat to the regime is endogenous and depends on the profits of the middle class. In this case, the elite realize that the richer are the middle class, the greater the threat from them in the future. When political power is very valuable, for example because tax revenues or rents from natural resources are high, the elite will wish to "overtax" the middle class to impoverish them and to reduce their political power. These higher taxes will, in turn, increase institutional persistence by making it more difficult for the middle class to solve their collective action problem and mount challenges against the dictatorship of the elite. This suggests another interesting interaction, this time between inefficient policies and institutional persistence.

7 Concluding Remarks

This paper developed a simple framework to investigate why inefficient—non-growth enhancing—institutions emerge and persist. Political institutions shape the allocation of political power. Economic institutions, in turn, determine the framework for policy-making and place constraints on policies. Groups with political power—the elite—choose policies in order to transfer resources from the rest of the society to themselves. Consequently, they have *induced preferences* over institutions, depending on how institutions map into policies and economic outcomes. This methodological approach therefore necessitates a baseline model in which preferences over policies can be studied.

The bulk of the paper analyzed such a baseline model. Though relatively simple, this model is rich enough to encompass various distinct sources of inefficient policies. These include revenue extraction, factor price manipulation and political consolidation. According to the revenue extraction mechanism, the elite pursue inefficient policies to extract revenue

[47] This is related to the result in Acemoglu and Robinson (2006a) that democracy is less likely to emerge, and to consolidate when it emerges, in agricultural societies where the political stakes are high for the elite.

from other groups. The factor price manipulation mechanism implies that the elite seek to reduce the demand for factors from other groups in order to indirectly benefit from changes in factor prices. Finally, political consolidation implies that to increase their political power, the elite may wish to impoverish other groups that are competing for political power. The elite's preferences over inefficient policies translate into inefficient economic institutions. Consequently, institutions that can restrict inefficient policies will typically fail to emerge. Instead, the elite may choose to manipulate economic institutions to further increase their income or facilitate their rent extraction. The exception is when there is a holdup problem (e.g., because there are investments that involve long horizons), so that equilibrium taxes and regulations are worse than the elite would like from an ex ante point of view. In this case, economic institutions that place limits on future policies and provide additional security of property rights to other groups can be useful.

The paper also provided a framework for the analysis of institutional change and institutional persistence. The key mechanism for institutional change is challenges from groups without de jure political power. The model shows how the elite may be forced to change political institutions in order to make concessions in response to these challenges. The important result from this analysis is that, when political stakes are high, for example, because of large rents from natural resources or the importance of tax revenues, the elite will be unwilling to make such concessions and may prefer to use repression in order to deal with outside challenges. In this case, existing (potentially inefficient) political and economic institutions are more likely to persist. There is also an interesting interaction between economic and political institutions: if economic institutions limit policies and thus reduce political stakes, change in political institutions may be easier.

The paper also highlights a number of important areas for future research:

1. While the model featured three distinct groups, it sidestepped issues of political coalitions. One of the most major areas for the theory of political economy is the analysis of coalitions between different social groups.

2. Relatedly, as noted in the Introduction, to map a model like this to reality, one

needs to know who "the elite" are. However, the concept of the elite is both abstract and a shorthand for a variety of groups that are able to capture political power. The identity of the elite often changes in practice, and a dynamic model is necessary for understanding how such changes may occur in practice.

3. The discussion of inappropriate institutions also raised questions related to institutional flexibility. While the discussion here focused on inefficient institutions, another important dimension is whether a given set of institutions are flexible, i.e., capable of changing rapidly in the face of changes in the environment. Which features makes institutions flexible and whether institutional flexibility matters for economic performance are also interesting areas for future research.

4. The model presented here features only limited intertemporal interactions. Introducing capital accumulation (without full depreciation) is one important area of investigation. This will enable both an analysis of dynamic taxation and also of questions related to how inefficiencies change as the economy becomes richer.

5. The class of models used for political economy also need to be enriched by considering more realistic policies. Although taxes here stand for various different distortionary redistributive policies, explicitly allowing for these policies is likely to lead to new and richer results. Most importantly, such a generalization will allow a discussion of the "optimal" and equilibrium mix of policies in the context of political economic interactions.

6. In the model, government policy is purely redistributive. Another important area of investigation is the interaction of the rent-seeking and efficiency-enhancing roles of governments.[48]

7. Last, but not least, there is much more that needs to be done on institutional persistence. In practice, there is a mixture of frequent changes in certain dimensions of institutions (e.g., switches from dictatorship to democracy), associated with relative persistence in other dimensions (such as the political power of different groups or the inefficiency of various economic institutions). Constructing dynamic models that can shed light on

[48] See Acemoglu (2005) for an attempt in this direction.

these issues is a major area for future research.

8 Appendix A: Proof of Proposition 20

Here I prove that in a democracy workers will always set a zero tax rate on the less productive group. Without loss of generality, focus on the case where $A^m > A^e$ and denote $\theta^m = \theta^e = \theta$.

First, note that workers can adopt two different strategies, either choose a policy vector such that $(1-\tau^m)^{1/\alpha}A^m \geq (1-\tau^e)^{1/\alpha}A^e$ or such that $(1-\tau^m)^{1/\alpha}A^m \leq (1-\tau^e)^{1/\alpha}A^e$. In the first case, the elite producers have lower net productivity and thus the equilibrium wage is $w_t = \alpha(1-\tau^e)^{1/\alpha}A^e/\,(1-\alpha)$, while in the second $w_t = \alpha(1-\tau^m)^{1/\alpha}A^m/\,(1-\alpha)$.

The payoffs to the workers from the two strategies are:

$$\begin{aligned} W^1(\tau^m,\tau^e) &= \frac{\alpha}{1-\alpha}(1-\tau^e)^{1/\alpha}A^e \\ &+\frac{\phi}{1-\alpha}\tau^e(1-\tau^e)^{(1-\alpha)/\alpha}A^e(1-\lambda\theta)+\frac{\phi}{1-\alpha}\tau^m(1-\tau^m)^{(1-\alpha)/\alpha}A^m\lambda\theta. \end{aligned} \tag{31}$$

and

$$\begin{aligned} W^2(\tau^m,\tau^e) &= \frac{\alpha}{1-\alpha}(1-\tau^m)^{1/\alpha}A^m \\ &+\frac{\phi}{1-\alpha}\tau^e(1-\tau^e)^{(1-\alpha)/\alpha}A^e\lambda\theta+\frac{\phi}{1-\alpha}\tau^m(1-\tau^m)^{(1-\alpha)/\alpha}A^m(1-\lambda\theta), \end{aligned} \tag{32}$$

which incorporate the fact that the more productive group will employ $\lambda\theta$ workers, while the less productive group will employ the remainder $1-\lambda\theta$ workers.

The proof will consist of two steps. First, I will show that the first strategy is preferred. Second, I will prove that in this case $\tau^e = 0$.

Step 1: To show that the first strategy is preferred it is sufficient to show that $\max_{\tau^m,\tau^e} W^1(\tau^m,\tau^e) \geq \max_{\tau^m,\tau^e} W^2(\tau^m,\tau^e)$.

To obtain a contradiction, suppose this is not the case. This implies that there exists $(\tilde{\tau}^m,\tilde{\tau}^e) \in \arg\max_{\tau^m,\tau^e} W^2(\tau^m,\tau^e)$ subject to $(1-\tau^m)^{1/\alpha}A^m \leq (1-\tau^e)^{1/\alpha}A^e$ and $W^2(\tilde{\tau}^m,\tilde{\tau}^e) \geq W^1(\tau^m,\tau^e)$ for all (τ^m,τ^e) that satisfy $(1-\tau^m)^{1/\alpha}A^m \geq (1-\tau^e)^{1/\alpha}A^e$.

Consider two cases. First, the constraint on the problem $\max_{\tau^m,\tau^e} W^2(\tau^m,\tau^e)$ is slack, so that $(1-\tilde{\tau}^m)^{1/\alpha}A^m < (1-\tilde{\tau}^e)^{1/\alpha}A^e$. But in this case, the derivative of (32) with respect to τ^m is

$$-\frac{1}{1-\alpha}\left(1-\tau^m\right)^{(1-2\alpha)/\alpha} A^m \left\{\frac{\phi\lambda\theta-\alpha}{\phi\lambda\theta}\tau^m + (1-\phi\lambda\theta)\right\},$$

which is negative for all τ^m, implying that the optimal tax rate on middle class producers in this case is $\tau^m = 0$. This combined with $A^m > A^e$ contradicts $(1-\tilde{\tau}^m)^{1/\alpha}A^m \leq (1-\tilde{\tau}^e)^{1/\alpha}A^e$. Therefore, we must have the constraint tight, i.e., $(1-\tilde{\tau}^m)^{1/\alpha}A^m = (1-\tilde{\tau}^e)^{1/\alpha}A^e$.

Then suppose that $(1-\tilde{\tau}^m)^{1/\alpha}A^m = (1-\tilde{\tau}^e)^{1/\alpha}A^e$, and consider the policy vector $(\tilde{\tau}^m, \tilde{\tau}^e - \varepsilon)$, which clearly satisfies the constraint $(1-\tau^m)^{1/\alpha}A^m \geq (1-\tau^e)^{1/\alpha}A^e$, and thus corresponds to the first strategy. Then substituting for the relationship $(1-\tilde{\tau}^m)^{1/\alpha}A^m = (1-\tilde{\tau}^e)^{1/\alpha}A^e$ in (31) and (32), we have:

$$\begin{aligned} W^1\left(\tilde{\tau}^m, \tilde{\tau}^e - \varepsilon\right) &= \frac{\alpha}{1-\alpha}\left(1-\tilde{\tau}^e-\varepsilon\right)^{1/\alpha} A^e + \\ & \frac{\phi}{1-\alpha}\frac{\tilde{\tau}^e-\varepsilon}{1-\tilde{\tau}^e+\varepsilon}(1-\tilde{\tau}^e-\varepsilon)^{1/\alpha}A^e\left(1-\lambda\theta\right) + \frac{\phi}{1-\alpha}\frac{\tilde{\tau}^m}{1-\tilde{\tau}^m}(1-\tilde{\tau}^e)^{1/\alpha}A^e\lambda\theta. \end{aligned}$$

and

$$\begin{aligned} W^2\left(\tilde{\tau}^m, \tilde{\tau}^e\right) &= \frac{\alpha}{1-\alpha}\left(1-\tilde{\tau}^e\right)^{1/\alpha} A^e \\ & +\frac{\phi}{1-\alpha}\frac{\tilde{\tau}^e}{(1-\tilde{\tau}^e)}(1-\tilde{\tau}^e)^{1/\alpha}A^e\lambda\theta + \frac{\phi}{1-\alpha}\frac{\tilde{\tau}^m}{(1-\tilde{\tau}^m)}(1-\tilde{\tau}^e)^{1/\alpha}A^e\left(1-\lambda\theta\right). \end{aligned}$$

Since $A^m > A^e$, it must be that $\tilde{\tau}^m > \tilde{\tau}^e$. Using the fact that $\lambda\theta > 1-\lambda\theta$, as $\varepsilon \to 0$, $W^1\left(\tilde{\tau}^m, \tilde{\tau}^e - \varepsilon\right) > W^2\left(\tilde{\tau}^m, \tilde{\tau}^e\right)$, which leads to a contradiction, establishing Step 1.

Step 2: Given the result in Step 1, the problem of the workers is to maximize

$$W^1\left(\tau^m, \tau^e\right) = \frac{\alpha}{1-\alpha}\left(1-\tau^e\right)^{1/\alpha} A^e + \frac{\phi}{1-\alpha}\tau^e(1-\tau^e)^{(1-\alpha)/\alpha}A^e\left(1-\lambda\theta\right) + \frac{\phi}{1-\alpha}\tau^m(1-\tau^m)^{(1-\alpha)/\alpha}A^m\lambda\theta$$

subject to

$$(1-\tau^m)^{1/\alpha}A^m \geq A^e(1-\tau^e)^{1/\alpha}.$$

If the constraint is slack, the first-order condition with respect to τ^e is

$$-\frac{1}{1-\alpha}\left(1-\tau^e\right)^{(1-2\alpha)/\alpha} A^e \left\{\frac{\phi\lambda\theta-\alpha}{\phi\lambda\theta}\tau^e + (1-\phi\lambda\theta)\right\} \leq 0 \text{ and } \tau^e \geq 0,$$

with complementary slackness, which again yields $\tau^e = 0$, and hence $\tau^m = \alpha$, as claimed in the proposition. If the constraint is tight, then substituting for it, we obtain

$$W^1(\tau^e) = \frac{1}{1-\alpha}(1-\tau^e)^{(1-\alpha)/\alpha} A^e \left\{ \alpha(1-\tau^e) + \phi\tau^e + \phi\lambda\theta\left(\left(\frac{A^m}{A^e}\right)^{\alpha} - 1\right)\right\}.$$

The first-order condition for the maximization of this expression is

$$-\frac{1}{1-\alpha}(1-\tau^e)^{(1-2\alpha)/\alpha} A^e \left\{\frac{\phi-\alpha}{\phi}\tau^e + (1-\phi)\right\} \le 0,$$

which again implies $\tau^e = 0$. This establishes the claim in Step 2, and completes the proof of the proposition.

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