Institutional Specialization[*]

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Abstract

This paper presents a theory of institutional specialization in which some countries uphold the rule of law while others choose extractive institutions, even when countries are ex-ante identical. The driving force of specialization is that for incumbents in each country, the first steps to the rule of law have the greatest cost. Good institutions require sharing power and rents, but in places where power is already shared broadly, each power base or branch of government underpinning institutions is individually less important and thus receives lower rents. Countries with diametrically opposed institutions have a symbiotic relationship in the world equilibrium. The transition from sail to steam-powered vessels in 19th-century trade provides suggestive evidence supporting the theory.

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1   Introduction

In spite of its well-known economic gains, international trade has its critics. Much of the opposition to free trade comes from a sense that some economies end up specializing in the wrong kinds of goods — primary goods — which is detrimental to development. In a famous example, Williamson (2011) shows economic divergence followed the first wave of globalization in the early 19th century when the third world 'fell behind'. But how can opportunities to trade be welfare decreasing?

This paper proposes and investigates an explanation: trade openness leads to specialization in political institutions. The possibility of trade induces rulers in some countries to share power and build institutions with the rule of law allowing for production of institutionally-intensive goods, but incentivizes others to choose extractive institutions with a narrow power base and an economy based on primary goods. This specialization in political institutions results in economic divergence.

Institutional specialization arises in a global model of endogenous institutions and self-interested rulers with one key feature: as the group in power in a country becomes larger, the marginal importance of each group member in buttressing the country's institutions declines. This yields a negative relationship between the number of people in power and the rents each receives. For incumbents, the marginal cost of strengthening property rights is the additional rents paid to those with whom they must share power. Hence, rulers face a decreasing marginal cost of better institutional quality.

The driving force of institutional specialization comes from the shape of the marginal benefit and marginal cost functions of institutional quality. The benefit of institutions protecting property rights is the possibility of producing goods requiring long-term investments that could easily be expropriated. Given imperfect substitutability between these goods and others less sensitive to property rights, their relative price declines when more is produced at the world level. Globally, the marginal benefit of improvements in institutional quality is decreasing, however, for a small open economy that does not affect world prices, the marginal benefit is constant.

With a decreasing marginal cost and a constant marginal benefit of institutional quality at the country level, incentives of those in power push institutions towards the extremes. Countries either uphold the rule of law with full protection of property rights, or consciously choose not to provide security to investors. At the world level, when good institutions are more widespread, prices of goods requiring protection of property rights are lower, so those in power in a given country want weak institutions. This leads to strategic substitutability in rulers' choices of institutions across countries and implies an interconnected world will sustain diametrically opposed systems of government.

The world equilibrium features a symbiotic relationship between rule-of-law economies and authoritarian regimes. The production of rule-of-law intensive goods raises the relative price of other goods such as natural resources, thus increasing incentives for extractive institutions in other countries. Conversely, countries with extractive institutions generate a positive externality in the rest of the world because cheap natural resources make the rule of law more attractive elsewhere.

These results are demonstrated in an environment with ex-ante identical countries and no funda-

mental economic reason for trade. In equilibrium, those in power are indifferent between having the rule of law or extractive institutions, and they always gain from trade with other countries. However, the ensuing institutional specialization leads to economic divergence. The economies that adopt the rule of law become substantially richer than those with extractive institutions. International trade thus benefits some countries but harms others.

This paper provides a way of reconciling the claim that corruption, rent-seeking, and insecure property rights create significant barriers to development in some countries with the fact that history is replete with examples of other countries having overcome precisely these challenges. The paper answers the question of why good institutions have been adopted in some places but not others without resorting to different models or different parameters for particular countries. The polarization of institutions predicted by the model does not depend on ex-ante differences between countries.

Dropping the assumption of ex-ante identical countries merely removes the arbitrariness of which particular countries end up with the rule of law or extractive institutions. Good institutions now emerge in countries with a comparative advantage in rule-of-law intensive goods. A 'natural resource curse' arises owing to the effects of a comparative advantage in natural resources on incentives of those in power to resist institutional reforms that would restrict their ability to extract rents.

The theory has some important lessons on how the problem of authoritarian regimes should be addressed. One prediction is that exogenous improvements in one country's political institutions, perhaps brought about by well-intentioned international pressure or intervention, will be counteracted by stronger incentives for extractive institutions in other countries. However, this does not preclude a role for international policy because the total number of authoritarian regimes in the world is affected by the relative price of rule-of-law intensive goods, which is in turn influenced by patterns of demand. The theory thus suggests that subsidizing rule-of-law intensive goods, for example, channelling resources to the development of technology-intensive alternative fuels, would be more effective than efforts directed to affect the political systems of particular countries.

A key implication of the theory is that an exogenous increase in trade openness leads to greater institutional specialization. This is tested by exploring the transition from sail to steam power for shipping in the second half of the 19$^{\text{th}}$ century. Pascali (2017) shows this technological advance worked as a shock to trade openness that occurred around 1865–1875. He builds a country-level measure of predicted trade based on geographical variables, with the direction of prevailing winds playing a key role. Here, differences in predicted trade in the years before and after the transition are taken as an exogenous shock to trade openness. Importantly, there is large cross-country variation in the magnitude of the shock because wind patterns have a strong effect on shipping times only in the period when sailing vessels were used. Identification comes from countries being more or less exposed to the transition from sail to steam-powered shipping owing to geography.

This paper finds some evidence that the trade-openness shock induced institutional specialization. Institutional quality is measured using the executive constraints index from the Polity IV

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Project, a widely employed proxy for power sharing and limits to expropriation. Exposure to a larger trade shock implies a higher expected executive constraints score for countries starting from a relatively good score in the earlier period, but a lower executive constraints score for countries starting from a low score. Given the usual caveats with cross-country studies and the relatively small sample, the results should be treated with caution. But they suggest the channels emphasized in this paper might play an important role in reality, and call for further research.

The plan of the paper is as follows. Related literature is discussed below. Section 2 presents the model. Section 3 analyses the institutional choices of rulers. Section 4 studies the strategic interactions among countries and the equilibrium cross-country distribution of institutions, as well as policy implications and extensions. Section 5 presents the empirical analysis. Section 6 concludes.

Relation to the literature A large field of research is dedicated to studying the determinants of political institutions. A branch of this literature focuses on how those institutions are affected by international trade. For example, in Acemoglu, Johnson and Robinson (2005) and Puga and Trefler (2014), international trade induces institutional change by enriching and empowering merchant groups.[1] Bourguignon and Verdier (2000, 2005) study how trade openness and financial liberalization affect the incentives of a ruling elite to subsidize education for poorer workers. Closer to this paper, Chatterjee (2017) studies how international trade can give rise to asymmetries in policies. Zissimos (2017) shows conditions under which a ruling elite will be able to use trade policy to forestall democratization. In a similar vein, special-interest groups play a key role in Levchenko's (2013) analysis of the impact of international trade on institutional quality.[2]

In that literature, institutions typically depend on the balance of power between groups with different strengths and endowments of resources. Here, instead of focusing on the game between domestic groups, the novelty is to analyse how interactions between countries through trade shape the world distribution of political institutions. And rather than focusing on historical differences between particular countries, here, the nature of the cost function of institutional quality faced by rulers all around the world by itself makes trade a force for political divergence.

A body of research surveyed by Nunn and Trefler (2014) shows that institutional quality has an important role in explaining international trade.[3] That is consistent with the reason why countries trade in the theory proposed here. However, in that literature, institutions are typically taken as given, and the trade resulting from institutional differences is Pareto improving. Here, in contrast,

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[1] Acemoglu, Johnson and Robinson (2005) argue that the Atlantic trade led to better institutions in European countries where monarchies were not so strong, while Puga and Trefler (2014) show how empowering merchants in Venice led to important institutional innovations up to the 13th century, but also to political closure and reduced competition thereafter.

[2] Related to this question in a broader sense, Gancia, Ponzetto and Ventura (2022) study how trade affects the size and number of countries in the world. Milgrom, North and Weingast (1990), Greif (1993), Greif, Milgrom and Weingast (1994), and Greif (2006) combine historical analysis and game theory to understand how institutions in medieval times allowed merchants groups to solve the commitment problems that arise in large-scale international trade.

[3] The literature studies how institutions affect trade flows (for example, Anderson and Marcouiller, 2002), the pattern of comparative advantage (Levchenko, 2007, Nunn, 2007), and its dynamic effects (Araujo, Mion and Ornelas, 2016).

institutions are endogenous, and trade benefits only countries with good institutions in equilibrium.

The paper is also related to Acemoglu, Robinson and Verdier (2017), who study specialization in economic systems and also find an asymmetric world equilibrium. But the question there is a very different one: understanding why different types of capitalism can co-exist, in particular, why we cannot all be like Scandinavians as opposed to Americans. Here, the question is why examples of good institutions in some countries co-exist with examples of abject failure in others — why some of us must be Venezuelans. Hence, the model here is completely different from theirs. For example, political power plays a central role here but is absent from their analysis, while this paper abstracts from changes in the world technological frontier, which is central to their paper.

The links between power sharing, rents, and institutions are also the subject of Guimaraes and Sheedy (2017). However, that paper studies how commitment to otherwise time-inconsistent rules can be achieved in a model based on coalition formation and costly conflicts. Here, a simpler model is used to study the marginal cost of institutional quality and strategic interactions among countries.[4]

This paper is also related to the large literature on the 'natural resource curse' working through political institutions.[5] Robinson, Torvik and Verdier (2006) and Mehlum, Moene and Torvik (2006) study the role of institutions in the natural resource curse. While in those papers the curse is a consequence of bad institutions, here the key institutional variable — power sharing — is endogenous, and causation goes from comparative advantage in natural resources to institutions. There are models in which natural resources distort rulers' choices (e.g., Acemoglu, Verdier and Robinson, 2004, Caselli and Cunningham, 2009, Caselli and Tesei, 2016), but one distinguishing and important feature of this paper is that it shows how the equilibrium number of authoritarian regimes is determined for the world as a whole, which depends on factors such as the demand for natural resources.

There is also a large collection of studies based around the idea that trade hurts economies that specialize in primary goods. One possibility is that some sectors give rise to positive externalities on the whole economy or within an industry through knowledge creation.[6] In this paper, trade harms those economies that fail to establish institutions conducive to development, but not because of any intrinsic disadvantage of producing primary goods.[7]

Empirical work on the determinants of political institutions faces formidable obstacles. In particular, clean identification is very difficult to obtain.[8] The strategy proposed by Pascali (2017) —

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[4]Acemoglu and Robinson (2000), Jack and Lagunoff (2006), and Bai and Lagunoff (2011) also study power sharing, but in the sense of extensions of the democratic franchise. Closer to this paper, power sharing in Guimaraes and Sheedy (2017) is connected to the establishment of the rule of law. In a related contribution, Baron and Ferejohn (1989) analyse legislative bargaining and derive implications for rent sharing.

[5]For a discussion of the empirical evidence on the natural resource curse, see Ross (2001), Sachs and Warner (2001), and Van der Ploeg (2011).

[6]See, for example, Krugman (1987), Rodrik (1996), and Melitz (2005).

[7]There is also a large literature in sociology that attempts to explain underdevelopment as the result of rich countries exploiting poor ones, so-called 'dependency theory'. See, for example, Cardoso and Faletto (1979).

[8]The empirical literature on the effects of trade on democracy often runs into this challenge. Some papers study whether trade liberalization leads to democracy (e.g., Giavazzi and Tabellini, 2005), but trade liberalization is in principle endogenous. López-Córdova and Meissner (2008) use the geographical variables proposed by Frankel and Romer (1999)

and used here — is one of the very few quasi-experimental settings available in the literature. The estimates of the effect of trade on institutional specialization presented in this paper are based on a large exogenous trade shock with heterogeneous impacts on a wide range of countries.

Last, the paper is broadly related to discussions of democratization in the social sciences.[9] Following the demise of the Soviet Union and the end of the cold war in the early 1990s, Fukuyama (1992) famously predicted the 'end of history', arguing that the days of autocratic regimes were numbered. Reality, however, has not been so kind, and Fukuyama has since acknowledged that autocratic regimes have been stubbornly persistent (Fukuyama, 2011).[10] Using methods developed in the literature on testing for convergence in levels of GDP per person across countries, the lack of cross-country convergence in Polity scores has been noted in work by Goorha (2007).[11]

2 The model

The model features a simple economic environment with two goods, several countries that might trade with each other, and the choice of institutional quality by those who hold power in each country.

2.1 Environment: countries, individuals, preferences, and technologies

The world The world comprises a measure-one continuum of countries each with a measure-one continuum of individuals. There is no mobility of individuals between countries. Individuals within a country are indexed by $i \in [0,1]$, countries by $n \in [0,1]$.

There are two goods in the world, an endowment good (E) and an investment good (I). These goods can be exchanged between countries in perfectly competitive world markets, with $X_E(n)$ and $X_I(n)$ denoting country n's net exports of the endowment and investment goods respectively. The relative price π^* of the investment good in world markets adjusts to ensure these markets clear:

$$\int_0^1 X_E(n)\mathrm{d}n = 0 = \int_0^1 X_I(n)\mathrm{d}n. \tag{1}$$

International trade In each country, net exports X_E and X_I of endowment and investment goods (dropping the country index n) must satisfy the country's international budget constraint

$$X_E + \pi^* X_I = 0. \tag{2}$$

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as an instrument for international trade, but these variables have no time variation for most countries.

[9]Huntington (1993) is an influential example.

[10]There is much work in political science on the survival of autocracies (for example, Gandhi and Przeworski, 2007), but which focuses on individual countries, while this paper studies the political equilibrium of the world as a whole.

[11]Alesina, Tabellini and Trebbi (2017) document divergence in the quality of governance and institutions among EU countries, in spite of the incentives for institutional convergence provided by the EU. This is an example where greater economic integration occurs alongside political divergence.

Production In a given country, all individuals exogenously receive a common amount Q of the endowment good. Moreover, a positive fraction χ of individuals receives investment opportunities, each leading to the production of one unit of the investment good (a normalization) if it is undertaken. The stochastic arrival of an investment opportunity is private information to an individual. All investment opportunities entail an effort cost specified below, which is sunk once the investment good becomes available. For an individual i receiving an opportunity, the decision to invest is denoted by the binary variable $\kappa(i) \in \{0,1\}$ ($\kappa(i)$ must be 0 for those who do not receive an opportunity). The supply of investment goods produced, referred to as the capital stock K, is

$$K = \int_0^1 \kappa(i)\mathrm{d}i. \tag{3}$$

Whether an individual has taken an opportunity is common knowledge after the good is produced.

Consumption The only use of both the endowment and investment goods is consumption. All individuals throughout the world have constant-elasticity-of-substitution consumption preferences

$$C(i) = \left((1-\alpha)^{\frac{1}{\varepsilon}} C_E(i)^{\frac{\varepsilon-1}{\varepsilon}} + \alpha^{\frac{1}{\varepsilon}} C_I(i)^{\frac{\varepsilon-1}{\varepsilon}} \right)^{\frac{\varepsilon}{\varepsilon-1}}, \tag{4}$$

where $C_E(i)$ and $C_I(i)$ are individual i's consumption of the two goods. The parameter α, satisfying $0 < \alpha < 1$, indicates the relative importance of the investment good. The parameter ε is the elasticity of substitution between the endowment and investment goods, which satisfies $0 < \varepsilon < \infty$.

Given (4), the value C of a country's output of Q and K that can be traded internationally is

$$C = \frac{Q + \pi^* K}{\left(1 - \alpha + \alpha \pi^{*1-\varepsilon} \right)^{\frac{1}{1-\varepsilon}}}. \tag{5}$$

This indirect utility function maximizes (4) subject to $C_E + \pi^* C_I = Q + \pi^* K$.

Preferences All individuals in the world have preferences represented by the utility function

$$U(i) = \log C(i) - \kappa(i)\log(1+\theta) - R(i), \tag{6}$$

where $C(i)$ is the amount consumed of the CES aggregate of goods (4), θ is a positive parameter specifying the cost of undertaking an investment opportunity, and $R(i)$ denotes effort incurred during the political process described below.

2.2 Institutions: the allocation of power and resources

Institutions Institutions take many different forms around the world from absolute monarchies and autocratic regimes through to democracies with constitutions upholding the rule of law. The model here represents this spectrum in a parsimonious way.

The essence of the approach taken here is to model institutions along a single key dimension of how broadly they distribute power among the population of a country. Power sharing p is defined as

the fraction of the population holding positions of power, a group referred to as the incumbents. The fundamental assumptions are that (i) wider power sharing raises the cost of insurgencies against the regime, and (ii) sharing power requires sharing rents.

There are many different varieties of power sharing in practice, including courts, parliaments, local governments, armies, police forces, councils of nobles, and communist parties. By making no distinction among them, the model misses many important aspects of existing political systems — especially modern democracies. However, it captures the idea that broader power (and rent) sharing raises the number of people willing to defend the institutions.[12]

Besides allocating power, institutions also allocate resources between different uses, including individuals' consumption and how much is exported or imported, subject to resource and informational constraints. Note that institutions directly specify individuals' quantities of consumption of each good.[13] Since an objective of this paper is to study how political power interacts with private property, free exchange is not built in as an assumption.

As capital is observable once it is produced, institutions can specify a consumption allocation for some or all individuals that depends on whether an investment opportunity was taken. The fraction of individuals with an investment-contingent consumption allocation is denoted by λ. Someone with an investment-contingent consumption allocation who takes an investment opportunity is referred to as an investor.

An individual neither in power nor an investor is referred to as a worker. Consumption allocated to individuals can depend on whether they are incumbents, investors, or workers. The quantities of endowment and investment goods assigned to each incumbent are C_{pE} and C_{pI}, to each investor C_{kE} and C_{kI}, and to each worker C_{wE} and C_{wI}. The net amounts of the two goods exported are X_E and X_I.

Formally, institutions $\mathscr{I}$ are defined as a collection $\{p, \lambda, C_{pE}, C_{pI}, C_{kE}, C_{kI}, C_{wE}, C_{wI}, X_E, X_I\}$.

Incentive compatibility   Suppose individual i receives an investment opportunity. If she does not have an investment-contingent consumption allocation, it is not rational for her to invest. If her consumption does depend on investing, let C_k and C_w denote the consumption payoffs in terms of (4) from investing or not, obtained respectively from $\{C_{kE}, C_{kI}\}$ and $\{C_{wE}, C_{wI}\}$. According to the utility function (6), the choice of $\kappa(i) = 1$ is rational if the incentive-compatibility condition holds:

$$C_k \geq (1 + \theta)C_w. \tag{7}$$

Since χ individuals receive investment opportunities at random, production of capital (3) is

$$K = \begin{cases} \chi\lambda & \text{if (7) holds} \\ 0 & \text{otherwise} \end{cases}. \tag{8}$$

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[12]It does not follow that political systems with more power sharing should be more stable because incumbents will make choices taking institutional strength into account.

[13]A 'primal' approach to analysing institutions is adopted here: institutions are rules allocating resources subject to fundamental constraints. Specific instruments or arrangements that implement an allocation are discussed later.

We assume investment opportunities are randomly distributed among the population, excluding those in power. Besides simplifying the analysis and exposition, this assumption allows us to focus on the more interesting aspect of institutions: providing property rights to outsiders.

The variable λ captures the extent of the rule of law or the strength of property rights, a key measure of institutional quality. If $\lambda = 1$ then institutions feature perfect rule of law in that anyone with an investment opportunity can take it knowing the fruits of the investment will not be confiscated. In equilibrium, (7) must bind, so investors pay more tax than workers, but have property rights that allow them to keep enough of the proceeds to justify undertaking investments. $\lambda < 1$ represents imperfect rule of law in that some individuals would face expropriation (and hence choose not to invest) while others' property rights are secure.[14] Last, $\lambda = 0$ represents fully extractive institutions where any investments would be seized.

Feasibility   Using capital K from (8), the sizes of the groups of investors and workers are $k = K$ and $w = 1 - p - K$ respectively. Feasibility of institutions requires that the (non-negative) allocation of consumption goods across groups of individuals satisfies the resource constraints

$$pC_{pE} + KC_{kE} + (1 - p - K)C_{wE} + X_E = Q, \quad \text{and} \quad pC_{pI} + KC_{kI} + (1 - p - K)C_{wI} + X_I = K. \quad (9)$$

Net exports X_E and X_I must satisfy (2) given the world price π^*. Capital K must satisfy (8).

2.3   The political process and equilibrium institutions

Politics   Institutions are endogenously shaped by a political process. In the model, insiders act in their own interests, but are wary of challenges coming from outsiders. These challenges might take a variety of forms, including outright rebellions, coups d'etat, and civil wars.

Suppose a successful challenge by a group of workers to institutions allocating them a consumption payoff C_w allows each instead to receive a multiple $\zeta > 1$ of the economy's per-person resources C. Assume that for this challenge to be successful, each worker is required to exert political effort $R(p)$, where $R(p)$ is an increasing function of the size p of the group in power. The function $R(p)$ models the cost of challenging incumbents. The current institutions survive only if the necessary political effort to change the institutions outweighs the extra consumption gained:

$$\log C_w \geq \log(\zeta C) - R(p), \quad (10)$$

where the form of this condition comes from the utility function (6). It is natural to focus on workers' incentives to rebel because they will have the least stake in the status quo. This constraint leads to

$$C_w \geq \frac{C}{F(p)}, \quad \text{where } F(p) = \frac{e^{R(p)}}{\zeta}, \quad (11)$$

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[14]One interpretation of $\lambda \in (0,1)$ is a group of potential entrepreneurs with close ties to the group in power.

a lower bound on workers' consumption C_w that is proportional to C for a given extent of power sharing p. The function $F(p)$ incorporates the effort cost function $R(p)$ and the gain parameter ζ.

Incumbents must ensure that (11) holds. This constraint captures in a simple way the notion that while incumbents will shape institutions in their own interests, these can always be contested and replaced through various means if they go too much against the interests of others.

Since workers do not produce capital, the lower bound on their consumption C_w relative to C in the political constraint (11) is harder to satisfy when institutions grant property rights to a minority of rich investors. This will hinder institutional quality.

The lower bound on workers' consumption implied by (11) is decreasing in power sharing p. This represents the general idea that having more people in positions of power — whether they be members of a parliament, judges, village chiefs, or army officers — makes institutions stronger and better able to resist challenges. While the direct consequence of higher p is distributional in pushing down C_w relative to C, it does not follow that power sharing reduces workers' consumption overall because p is related in equilibrium to institutional quality and the amount of investment.

Power can be shared, and incumbents will add more people to their group as long as it raises the consumption C_p of each member of their group. Institutions are chosen to maximize the consumption payoff C_p of each member of the incumbent group subject to feasibility and to avoiding successful challenges. Sharing power strengthens the institutions against the threat of rebellions but requires sharing rents. For simplicity, all members of the incumbent group receive the same payoff. While this particular assumption could be relaxed, it is important that all members of the group in power obtain some benefit from their positions.

The constraints on C_k and C_w are binding, so the following must hold:[15]

$$C_k = (1+\theta)C_w, \quad C_w = \frac{C}{F(p)}, \quad \text{and } K = \lambda\chi. \tag{12}$$

Institutions are thus the result of maximizing incumbents' payoffs subject to avoiding rebellions and providing incentives for investment, besides feasibility.[16] Formally, they result from

$$\max_{\mathscr{I}} C_p \text{ subject to (2), (5), (9), and (12).} \tag{13}$$

Political productivity The function $F(p)$ in the political constraint (11) has a precise interpretation as a 'political production function'. Defining $\omega = wC_w/C$ to be the share of the economy's total resources allocated by institutions to workers, (11) can be rearranged and expressed as follows:

$$w \leq \omega F(p). \tag{14}$$

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[15]To have $K > 0$ the incentive compatibility constraint (7) must be satisfied, while if $K = 0$ then C_k becomes irrelevant. Thus, (7) holds without loss of generality. Owing to the resource constraints in (9), those in power do not want C_k any larger than needed for (7). Similarly, if C_w is larger than needed for the political constraint (11) then the incumbent payoff is reduced, so this also holds with equality.

[16]Incumbents are also constrained by the threat of rebellions in Acemoglu and Robinson (2000), Guimaraes and Sheedy (2017), Zissimos (2017), Campante, Do and Guimaraes (2019), and Gawande and Zissimos (2023), for example.

This states that given workers' share ω, the p incumbents are able to deter challenges to the institutions when the number of workers w is no more than $\omega F(p)$. Since ω is unitless, $F(p)$ is measured in units of workers pacified. The logarithmic functional form of (6) implies the number of workers pacified in (14) scales proportionately with ω for given p, hence income effects on the decision to exert political effort are neutralized in the constraint (10), making the analysis of politics invariant to the scale of the economy.[17]

The 'marginal political product' of an additional person in power is $\omega F'(p)$, the extra workers such a person can deter from challenging the institutions, and the 'average political product' is $\omega F(p)/p$, the average number of workers pacified per incumbent. We will make assumptions on political productivity in terms of functions $a(p) = F(p)/p$ and $m(p) = F'(p)$ that capture the implications of $F(p)$ for the average and marginal political products.

First, it is reasonable that $F(p) > p$, so each incumbent can deter more than one worker from challenging institutions if workers were allocated a large enough share ω of the total pie; and $F'(p) > 0$, implying that more people in power deter more workers from mounting such challenges.

Assumption 1 *For all $p \in (0,1)$, the function $F(p)$ is continuously differentiable and satisfies*

$$a(p) \equiv F(p)/p > 1, \quad \text{and} \quad m(p) \equiv F'(p) > 0. \qquad \square$$

Second, we will assume that the marginal political product $m(p)$ is non-increasing. This captures the idea of decreasing returns to power sharing. Once power has been shared more broadly, an extra member of the incumbent group is less important in deterring rebellions. Intuitively, even a small group of incumbents entrenched in power is difficult for outsiders to dislodge, but the advantage does not grow proportionately with the size of the incumbent group.

Assumption 2 *For all $p \in (0,1)$, the marginal political product $m(p) = F'(p)$ is non-increasing:*

$$m'(p) \leq 0. \qquad \square$$

As will be shown, this condition is sufficient for the incumbent payoff to be a strictly quasi-concave function of power sharing, yielding an interior solution to the problem of choosing p.

Under Assumption 1 and Assumption 2, the average political product $a(p) = F(p)/p$ is bounded below by the marginal product $m(p)$, and the derivative of the average product is

$$a'(p) = \frac{m(p) - a(p)}{p} \leq 0, \quad \text{since } a(p) \geq m(p) \text{ for all } p \in (0,1).$$

Third, we will assume that $m(p)$ does not decline too fast. The assumed lower bound on $m'(p)$ is a convoluted expression, but it is easy to understand its implication for the relation between p and $s = pC_p/C$, the share of the economy's total resources allocated to those in power. The lower

bound on $m'(p)$ in Assumption 3 ensures that the relative remuneration of incumbents does not fall too rapidly with p so that the total share appropriated by incumbents s ends up decreasing in p. Assumption 3 also states that $a'(p) < 0$, which is a slight strengthening of Assumption 2. This holds if $a(p) > m(p)$, which again relates to the notion that the first members of the group in power play a more important role in defending institutions than those who join an expanded group.

Assumption 3 *Average and marginal political products $a(p) = F(p)/p$ and $m(p) = F'(p)$ satisfy*

$$a'(p) < 0 \text{ and } m'(p) > -\frac{(1+m(p))(a(p)-m(p))^2}{2pa(p)(a(p)-1)} \text{ for all } p \in (0,1). \qquad \square$$

The simplest functional form satisfying these assumptions is the linear function $F(p) = \beta + \delta p$ with $\beta > 0$ and $\beta + \delta > 1$.[18] A positive β captures the notion that incumbents have an advantage in defending institutions independent of the size of the group in power.

3 The choice of institutions

This section analyses features of the equilibrium institutions that are solutions of (13). First, we look at the allocation of resources for given institutional quality λ and power sharing p. Then, we study the choice of p and how it is affected by λ. We then characterize the cost of improving institutions faced by those in power. The key variables in this section are p, λ, and the share of resources $s = pC_p/C$ received by the group in power.

3.1 A market economy

Conditional on λ (which pins down K) and p, the problem in (13) is equivalent to maximizing incumbents' consumption payoff C_p subject to resource constraints (9) and given levels $C_w = C/F(p)$ and $C_k = (1+\theta)C/F(p)$ of workers' and investors' consumption payoffs from (12). This implies allocative efficiency by definition, and the first-order conditions equate marginal rates of substitution between investment and endowment goods across all individuals. For homothetic consumption preferences (4), this requires $C_{pI}/C_{pE} = C_{kI}/C_{kE} = C_{wI}/C_{wE}$.

This paper models institutions in terms of allocations, but it is still possible to describe the means by which an allocation can be implemented. This section shows that allocative efficiency is achievable by allowing individuals free exchange of goods in competitive markets after taxes and transfers — essentially an application of the second welfare theorem. Equilibrium institutions are thus said to feature a market-based economy.

Suppose individual i can buy or sell investment goods in a competitive market at price π in terms of endowment goods. Faced with a budget constraint $C_E(i) + \pi C_I(i) = Y(i)$, where $Y(i)$ is the

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[18]$F(p) = \beta + \delta p$ yields $m(p) = \delta$ (hence $m'(p) = 0$) and $a(p) = \delta + \beta/p$ (hence $a'(p) < 0$). $\beta + \delta > 1$ is needed for Assumption 1 and $\beta > 0$ is needed for Assumption 3.

individual's post-tax income in terms of the endowment good as numeraire, and choosing $C_E(i)$ and $C_I(i)$ to maximize $C(i)$ from (4), the first-order condition $C_I(i)/C_E(i) = \alpha\pi^{-\varepsilon}/(1-\alpha)$ equates the marginal rate of substitution between the investment and endowment goods to the relative price π. The resulting demand functions and the maximized consumption payoff are

$$C_E(i) = \frac{(1-\alpha)Y(i)}{1-\alpha+\alpha\pi^{1-\varepsilon}}, \quad C_I(i) = \frac{\alpha\pi^{-\varepsilon}Y(i)}{1-\alpha+\alpha\pi^{1-\varepsilon}}, \quad \text{and } C(i) = \frac{Y(i)}{(1-\alpha+\alpha\pi^{1-\varepsilon})^{\frac{1}{1-\varepsilon}}}. \quad (15)$$

Given production and net exports, markets clear — that is, the resource constraints (9) hold — if

$$\pi = \left(\frac{\alpha(Q-X_E)}{(1-\alpha)(K-X_I)} \right)^{\frac{1}{\varepsilon}}. \quad (16)$$

In addition, if goods can be exchanged in world markets, the domestic price π equals the world price π^*. Using the international budget constraint (2) with (16), net exports with free trade are then

$$X_E = \frac{\alpha\pi^{*1-\varepsilon}Q - (1-\alpha)\pi^*K}{1-\alpha+\alpha\pi^{*1-\varepsilon}}, \quad \text{and } X_I = \frac{(1-\alpha)K - \alpha\pi^{*-\varepsilon}Q}{1-\alpha+\alpha\pi^{*1-\varepsilon}}. \quad (17)$$

Proposition 1 (Market economy) *Equilibrium institutions can be implemented as a free-market economy fully open to international trade together with taxes on incomes and transfer payments:*

(i) *There are income levels Y_p, Y_k, and Y_w net of taxes and transfers for incumbents, investors, and workers such that consumption of each good by each individual is given by* (15).

(ii) *The market-clearing price* (16) *is $\pi = \pi^*$, and net exports are given by* (17).

(iii) *Individual incomes satisfy $pY_p + KY_k + (1-p-K)Y_w = Y$, where Y is the market economy's GDP $Y = Q + \pi^*K$ in terms of the endowment good as numeraire, with capital $K = \chi\lambda$.*

(iv) *All individuals' maximized consumption payoffs sum to real GDP C (the same as C in* 5*):*

$$pC_p + \chi\lambda C_k + (1-p-\chi\lambda)C_w = C, \quad \text{where } C = \frac{Q + \pi^*\chi\lambda}{\left(1-\alpha+\alpha\pi^{*1-\varepsilon}\right)^{\frac{1}{1-\varepsilon}}}. \quad (18)$$

(v) *The allocation of given amounts produced of the two goods Q and $K = \chi\lambda$ is Pareto efficient.*

PROOF See appendix A.1. ■

The individual incomes Y_p, Y_k, and Y_w are implemented using taxes and transfers. Everyone pays a tax on their endowment Q, investors are able to keep their capital but pay a tax that just incentivizes them to produce, and all these tax revenues are shared out among those in power.

Even though incumbents care only about their own interests, they are compelled to consider the impact of their choices on others to avoid challenges to the institutions they establish. This force pushes them to create economically efficient institutions, at least in respect of exchanges of goods.

With no exogenous restrictions on taxes and transfers, the political process has not led so far to any tension between distribution and efficiency. For example, opening up to international trade maximizes the value of the pie available for consumption, but also has differential effects on the real incomes of investors, workers, and incumbents resulting from the relative price π adjusting to π^*.

Efficient institutions that eschew barriers to international trade are adopted by incumbents because taxes and transfers can be used to sterilize any distributional consequences.[19]

3.2 Power sharing and the distribution of income

Section 3.1 looks at allocations conditional on given p and λ. Now, we study the problem of choosing p to maximize C_p.

Given the binding incentive constraint $C_k = (1 + \theta)C_w$ from (12), the consumption levels of workers and incumbents are linked to real GDP C in (18) by the equation $pC_p + (1 - p + \chi\theta\lambda)C_w = C$. The binding political constraint $C_w = C/F(p)$ from (12) and Assumption 1 imply incumbents can shift resources from workers to themselves by increasing p. The consumption payoff C_p of each incumbent therefore depends on p as follows:

$$C_p = \frac{1}{p}\left(1 - \frac{(1 - p + \chi\theta\lambda)}{F(p)}\right)C. \tag{19}$$

The first-order condition $\partial C_p/\partial p = 0$ for power sharing is

$$\frac{\partial C_p}{\partial p} = \frac{C}{p}\left(\frac{(1 - p + \chi\theta\lambda)}{F(p)^2}m(p) - \frac{1}{p}\left(1 - \frac{(1 - p + \chi\theta\lambda)}{F(p)}\right) + \frac{1}{F(p)}\right) = 0.$$

Using (12) and (19), the first-order condition for p becomes

$$(1 - s)m(p)C_w = C_p - C_w. \tag{20}$$

The marginal benefit to incumbents of an additional person in power is the marginal political productivity $(1 - s)m(p)$, the increase in the number of workers deterred from challenging the institutions, multiplied by a worker's consumption payoff C_w (note that $m(p)$ is multiplied by $1 - s$ rather than workers' share ω because 12 implies all non-incumbents including investors obtain a payoff proportional to that of a worker). The marginal cost to incumbents of an additional person in power is the extra pay $C_p - C_w$ he receives relative to a worker.

Using $C_w = C/F(p)$ from (12), $s = pC_p/C$, $m(p) = F'(p)$, and $a(p) = F(p)/p$, (20) yields the equilibrium s as a function of p:

$$s = \frac{1 + m(p)}{a(p) + m(p)}, \tag{21}$$

The determination of incumbents' income share in an environment with contestability of institutions and optimization by incumbents is analogous to explaining factor income shares in a competitive economy in terms of marginal and average products. We are ready to state Proposition 2:

Proposition 2 (Distribution of power and income) *The power sharing first-order condition is* (21):
   (i) *Under Assumption 1, each p satisfies* (21) *for some incumbent income share $s \in (0, 1)$.*
   (ii) *Under Assumption 2,* (21) *is necessary and sufficient for an interior p value maximizing C_p.*

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[19]Restrictions on trade might arise if the set of tax instruments were limited (see, for example, Zissimos, 2017).

(iii) Under Assumption 3, equation (21) implies the income share s rises with power sharing p.

PROOF See appendix A.2.   ∎

Under Assumption 1, s lies between 0 and 1. Under Assumption 2, C_p is strictly quasi-concave in p. Hence the second-order condition of the maximization problem is satisfied, so equilibrium institutions have power shared up to the point where the marginal benefit equals the marginal cost from the perspective of those already in power. Assumption 3 is sufficient, but not necessary, to ensure that s rises with p. Alternative assumptions on the political production function that allow for a positive relation between s and p would lead to similar results in the remainder of the paper.

From now on, unless otherwise noted, results are conditional on these three assumptions.

3.3   Property rights and power sharing

We now study how the choice of p is affected by λ, the fraction of individuals with a consumption allocation that depends on whether they produce capital.

An important idea is that strengthening property rights matters not only for incentives to invest, but also for politics. Higher λ means that rewards for investors take up a greater share of the pie, while the presence of extra capital raises output and makes it harder to pacify workers who have more to gain from challenging the status quo once production of capital is sunk. With a higher λ, rebellions can only be avoided by increasing p or reducing s.

Equation (19), which incorporates the resource, incentive, and political constraints, links $s = pC_p/C$ to p and λ:

$$s = 1 - \frac{1 - p + \chi\theta\lambda}{F(p)}. \tag{22}$$

This combined constraint implies a positive relationship between s and p conditional on λ. Given incentives offered to investors, a higher p puts the incumbent group in a more powerful position, allowing them to appropriate a larger income share s.

The equilibrium values of p and s are jointly determined by the constraint (22) and the power-sharing first-order condition (21) given a still-to-be-characterized level of λ. Graphically, the two relationships are shown in Figure 1 with p and s on the axes. Subject to (22), incumbents gain from increasing p in the region below the first-order condition, so incumbents' choice of p conditional on λ is found at a point in the diagram where the first-order condition intersects the constraint from above. Given λ and hence real GDP C, p maximizes each incumbent's income as a multiple ψ of GDP, as defined by $C_p = \psi C$. Since $\psi = s/p$, constant income multiples in the diagram are rays from the origin, and the choice of power sharing is found on the steepest ray touching the constraint.

Higher λ means offering greater rewards to investors, and given p, this reduces s. Graphically, an increase in λ shifts down the combined constraint in Figure 1, which reduces the highest attainable

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Figure 1: *Institutional equilibrium for power sharing and incumbents' income share*
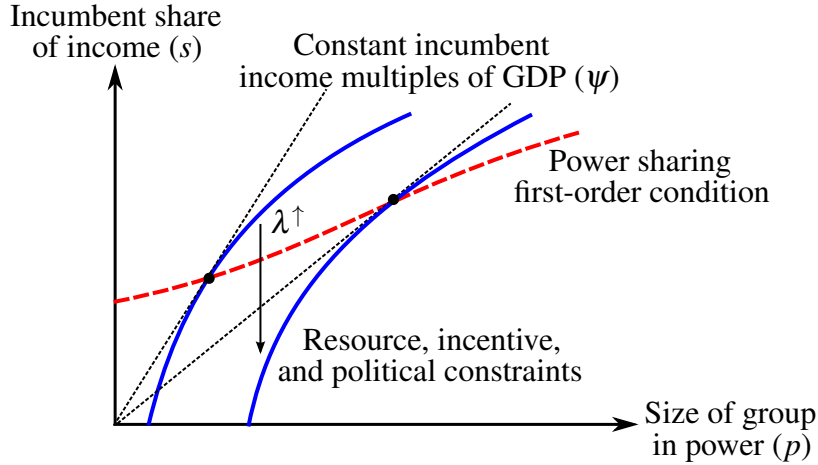
Notes: The red dashed line represents (21) and the blue solid lines represent (22) for two values of λ.

income multiple ψ for individual incumbents. As the constraint must be steeper than the first-order condition at the intersection point, improvements in institutional quality are associated with incumbents choosing to expand p.

The analysis above supposes an interior equilibrium for power sharing p. A sufficient condition for this is:

Assumption 4 *The political production function $F(p)$ and fraction of potential investors χ satisfy:*

$$F(0) < 1, \quad and \quad \frac{\chi}{1-\chi} < \frac{a(1-\chi)-1}{(1+\theta)(1+m(1-\chi)/a(1-\chi))}. \qquad \Box$$

The first condition means that a zero-sized incumbent group cannot defend institutions even if all resources were allocated to workers, hence $p = 0$ cannot be an equilibrium. The second condition puts an upper bound on the number of potential investors χ, so that a very large incumbent group means a very small number of workers, which is not in incumbents' interests.[20]

Proposition 3 (Institutional quality and power sharing) *Taking institutional quality λ as given:*
- *(i) Under Assumption 4, for any $\lambda \in [0,1]$, there is an interior equilibrium ($0 < p < 1-\chi$) for power sharing p and the incumbent income share s, found as the unique solution of equations (21) and (22).*
- *(ii) With an interior equilibrium, higher λ raises p and s.*

PROOF See appendix A.3. ∎

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[20]The second condition is guaranteed to hold for sufficiently low χ conditional on a given investment effort parameter θ and political production function $F(p)$.

Geometrically, Assumption 4 implies the constraint in Figure 1 intersects the horizontal axis to the right of $p = 0$, and is thus initially below the first-order condition, but rises above the first-order condition before $p = 1 - \chi$.

In contrast to the results in Proposition 1, the provision of property rights to investors is inherently political. Greater ex-ante incentives for investors imply greater ex-post distributional conflict once capital is sunk, which leads incumbents to manage the threat to institutions by sharing power more broadly.

3.4 The cost of institutional quality

Why do incumbents in many countries around the world — but not all — fall so far short of providing an economically efficient level of property rights?

In the model, an increase in λ leads to more investment ($K = \chi\lambda$ from 12) and boosts the size of the total pie $C(\lambda)$ incumbents are able to tax. All surplus is extracted from those who invest up to the point where the incentive-compatibility constraint (7) binds. Hence $\lambda < 1$ always reduces revenue from taxing capital. But then, why don't incumbents choose $\lambda = 1$?

The answer provided by the model is that politics gives those outside the group in power an effective claim on some of the additional output created by investors. Intuitively, bolstering property rights raises capital and output, but requires some combination of buying off workers and strengthening institutions by sharing power among a larger group to prevent a successful challenge to investor-friendly institutions. Both of these options dilute the 'rents' individual incumbents obtain from their positions of power. Hence, when it comes to decisions about property rights, the political process generates a clash between distribution and efficiency. More investment is good for the economy, but not necessarily for incumbents reluctant to share power and rents with others.

We now study the wedge between the marginal benefit of institutional quality, given by $C'(\lambda)$, and the resource cost of more investment.

Writing equilibrium objects as functions of λ, (19) becomes

$$C_p(\lambda) = \psi(\lambda)C(\lambda), \quad \text{where } \psi(\lambda) = \frac{1}{p(\lambda)}\left(1 - \frac{(1 - p(\lambda) + \chi\theta\lambda)}{F(p(\lambda))}\right). \tag{23}$$

Incumbents face a trade-off between the benefit of stronger property rights in terms of boosting GDP ($C'(\lambda) > 0$) and the cost in terms of a less favourable distribution of income ($\psi'(\lambda) < 0$).

As p maximizes ψ conditional on λ, the envelope theorem applied to (23) yields an expression for the effect of λ on the income distribution through $\psi(\lambda)$:

$$\psi'(\lambda) = \frac{\partial\psi}{\partial\lambda} = -\frac{\chi\theta}{p(\lambda)F(p(\lambda))}. \tag{24}$$

Together with the constraint $C_w(\lambda) = C(\lambda)/F(p(\lambda))$ from (12), the derivative of $C_p(\lambda)$ in (23) is

$$C_p'(\lambda) = \psi(\lambda)\left(C'(\lambda) - \frac{\chi\theta C_w(\lambda)}{s(\lambda)}\right). \tag{25}$$

This shows incumbents compare the marginal benefit $C'(\lambda)$ not to the resource cost $\chi\theta C_w(\lambda)$ of the extra rewards needed to incentivize investment, but to the larger marginal cost $\chi\theta C_w(\lambda)/s(\lambda)$. Owing to this wedge, institutions might feature inefficiently weak property rights.

The private marginal cost of institutional quality exceeds its social cost by a factor $1/s(\lambda) > 1$. Intuitively, if the decision-making group accounts for a small share of total GDP, an improvement in institutional quality is privately more expensive for incumbents because, owing to political constraints, they cannot capture most of the improvement in GDP for themselves. The behaviour of the marginal cost of institutional quality thus critically depends on the behaviour of $s(\lambda)$. Crucially, since s rises with p (and hence with λ), the wedge between the private and social marginal costs of better institutions declines as institutional quality improves.

Proposition 4 (Marginal cost of institutional quality) *The effect of institutional quality λ on the incumbent payoff $C_p(\lambda)$ is given by (25), so the private marginal cost of λ is $\chi\theta C_w(\lambda)/s(\lambda)$.*
 (i) *The private marginal cost exceeds the social marginal cost $\chi\theta C_w(\lambda)$.*
 (ii) *If $\lambda < 1$ and $C'(\lambda) > \chi\theta C_w(\lambda)$ then the level of investment is Pareto inefficient.*
 (iii) *Incumbents' private marginal cost of λ as a fraction $\mu(\lambda)$ of their own consumption $C_p(\lambda)$ is*

$$\mu(\lambda) = \frac{\chi\theta}{a(p(\lambda))s(\lambda)^2}, \quad \text{with which } C_p'(\lambda) = \psi(\lambda)\left(C'(\lambda) - \mu(\lambda)C_p(\lambda)\right). \tag{26}$$

 (iv) *The marginal cost of institutional quality $\mu(\lambda)$ falls with λ.*

PROOF See appendix A.4. ∎

We now show that this decreasing marginal cost of institutional quality offers an explanation for the global heterogeneity in institutional outcomes.

4 The cross-country distribution of institutions

This section builds on Proposition 3 and Proposition 4 to characterize the distribution of λ across countries. Using (26), we obtain

$$C_p''(\lambda) = \psi(\lambda)\left(C''(\lambda) - \mu'(\lambda)C_p(\lambda)\right) \text{ for } \lambda \text{ where } C_p'(\lambda) = 0. \tag{27}$$

The sign of this second derivative determines whether $C_p(\lambda)$ is quasi-concave or quasi-convex in λ.

4.1 Institutions in a small open economy

Since a small open economy takes the world price π^* as given, the marginal benefit of institutional quality is independent of λ and equalized across countries through trade.[21] With $C_p''(\lambda) = 0$ and

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[21]The marginal benefit of institutional quality is $C'(\lambda) = \pi^*\chi/(1-\alpha+\alpha\pi^{*1-\varepsilon})^{1/(1-\varepsilon)}$ using (18).

a diminishing marginal cost of institutional quality $\mu'(\lambda) < 0$, (27) establishes that the incumbent payoff is a globally quasi-convex function of λ.

Proposition 5 (Institutional specialization) *For a small open economy:*
  (i) The incumbent payoff $C_p(\lambda)$ is a strictly quasi-convex function of institutional quality λ.
  (ii) Equilibrium institutions have either $\lambda = 0$ with low $p^\dagger = p(0)$ and high $\psi^\dagger = \psi(0)$, or $\lambda = 1$ with high $\tilde{p} = p(1)$ and low $\tilde{\psi} = \psi(1)$, where $p^\dagger < \tilde{p}$ and $\psi^\dagger > \tilde{\psi}$.
  (iii) Incumbents choose $\lambda = 1$ only if $\pi^* \chi \geq \xi Q$, where $\xi = (\psi^\dagger - \tilde{\psi})/\tilde{\psi} > 0$.

PROOF See appendix A.5. ∎

As the payoff of those in power is a quasi-convex function of λ, property rights are either so weak that there is no investment ($\lambda = 0$) or sufficiently strong that all profitable investment opportunities are taken ($\lambda = 1$). These two institutional extremes are referred to as extractive institutions and the rule of law respectively (institutional variables under the former have a † superscript, the latter a $\tilde{\ }$). Extractive institutions feature concentrated power (low $p^\dagger$) and incumbents who receive large rents (high incomes $\psi^\dagger$ relative to GDP). Institutions with the rule of law have power shared more broadly (high $\tilde{p}$) and small rents (low incomes $\tilde{\psi}$ relative to GDP) for incumbents.

Why do those in power favour the extremes of institutional quality? The diminishing marginal cost of institutional quality means that on the one hand, the first steps to the rule of law have the greatest private cost to those in power. On the other hand, the marginal benefit of institutional quality does not decline as institutions improve because a small open economy can export more of the institutionally-intensive investment good without affecting world prices. Therefore, for those in power, it makes sense either to go all the way to the best institutions and establish the rule of law, thereby obtaining a smaller share of a larger pie, or never to take the first steps and remain with extractive institutions that allow them to appropriate a larger share of a smaller pie.

Going all the way from extractive institutions to the rule of law adds $\pi^* \chi$ to national income, but at a cost to incumbents of rents equal to a multiple $\xi = (\psi^\dagger - \tilde{\psi})/\tilde{\psi}$ of initial national income Q.

4.2 The world equilibrium

For some parameters, institutional quality would be perfect everywhere in the world. Assumption 5 rules out this possibility.

Assumption 5 *The model parameters satisfy:*

$$\frac{\alpha}{1-\alpha} \left(\frac{1}{\min\{\mu(1)\psi(1), 1\}} - 1 \right)^\varepsilon < \left(\frac{\chi}{Q} \right)^{1-\varepsilon}.$$ □

The key finding in Proposition 5 is that each country n has either $\lambda = 0$ or $\lambda = 1$ in equilibrium, implying $K(n) = 0$ or $K(n) = \chi$. Let γ denote the global fraction of rule-of-law countries ($\lambda = 1$).

Integrating net exports (17) over countries, world market clearing (1) is obtained at relative price

$$\bar{\pi}^* = \left(\frac{\alpha Q^*}{(1-\alpha)K^*} \right)^{\frac{1}{\varepsilon}}, \quad \text{where } K^* = \gamma \chi \text{ and } Q^* = \int_0^1 Q(n)\mathrm{d}n, \tag{28}$$

with Q^* and K^* denoting the world supplies of the endowment and investment goods.

The baseline assumption in what follows is that there are no ex-ante differences between countries. This means all countries share a common supply $Q(n) = Q = Q^*$ of the endowment good.

Proposition 6 (Polarization) *With $Q(n) = Q$ for all $n \in [0,1]$:*

(i) *There is strategic substitutability in incumbents' choices of institutional quality across countries: a given country has $\lambda = 1$ if the fraction of others satisfies $\gamma \leq (\alpha/((1-\alpha))(Q/\chi)^{1-\varepsilon}/\xi^\varepsilon$.*

(ii) *Under Assumption 5, the equilibrium fraction of countries with $\lambda = 1$ and the world price are:*

$$\bar{\gamma} = \frac{\alpha}{1-\alpha} \left(\frac{Q}{\chi} \right)^{1-\varepsilon} \frac{1}{\xi^\varepsilon} \text{ which satisfies } 0 < \bar{\gamma} < 1, \quad \text{and } \bar{\pi}^* = \xi \frac{Q}{\chi}.$$

(iii) *Those in power receive the same payoff irrespective of whether institutions have $\lambda = 0$ or $\lambda = 1$, while payoffs of workers and investors are higher in countries with $\lambda = 1$ than $\lambda = 0$.*

(iv) *Countries with $\lambda = 1$ have Pareto-efficient institutions and higher real GDP than those with $\lambda = 0$. Production of capital is inefficiently low in countries with $\lambda = 0$.*

PROOF See appendix A.6. ∎

While the logic of Proposition 5 pushes individual countries to the extremes of institutional quality, the same reasoning does not apply to the world as a whole. At the global level, prices depend on how much of the investment good is produced and hence on the number of economies with the rule of law. If more countries adopt the rule of law, the price of the investment good π^* falls — thus, the marginal benefit of institutional quality is diminishing at the world level. This means that choices of institutions are strategic substitutes across countries: an increase in the global prevalence of the rule of law tilts the balance in favour of extractive institutions for others, all else equal.[22]

In equilibrium, the world relative price adjusts to equalize the payoffs of incumbents under the two institutional extremes. If the rule of law were preferred by incumbents and adopted everywhere, the price π^* would fall, raising incumbents' payoff from extractive institutions until a point of indifference is reached. Consequently, the world equilibrium features a polarized distribution of political institutions. The spread of the rule of law around the world is limited by the size of the global market for institutionally intensive goods. Even in the absence of any cultural or technological differences, some economies end up with extractive institutions, while others end up with the rule of law.

While incumbents are indifferent between $\lambda = 0$ and $\lambda = 1$, these economies are very different. Rule-of-law economies produce $Q + \pi^* \chi$, which is efficient, while economies with extractive

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[22]In equilibrium, the total number of rule-of-law countries could still rise if, for example, the parameter α increases. This could be due to technological progress that raises the importance of capital accumulation.

institutions only produce Q, which is inefficiently low. By engendering institutional specialization, international trade leads to economic divergence.

4.3   Understanding institutional specialization

The logic behind institutional specialization can be illustrated by making two changes to the assumptions: first, countries in autarky; and second, alternative assumptions about the political productivity of incumbents implying that they face an increasing marginal cost of institutional quality.

Suppose a country has no access to international markets. Net exports of each good are zero ($X_E = 0$ and $X_I = 0$) in place of the international budget constraint (2). The logic of Proposition 1 still applies to domestic markets, so the following autarky real GDP replaces C in (5) and (18):

$$\hat{C}(\lambda) = \frac{Q + \hat{\pi}\chi\lambda}{(1 - \alpha + \alpha\hat{\pi}^{1-\varepsilon})^{\frac{1}{1-\varepsilon}}}, \quad \text{with } \hat{\pi} = \left(\frac{\alpha Q}{(1-\alpha)\chi\lambda}\right)^{\frac{1}{\varepsilon}}, \tag{29}$$

where $\hat{\pi}$ is the market-clearing relative price (16) in autarky with capital stock $K = \chi\lambda$. The marginal benefit of institutional quality is $\hat{C}'(\lambda) = \chi(\alpha + (1-\alpha)\hat{\pi}^{\varepsilon-1})^{1/(\varepsilon-1)}$, which depends positively on $\hat{\pi}$. But since any extra output of the investment good must be sold in domestic markets without the option of exporting at the world price, $\hat{\pi}$ declines as production increases. As improvements in institutions raise output of the investment good but have no effect on endowments, the country-level marginal benefit of institutional quality is diminishing.

Compared to an open economy with a diminishing marginal cost of institutional quality, in autarky, both the marginal benefit and marginal cost of better institutions are diminishing. The easiest comparison with the earlier open-economy results is where the marginal benefit diminishes faster.

Assumption 6 $\varepsilon = 1$ in (4), and function $F(p) = \beta + \delta p$ in (11) with $0 < \beta < 1$ and $\delta > 1 - \beta$. □

The unit elasticity of substitution ε between investment and endowment goods means preferences (4) are the Cobb-Douglas special case and real GDP in (29) is $\hat{C}(\lambda) = Q^{1-\alpha}\chi^{\alpha}\lambda^{\alpha}/((1-\alpha)^{1-\alpha}\alpha^{\alpha})$. The political production function $F(p) = \beta + \delta p$ with the restrictions on β and δ is the simplest functional form of $F(p)$ that satisfies all the earlier assumptions and implies $\mu'(\lambda) < 0$.

Proposition 7 (Institutions in autarky) *With real GDP* (29) *in autarky, and under Assumption 6:*
  (i) *The payoff of incumbents $\hat{C}_p(\lambda)$ is a strictly quasi-concave function of λ.*
 (ii) *Under Assumption 5, the equilibrium value of λ satisfies $0 < \hat{\lambda} < 1$, implying an intermediate degree of power sharing $p^{\dagger} < \hat{p} < \bar{p}$ and incumbent income multiple $\tilde{\psi} < \hat{\psi} < \psi^{\dagger}$.*
(iii) *Equilibrium institutional quality $\hat{\lambda}$ is independent of an economy's endowment Q.*
 (iv) *Those in power would be strictly better off if international trade were possible (for any world price π^*) irrespective of whether they would choose $\lambda = 0$ or $\lambda = 1$. If $\lambda = 1$ were chosen with trade, real GDP and payoffs for workers and investors would be higher than under autarky. Access to world markets is Pareto improving for countries that adopt institutions with $\lambda = 1$.*

PROOF See appendix A.7 ■

There is an interior solution for $\hat{\lambda}$ in autarky because $\hat{C}_p(\lambda)$ is quasi-concave. The first steps to better institutions have a very large marginal benefit because the investment good is scarce. As institutional quality rises, the scarcity of the investment good and its value are lower. Those in power choose institutional quality where the marginal benefit equals the marginal cost.

Institutional quality $\hat{\lambda}$ is not affected by Q under the Cobb-Douglas preferences of Assumption 6 because changes in quantities would lead to opposite changes in autarky prices, and total values are what matter to incumbents.

The left panel of Figure 2 shows C_p in a small open economy and in autarky as functions of λ. The open-economy case is depicted both for an arbitrary world price π^* and for a world price equal to the autarky equilibrium price $\hat{\pi}$. In an open economy that happens to face the autarky price in world markets and does not trade at $\lambda = \hat{\lambda}$, the payoff of incumbents is the same as in autarky. In both the open economy and in autarky, the marginal cost of institutional quality equals its marginal benefit. In autarky, that is the point where the incumbent payoff is maximized; in an open economy, that is the point at which improvements in institutional quality begin to raise the incumbent payoff.

Figure 2: *Incumbent payoffs in open economies and in autarky, and the world equilibrium*
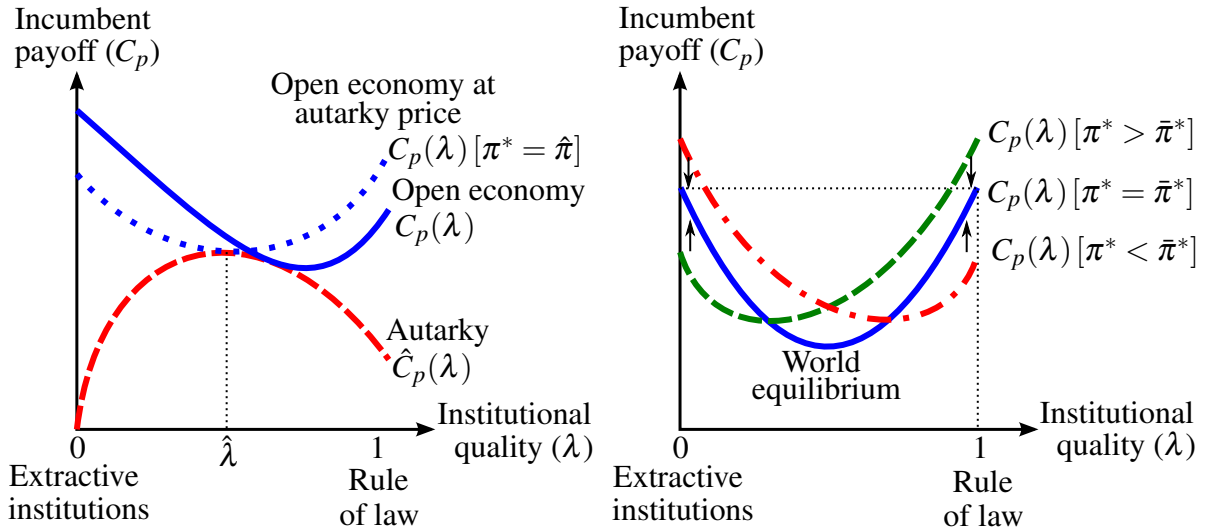
Notes: The left panel shows how C_p varies with λ for 3 cases: autarky; open economy with autarky equilibrium price $\hat{\pi}$; open economy with arbitrary price π^*. The right panel shows that at the equilibrium price $\bar{\pi}^*$, rulers are indifferent between $\lambda = 0$ and $\lambda = 1$, and other prices cannot be an equilibrium.

Figure 2 shows there are gains from international trade for those in power. This is because trade allows for institutional specialization. Some countries specialize in having the rule of law and gain a comparative advantage in producing institutionally intensive investment goods. These goods are exported ($\tilde{X}_I > 0$) to countries that specialize in having extractive institutions in exchange for their

endowment goods ($X_E^\dagger > 0$). In equilibrium, world markets clear where international prices adjust so that incumbents are indifferent between the two institutional extremes, as illustrated in the right panel of the figure ($\bar{\pi}^*$ denotes the equilibrium price). Comparative advantage in institutionally intensive goods would be seen to explain observed trade flows, consistent with the evidence in Nunn and Trefler (2014). However, the pattern of comparative advantage here does not reflect any intrinsic differences between the countries: it is an endogenous outcome of institutional specialization.

As in the 'new trade theory' models of Krugman (1979, 1980), there is a substantial amount of trade between ex-ante identical economies. Those papers assume production technologies with increasing returns, so countries specialize in different varieties of goods to exploit economies of scale, and trade benefits all countries. Here, there are no increasing returns in production itself. There is a diminishing marginal cost of institutional quality from the perspective of those in power, which leads to specialization in institutions, and trade benefits those in power anywhere in the world irrespective of political system. However, different from 'new trade theory', not all countries gain from trade here. While countries with $\lambda = 1$ have higher real GDP than in autarky (workers and investors in countries with $\lambda = 1$ also gain from trade), countries with low institutional quality actually lose by trading internationally.

Closer to Krugman (1979), Chatterjee (2017) presents a model where aggregate income is assumed to be a convex function of the government's policy parameters. This implies there is an endogenous source of comparative advantage through differences in policies, but all countries gain from the trade that results.

Underlying the specialization in institutions is the symbiotic relationship between despots and those in power in rule-of-law economies that arises from international trade. The existence of the rule of law elsewhere in the world allows an authoritarian regime to import what its own institutions preclude it from producing. The existence of extractive institutions elsewhere in the world allows a country with the rule of law to expand the institutionally intensive sector of its economy because it can capture a greater share of the global market for goods that depend on high-quality institutions.

While trade allows institutional specialization, the decreasing marginal cost of institutional quality is what makes this specialization mutually beneficial for incumbents in countries with extractive institutions as well as those with the rule of law. For those in power in countries with weak institutions, improvements in institutional quality are very expensive, so it is mutually beneficial to import the products requiring better institutions from countries where the marginal cost to incumbents is low, rather than taking steps directly to reform their own institutions.

Proposition 8 (Increasing marginal cost) *In open economies with $\mu'(\lambda) > 0$ and $Q(n) = Q$ for all n, all countries have identical institutional quality $\hat{\lambda} \in (0, 1)$ in equilibrium, the same $\hat{\lambda}$ as in autarky.*

PROOF See appendix A.8 ∎

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An increasing marginal cost of institutional quality removes the incentives for incumbents to specialize in different types of institutions. Note that this would imply a negative relationship between power sharing and the share of income received by those in power.[23]

4.4 The effects of trade openness on political institutions

The key prediction of the model is that countries' ability to trade internationally gives rise to institutional specialization. To study how the degree of openness affects political institutions, this section relaxes the assumption that all goods are fully tradable in international markets. Instead, countries have an intermediate degree of openness between the extremes of frictionless trade and autarky.

Let σ be a parameter that represents the fraction of the potential supply of investment goods χ that a country can export or import. Formally, net exports of investment goods X_I must satisfy $X_I \leq \sigma\chi$ and $X_I \geq -\sigma\chi$ in addition to the international budget constraint (2). The parameter σ indexes the degree of openness, with $\sigma = 0$ and $\sigma = 1$ representing respectively the special cases of autarky and frictionless international trade.

Proposition 9 *Suppose the partial openness constraints $-\sigma\chi \leq X_I \leq \sigma\chi$ must hold:*
  (i) *There is a positive threshold $\bar{\sigma}$ such that for any $\sigma \in (0, \bar{\sigma})$, the unique global equilibrium has partial openness constraints bind for all countries and a distribution of institutional quality having a positive mass of countries with $\lambda^\dagger$ and a positive mass with $\tilde{\lambda}$, where $0 < \lambda^\dagger < \tilde{\lambda} < 1$.*
  (ii) *For $\sigma \in (0, \bar{\sigma})$, an increase in openness σ lowers institutional quality $\lambda^\dagger$ in some countries while raising institutional quality $\tilde{\lambda}$ in other countries.*

PROOF See appendix A.9. ∎

Intuitively, a partially open economy with a sufficiently low σ has a payoff of those in power $C_p(\lambda)$ that is a quasi-convex function of λ only for a limited range of intermediate λ values where the constraints on trade do not bind. For low or high values of λ, the constraints become binding, the incumbent payoff $C_p(\lambda)$ is a quasi-concave function, and the equilibrium values of λ move away from the extremes of 0 and 1 for sufficiently low openness (C_p can have a peak to the left and a peak to the right of the range where it is quasi-convex). There is still institutional specialization of countries in the world equilibrium in that some countries will have low λ and others high λ, but there is less polarization than all countries being pushed to 0 or 1. In this case, the proximity of countries to the extremes of institutional quality is increasing in the degree of openness σ. Empirical support for this prediction of the model is presented in section 5.

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[23]The political production function $F(p) = (1+c)p - (c/2)p^2$ implies a negative relationship between s and p for parameter values with $c > 2$. With a constant marginal cost ($\mu'(\lambda) = 0$), the global distribution of λ is indeterminate.

4.5 Policy implications

The theory of institutional specialization proposed here has some strong implications for how the problem of authoritarian regimes ought to be addressed. Suppose benevolent global powers are able to intervene and force countries to adopt particular institutions, or alternatively, act altruistically in making some of their own institutional choices. The first policy instrument considered is the direct imposition of institutions on some countries, rather than institutional quality λ being chosen by the countries' own rulers. Offering aid payments conditional on the adoption of better institutions is another interpretation of this — as carrot rather than stick. The second policy instrument considered is the use of tariffs or subsidies rather than those in power choosing free trade (see Proposition 1). A proportional tariff τ on the investment good creates a wedge $\pi = (1+\tau)\pi^*$ between the world price π^* and the domestic market-clearing price π from (16) in the countries imposing it.

Proposition 10 *Some countries' λ or τ are set exogenously; all others are equilibrium institutions:*

   (i) *If a fraction $\varkappa$ of countries has $\lambda = 1$ imposed then the equilibrium fraction $\bar{\gamma}$ with $\lambda = 1$ is unchanged as long as $\varkappa \leq \bar{\gamma}_0$ for the initial $\bar{\gamma}_0$ (if $\varkappa > \bar{\gamma}_0$ then $\lambda = 1$ only where it is imposed).*

   (ii) *If a subsidy $\tau < 0$ on the investment good is imposed in a fraction $\upsilon > 0$ of countries then this raises the fraction $\bar{\gamma}$ of countries choosing $\lambda = 1$ above the initial fraction $\bar{\gamma}_0$.*

   (iii) *If a subsidy $\tilde{\tau} = \left((\alpha/(1-\alpha))^{\frac{1}{\varepsilon}} (Q/\chi)^{\frac{1}{\varepsilon}-1}/\xi \right) - 1 < 0$ is imposed by all then all choose $\lambda = 1$.*

PROOF See appendix A.10. ∎

Perhaps surprisingly, direct intervention — even supposing it is feasible — turns out to have no effect whatsoever on the equilibrium fraction of countries with the rule of law, unless a point is reached where every country with good institutions has them imposed by external force. Owing to the strategic substitutability of political institutions, an exogenous shift of a country from authoritarianism to the rule of law must be counteracted in equilibrium by another country moving in the opposite direction. The key point here is that localized 'whack-a-mole' interventions are bound to fail owing to the general-equilibrium effects on incumbents' incentives in other countries.

An analogous argument implies that trade sanctions or blockades of particular countries tend to backfire as well. Institutions in an autocratic country that is (hypothetically) precluded from trading will tend to improve towards the autarky equilibrium. However, this will raise incentives for autocracy elsewhere in the world as the determinants of $\bar{\gamma}$ in the world equilibrium have not changed.

Wenar (2016) points out that owing to international trade, consumers in the 'West' sustain dictatorships in poorer countries by buying their natural resources and argues for prohibiting commercial engagement with autocracies. Our model captures the symbiotic relationship between autocratic and rule-of-law countries which is crucial in his book, but raises questions about its policy prescriptions. In practice, trade sanctions would likely be levied on particular countries only. Hence, the world equilibrium would not be affected. Similar reasoning applies to the sanctions on Russian oil and

gas imposed by many Western countries following the war on Ukraine: more expensive oil raises incentives for extractive institutions elsewhere in the world.

This negative result shifts the focus from 'supply-side' policies to 'demand-side' policies. If a group of altruistic countries were to subsidize consumption of institutionally intensive goods then, all else equal, this would raise the world relative price of those goods and reduce the incentive for incumbents in other countries to choose extractive institutions.[24] The effects of this policy are analogous to those of an increase in the demand parameter α for investment goods.

4.6 Ex-ante heterogeneity across countries

When countries are ex ante identical, the world has a unique equilibrium distribution of λ, but the selection of which countries have $\lambda = 0$ and $\lambda = 1$ is not uniquely determined. The result that specialization in institutions arises without any ex-ante heterogeneity highlights the strength of the mechanism in this paper, but leaves open the path taken by any particular country. This section presents an extension with ex-ante heterogeneity that explains which countries will adopt extractive institutions.

Countries $n \in [0, 1]$ differ in their endowments $Q(n)$. Given the world supply Q^* of the endowment good, the distribution of relative endowments $q(n) = Q(n)/Q^*$ across countries has a cumulative distribution function $G(q)$ with a mean of one. In autarky, with Cobb-Douglas preferences ($\varepsilon = 1$), heterogeneity in endowments has no effect on either institutional quality or output of investment goods across countries (Proposition 7). Hence, any consequences of ex-ante heterogeneity found here in a world of open economies are due to its impact on specialization and trade.

The reason for institutional specialization in an open economy remains unchanged. However, the selection of countries having extractive institutions is no longer arbitrary. The criterion in Proposition 5 for $\lambda = 1$ to be chosen by a country's incumbents determines selection with heterogeneity.

Proposition 11 *Assuming $G(q)$ is a continuous function satisfying $\int_0^\infty q \, \mathrm{d}G(q) = 1$ and $G(1) < 1$:*

(i) *There is a threshold $\bar{q}$ such that those countries with $\lambda = 1$ in equilibrium all have low relative endowments $q \leq \bar{q}$, and those with $\lambda = 0$ all have high relative endowments $q \geq \bar{q}$.*

(ii) *There exists a unique equilibrium fraction $\bar{\gamma}$ of countries with $\lambda = 1$, which is the solution of the equation $\bar{\gamma} = G\left(\left((\alpha/(1-\alpha))(Q^*/\chi)^{1-\varepsilon}/(\xi^\varepsilon \bar{\gamma}) \right)^{1/\varepsilon} \right)$ and satisfies $0 < \bar{\gamma} < 1$.*

(iii) *The equilibrium $\bar{\gamma}$ lies between the equilibrium $\bar{\gamma}_0$ with homogeneous endowments ($Q = Q^*$) from Proposition 6 and the fraction $\gamma^* = G(1)$ of countries with endowments below the mean.*

PROOF See appendix A.11. ∎

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[24]In reality, cartels of high-endowment countries might try to lower this relative price. See section 4.7.

Economies with relatively small endowments attain the rule of law;[25] economies with large supplies of the endowment good are condemned to suffer extractive institutions.[26] As before, the global equilibrium features a mixture of regimes with extractive institutions and rule-of-law economies.

Figure 3 depicts the consumption of incumbents and the per-person within-country average (real GDP per person) for the cross-section of economies. Incumbents' consumption is strictly increasing in Q, especially so for despots because the gradient reflects the share incumbents receive, which is greater with extractive institutions (see Proposition 3). Consumption per person is also increasing in Q (see 18), controlling for institutions. However, there is a discrete step down at the threshold $\bar{Q}$ between the rule of law and extractive institutions. Crucially, at least some and possibly all economies with a large endowment are poorer than those with endowments low enough to have the rule of law. The model thus gives rise to a natural resource curse.

Figure 3: *Ex-ante heterogeneity between countries*
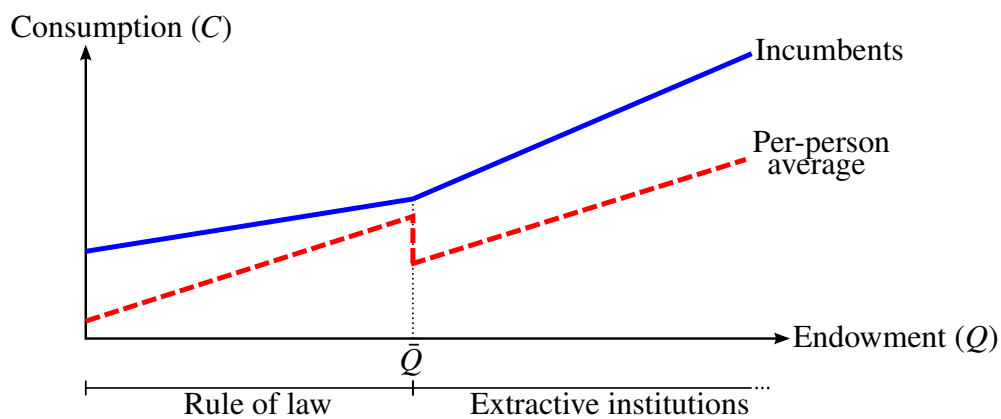
The equilibrium fraction of rule-of-law economies could be larger or smaller than in the case of ex-ante identical countries. However, the rule of law is more widespread when endowments are concentrated in a small group of countries.

4.7 A cartel of countries influencing world prices

The policy prescriptions in section 4.5 call for subsidies to raise the price of rule-of-law intensive goods in world markets. Implementing this requires some degree of cooperation between countries. Sadly, it is easier to think of examples of international cooperation intended to do the opposite. A cartel of countries with extractive institutions that exploits its market power to push up the price of natural resources effectively imposes a tariff on rule-of-law intensive goods.

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[25]The output from an investment opportunity is normalized to one unit of the investment good, so Q can also be interpreted as the size of the endowment relative to the potential production of the investment good in a country.

[26]Empirical studies have shown a link between the abundance of natural resources and extractive institutions. Identifying causality is not an easy task, but Tsui (2011) finds that oil discoveries have a negative effect on governance as measured by Polity scores.

The model is extended to include a positive measure of countries ς that act together as a cartel. To simplify the analysis, it is assumed the cartel acts collectively, abstracting from its internal dynamics, so it is essentially one large open economy with a government that maximizes the payoff of those in power. Different from before, its choice of exports affects world prices. Formally, the cartel is a Stackelberg leader playing against an auctioneer who sets the world relative price π^*, with all other countries being price takers in world markets. The cartel first chooses exports of the endowment good, then the auctioneer chooses π^* to ensure that world markets clear, given the demand functions of the small open economies.

Cartel members have a common endowment. Across the $1 - \varsigma$ non-members there is a continuous distribution of relative endowments $q = Q/Q^*$ with distribution function $G(q)$ as in section 4.6.

Proposition 12 *Assuming $\varepsilon = 1$, suppose a cartel $\varsigma > 0$ chooses equilibrium institutions with $\lambda = 0$:*
  (i) The cartel's choice of net exports is isomorphic to a tariff on imports of rule-of-law intensive goods, that is, domestic and international prices satisfy $\pi = (1 + \tau)\pi^*$ with $\tau > 0$ in the cartel.
  (ii) If the cartel were broken up and its former members instead acted as small open economies then the equilibrium fraction $\bar{\gamma}$ of countries with the rule of law would be higher.

PROOF   See appendix A.12.   ∎

The cartel's pricing strategy is standard: in order to exploit its market power, the cartel exports less of the endowment good at a higher price. This can be implemented by a tariff on imports of rule-of-law intensive goods. Trade theory points out that tariffs might be optimal for large countries because part of the tax is effectively paid by foreigners. But from the perspective of the world as a whole, tariffs create inefficiencies by inhibiting some mutually beneficial exchanges.

The analysis yields a novel implication: by reducing the relative price of the rule-of-law intensive good in world markets, the presence of the cartel raises incentives for extractive institutions elsewhere, which leads to a smaller fraction of countries with the rule of law in equilibrium. A cartel of countries with large endowments is therefore the exact opposite of the policy implication in Proposition 10 for fostering the rule of law.

5   Evidence from 19th-century winds

International trade was conducted mainly by sailing ships up to 1865, and mainly by steam-powered vessels from 1875 onward, with a transitional period between 1865 and 1875. Exploring this revolution in shipping, Pascali (2017) constructs time series for the predicted volume of trade in many countries based on the interaction between geography and the available shipping technology, with the direction of prevailing winds playing a key role in the era of sail.

Changes in predicted trade can be seen as shocks to trade openness that are exogenous to individual countries.[27] Importantly, the transition from sail to steam affected the trade costs of countries in very different ways because (i) shipping times depend on wind patterns when sailing vessels are used, but not when steam-powered vessels are used, and (ii) the Suez canal, opened in 1869, was more suitable for steam-powered ships than sailing ships. Consequently, the introduction of steam-powered shipping led to large and heterogeneous shocks to trade openness across countries.

A key implication of the theory proposed in this paper is that moving from autarky to free trade engenders institutional specialization. Proposition 9 generalizes the argument to show that increasing the degree of trade openness pushes countries' institutions further towards the extremes. This section attempts to test this prediction using the exogenous shock to trade openness from Pascali (2017).[28]

The quality of countries' institutions is gauged using the Executive Constraints index produced by the Polity IV Project, a score from 1 to 7.[29] This is considered to be one of the leading measures of the extent of investors' protection against expropriation, which is what institutional quality means in the theory.[30] The executive constraints index is also a suitable proxy for power sharing because constraints on those in power can only be imposed by other people who hold power.[31] Recall that protection of property rights and sharing power go hand-in-hand in the model.

Pascali's (2017) predicted-trade data are available at a 5-yearly frequency and Polity data annually. Political institutions, however, change slowly.[32] It therefore makes sense in testing the theory to disregard data for a reasonably long period around the shock to allow time for institutions to adjust. Furthermore, given the persistence in the data, replacing year-by-year observations of executive constraints scores with averages over longer periods more fairly represents the number of independent observations. Averaging also smooths out any short-lived changes in executive constraints.

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[27]It could be argued that the reduction in trade costs might also affect migration or even war in addition to its effects on openness to trade. However, these effects are likely to be small for most countries, and the direction of any possible bias this might create is unclear.

[28]The large expansion of Ricardian trade during the 19th century makes that era a good one to test the theoretical mechanism because the pattern of trade resembles the exchange of endowment/primary goods for investment/industrial goods emphasized in the model.

[29]The minimum score of 1 indicates "unlimited authority: no regular limitations on the executive's actions", a score of 3 indicates some real but limited restraints on the executive, a score of 5 indicates that the executive is subject to substantial constraints by accountability groups, and the maximum score of 7 indicates "executive parity or subordination". The distribution of scores is plotted in appendix B.1, with 1, 3, and 7 being the most common occurrences.

[30]According to Woodruff (2006), "The current measures of choice for broad institutions are the risk of expropriation developed by PRS, and the Polity IV measure of constraints on the executive."

[31]The Polity IV Dataset Users' Manual (Marshall, Gurr and Jaggers, 2016, p. 24) states that executive constraints "refer to the extent of institutionalized constraints on the decision making powers of chief executives, whether individuals or collectivities. Such limitations may be imposed by any accountability groups. In Western democracies these are usually legislatures. Other kinds of accountability groups are the ruling party in a one-party state; councils of nobles or powerful advisors in monarchies; the military in coup-prone polities; and in many states a strong, independent judiciary. The concern is therefore with the checks and balances between the various parts of the decision-making process."

[32]In the sample used here, the probability of a change in a country's executive constraints score from one year to the next is smaller than 4%. The low number of transitions in Polity IV data is consistent with strategic substitutability in the choice of institutions, but poses a challenge in empirical work.

The baseline specification averages the data over a pre-shock period 1841–1860 and a post-shock period 1881–1900 and discards observations in the intermediate transitional period. Pre- and post-shock periods of 15 or 25 years' length are also considered, as are shorter transitional periods. The sample comprises all countries in Pascali's (2017) data set for which executive constraints scores are available covering the whole period except for at most three years of missing data.[33] Note that the Polity IV Project only evaluates independent countries, so no colonies appear in the sample. A list of countries together with a full description of the data is found in appendix B.1.

Let P_{jB} and P_{jA} denote averages of the executive constraints scores of country j in the periods before and after the shock respectively. These provide measures of pre- and post-shock institutional quality. The log difference between post- and pre-shock predicted trade for country j is Z_j, which is a measure of the size of the trade shock. Fortunately for the empirical analysis, there is substantial heterogeneity in Z_j. In the baseline specification, Z_j varies from less than 0.6 in Chile, Ecuador, El Salvador, and Peru to more than 1.25 in Morocco, Portugal, and Russia.

The empirical specification regresses P_{jA} on P_{jB}, Z_j, and the interaction between P_{jB} and Z_j:

$$P_{jA} = \phi_0 + \phi_B P_{jB} + \phi_Z Z_j + \phi_{BZ} P_{jB} Z_j + \eta_j, \tag{30}$$

where η_j is an error term. Assuming some inertia in political institutions or some heterogeneity as in section 4.6, the specialization due to trade predicted by the model translates into a positive coefficient ϕ_{BZ} of the interaction term. The trade shock would boost institutional quality in countries with relatively good institutions initially but hold back progress in countries with a bad start.

The regression (30) is estimated by (i) simple OLS; (ii) a Tobit regression where the upper limit of 7 on P_{jA} is imposed;[34] and (iii) a Probit regression where the dependent variable is replaced by an indicator of 1 for an improved score ($P_{jA} > P_{jB}$) and 0 otherwise.[35] The estimation results for the baseline specification are shown in Table 1.

The coefficient of the interaction term is positive and statistically significant at the usual levels in all of the OLS, Tobit, and Probit regressions. The results for different lengths of the transitional and pre- and post-shock periods are reported in appendix B.2. There, in the OLS and Tobit regressions, the interaction coefficient is usually positive, but it is statistically significant only in some cases. In the Probit regressions, the coefficient is always positive and usually statistically significant.

Figure 4 shows the post-shock executive constraints score predicted by the OLS regression for countries respectively with pre-shock scores of 1 and 3.[36] It reveals a pattern of institutional specialization for countries exposed to larger trade shocks. Among countries that have a large trade shock, those with an initial score of 1 show little improvement, whereas those with a score of 3 typically

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[33]Specifications covering different time periods might therefore comprise slightly different countries.

[34]When the Tobit regression has a lower limit of 1 as well, statistical significance is typically lost because many countries have a score equal to 1 throughout the whole sample. But since there is a substantial improvement in the average executive constraints score during this period, a lower limit seems less important than an upper limit.

[35]Countries where the executive constraints score is at the maximum in the pre-shock period are excluded in (iii).

[36]Predictions using the Tobit regression results are very similar.

Table 1: *Baseline regression results*

Executive constraints (post-shock)	Pre: 1841–1860 Post: 1881–1900		
	OLS	Tobit	Probit
Constant	3.38	3.59	3.51
	(2.32) [0.15]	(2.61) [0.18]	(2.52) [0.16]
Executive constraints (pre-shock)	−0.43	−0.51	−2.21
	(0.69) [0.54]	(0.96) [0.60]	(1.00) [0.03]
Trade shock	−2.44	−3.37	−4.73
	(2.32) [0.30]	(2.61) [0.21]	(2.90) [0.10]
Executive constraints (pre-shock) × Trade shock	1.55	2.10	2.84
	(0.71) [0.04]	(1.04) [0.05]	(1.17) [0.02]
Countries	36	36	34

Notes: Standard errors are in parentheses and p-values are in brackets under the coefficients.

improve substantially. Things look very different for countries hit by small shocks: those with a initial score of 1 experience larger improvements, possibly owing to mean reversion.[37]

Figure 5 illustrates the polarizing effect of the trade shock on institutional quality. It plots weighted cumulative distribution functions of executive constraints scores for the pre-shock period 1841–1860 in and the post-shock period 1881–1900 for two sets of countries: a small-shock group and a large-shock group based on whether their trade shocks are below or above the mean trade shock. Countries' executive constraints scores are weighted by the absolute distance between their trade shocks and the mean trade shock. Roughly speaking, this weighting reflects how each data point would affect the estimated coefficient of the trade shock in a regression. In the figure, a degenerate distribution would appear as a vertical line, while complete polarization would appear as a horizontal line.

In the 1841–1860 period, the group of countries that will subsequently receive a large trade shock has a slightly better distribution of executive constraints scores than the group that will receive a small shock, but neither group appears to be more institutionally specialized than the other. However, by the 1881–1900 period, the distribution of executive constraints scores became noticeably more polarized for the large-shock group of countries than the small-shock group.[38]

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[37]These empirical findings and the model in this paper imply that the trade shock is predicted to boost GDP in countries with higher executive constraints scores, but reduce GDP for those with low scores. That is exactly what Pascali (2017) finds. This paper thus provides a rationale for his empirical results.

[38]Unfortunately, it is difficult to investigate any pre-trends in Polity IV scores prior to 1840 owing to the scarcity of

Figure 4: *Marginal effects of the trade shock for countries with different initial conditions*
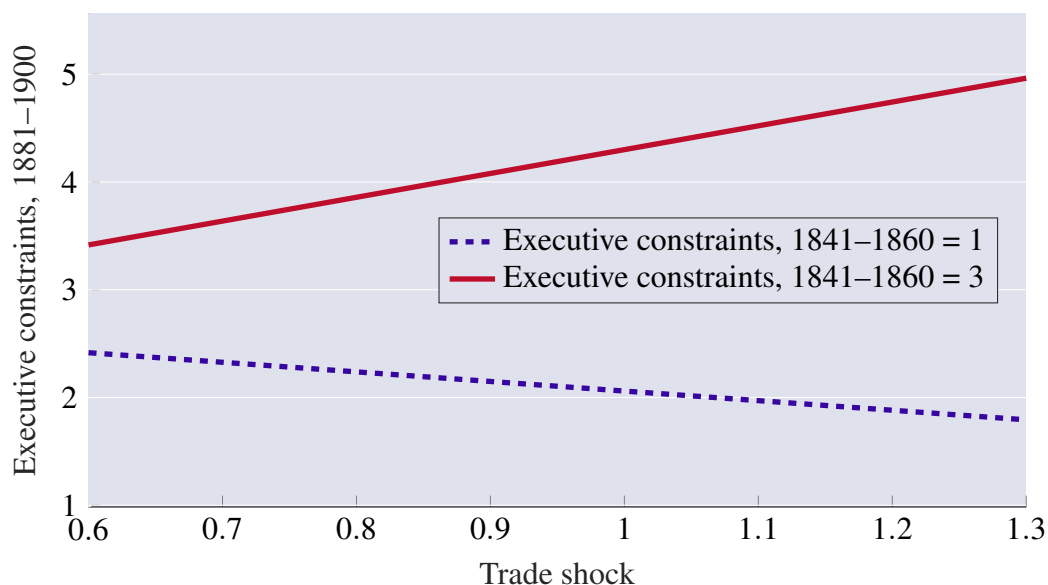
Notes: The graph shows predicted executive constraints scores according to the OLS estimation in Table 1.

While there is a strong case that the trade shock used here is exogenous, as in Pascali (2017) and other cross-country studies, it is not possible to rule out stories based on alternative shocks specific to a set of countries. For example, geographically close countries might be hit by similar shocks and move in the same direction for other reasons. Hence, the results should be treated with caution, providing suggestive but not conclusive evidence that the channels developed in the theoretical model might be playing an important role.

It is instructive to dig down into the experiences of particular countries. Very different countries on all continents remain with scores of 1 for the whole period: China, Haiti, Mexico, Morocco, Nicaragua, Oman, the Ottoman Empire, Persia, Russia, Siam, and Uruguay. Those transitioning from a score of 1 to intermediate scores are mostly Latin American countries in the small-shock group, with Austria-Hungary in the large-shock group as the main exception. Moreover, many countries remain with intermediate scores close to 3 for the whole period. Those that specialize in good institutions and attain high scores are mostly European countries in the large-shock group, with Costa Rica, Japan, and Chile (to an extent) as exceptions.

Russia, a relatively prosperous country in the 18th century that lost ground with the first wave of globalization, is a particularly interesting case in the large-shock group.[39] During the 18th and early 19th centuries, Russia was a powerful European country that went through modernizing reforms both

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data covering the early 19th century.

[39]Nafziger (2008) claims that "understanding what inhibited Russian economic development in the nineteenth century is an important task for economic historians."

Figure 5: *Weighted cumulative distribution functions of executive constraints*
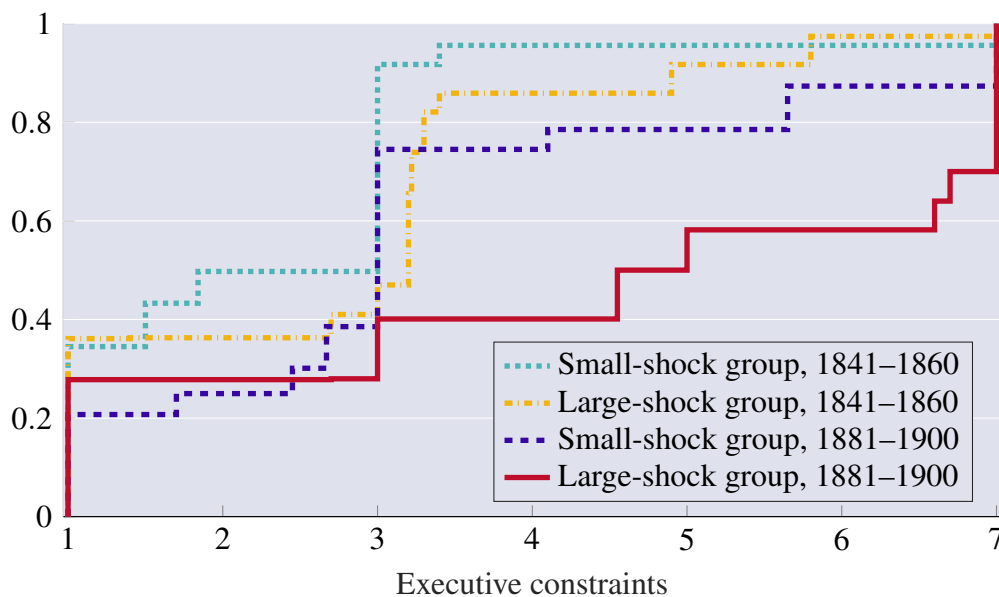
Notes: The figure depicts the weighted CDFs of executive constraints for two groups of countries in the pre-shock and post-shock sub-periods. Executive constraints are weighted by the absolute distance between a country's trade shock and the mean trade shock. The small-shock and large-shock groups of countries comprise those with trade shocks below and above the mean, respectively. Trade shocks and weights are reported in appendix B.1.
Sources: Predicted trade data from Pascali (2017); Executive Constraints data from the Polity IV Project, Center for Systemic Peace (http://www.systemicpeace.org/inscrdata.html).

in the reign of Peter the Great and in the age of the Russian Enlightenment.[40] However, in the 19th century, Russian rulers chose to remain with despotic institutions, and by the end of the century, Russia was one of the poorest countries in Europe (Nafziger, 2008). In contrast to the expansion of power sharing in other European countries at the time, Russia went through the whole 19th century without any kind of elected parliament and the lowest possible score for executive constraints.[41]

6   Concluding remarks

For social scientists grappling with the welter of autocratic regimes around the world, one particular fact is noteworthy: the stubborn resistance to adopting the rule of law despite its proven success elsewhere. Notwithstanding the unprecedented flow of goods and ideas that would allow emulation of faraway countries, there is a large dispersion in political institutions worldwide. North and South

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[40]The expansion of the Russian empire was a sign of its power and development at the time. In the early 19th century, the Russians colonized Alaska and even founded settlements in California. Among other notable Russian sea exploration voyages, in 1820, a Russian expedition discovered the continent of Antarctica.

[41]Nicholas I ruled between 1825 and 1855, the time when Russian exports were becoming more expensive. He resisted any kind of power sharing and concentrated his existing powers even more, crushing demonstrations demanding power sharing and abolishing several areas of local autonomy (Bessarabia, Poland, and the Jewish Qahal).

Korea offer perhaps the most prominent example of ex-ante similar countries with entirely different institutions.

An important policy question is what can be done to bring about positive political change. The literature in political science has focused on country-specific factors that are seen as barriers to progress such as culture and history. This paper highlights the importance of thinking about the problem in general equilibrium at the world level.

The adoption of the rule of law increases output of goods that require strong protection of property rights and thus reduces their relative price. This increases incentives for those in power in other countries to choose autocracy. Whether or not this results in institutional specialization depends on the nature of the cost function faced by rulers when choosing institutional quality. This paper argues that the first steps to the rule of law have the greatest cost for rulers. The crucial cost associated with better institutions is the need to share power and rents. In places where power is shared more widely, each power base or branch of government buttressing the institutions is individually less important and thus receives lower rents. Hence the marginal cost associated with sharing power and strengthening institutions is smaller where institutional quality is already high.

This paper thus offers a theory of institutional specialization that implies globalization has fostered institutional development in many countries, but at the same time and for the same reason, has held down the Venezuelas and Nigerias of the world. The importance of this point cannot be exaggerated.

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A Derivations of the theoretical results

A.1 Proof of Proposition 1

The first-order conditions for maximizing C_p subject to (9) and (12) equate marginal rates of substitution between investment and endowment goods across all individuals. Given preferences in (4), this means all individuals i should have the same ratio $C_I(i)/C_E(i)$ of consumption of the two goods. These are the same conditions for Pareto efficiency in respect of the allocation of consumption goods.

Market economy

Consider a market economy with free exchange of goods domestically at relative price π and incomes subject to taxes and transfers. Workers have incomes $Y_w = Q - T_Q$ in units of the endowment good after a tax T_Q is levied on their endowment Q. Investors have incomes $Y_k = (Q - T_Q) + (\pi - T_k)$, where T_k is a tax on producing capital. Incumbents have incomes $Y_p = (Q - T_Q) + V$, where V is a transfer representing the private benefit of being in power.

The market economy has international trade conducted by competitive import-export firms that choose X_E and X_I to maximize their profits subject to the trade budget constraint (2). There can be a proportional tariff τ (if positive, or subsidy, if negative) on imports of the investment good ($X_I < 0$), which raises revenue $-\tau \pi^* X_I$. The profits of a representative import-export firm are $-X_E - \pi X_I + \tau \pi^* X_I$, which is $((1 + \tau)\pi^* - \pi)X_I$ after imposing (2). There is no competitive equilibrium unless

$$\pi = (1 + \tau)\pi^*, \tag{A.1}$$

as otherwise profits would be unbounded. The tariff drives a wedge between the domestic market-clearing price π and the price π^* in world markets.[42]

The definition of GDP Y in units of endowment goods, and the fiscal budget constraint are

$$Y = Q + \pi K + (\pi^* - \pi)X_\mathrm{I}, \quad \text{and} \quad pV = T_Q + T_K K - \tau \pi^* X_I, \tag{A.2}$$

where the final term in GDP accounts for some production X_I being exported and sold at world price π^* rather than domestic price π. Using post-tax-and-transfer incomes Y_w, Y_k, and Y_p, the domestic-foreign price relationship (A.1), and firm and government budget constraints in (2) and (A.2):

$$pY_p + KY_k + (1 - p - K)Y_w = (Q - X_E) + \pi(K - X_I) = Y, \tag{A.3}$$

which says that GDP Y is also the sum of incomes (noting firms' profits are zero) and the sum of the value of domestic sales of the two goods $Q - X_E$ and $K - X_I$ (the trade balance is zero).

With individual incomes $Y(i)$, each person maximizes $C(i)$ from (4) subject to a budget constraint $C_E(i) + \pi C_I(i) = Y(i)$. Combining the first-order conditions $C_I(i)/C_E(i) = \alpha \pi^{-\varepsilon}/(1 - \alpha)$ with the budget constraints implies the demand functions in (15). Marginal rates of substitution, and hence

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[42]Since π and π^* are relative prices in terms of the endowment good, the effects of a tariff on the endowment good are equivalent here to subsidizing the investment good, and vice versa.

the ratios $C_I(i)/C_E(i)$, are aligned across all individuals i because everyone faces the same relative price. The resource constraints (9) are also the market-clearing conditions for endowment and investment goods. Using the demand functions (15) and the expressions for GDP in (A.3), the two market-clearing conditions are equivalent to $(1 - \alpha + \alpha \pi^{1-\varepsilon})(Q - X_E) = (1 - \alpha)((Q - X_E) + \pi(K - X_I))$ and $(1 - \alpha + \alpha \pi^{1-\varepsilon})(K - X_I) = \alpha \pi^{-\varepsilon}((Q - X_E) + \pi(K - X_I))$. Both equations hold at the relative price π given in (16), confirming this is the market clearing price.

Hence, the consumption allocation for the equilibrium institutions with $C_w = C/F(p)$ and $C_k = (1 + \theta)C/F(p)$ and equal marginal rates of substitution can be implemented by a market economy with taxes $T_Q = Q - (1 - \alpha + \alpha \pi^{1-\varepsilon})^{1/(1-\varepsilon)}C/F(p)$ and $T_k = \pi - \theta(1 - \alpha + \alpha \pi^{1-\varepsilon})^{1/(1-\varepsilon)}C/F(p)$. These formulas follow from the binding constraints (12), the definitions of Y_w and Y_k, and the utility-maximizing value of the consumption basket $C(i)$ from (15). In a market economy, (15) and (A.3) imply the consumption baskets C_p, C_k, and C_w satisfy

$$pC_p + KC_k + (1 - p - K)C_w = \frac{Y}{(1 - \alpha + \alpha \pi^{1-\varepsilon})^{\frac{1}{1-\varepsilon}}} = \frac{(Q - X_E) + \pi(K - X_I)}{(1 - \alpha + \alpha \pi^{1-\varepsilon})^{\frac{1}{1-\varepsilon}}}, \tag{A.4}$$

where the left- and right-hand sides are aggregate consumption and the economy's real GDP.

Free trade

Given a tariff τ, the net exports of profit-maximizing firms are finite only if (A.1) holds, which in equilibrium means X_E and X_I adjust until the domestic market-clearing price π in (16) satisfies (A.1). Combining equations (2), (16), and (A.1) gives the implied levels of net exports

$$X_E = \frac{\alpha \pi^{*1-\varepsilon}Q - (1 - \alpha)(1 + \tau)^\varepsilon \pi^* K}{(1 - \alpha)(1 + \tau)^\varepsilon + \alpha \pi^{*1-\varepsilon}}, \quad \text{and } X_I = \frac{(1 - \alpha)(1 + \tau)^\varepsilon K - \alpha \pi^{*-\varepsilon}Q}{(1 - \alpha)(1 + \tau)^\varepsilon + \alpha \pi^{*1-\varepsilon}}. \tag{A.5}$$

Varying τ over its maximum range $-1 < \tau < \infty$ is equivalent to X_E moving between Q and $-\pi^* K$, and X_I moving between $-Q/\pi^*$ and K, which are the full ranges of values of net exports consistent with the budget and resource constraints (2) and (9) for non-negative levels of consumption.

Substituting the price relationship (A.1) and net exports (A.5) into GDP (A.3) demonstrates that real GDP $Y/(1 - \alpha + \alpha \pi^{1-\varepsilon})^{1/(1-\varepsilon)}$ is $D(\tau)(Q + \pi^* K)/(1 - \alpha + \alpha \pi^{*1-\varepsilon})^{1/(1-\varepsilon)}$, where $D(\tau)$ is the impact of the tariff τ on real GDP $(Q + \pi^* K)/(1 - \alpha + \alpha \pi^{*1-\varepsilon})^{1/(1-\varepsilon)}$ at world prices:

$$D(\tau) = \frac{\left(1 - \alpha + \alpha(1 + \tau)^{1-\varepsilon}\pi^{*1-\varepsilon}\right)^{\frac{\varepsilon}{\varepsilon-1}}}{\left(1 - \alpha + \alpha(1 + \tau)^{-\varepsilon}\pi^{*1-\varepsilon}\right)\left(1 - \alpha + \alpha \pi^{*1-\varepsilon}\right)^{\frac{1}{\varepsilon-1}}}. \tag{A.6}$$

The function $D(\tau)$ is strictly positive, satisfies $D(0) = 1$, and has derivative

$$D'(\tau) = -\frac{\alpha(1 - \alpha)\pi^{*1-\varepsilon}D(\tau)(1 + \tau)^{-\varepsilon-1}\tau}{\left(1 - \alpha + \alpha(1 + \tau)^{-\varepsilon}\pi^{*1-\varepsilon}\right)\left(1 - \alpha + \alpha(1 + \tau)^{1-\varepsilon}\pi^{*1-\varepsilon}\right)}.$$

This shows the first-order condition $D'(\tau) = 0$ holds only for $\tau = 0$, and also that $D''(0) < 0$, demonstrating that $D(\tau)$ is a strictly quasi-concave function maximized at $D(0) = 1$ by $\tau = 0$.

Since equilibrium institutions have consumption payoffs where $pC_p + KC_k + (1-p-K)C_w$ equals real GDP from (A.4), net exports X_E and X_I must maximize real GDP subject to the budget constraint (2). This requires the domestic market-clearing price is $\pi = \pi^*$ (noting the partial effect of π on real GDP is zero at the market-clearing price 16), and hence the tariff τ in (A.1) is zero. Equivalently, τ maximizes $D(\tau)$, the impact of trade on real GDP, which requires $\tau = 0$. International trade under the equilibrium institutions thus can be implemented in a market economy with no tariffs or subsidies driving a wedge between domestic and foreign prices. Given constraints (2) and (9), Pareto efficiency in respect of international trade requires the common marginal rate of substitution across individuals is equated to π^*, which is the same as $\pi = \pi^*$ because marginal rates of substitution are equal to π in a market economy.

With $K = \lambda\chi$ from (12), the economy's level of real GDP C under the equilibrium institutions follows from (A.4) with $\pi = \pi^*$ and using (2), or by noting $D(0) = 1$ at $\tau = 0$.

A.2   Proof of Proposition 2

The partial derivative of the incumbent payoff (19) with respect to power sharing p is given in the main text and the first-order condition is equivalent to equation (21) following the steps there.

(i)   Since $a(p) > 1$ and $m(p) > 0$ under Assumption 1, it follows immediately for each p that (21) implies a value of s between 0 and 1.

(ii)   The second partial derivative of the incumbent payoff (19) with respect to p is

$$\frac{\partial^2 C_p}{\partial p^2} = -\frac{CF'(p)}{pF(p)^2}\left(2 + 2(1-p+\chi\theta\lambda)\frac{F'(p)}{F(p)} - (1-p+\chi\theta\lambda)\frac{F''(p)}{F'(p)}\right) - \frac{2}{p}\frac{\partial C_p}{\partial p}.$$

Evaluating the second derivative at a level of power sharing p where the first partial derivative is zero ($\partial C_p/\partial p = 0$) and writing it in terms of $m(p) = F'(p)$ and $a(p) = F(p)/p$:

$$\left.\frac{\partial^2 C_p}{\partial p^2}\right|_{\frac{\partial C_p}{\partial p}=0} = -\frac{m(p)C}{p^3 a(p)^2}\left(2 + 2(1-p+\chi\theta\lambda)\frac{m(p)}{pa(p)} - (1-p+\chi\theta\lambda)\frac{m'(p)}{m(p)}\right). \tag{A.7}$$

With $m'(p) \leq 0$ under Assumption 2, the above is necessarily negative because C, $m(p)$, $a(p)$, and $1-p+\chi\theta\lambda$ are all positive. Hence, the second derivative (A.7) is strictly negative whenever the first derivative is zero. This implies C_p in (19) is a strictly quasi-concave function of p, which means the first-order condition (21) is necessary and sufficient for an interior value of p that maximizes C_p.

(iii)   Differentiating the incumbent income share s from (21) with respect to power sharing p:

$$\frac{\partial s}{\partial p} = \frac{(a(p)-1)}{(a(p)+m(p))^2}m'(p) - \frac{(1+m(p))}{(a(p)+m(p))^2}a'(p). \tag{A.8}$$

With $a(p) - 1 > 0$ given Assumption 1, the lower bound on $m'(p)$ in Assumption 3 implies

$$\frac{\partial s}{\partial p} \geq \frac{(1+m(p))}{(a(p)+m(p))^2}\left(-a'(p) - \frac{(a(p)-m(p))^2}{2pa(p)}\right) = \frac{(1+m(p))(-a'(p))}{2a(p)(a(p)+m(p))},$$

where the second expression follows by noting $(a(p)-m(p))/p = -a'(p)$ and simplifying. Since $a'(p) < 0$ under Assumption 3, the right-hand side is positive, so the s given by (21) rises with p.

A.3 Proof of Proposition 3

(i) The partial derivative of the incumbent payoff (19) with respect to power sharing is $\partial C_p/\partial p = ((1-s)F'(p)C_w - (C_p - C_w))/p$. Using the political constraint $C_w = C/F(p)$ from (12) and the definitions $s = pC_p/C$, $a(p) = F(p)/p$, and $m(p) = F'(p)$, this derivative can be written as

$$\frac{\partial C_p}{\partial p} = \frac{(a(p)+m(p))C}{pa(p)}\left(\frac{1+m(p)}{a(p)+m(p)}-s\right),$$

Comparison with the first-order condition (21) shows that C_p is increasing in p subject to the constraint (22) if the (p,s) satisfying (22) lies below the first-order condition (21) in Figure 1.

Given Assumption 1, at $p = 0$, the first-order condition (21) yields a value of s satisfying $s \geq 0$. Under Assumption 4, the constraint (22) implies $s = 1 - (1+\chi\theta\lambda)/F(0)$, thus $s < 1 - (1+\chi\theta\lambda) = -\chi\theta\lambda \leq 0$ for any $\lambda \in [0,1]$ because $F(0) < 1$. Geometrically, this means the first-order condition is initially above the combined constraint in Figure 1 at $p = 0$, and as C_p is increasing in p in this region, there cannot be a corner equilibrium at $p = 0$.

To rule out a corner equilibrium with $p = 1 - \chi$ for all $\lambda \in [0,1]$ (if $p = 1 - \chi$ and $\lambda = 1$, the number of workers is zero), it suffices that the first-order condition (21) lies below the constraint (22) at $p = 1 - \chi$ for all $\lambda \in [0,1]$. This would imply C_p is decreasing in p in a neighbourhood of $p = 1 - \chi$, so there cannot be an equilibrium at $p = 1 - \chi$. Since the value of s implied by (22) is decreasing in λ, it is sufficient to confirm the first-order condition is below the constraint at this point when $\lambda = 1$. At $p = 1 - \chi$ and $\lambda = 1$, (22) implies $1 - s = (\chi/(1-\chi))((1+\theta)/a(1-\chi))$ using $a(p) = F(p)/p$, and (21) yields $1 - s = (a(1-\chi)-1)/(a(1-\chi)+m(1-\chi))$. Hence, the first-order condition (21) is below the constraint (22) if $(\chi/(1-\chi))((1+\theta)/a(1-\chi)) < (a(1-\chi)-1)/(a(1-\chi)+m(1-\chi))$, which holds because it is a rearrangement of the second condition stated in Assumption 4. That condition is satisfied for sufficiently small χ because the left-hand side approaches zero as χ does, while the right-hand side approaches a positive number given Assumption 1.

Hence, under Assumption 1 and Assumption 4, for any $\lambda \in [0,1]$, the value of p that maximizes C_p is an interior equilibrium with $0 < p < 1 - \chi$. The first-order condition (21) is necessary for an interior maximum, so the equilibrium conditional on λ is found at an intersection point of (21) and (22) in Figure 1. The partial derivative of the constraint $s = 1 - (1 - p + \chi\theta\lambda)/F(p)$ in (22) is

$$\left.\frac{\partial s}{\partial p}\right|_{\text{Constraint}} = \frac{1}{F(p)} + \frac{(1-p+\chi\theta\lambda)F'(p)}{F(p)^2} = \frac{1+(1-s)m(p)}{pa(p)}, \tag{A.9}$$

where the second expression substitutes back the constraint itself and uses the definitions of $a(p)$ and $m(p)$. This derivative is positive given Assumption 1, so (22) is upward sloping in Figure 1.

At a point of intersection, (21) implies $1 - s = (a(p)-1)/(a(p)+m(p))$, so $1 + (1-s)m(p) = a(p)(1+m(p))/(a(p)+m(p)) = sa(p)$ and hence the constraint gradient (A.9) is $\partial s/\partial p|_{\text{Constraint}} =$

$s/p = \psi$. In the diagram, the tangent to the constraint at the equilibrium point is the ray through the origin with gradient equal to the incumbent income multiple ψ. Equation (A.8) gives the derivative of the first-order condition $s = (1+m(p))/(a(p)+m(p))$ in (21), which can be stated as follows using the formula for s in the first-order condition itself:

$$\left.\frac{\partial s}{\partial p}\right|_{\text{FOC}} = \frac{(1-s)m'(p) - sa'(p)}{a(p)+m(p)}. \tag{A.10}$$

The second derivative of the incumbent payoff $\partial^2 C_p / \partial p^2$ at a point where the first-order condition (21) holds (and so $\partial C_p / \partial p = 0$) is given in (A.7). At a point of intersection with the constraint (22), and hence where $1 - p + \chi\theta\lambda = (1-p)pa(p)$, this second derivative is

$$\left.\frac{\partial^2 C_p}{\partial p^2}\right|_{\frac{\partial C_p}{\partial p}=0} = -\frac{C}{p^2 a(p)}\left(2m(p)\left(\frac{1+(1-s)m(p)}{pa(p)}\right) - (1-s)m'(p)\right)$$

$$= -\frac{C}{p^2 a(p)}\left((a(p)+m(p))\left.\frac{\partial s}{\partial p}\right|_{\text{Constraint}} + (m(p)-a(p))\frac{s}{p} - (1-s)m'(p)\right),$$

where the second equality uses (A.9) and $\partial s / \partial p|_{\text{Constraint}} = s/p$ at a point of intersection. Noting that $a'(p) = (m(p) - a(p))/p$ and substituting (A.10) into the equation above:

$$\left.\frac{\partial^2 C_p}{\partial p^2}\right|_{\frac{\partial C_p}{\partial p}=0} = -\frac{(a(p)+m(p))C}{p^2 a(p)}\left(\left.\frac{\partial s}{\partial p}\right|_{\text{Constraint}} - \left.\frac{\partial s}{\partial p}\right|_{\text{FOC}}\right).$$

Proposition 2 shows that Assumption 2 suffices for C_p to be a quasi-concave function of p, hence this second derivative is negative at a point where the first-order condition (21) is satisfied. The coefficient of the term in parentheses above is negative, so quasi-concavity implies that $\partial s / \partial p|_{\text{FOC}} < \partial s / \partial p|_{\text{Constraint}}$ at any point of intersection between (21) and (22), that is, the first-order condition always cuts the constraint from above in Figure 1. Therefore, it follows that any point of intersection between the two is unique.

(ii)   Conditional on λ, equilibrium power sharing p is found by eliminating s from (21) and (22) and solving the equation $(1+m(p))/(a(p)+m(p)) = 1 - (1 - p + \chi\theta\lambda)/F(p)$, assuming there is a unique solution (Assumption 2 suffices). Differentiation gives the effect of higher λ on p:

$$\frac{dp}{d\lambda} = \frac{\chi\theta}{F(p)}\left(\left.\frac{\partial s}{\partial p}\right|_{\text{Constraint}} - \left.\frac{\partial s}{\partial p}\right|_{\text{FOC}}\right)^{-1} > 0,$$

using $\partial s / \partial\lambda = -\chi\theta/F(p)$ from (22) and that $\partial s / \partial p$ is larger along the constraint than along the first-order condition. This confirms that p increases with λ. Using (22), the incumbent income multiple $\psi = s/p$ is $\psi = (1 - (1 - p + \chi\theta\lambda)/F(p))/p$, and comparison to (19) shows that $C_p = \psi C$. The first-order condition (21) for maximizing C_p with respect to p given λ is therefore also the first-order condition for maximizing ψ. Since $\partial\psi/\partial\lambda = -\chi\theta/(pF(p)) < 0$ holding p constant, the envelope theorem implies $d\psi/d\lambda < 0$, so ψ falls as λ increases. Finally, as λ does not appear in the first-order condition (21), but p is known to increase with λ, it follows that the direction of the effect of λ on s has the same sign as $\partial s / \partial p|_{\text{FOC}}$.

A.4 Proof of Proposition 4

Equation (25) is obtained from the derivative $C'_p(\lambda) = \psi(\lambda)C'(\lambda) + \psi'(\lambda)C(\lambda)$ of (23), using the envelope condition (24) to deduce $\psi'(\lambda)/\psi(\lambda) = -\chi\theta/(s(\lambda)F(p(\lambda)))$ by noting $s(\lambda) = p(\lambda)\psi(\lambda)$ and $1/F(p(\lambda)) = C_w(\lambda)/C(\lambda)$ from (12). Since $\chi\theta C_w(\lambda)/s(\lambda)$ is subtracted from $C'(\lambda)$ in (25), the term $\chi\theta C_w(\lambda)/s(\lambda)$ is the private marginal cost of institutional quality that incumbents compare to the marginal benefit $C'(\lambda)$ when choosing λ.

(i)   Proposition 2 shows that $0 < s < 1$ for any p under Assumption 1, and consequently $1/s(\lambda) > 1$ for any $\lambda \in [0,1]$, hence $\chi\theta C_w(\lambda)/s(\lambda) > \chi\theta C_w(\lambda)$.

(ii)   Proposition 1 shows that equilibrium institutions equate marginal rates of substitution between goods across all individuals, and the resulting combined resource constraint is (18). Suppose institutions feature $\lambda < 1$ with $C'(\lambda) > \chi\theta C_w(\lambda)$, and consider a small feasible increase in λ. The incentive constraint (7) initially binds given (12), and continue to assume consumption is allocated so that $C_k = (1+\theta)C_w$ and marginal rates of substitution are aligned. With the utility function (6), this means the additional and existing individuals undertaking investment opportunities are not worse off as long as C_w does not decline. As the incentive constraint (7) continues to hold, (3) implies $K = \chi\lambda$.

Substituting $C_k = (1+\theta)C_w$ into the resource constraint (18) (which assumes $K = \chi\lambda$) demonstrates that the consumption payoffs C_p and C_w are limited by $pC_p + (1 - p + \chi\theta\lambda)C_w = C$. Fixing p and differentiating with respect to λ:

$$p\frac{dC_p}{d\lambda} + (1 - p + \chi\theta\lambda)\frac{dC_w}{d\lambda} = \frac{dC}{d\lambda} - \chi\theta C_w,$$

where the right-hand side is positive if $C'(\lambda) > \chi\theta C_w(\lambda)$. It follows that either C_p or C_w (or both) can be raised without lowering the other, so a Pareto improvement is possible when λ increases. The social marginal cost of more investment is $\chi\theta C_w(\lambda)$, which is compared to $C'(\lambda)$ to judge efficiency.

(iii)   The function $\mu(\lambda) = (\chi\theta C_w(\lambda)/s(\lambda))/C_p(\lambda)$ is incumbents' private marginal cost of λ as a fraction of $C_p(\lambda)$. Using (25), the expression for $C'_p(\lambda)$ in (26) follows immediately. The definition $s = pC_p/C$ and $C_w = C/F(p)$ from (12) imply $\mu(\lambda) = \chi\theta C(\lambda)/(s(\lambda)F(p(\lambda))s(\lambda)C(\lambda)/p(\lambda))$, which simplifies to $\mu(\lambda) = \chi\theta/(a(p(\lambda))s(\lambda)^2)$ using $a(p) = F(p)/p$, confirming equation (26).

(iv)   The derivative of $\mu(\lambda)$ from (26) is

$$\mu'(\lambda) = -\frac{\chi\theta s(\lambda)p'(\lambda)}{(a(p(\lambda))s(\lambda)^2)^2}\left(s(\lambda)a'(p(\lambda)) + 2a(p(\lambda))\frac{\partial s}{\partial p}\Big|_{\text{FOC}}\right),$$

which uses $s'(\lambda) = \partial s/\partial p|_{\text{FOC}}p'(\lambda)$ because $s(\lambda)$ must satisfy the first-order condition (21). Substituting from (21) and (A.8) and simplifying (dropping the explicit dependence of p and s on λ):

$$\mu'(\lambda) = -\frac{\chi\theta s p'(\lambda)((1+m(p))((a(p)+m(p)) - 2a(p))a'(p) + 2a(p)(a(p) - 1)m'(p))}{((a(p)+m(p))a(p)s^2)^2}.$$

By using $a'(p) = (m(p) - a(p))/p$, the derivative can be written as:

$$\mu'(\lambda) = -\frac{\chi\theta s p'(\lambda)\left((1+m(p))(a(p)-m(p))^2 + 2pa(p)(a(p)-1)m'(p)\right)}{((a(p)+m(p))a(p)s^2)^2 p}.$$

The first term in the parentheses is strictly positive given the first condition $a'(p) < 0$ in Assumption 3. Since $a(p) - 1 > 0$ under Assumption 1, the second condition in Assumption 3 implies $2pa(p)(a(p)-1)m'(p) > -(1+m(p))(a(p)-m(p))^2$, and hence the whole term in parentheses is positive. Together with $p'(\lambda) > 0$ from Proposition 3, this demonstrates that $\mu'(\lambda) < 0$.

A.5   Proof of Proposition 5

(i)   With π^* taken as given by a small open economy, it follows from the expression for real GDP in (18) that $C(\lambda)$ is linear in λ, and thus $C''(\lambda) = 0$. Using (27), the second derivative of $C_p(\lambda)$ evaluated at a critical point is therefore $-\psi(\lambda)\mu'(\lambda)C_p(\lambda)$, which is strictly positive under the assumption $\mu'(\lambda) < 0$. Therefore, $C_p(\lambda)$ is a strictly quasi-convex function of λ.

(ii)   Given that the incumbent payoff is strictly quasi-convex in $\lambda \in [0,1]$, the maximum value of $C_p(\lambda)$ is found either at $\lambda = 0$ or $\lambda = 1$. The differences between p and ψ at these two values of λ follow immediately from Proposition 3.

(iii)   Using (18) and (23), $C_p(\lambda) = \psi(\lambda)(Q + \pi^*\chi\lambda)/(1 - \alpha + \alpha\pi^{*1-\varepsilon})^{1/(1-\varepsilon)}$ is the payoff received by those in power. The equilibrium λ maximizing $C_p(\lambda)$ is $\lambda = 1$ rather than $\lambda = 0$ if $\psi(1)(Q + \pi^*\chi) \geq \psi(0)Q$ given that the denominator of the payoff is independent of λ. This is equivalent to $\pi^*\chi \geq ((\psi(0) - \psi(1))/\psi(1))Q$ and hence to the condition stated using the definitions $\psi^\dagger = \psi(0)$ and $\tilde{\psi} = \psi(1)$.

A.6   Proof of Proposition 6

(i)   The equilibrium world price is (28), and endowments are equal across countries, so $Q = Q^*$. Given a fraction γ of countries where $\lambda = 1$, the world supply of investment goods is $K^* = \chi\gamma$, which implies $\bar{\pi}^* = (\alpha Q/((1-\alpha)\chi\gamma))^{1/\varepsilon}$. Proposition 5 shows that the condition for $\lambda = 1$ to be optimal for those in power is $\pi^*\chi \geq \xi Q$, which is therefore equivalent to $(\alpha Q/((1-\alpha)\chi\gamma)) \geq (Q/\chi)^\varepsilon\xi^\varepsilon$. Rearranging to have γ on one side and all remaining terms on the other confirms the upper bound on γ given in the proposition.

(ii)   Let the threshold for γ from (i) where $\lambda = 1$ is an equilibrium in a given country be denoted by $\bar{\gamma} = (\alpha/(1-\alpha))(Q/\chi)^{1-\varepsilon}(1/\xi^\varepsilon)$. The value of λ (either 0 or 1 according to Proposition 5) in each country must be an equilibrium given the world price π^*, and world markets must clear given the fraction γ of countries with $\lambda = 1$. Since $\bar{\gamma}$ is strictly positive for all parameters and prices,

there cannot be an equilibrium with $\gamma = 0$ because this would imply incumbents everywhere want to choose $\lambda = 1$, resulting in $\gamma = 1$.

By using (25), (26), and $C_p(\lambda) = \psi(\lambda)C(\lambda)$, the marginal cost of institutional quality $\mu(\lambda)$ satisfies the differential equation $\mu(\lambda) = -\psi'(\lambda)/\psi(\lambda)^2$ in terms of the incumbent income multiple $\psi(\lambda)$. This differential equation is equivalent to $\mu(\lambda) = \mathrm{d}(1/\psi(\lambda))/\mathrm{d}\lambda$, hence $\psi(1)^{-1} - \psi(0)^{-1} = \int_0^1 \mu(\lambda)\mathrm{d}\lambda$. With assumptions guaranteeing $\mu'(\lambda) < 0$, it follows that $\int_0^1 \mu(\lambda)\mathrm{d}\lambda > \mu(1)$ and $\psi(1)^{-1} - \psi(0)^{-1} > \mu(1)$. Multiplying both sides by $\psi(1)$ implies $\mu(1)\psi(1) < 1 - (\psi(1)/\psi(0))$. To have Assumption 5 hold, it is therefore necessary that $\alpha \leq \bar{\alpha}$ for some $0 < \bar{\alpha} < 1$ because $\min\{\mu(1)\psi(1), 1\} < 1$ when the marginal cost of institutional quality is decreasing. Using $\mu(1)\psi(1) < 1 - (\psi(1)/\psi(0))$, it follows that $(1/\min\{\mu(1)\psi(1), 1\}) - 1 > \psi(1)/(\psi(0) - \psi(1))$. With reference to the definitions $\psi^\dagger = \psi(0)$, $\tilde{\psi} = \psi(1)$, and $\xi = (\psi^\dagger - \tilde{\psi})/\tilde{\psi}$ from Proposition 5, this means $(1/\min\{\mu(1)\psi(1), 1\}) - 1 > 1/\xi$. Combining this result with Assumption 5, it follows that $(\alpha/(1-\alpha))(Q/\chi)^{1-\varepsilon}(1/\xi^\varepsilon) < 1$ and hence $0 < \bar{\gamma} < 1$.

Since $\bar{\gamma} < 1$, if there were an equilibrium with $\gamma = 1$ then this would mean $\gamma > \bar{\gamma}$, and incumbents in all countries would have an incentive to choose $\lambda = 0$, resulting in $\gamma = 0$, and thus ruling out $\gamma = 1$ as an equilibrium. Finally, consider an equilibrium with $0 < \gamma < 1$, which requires that incumbents in some countries choose $\lambda = 0$ and others choose $\lambda = 1$. Since incumbents in all ex-ante identical countries share the same optimality condition for $\lambda = 1$, the condition from (i) must hold with equality, and thus $\gamma = \bar{\gamma}$. With $0 < \bar{\gamma} < 1$ as shown above, the existence of this equilibrium is confirmed. The equilibrium world price $\bar{\pi}^*$ follows by using (28) with $Q^* = Q$ and substituting the expression for $\bar{\gamma}$ into $K^* = \bar{\gamma}\chi$.

(iii)   Since the condition for $\lambda = 1$ to be chosen by incumbents holds with equality, incumbents must receive identical payoffs $C_p^\dagger = C_p(0) = C_p(1) = \tilde{C}_p$ in equilibrium. Using the binding political constraint (12), the payoff of a worker is $C_w(\lambda) = C(\lambda)/F(p(\lambda))$. Combined with (23), this implies $C_w(\lambda) = C_p(\lambda)/(\psi(\lambda)F(p(\lambda)))$ in terms of the incumbent income multiple $\psi(\lambda)$, and $C_w(\lambda) = C_p(\lambda)/(s(\lambda)a(p(\lambda)))$ using the definitions $s = \psi/p$ and $a(p) = F(p)/p$. Rearranging equation (21) shows that the incumbent income share satisfies $sa(p) = 1 + (1-s)m(p)$, so $\mathrm{d}(s(\lambda)a(p(\lambda)))/\mathrm{d}\lambda = -(m(p(\lambda))s'(\lambda) - (1-s(\lambda))m'(\lambda))p'(\lambda)$, which is negative because $m(p) > 0$, $m'(p) \leq 0$, $p'(\lambda) > 0$, and $s'(\lambda) > 0$ (equation 26 shows that $s'(\lambda) > 0$ is necessary for $\mu'(\lambda) < 0$). It follows that $C_w^\dagger = C_w(0) = C_p^\dagger/(s(0)a(p(0))) < \tilde{C}_p/(s(1)a(p(1))) = C_w(1) = \tilde{C}_w$, so workers receive more consumption in countries where $\lambda = 1$.

The binding incentive constraint in (12) is $C_k(\lambda) = (1+\theta)C_w(\lambda)$, and thus (6) implies the utility payoff of an investor is $\log C_w(\lambda)$, which moves in line with that of a worker. Therefore, workers and investors in countries with $\lambda = 1$ are strictly better off than workers in $\lambda = 0$ countries (where there are no investors).

(iv)   Using (18), it follows immediately that countries with $\lambda = 1$ have higher real GDP C than those with $\lambda = 0$ because there is an extra positive term $\pi^*\chi$ in the numerator.

From (18), the marginal benefit of institutional quality is $C'(\lambda) = \pi^* \chi / (1 - \alpha + \alpha \pi^{*1-\varepsilon})^{1/(1-\varepsilon)}$, which is independent of λ and identical for countries with $\lambda = 0$ and $\lambda = 1$. Since $C_p(\lambda)$ is strictly quasi-convex and is maximized by both $\lambda = 0$ and $\lambda = 1$, it must be the case that $C'_p(1) > 0$, and hence $C'(1) > \chi \theta \tilde{C}_w / s(1)$ using (25). Using $s(1) < 1$ from Proposition 2, $C'(0) = C'(1)$, and $\tilde{C}_w > C_w^\dagger$ as shown above, it follows that $C'(0) > \chi \theta C_w^\dagger$. Hence, the criterion in Proposition 4 demonstrates that countries with $\lambda = 0$ have an inefficiently low level of investment. All other aspects of institutions are efficient given Proposition 1, so countries with $\lambda = 1$ have Pareto efficient institutions.

A.7 Proof of Proposition 7

(i) The derivative of autarky GDP $\hat{C}(\lambda)$ from (29) is the marginal benefit of institutional quality, and hence $\hat{C}'(\lambda) = \chi(\alpha + (1 - \alpha)\hat{\pi}^{\varepsilon-1})^{1/(\varepsilon-1)}$ where $\hat{\pi}$ is the domestic market-clearing price also given in (29), noting that $\partial \hat{C}(\lambda)/\partial \hat{\pi} = 0$. The latter follows because $\chi \lambda - \alpha \hat{\pi}^{-\varepsilon}(Q + \hat{\pi}\chi\lambda)/(1 - \alpha + \alpha \hat{\pi}^{1-\varepsilon}) = 0$ after rearranging and using (29). Imposing $\varepsilon = 1$ from Assumption 6 yields $\hat{C}'(\lambda) = \chi \hat{\pi}^{1-\alpha}$ and $\hat{\pi} = \alpha Q / ((1 - \alpha)\chi\lambda)$. Using $\hat{C}(\lambda) = Q^{1-\alpha} \chi^\alpha \lambda^\alpha / ((1-\alpha)^{1-\alpha}\alpha^\alpha)$, the marginal benefit can be expressed as $\hat{C}'(\lambda) = \alpha \hat{C}(\lambda)/\lambda$. Together with (23) and (26), the derivative of incumbents' payoff with respect to institutional quality is $\hat{C}'_p(\lambda) = \psi(\lambda)((\alpha/\lambda) - \mu(\lambda)\psi(\lambda))\hat{C}(\lambda)$. Since $\alpha > 0$ and $\psi(\lambda)$, $\mu(\lambda)$, and $\hat{C}(\lambda)$ are all positive and finite, this derivative is positive for λ in the neighbourhood of $\lambda = 0$. Therefore, equilibrium institutions in autarky always have $\hat{\lambda} > 0$, and the incumbent payoff derivative can be written as

$$\hat{C}'_p(\lambda) = \frac{\psi(\lambda)\hat{C}(\lambda)}{\lambda}(\alpha - \lambda\mu(\lambda)\psi(\lambda)). \tag{A.11}$$

With the functional form $F(p) = \beta + \delta p$ in Assumption 6, the marginal and average political products are $m(p) = \delta$ and $a(p) = (\beta + \delta p)/p$. Substituting into (21) implies $s = (1 + \delta)p/(\beta + 2\delta p)$ and hence the incumbent income multiple is $\psi = s/p = (1 + \delta)/(\beta + 2\delta p)$. Further substituting for s and $a(p)$ in the marginal cost of institutional quality $\mu(\lambda)$ from (26) and evaluating at $p = p(\lambda)$:

$$\mu(\lambda) = \frac{\chi \theta (\beta + 2\delta p(\lambda))^2}{(1 + \delta)^2 (\beta + \delta p(\lambda))p(\lambda)}, \quad \text{and} \quad \psi(\lambda) = \frac{1 + \delta}{\beta + 2\delta p(\lambda)}. \tag{A.12}$$

From the constraint (22), it follows that $1 + \chi\theta\lambda = p + (1 - s)F(p) = p(1 + (1 - s)a(p))$. Since (21) implies $sa(p) = 1 + (1 - s)m(p)$, this leads to $1 + \chi\theta\lambda = p(a(p) - m(p) + sm(p)) = \beta + \delta p s$ by using $m(p) = \delta$ and $a(p) = (\beta + \delta p)/p$. Hence, by using $s = (1 + \delta)p/(\beta + 2\delta p)$ again, the inverse of the function $p(\lambda)$ is

$$\lambda = \frac{\delta(1 + \delta)p^2 - (1 - \beta)(\beta + 2\delta p)}{\chi\theta(\beta + 2\delta p)}. \tag{A.13}$$

Combining (A.12) and (A.13) yields the following formulas in terms of $p = p(\lambda)$:

$$\mu(\lambda)\psi(\lambda) = \frac{\chi\theta(\beta + 2\delta p)}{(1 + \delta)(\beta + \delta p)p}, \quad \lambda\mu(\lambda)\psi(\lambda) = \frac{\delta(1 + \delta)p^2 - (1 - \beta)(\beta + 2\delta p)}{(1 + \delta)(\beta + \delta p)p}. \tag{A.14}$$

Therefore, the derivative of the incumbent payoff (A.11) is

$$\hat{C}_p'(\lambda) = \frac{\psi(\lambda)\hat{C}(\lambda)J(p(\lambda))}{(1+\delta)(\beta+\delta p(\lambda))p(\lambda)\lambda}, \quad \text{so } \hat{C}_p'(\lambda) = 0 \text{ only if } J(p(\lambda)) = 0, \tag{A.15}$$

where the function $J(p)$ is defined by:

$$J(p) = (1-\beta)\beta + (2\delta(1-\beta) + \alpha\beta(1+\delta))p - (1-\alpha)\delta(1+\delta)p^2. \tag{A.16}$$

Using (A.15), the second derivative of the incumbent payoff (A.11) evaluated at a critical point is

$$\hat{C}_p''(\lambda) = \frac{\psi(\lambda)\hat{C}(\lambda)J'(p(\lambda))}{(1+\delta)(\beta+\delta p(\lambda))p(\lambda)\lambda} \quad \text{where } \hat{C}_p'(\lambda) = 0. \tag{A.17}$$

Since $0 < \alpha < 1$ and $0 < \beta < 1$, the quadratic equation (A.16) has a positive and a negative root, and $J''(p) < 0$. Given that $\hat{C}_p'(0) > 0$, equation (A.15) implies $J(p^\dagger) > 0$ for $p^\dagger = p(0)$, so it follows that for any $\lambda \in [0,1]$ where $J(p(\lambda)) = 0$, it must be the case that $J'(p(\lambda)) < 0$ because $p(\lambda) \geq p^\dagger$. Using (A.17), this means $\hat{C}_p''(\lambda) < 0$ for any $\lambda \in [0,1]$ where $\hat{C}_p'(\lambda) = 0$, which establishes that $\hat{C}_p(\lambda)$ is a strictly quasi-concave function of λ.

(ii)   The condition in Assumption 5 with $\varepsilon = 1$ is $(\alpha/(1-\alpha))((1/\min\{\mu(1)\psi(1),1\})-1) < 1$. With $\mu'(\lambda) < 0$, the proof of Proposition 6 shows that $\mu(1)\psi(1) < 1$, so this can be further simplified to $(1/(\mu(1)\psi(1)))-1 < (1/\alpha)-1$ and hence to $\alpha < \mu(1)\psi(1)$. Referring to (A.11), it follows that $\hat{C}_p'(1) < 0$, so institutional quality must satisfy $\hat{\lambda} < 1$. It is already shown that $\hat{\lambda} > 0$, so there must be an interior equilibrium $\hat{\lambda} \in (0,1)$. Since $\hat{C}_p(\lambda)$ is a quasi-concave function, this equilibrium is the unique solution of the first-order condition $\alpha = \lambda\mu(\lambda)\phi(\lambda)$ where $\hat{C}_p'(\lambda) = 0$ according to (A.11). With $0 < \hat{\lambda} < 1$, the results of Proposition 3 imply that $\hat{p} = p(\hat{\lambda})$ and $\hat{\psi} = \psi(\hat{\lambda})$ respectively lie between $p^\dagger = p(0)$ and $\tilde{p} = p(1)$, and between $\tilde{\psi} = \psi(1)$ and $\psi^\dagger = \psi(0)$.

(iii)   Since Q does not appear in the equation $\alpha = \hat{\lambda}\mu(\hat{\lambda})\phi(\hat{\lambda})$ for equilibrium institutional quality, the equilibrium value $\hat{\lambda}$ is independent of the endowment Q.

(iv)   Now allow for the possibility of trade and take an arbitrary world price π^*. For each $\lambda \in [0,1]$, let the functions $\hat{C}(\lambda)$ and $C(\lambda)$ respectively denote the levels of real GDP in autarky and with free trade in an open economy. Note that in an open economy with a particular λ, it is possible to obtain the same consumption outcomes as autarky (with the same λ) by setting a tariff τ (see A.1) that results in net exports of zero. Using the formulas from (A.5) with $\varepsilon = 1$ and $K = \chi\lambda$, the required tariff is $\hat{\tau} = (\alpha Q/((1-\alpha)\pi^*\chi\lambda)) - 1$, which can be written as $\hat{\tau} = (\hat{\pi}/\pi^*) - 1$ in terms of the autarky price $\hat{\pi}$ from (29). With $X_E = 0$ and $X_I = 0$ and the same λ, real GDP would be equal to its autarky value $\hat{C}(\lambda)$. This level of real GDP can also be compared to the free-trade ($\tau = 0$) open-economy level $C(\lambda)$ using the relationship $\hat{C}(\lambda) = D(\hat{\tau})C(\lambda)$ derived in the proof of Proposition 1 in terms of the function $D(\tau)$ from (A.6).

It follows that $\hat{C}_p(\lambda) = D(\hat{\tau})C_p(\lambda)$ using incumbents' consumption levels $\hat{C}_p(\lambda) = \psi(\lambda)\hat{C}(\lambda)$ and $C_p(\lambda) = \psi(\lambda)C(\lambda)$ respectively under autarky and in an open economy with free trade. Since

$D(\tau) \leq 1$ for all τ using the properties of $D(\tau)$ from (A.6), this implies $\hat{C}_p(\lambda) \leq C_p(\lambda)$ for all $0 \leq \lambda \leq 1$. If $\pi^* = \hat{\pi}$ for some particular λ then $\hat{\tau} = 0$ and $D(\hat{\tau}) = 1$, in which case $\hat{C}_p(\lambda) = C_p(\lambda)$.

The strict quasi-convexity of $C_p(\lambda)$ implies $\max\{C_p(0), C_p(1)\} > C_p(\hat{\lambda})$, where $0 < \hat{\lambda} < 1$ is equilibrium institutional quality under autarky. Together with $C_p(\hat{\lambda}) \geq \hat{C}_p(\hat{\lambda})$, it follows that incumbents' consumption with international trade, either $C_p(0)$ or $C_p(1)$, is greater than their consumption $\hat{C}_p = \hat{C}_p(\hat{\lambda})$ in autarky. Therefore, those in power always strictly gain from the ability to trade with the rest of the world irrespective of world prices.

If $\lambda = 1$ is chosen with trade, it must be the case that $\tilde{C}_p = C_p(1) > \hat{C}_p$. Since $\tilde{C}_p = \psi(1)\tilde{C}$ with $\tilde{C} = C(1)$, it follows that $\tilde{C} = \tilde{C}_p/\psi(1) > \hat{C}_p/\psi(1) = (\psi(\hat{\lambda})/\psi(1))\hat{C} > \hat{C}$ because $\psi(\hat{\lambda}) > \psi(1)$. The real value of the economy's output is thus increased by trade if those in power choose $\lambda = 1$. The proof of Proposition 6 shows that $C_w(\lambda) = C_p(\lambda)/(s(\lambda)a(p(\lambda)))$, where $s(\lambda)a(p(\lambda))$ is decreasing in λ, and this relationship between C_w and C_p holds in autarky as well as in an open economy. As $\tilde{C}_p > \hat{C}_p$ and $\hat{\lambda} < 1$, this means that $\tilde{C}_w > \hat{C}_w$, so workers in economies with $\lambda = 1$ gain from trade. The same is true for investors who receive a utility payoff that moves in line with workers' consumption. With $\tilde{p} = p(1) > p(\hat{\lambda}) = \hat{p}$, there are also more members of the group in power, who receive higher payoffs than workers ($C_p > C_w$, as can be shown by noting $sa(p) = 1 + (1-s)m(p) > 1$). Hence, for economies that move to $\lambda = 1$, opening up to trade is a Pareto improvement.

A.8 Proof of Proposition 8

An open economy with real GDP from (18) has $C''(\lambda) = 0$, so equation (27) implies $C_p''(\lambda) = -\mu'(\lambda)\psi(\lambda)C_p(\lambda)$ for any λ with $C_p'(\lambda) = 0$. The assumption $\mu'(\lambda) > 0$ thus implies $C_p''(\lambda) < 0$ at a critical point, so $C_p(\lambda)$ is a strictly quasi-concave function of λ. This is maximized at a unique value of λ. With $Q(n) = Q$ for all $n \in [0,1]$, the function $C(\lambda)$ is the same for all countries, and hence so is $C_p(\lambda)$ in (23). Therefore, the same level of institutional quality maximizes $C_p(\lambda)$ in all countries, so there is a degenerate global distribution of λ.

Since $Q(n) = Q$ and $\lambda(n) = \lambda$ for all countries $n \in [0,1]$, the global supplies of the endowment and investment goods are $Q^* = Q$ and $K^* = \chi\lambda$. The world market-clearing relative price $\bar{\pi}^*$ from (28) thus reduces to the same function of λ as the autarky market-clearing price $\hat{\pi}$ within a country from (29). Using (23) and (26), the first-order condition that characterizes the unique equilibrium value of λ across all countries is $C'(\lambda)/C(\lambda) = \mu(\lambda)\psi(\lambda)$. From real GDP (18) evaluated at $\pi^* = \bar{\pi}^*$, it follows that $C'(\lambda)/C(\lambda) = \bar{\pi}^*\lambda/(Q + \bar{\pi}^*\chi\lambda)$. In autarky where $\hat{C}_p(\lambda)$ is a quasi-concave function, the first-order condition uniquely characterizing equilibrium institutional quality $\hat{\lambda}$ is $\hat{C}'(\lambda)/\hat{C}(\lambda) = \mu(\lambda)\psi(\lambda)$. With $\hat{C}'(\lambda)/\hat{C}(\lambda) = \hat{\pi}\lambda/(Q + \hat{\pi}\chi\lambda)$ and $\hat{\pi}$ being the same function of λ as $\bar{\pi}^*$, the equation for the equilibrium λ in open economies is the same as in autarky, so $\lambda = \hat{\lambda}$.

A.9 Proof of Proposition 9

(i)   If the partial openness constraints $-\sigma\chi \leq X_I \leq \sigma\chi$ do not bind then the equilibrium institutions have net exports (17) consistent with free trade ($\pi = \pi^*$). With $K = \chi\lambda$ and $\varepsilon = 1$ under Assumption 6, (17) implies $X_I = (1-\alpha)\chi\lambda - \alpha Q/\pi^*$, so the partial openness constraints are slack if $\lambda \in [\underline{\lambda}, \overline{\lambda}]$ where

$$\underline{\lambda} = \frac{\alpha Q}{(1-\alpha)\pi^*\chi} - \frac{\sigma}{1-\alpha} \quad \text{and} \quad \overline{\lambda} = \frac{\alpha Q}{(1-\alpha)\pi^*\chi} + \frac{\sigma}{1-\alpha}. \tag{A.18}$$

These bounds on λ satisfy $\underline{\lambda} < \overline{\lambda}$ because $\sigma > 0$ and $0 < \alpha < 1$, so the interval $[\underline{\lambda}, \overline{\lambda}]$ always contains a continuum of λ values, though it is possible that $\underline{\lambda} < 0$ or $\overline{\lambda} > 1$, so it may not be contained entirely within the unit interval of valid $\lambda \in [0,1]$ values.

If $\lambda \in [0, \underline{\lambda})$ then the constraint on imports of the investment good binds, hence $X_I = -\sigma\chi$, and if $\lambda \in (\overline{\lambda}, 1]$ then the constraint on exports binds, hence $X_I = \sigma\chi$. The argument from Proposition 1 that equilibrium institutions feature free exchange domestically still applies in these cases, so real GDP is given by (A.4) with $\varepsilon = 1$, that is, $C(\lambda) = ((Q-X_E) + \pi(\chi\lambda - X_I))/\pi^\alpha$, where the domestic market-clearing price is $\pi = (\alpha(Q-X_E))/((1-\alpha)(\chi\lambda - X_I))$ from (16). It follows that $C(\lambda) = (Q-X_E)^{1-\alpha}(\chi\lambda - X_I)^\alpha/((1-\alpha)^{1-\alpha}\alpha^\alpha)$ in these cases, and hence by using the binding partial openness constraints and the international budget constraint (2):

$$C(\lambda) = \begin{cases} \frac{\chi^\alpha(Q-\sigma\pi^*\chi)^{1-\alpha}(\lambda+\sigma)^\alpha}{(1-\alpha)^{1-\alpha}\alpha^\alpha} & \text{if } \lambda \in [0, \underline{\lambda}] \\ \frac{Q+\pi^*\chi\lambda}{\pi^{*\alpha}} & \text{if } \lambda \in [\underline{\lambda}, \overline{\lambda}], \\ \frac{\chi^\alpha(Q+\sigma\pi^*\chi)^{1-\alpha}(\lambda-\sigma)^\alpha}{(1-\alpha)^{1-\alpha}\alpha^\alpha} & \text{if } \lambda \in [\overline{\lambda}, 1] \end{cases} \tag{A.19}$$

noting that real GDP $C(\lambda)$ is identical to (18) in the range $\lambda \in [\underline{\lambda}, \overline{\lambda}]$. Net exports implied by (17) with no restrictions on trade are consistent with $X_I = -\sigma\chi$ and $X_I = \sigma\chi$ respectively at $\lambda = \underline{\lambda}$ and $\lambda = \overline{\lambda}$, so the expression for real GDP $C(\lambda)$ in (A.19) is continuous at the boundaries of the interval $[\underline{\lambda}, \overline{\lambda}]$. Furthermore, since $\partial C/\partial\pi = 0$ for real GDP $C = ((Q-X_E) + \pi(\chi\lambda - X_I))/\pi^\alpha$ using (16), it follows that $C'(\lambda) = \pi^{1-\alpha}\chi$ in all cases, whether or not the partial openness constraints are binding. Since $\pi = \pi^*$ at $\lambda = \underline{\lambda}$ and $\lambda = \overline{\lambda}$, as well as for all $\lambda \in (\underline{\lambda}, \overline{\lambda})$, this demonstrates that $C(\lambda)$ is differentiable for all $\lambda \in (0,1)$, even across the boundaries of the interval $[\underline{\lambda}, \overline{\lambda}]$. Therefore, the incumbent objective $C_p(\lambda)$ is continuous and differentiable for all λ.

Curvature of the incumbent payoff

In the range $\lambda \in [\underline{\lambda}, \overline{\lambda}]$, the incumbent payoff $C_p(\lambda) = \psi(\lambda)C(\lambda)$ is a strictly quasi-convex function following the proof in Proposition 5. To establish its properties outside this range, note that (A.19)

implies the marginal benefit of institutional quality satisfies

$$\frac{C'(\lambda)}{C(\lambda)} = \begin{cases} \frac{\alpha}{\lambda+\sigma} & \text{if } \lambda \in [0,\underline{\lambda}] \\ \frac{\pi^*\chi}{Q+\pi^*\chi\lambda} & \text{if } \lambda \in [\underline{\lambda},\overline{\lambda}] \\ \frac{\alpha}{\lambda-\sigma} & \text{if } \lambda \in [\overline{\lambda},1] \end{cases} \tag{A.20}$$

Together with (23) and (26), it follows that

$$C_p'(\lambda) = \begin{cases} \psi(\lambda)\left(\frac{\alpha}{\lambda+\sigma} - \mu(\lambda)\psi(\lambda)\right)C(\lambda) & \text{if } \lambda \in [0,\underline{\lambda}] \\ \psi(\lambda)\left(\frac{\pi^*\chi}{Q+\pi^*\lambda} - \mu(\lambda)\psi(\lambda)\right)C(\lambda) & \text{if } \lambda \in [\underline{\lambda},\overline{\lambda}] \\ \psi(\lambda)\left(\frac{\alpha}{\lambda-\sigma} - \mu(\lambda)\psi(\lambda)\right)C(\lambda) & \text{if } \lambda \in [\overline{\lambda},1] \end{cases} \tag{A.21}$$

As $F(p) = \beta + \delta p$ under Assumption 6, the formulas for $\mu(\lambda)\psi(\lambda)$ and $\lambda\mu(\lambda)\psi(\lambda)$ from (A.14) in the proof of Proposition 7 can be used here. Substituting these, the derivative of the incumbent payoff can be expressed as $C_p'(\lambda) = \psi(\lambda)C(\lambda)\underline{J}(p(\lambda))/((1+\delta)(\beta+\delta p(\lambda))p(\lambda)(\lambda+\sigma))$ if $\lambda \in [0,\underline{\lambda}]$ or $C_p'(\lambda) = \psi(\lambda)C(\lambda)\overline{J}(p(\lambda))/((1+\delta)(\beta+\delta p(\lambda))p(\lambda)(\lambda-\sigma))$ if $\lambda \in [\overline{\lambda},1]$ for functions $\underline{J}(p)$ and $\overline{J}(p)$ given by:

$$\underline{J}(p) = \beta(1-\beta-\sigma\chi\theta) + (2\delta(1-\beta-\sigma\chi\theta) + \alpha\beta(1+\delta))p - (1-\alpha)\delta(1+\delta)p^2, \quad \text{and}$$
$$\overline{J}(p) = \beta(1-\beta+\sigma\chi\theta) + (2\delta(1-\beta+\sigma\chi\theta) + \alpha\beta(1+\delta))p - (1-\alpha)\delta(1+\delta)p^2.$$

Critical points of the objective function $C_p(\lambda)$ in the two cases correspond to roots of the quadratic equations $\underline{J}(p) = 0$ and $\overline{J}(p) = 0$ for $p = p(\lambda)$. The functions both satisfy $\underline{J}''(p) < 0$ and $\overline{J}''(p) < 0$. Since $0 < \alpha < 1$ and $0 < \beta < 1$ under Assumption 6, the quadratic equation $\overline{J}(p) = 0$ has a positive and a negative root. As $p^\dagger > 0$, any $p \geq p^\dagger$ where $\overline{J}(p) = 0$ must have $\overline{J}'(p) < 0$. This establishes that $C_p(\lambda)$ is quasi-concave for $\lambda \in [\overline{\lambda},1]$. For values of σ less than the positive number $(1-\beta)/(\chi\theta)$, the quadratic $\underline{J}(p)$ also has a positive and a negative root because $1-\beta-\sigma\chi\theta > 0$. This means that any $p \geq p^\dagger$ where $\underline{J}(p) = 0$ has $\underline{J}'(p) < 0$, demonstrating that $C_p(\lambda)$ is quasi-concave for $\lambda \in [0,\underline{\lambda}]$.

Specialization in institutional quality

If there were no specialization in the global equilibrium then all ex-ante identical countries would choose a common λ^*. The global supply of investment goods would be $K^* = \chi\lambda^*$, and hence the world equilibrium price (28) with $Q = Q^*$ and $\varepsilon = 1$ is $\bar{\pi}^* = \alpha Q/((1-\alpha)\chi\lambda^*)$. Comparison with (A.18) shows that $\underline{\lambda} = \lambda^* - \sigma/(1-\alpha)$ and $\overline{\lambda} = \lambda^* + \sigma/(1-\alpha)$, so λ^* lies in the interior of the interval $[\underline{\lambda},\overline{\lambda}]$. Since $\lambda^* \in [\underline{\lambda},\overline{\lambda}]$, (A.19) and (A.21) imply the derivative of the incumbent payoff is $C_p'(\lambda) = \psi(\lambda)(\pi^*\chi - \mu(\lambda)\psi(\lambda)(Q+\pi^*\chi\lambda))/\pi^{*\alpha}$. Evaluating this at $\pi^* = \bar{\pi}^*$ and $\lambda = \lambda^*$ gives $C_p'(\lambda^*) = (\bar{\pi}^*\chi/\alpha)(\alpha - \lambda^*\mu(\lambda^*)\psi(\lambda^*))/\bar{\pi}^{*\alpha}$. If $\lambda^* = 0$ then this is positive, while if $\lambda^* = 1$ then this is negative under Assumption 5 because $\alpha < \mu(1)\psi(1)$ as demonstrated in the proof of Proposition 7. Therefore, it is not possible to have a common choice of $\lambda^* = 0$ or $\lambda^* = 1$ as this is not consistent with maximization of the incumbent payoff. With $\lambda^* \in (0,1)$, the interval $[\underline{\lambda},\overline{\lambda}]$ would

include a continuum of values inside $[0,1]$, so the quasi-convexity of $C_p(\lambda)$ in this range means that $\lambda = \lambda^*$ cannot maximize $C_p(\lambda)$. This rules out a global equilibrium without specialization.

In equilibrium, the world price π^* must be such that $\underline{\lambda}$ and $\overline{\lambda}$ in (A.18) satisfy $\underline{\lambda} < 1$ or $\overline{\lambda} > 0$. If not, $C_p(\lambda)$ would be strictly quasi-concave on the whole unit interval, and there would be a unique value of λ maximizing $C_p(\lambda)$ for all countries. Such an equilibrium without specialization has already been ruled out, so the interval $[\underline{\lambda}, \overline{\lambda}]$ must overlap with a unit interval $[0,1]$ for a continuum of λ values. Since $C_p(\lambda)$ is strictly quasi-convex for $\lambda \in [\underline{\lambda}, \overline{\lambda}]$, the only possible values of λ in this range that could maximize $C_p(\lambda)$ are $\lambda = \underline{\lambda}$ or $\lambda = \overline{\lambda}$, or the endpoints of $[0,1]$ if $\underline{\lambda} < 0$ or $\overline{\lambda} > 1$. The strict quasi-concavity of $C_p(\lambda)$ for $\lambda \in [0, \underline{\lambda}]$ and $\lambda \in [\overline{\lambda}, 1]$ means there is a unique value of λ that maximizes $C_p(\lambda)$ within each of the intervals $[0, \underline{\lambda}]$ and $[\overline{\lambda}, 1]$. Therefore, there are at most two possible values of λ that are local maximums of $C_p(\lambda)$, and hence could maximize $C_p(\lambda)$ over the whole unit interval. As the incumbent payoff function $C_p(\lambda)$ is the same in all countries, let these common values of λ be denoted by $\lambda^\dagger$ and $\tilde{\lambda}$, which satisfy $0 \leq \lambda^\dagger < \tilde{\lambda} \leq 1$. Equilibrium specialization in λ across countries must therefore take on a 'high-low' pattern.

The width of the interval $[\underline{\lambda}, \overline{\lambda}]$ is $2\sigma/(1-\alpha)$ using (A.18), and it is known that this interval overlaps with $[0,1]$ for a continuum of λ values. Hence, for a range of sufficiently small positive values of σ, it must be the case that $0 < \underline{\lambda} < \overline{\lambda} < 1$. As the endpoints of $[\underline{\lambda}, \overline{\lambda}]$ are strictly inside the unit interval, $C_p(\lambda)$ cannot be maximized where it is strictly quasi-convex. It follows that $\lambda^\dagger \in [0, \underline{\lambda})$ and $\tilde{\lambda} \in (\overline{\lambda}, 1]$, so one of the partial openness constraints $X_I \leq \sigma\chi$ or $X_I \geq -\sigma\chi$ is binding in each country.

Using (A.19), since the terms involving π^* in the expression for $C(\lambda)$ are multiplicative and independent of λ, it follows that the local maximums $\lambda^\dagger$ and $\tilde{\lambda}$ of $C_p(\lambda) = \psi(\lambda)C(\lambda)$ in the ranges $[0, \underline{\lambda}]$ and $[\overline{\lambda}, 1]$ are independent of π^*. As the function $C_p(\lambda)$ is the same in all countries, equilibrium where some choose $\lambda^\dagger$ and some $\tilde{\lambda}$ requires $C_p(\lambda^\dagger) = C_p(\tilde{\lambda})$. From (A.19), this occurs at the following unique equilibrium world price:

$$\bar{\pi}^* = \frac{1}{\sigma} \left(\frac{\left(\psi(\lambda^\dagger)(\lambda^\dagger + \sigma)^\alpha\right)^{\frac{1}{1-\alpha}} - \left(\psi(\tilde{\lambda})(\tilde{\lambda} + \sigma)^\alpha\right)^{\frac{1}{1-\alpha}}}{\left(\psi(\lambda^\dagger)(\lambda^\dagger + \sigma)^\alpha\right)^{\frac{1}{1-\alpha}} + \left(\psi(\tilde{\lambda})(\tilde{\lambda} + \sigma)^\alpha\right)^{\frac{1}{1-\alpha}}} \right) \frac{Q}{\chi}.$$

As $X_I = -\sigma\chi$ for countries with $\lambda = \lambda^\dagger$ and $X_I = \sigma\chi$ for countries with $\lambda = \tilde{\lambda}$, equilibrium in world markets (1) requires a fraction $\bar{\gamma} = 1/2$ of countries choose $\lambda = \tilde{\lambda}$ and a fraction $1/2$ choose $\lambda = \lambda^\dagger$.

Interior equilibria for institutional quality

The $\lambda = \lambda^\dagger$ maximizing $C_p(\lambda)$ in the range $[0, \underline{\lambda}]$ has $\lambda^\dagger > 0$ if $C_p'(0) > 0$ because $C_p(\lambda)$ is quasi-concave in that range. Likewise, $\tilde{\lambda} < 1$ if $C_p'(1) < 0$. Using (A.21), these require $\alpha/\sigma > \mu(0)\psi(0)$ and $\alpha/(1-\sigma) < \mu(1)\psi(1)$. Both conditions are satisfied when $\sigma \leq \min\{\alpha/(\mu(0)\psi(0)), 1 - (\alpha/(\mu(1)\psi(1)))\}$. The minimum value is positive because $\alpha < \mu(1)\psi(1)$, as shown under Assumption 5 in the proof of Proposition 7.

(ii) The expressions for $C'_p(\lambda)$ in (A.21) imply that $C'_p(\lambda)$ is decreasing in σ for $\lambda \in [0, \underline{\lambda}]$, and increasing in σ for $\lambda \in [\overline{\lambda}, 1]$. Since $C_p(\lambda)$ is strictly quasi-concave in these ranges, and $C'_p(\lambda^\dagger) = 0$ and $C'_p(\tilde{\lambda}) = 0$ where $0 < \lambda^\dagger < \underline{\lambda} < \overline{\lambda} < \tilde{\lambda} < 1$, it follows that $\lambda^\dagger$ is decreasing in σ and $\tilde{\lambda}$ is increasing in σ.

A.10 Proof of Proposition 10

(i) A fraction $\varkappa$ of countries has $\lambda = 1$ imposed, so the fraction γ of countries in the world with $\lambda = 1$ must satisfy $\gamma \geq \varkappa$. In the remaining fraction $1 - \varkappa$ of countries, the value of λ is chosen to maximize the payoff of those in power. For these countries Proposition 5 continues to apply, with either $\lambda = 0$ or $\lambda = 1$ being the equilibrium. For a particular value of γ, Proposition 6 shows that $\lambda = 1$ is an equilibrium only if $\gamma \leq \bar{\gamma}_0$, where $\bar{\gamma}_0 = (\alpha/(1-\alpha))(Q/\chi)^{1-\varepsilon}/\xi^\varepsilon$ is the equilibrium fraction of rule-of-law countries in the absence of intervention.

First consider the case where $\varkappa \leq \bar{\gamma}_0$. The equilibrium must be unchanged at $\bar{\gamma} = \bar{\gamma}_0$. If $\gamma < \bar{\gamma}_0$, this would imply all countries would have $\lambda = 1$, that is, $\gamma = 1$, but $\bar{\gamma}_0 < 1$. If $\gamma > \bar{\gamma}_0$ then no country would have $\lambda = 0$ except those where it is imposed, hence $\gamma = \varkappa$, but $\varkappa \leq \bar{\gamma}_0$. This leaves $\gamma = \bar{\gamma}_0$, which is an equilibrium because incumbents are indifferent between $\lambda = 0$ and $\lambda = 1$, so a fraction $\bar{\gamma}_0 - \varkappa$ of countries have rulers that choose $\lambda = 1$, and there is no change in $\bar{\gamma}$. Next, consider the case $\varkappa > \bar{\gamma}_0$. The equilibrium must be $\bar{\gamma} = \varkappa$ because $\gamma < \varkappa$ is not feasible and $\gamma > \varkappa$ would mean rulers would not choose $\lambda = 1$ unless it is imposed on them.

(ii) Now suppose a subsidy $\tau < 0$ to the investment good is exogenously imposed in a fraction $\upsilon > 0$ of countries, meaning the domestic market-clearing price in those countries is $\pi = (1 + \tau)\pi^*$, as in (A.1). The remaining fraction $1 - \upsilon$ of countries chooses institutions with free trade ($\tau = 0$, see Proposition 1). Since the imposition of τ has a multiplicative effect on real GDP as shown in the proof of Proposition 1, the argument in Proposition 5 that equilibrium institutional quality is either $\lambda = 0$ or $\lambda = 1$ still applies to all countries, and the same criterion $\pi^* \geq \xi Q/\chi$ for $\lambda = 1$ to be chosen remains valid for all. It is not possible to have world market clearing (1) with $\pi^* < \xi Q/\chi$ because all countries would have $\lambda = 0$, $K = 0$, and $X_I < 0$ using (A.5). If the subsidy results in $\pi^* > \xi Q/\chi$ then all countries would have $\lambda = 1$ and $\bar{\gamma}$ is increased. The remaining case to consider is where the equilibrium world price remains at $\bar{\pi}^* = \xi Q/\chi$.

With $\pi^* = \xi Q/\chi$, a fraction γ of countries have $\lambda = 1$ and a fraction $1 - \gamma$ have $\lambda = 0$. Differentiating net exports of investment goods X_I from (A.5) with respect to τ and K:

$$\frac{\partial X_I}{\partial \tau} = \frac{\alpha(1-\alpha)\varepsilon(1+\tau)^{\varepsilon-1}\pi^{*-\varepsilon}}{\left((1-\alpha)(1+\tau)^\varepsilon + \alpha\pi^{*1-\varepsilon}\right)^2} > 0, \quad \text{and} \quad \frac{\partial X_I}{\partial K} = \frac{(1-\alpha)(1+\tau)^\varepsilon}{(1-\alpha)(1+\tau)^\varepsilon + \alpha\pi^{*1-\varepsilon}} > 0,$$

where the signs of these partial derivatives do not depend on the initial value of τ. Following the imposition of the subsidy $\tau < 0$, X_I declines in a positive measure of countries υ. Given $\pi^* = \xi Q/\chi$, world market clearing (1) therefore requires an increase in K from $K = 0$ to $K = \chi$ in a positive

measure of countries, raising $\int_0^1 X_I(n)\mathrm{d}n$ to restore equilibrium. This shows that the equilibrium fraction $\bar{\gamma}$ of countries with good institutions is increased by the subsidy.

(iii) If all countries impose the subsidy $\tau < 0$, and the goal is that all will have $\lambda = 1$ in equilibrium ($\bar{\gamma} = 1$), then all will have the same $K = \chi$ and net exports X_I from (A.5). Equilibrium in world markets (1) therefore requires $X_I = 0$. The minimum world price π^* consistent with $\lambda = 1$ in equilibrium is $\pi^* = \xi Q/\chi$. Substituting $\bar{\pi}^* = \xi Q/\chi$ and $K = \chi$ into (A.5) and solving for the $\tau = \tilde{\tau}$ such that $X_I = 0$ yields:

$$\tilde{\tau} = \left(\frac{\alpha}{1-\alpha} \left(\frac{Q}{\chi} \right) \left(\xi \frac{Q}{\chi} \right)^{-\varepsilon} \right)^{\frac{1}{\varepsilon}} - 1.$$

This confirms the expression given for $\tilde{\tau}$.

A.11 Proof of Proposition 11

(i) The finding of Proposition 5 that equilibrium institutions in open economies have either $\lambda = 0$ or $\lambda = 1$ still applies here. If Q is an arbitrary country-specific endowment, the condition derived in Proposition 5 shows that $\lambda = 1$ is optimal only if $q \leq \bar{q}$, where $q = Q/Q^*$ is the endowment measured relative to the global mean Q^*, and the threshold for q is given by $\bar{q} = (\chi/Q^*)(\pi^*/\xi)$.

(ii) If a fraction γ of countries have institutions with $\lambda = 1$, the market-clearing world price from (28) is $\bar{\pi}^* = ((\alpha/(1-\alpha))(Q^*/\chi)/\gamma)^{1/\varepsilon}$. Hence, the threshold is $\bar{q} = (\alpha/(1-\alpha))^{1/\varepsilon}(Q^*/\chi)^{(1-\varepsilon)/\varepsilon}$ for extractive institutions versus the rule of law. Since $q < \bar{q}$ is necessary for $\lambda = 1$, the fraction of countries with $\lambda = 1$ must satisfy $\gamma = G(\bar{q})$. Note that the threshold can be written as $\bar{q} = (\bar{\gamma}_0/\gamma)^{1/\varepsilon}$, where $\bar{\gamma}_0 = (\alpha/(1-\alpha))(Q^*/\chi)^{1-\varepsilon}/\xi^\varepsilon$ is the equilibrium fraction of countries with $\lambda = 1$ in the case of homogeneous endowments ($Q = Q^*$) as given in Proposition 6. The equilibrium $\bar{\gamma}$ with heterogeneous endowments must therefore satisfy the equation $\bar{\gamma} = G\left((\bar{\gamma}_0/\bar{\gamma})^{1/\varepsilon} \right)$ as claimed.

This equation for $\bar{\gamma}$ can be stated as $H(\bar{\gamma}) = 0$, where $H(\bar{\gamma}) = \bar{\gamma} - G\left((\bar{\gamma}_0/\bar{\gamma})^{1/\varepsilon} \right)$. The positive term $\bar{\gamma}_0$ depends only on parameters. Since the cumulative distribution function $G(q)$ is weakly increasing in q and as $0 < \varepsilon < 1$, the function $H(\bar{\gamma})$ is strictly increasing in $\bar{\gamma}$. Any solution of the equation $H(\bar{\gamma}) = 0$ must therefore be unique. A property of the cumulative distribution function is $G(\infty) = 1$, which implies $H(0) = -1$. Proposition 6 shows that $\bar{\gamma}_0 < 1$, and since $G(1) < 1$ is assumed (the fraction of countries above the mean is strictly positive), it follows that $G(\bar{\gamma}_0^{1/\varepsilon}) \leq G(1) < 1$ and hence $H(1) = 1 - G(\bar{\gamma}_0^{1/\varepsilon}) > 0$. Since q has a continuous distribution, the function $H(\bar{\gamma})$ must be continuous. With $H(0) < 0$ and $H(1) > 0$, the intermediate value theorem implies there exists a $\bar{\gamma}$ such that $H(\bar{\gamma}) = 0$ satisfying $0 < \bar{\gamma} < 1$.

(iii) Observe that $H(\bar{\gamma}_0) = \bar{\gamma}_0 - G((\bar{\gamma}_0/\bar{\gamma}_0)^{1/\varepsilon}) = \bar{\gamma}_0 - G(1) = \bar{\gamma}_0 - \gamma^*$, where $\gamma^* = G(1)$ denotes the fraction of countries with an endowment below than the global mean. Furthermore, note $H(\gamma^*) =$

$\gamma^* - G((\bar{\gamma}_0/\gamma^*)^{1/\varepsilon}) = G(1) - G((\bar{\gamma}_0/\gamma^*)^{1/\varepsilon})$. Since $G(q)$ is weakly increasing, $G((\bar{\gamma}_0/\gamma^*)^{1/\varepsilon}) \leq G(1)$ if $\bar{\gamma}_0/\gamma^* < 1$ and $G((\bar{\gamma}_0/\gamma^*)^{1/\varepsilon}) \geq G(1)$ if $\gamma_0/\gamma^* > 1$. Together with the expressions for $H(\bar{\gamma}_0)$ and $H(\gamma^*)$ above, it follows that $H(\bar{\gamma})$ changes sign between $\bar{\gamma}_0$ and γ^* (irrespective of the ordering of the terms). The unique solution for $\bar{\gamma}$ must therefore lie between $\bar{\gamma}_0$ and γ^* (or coincide if equal).

A.12 Proof of Proposition 12

(i)   For the $1 - \varsigma$ countries that are price takers in world markets, the condition for $\lambda(n) = 1$ to be the equilibrium in country n is that derived in Proposition 5, namely $\pi^* \chi \geq \xi Q(n)$. This gives a threshold $\bar{q} = \pi^* \chi/(\xi Q^*)$ for endowments $q = Q/Q^*$ relative to the global mean Q^* such that those countries choosing $\lambda(n) = 1$ are those with $q(n) \leq \bar{q}$. The small open economies have a continuous probability distribution of relative endowments with cumulative distribution function $G(q)$. Since $\hat{\lambda} = 0$ is assumed to be the equilibrium within the cartel, the fraction of economies with the rule of law is $\gamma = (1 - \varsigma)G(\bar{q})$.

The cartel has positive measure ς in world markets and chooses net exports $\hat{X}_E$ of the endowment good. The cartel's endowment is $\hat{Q}$, and let $\check{Q}$ denote the average endowment of price-taking economies, so the global mean is $Q^* = \varsigma\hat{Q} + (1 - \varsigma)\check{Q}$ (the average value of q for small open economies is $\check{Q}/Q^*$). With net exports given by $X_E = \alpha Q - (1 - \alpha)\pi^* K$ for the small open economies (17 with $\varepsilon = 1$), and only those economies producing capital, world markets clear (1) if

$$\varsigma\hat{X}_E + \alpha(1 - \varsigma)\check{Q} - (1 - \alpha)\bar{\pi}^* \chi\gamma = 0.$$

It follows that the threshold $\bar{q}$ for the choice of $\lambda(n) = 0$ or $\lambda(n) = 1$ in small open economies is

$$\bar{q} = \frac{\bar{\pi}^* \chi}{\xi Q^*} = \frac{1}{\gamma}\left(\frac{\varsigma\hat{X}_E + \alpha(1 - \varsigma)\check{Q}}{(1 - \alpha)\xi Q^*}\right), \tag{A.22}$$

and combined with $\gamma = (1 - \varsigma)G(\bar{q})$, the equilibrium threshold $\bar{q}$ is therefore determined by

$$\bar{q}G(\bar{q}) = \frac{\varsigma\hat{X}_E + \alpha(1 - \varsigma)\check{Q}}{(1 - \alpha)(1 - \varsigma)\xi Q^*}. \tag{A.23}$$

The implied elasticity of the equilibrium threshold $\bar{q}$ with respect to the cartel's net exports $\hat{X}_E$ is

$$\nu = \frac{\partial\bar{q}}{\partial\hat{X}_E}\frac{\hat{X}_E}{\bar{q}} = \left(\frac{\varsigma\hat{X}_E}{\varsigma\hat{X}_E + \alpha(1 - \varsigma)\check{Q}}\right) \Big/ \left(1 + \frac{\bar{q}G'(\bar{q})}{G(\bar{q})}\right). \tag{A.24}$$

Since the cartel chooses $\hat{K} = 0$, the quantity of investment goods available for consumption is $-\hat{X}_I = \hat{X}_E/\bar{\pi}^*$ using (2). As the cartel cannot choose $\hat{X}_E < 0$, and with $\check{Q} > 0$ and $0 < \varsigma < 1$, it follows from (A.22) that $\bar{\pi}^*$ must be strictly positive. The cartel must therefore choose $\hat{X}_E > 0$. It further follows from (A.23) that $\bar{q}$ must be positive and finite, and $G(\bar{q})$ must be positive. Since q has a continuous probability distribution, $G'(\bar{q})$ is finite, and together with the other observations, the elasticity in (A.24) therefore satisfies $0 < \nu < 1$. With (A.22) showing that $\bar{q}$ and $\bar{\pi}^*$ are proportional for given parameters and (A.23) determining $\bar{q}$ for each $\hat{X}_E$, it follows that the equilibrium world price is a function $\bar{\pi}^*(\hat{X}_E)$ of the cartel's net exports, and the elasticity of $\bar{\pi}^*$ with respect to $\hat{X}_E$ is equal to ν.

Conditional on $\hat{\lambda} = 0$, and hence on an incumbent income multiple $\psi(0)$ of GDP, the cartel's equilibrium trade policy is to choose $\hat{X}_E$ and $\hat{X}_I$ to maximize real GDP. With $\varepsilon = 1$, substituting $\pi = (\alpha/(1-\alpha))((Q-X_E)/(K-X_I))$ from (16) into $C = ((Q-X_E)+\pi(K-X_I))/\pi^\alpha$ from (A.4), real GDP is $C = (Q-X_E)^{1-\alpha}(K-X_I)^\alpha/((1-\alpha)^{1-\alpha}\alpha^\alpha)$. This is maximized subject to the international budget constraint (2), where the world price $\bar{\pi}^*$ is now a function of the cartel's $\hat{X}_E$. Using $\hat{X}_I = -\hat{X}_E/\bar{\pi}^*$ to eliminate $\hat{X}_I$ and noting $\hat{K} = 0$, the objective function is $(\hat{Q}-\hat{X}_E)^{1-\alpha}(\hat{X}_E/\pi^*(\hat{X}_E))^\alpha/((1-\alpha)^{1-\alpha}\alpha^\alpha)$. The first-order condition with respect to $\hat{X}_E$ is

$$\frac{\alpha}{\hat{X}_E/\pi^*(\hat{X}_E)}\left(\frac{1}{\pi^*(\hat{X}_E)} - \frac{\hat{X}_E \pi^{*\prime}(\hat{X}_E)}{(\pi^*(\hat{X}_E))^2}\right) - \frac{1-\alpha}{\hat{Q}-\hat{X}_E} = 0.$$

The domestic market-clearing price (16) in the cartel is $\hat{\pi} = \alpha(\hat{Q}-\hat{X}_E)/((1-\alpha)(\hat{X}_E/\pi^*(\hat{X}_E)))$, and using $\hat{X}_E \pi^{*\prime}(\hat{X}_E)/\pi^*(\hat{X}_E) = \nu$ from (A.24), the first-order condition can be expressed as

$$\hat{\pi} = \frac{\pi^*(\hat{X}_E)}{1-\nu}, \quad \text{and hence (A.1) holds with } \tau = \frac{\nu}{1-\nu}.$$

The cartel's trade policy is thus equivalent to a positive tariff τ on the investment good as $0 < \nu < 1$. Substituting into (A.5) with $\hat{K} = 0$ shows that $\hat{X}_E = ((1-\nu)/(1-\alpha\nu))\alpha\hat{Q} < \alpha\hat{Q}$, so the countries of the cartel export less of the endowment good than they would have done as small open economies.

(ii)   With the cartel, equation (A.22) implies $\bar{q}$ and the equilibrium fraction $\bar{\gamma}$ of countries with $\lambda = 1$ jointly satisfy $\bar{\gamma}\bar{q} = (\varsigma\hat{X}_E + \alpha(1-\varsigma)\check{Q})/((1-\alpha)\xi Q^*)$. Since $\bar{\gamma}/(1-\varsigma) = G(\bar{q})$ and $G(q)$ is strictly increasing, it follows that $\bar{q} = G^{-1}(\bar{\gamma}/(1-\varsigma))$ and hence an equation for $\bar{\gamma}$ is

$$\bar{\gamma}G^{-1}\left(\frac{\bar{\gamma}}{1-\varsigma}\right) = \frac{\varsigma\hat{X}_E + \alpha(1-\varsigma)\check{Q}}{(1-\alpha)\xi Q^*}. \tag{A.25}$$

If the cartel were broken up and its members acted instead as small open economies then their optimal trade policy is $\tau = 0$ (Proposition 1), implying net exports $\hat{X}_E$ would rise to $\alpha\hat{Q}$ if a country continued to choose $\lambda(n) = 0$. Conditional on the fraction of countries $\bar{\gamma}$ choosing the rule of law (which may now include some of the former cartel members), the derivation of equation (A.22) is unaffected. As it possible former cartel members might choose $\lambda(n) = 1$ whereas they all previously had $\hat{\lambda} = 0$, the fraction of economies with the rule of law now satisfies $\bar{\gamma} \geq (1-\varsigma)G(\bar{q})$. This implies $\bar{q} \leq G^{-1}(\bar{\gamma}/(1-\varsigma))$, and therefore the new value of $\bar{\gamma}$ must have the left-hand side of (A.25) be no less than the right-hand side. The right-hand side increases as $\hat{X}_E$ is replaced by $\alpha\hat{Q}$, which is more than its previous value. As the left-hand side of (A.25) is a strictly increasing function of $\bar{\gamma}$, it follows that the new equilibrium value of $\bar{\gamma}$ must be greater than with the cartel.

B Further information about the empirical analysis

B.1 Description of the data

The empirical analysis uses data from the Center for Systemic Peace's Polity IV Project (http://www.systemicpeace.org/inscrdata.html) on 'Executive Constraints' (XCONST, a score between 1 and 7). Figure B.1 plots the frequency distribution of the executive constraint scores after pooling this annual data over the period 1841–1905. Note that approximately 60% of the observations are an extreme classification (1 or 7), and about 88% of all observations are in $\{1,3,7\}$.

Figure B.1: *Frequency distribution of executive constraints scores*
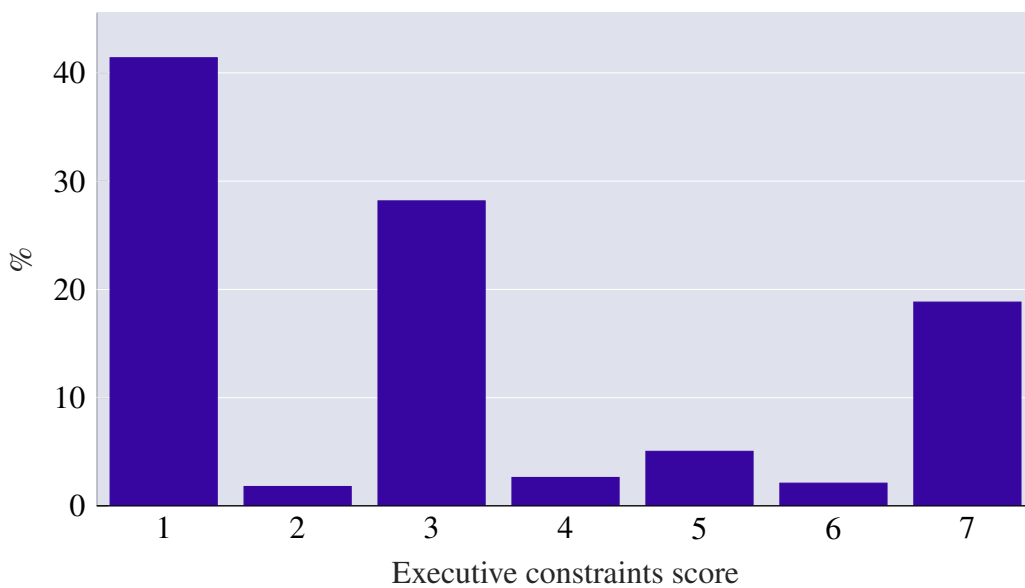
The time series of countries' executive constraints scores are very persistent, though the measured degree of persistence depends on exactly how missing data are treated. Since missing data usually reflect some political uncertainty, it is reasonable to treat missing observations as an eighth possible score. Doing this, the probability of a change in the score for a given country from one year to the next is less than 4%. On average, it takes somewhat more than 25 years for there to be a (usually not very large) change in a country's score.

Table B.1 gives the list of countries used in the empirical analysis from section 5. The reported executive constraints scores are averages over the 1841–1860 and 1881–1900 sub-periods.

The trade shock for each country is calculated using the predicted trade time series from Pascali (2017), which is available at a 5-yearly frequency. A country's trade shock is defined as the difference between the logarithms of average predicted trade in the two sub-periods. The trade shocks are reported in Table B.1, which orders countries by the size of their trade shocks.

The table also reports the numbers used to construct Figure 5. Countries are divided into two

Table B.1: *Executive constraints scores and trade shocks for countries in the sample*

Country	1841–1860	1880–1900	Trade shock	Weight	Data available
Chile	1.5	5.7	0.574	0.088	1841
Peru	3.0	2.7	0.587	0.084	1841
El Salvador	3.0	3.0	0.591	0.084	1841
Ecuador	3.0	3.0	0.596	0.082	1841
Bolivia	3.0	3.0	0.607	0.079	1841
Argentina	1.8	3.0	0.661	0.064	1841
Venezuela	1.0	2.5	0.710	0.051	1841
Dominican Republic	3.0	3.0	0.713	0.050	1844
United States	7.0	7.0	0.736	0.044	1841
Japan	1.0	7.0	0.737	0.044	1841
Brazil	1.0	1.7	0.742	0.043	1841
Haiti	1.0	1.0	0.743	0.042	1841
Uruguay	1.0	1.0	0.750	0.041	1841
Colombia	3.0	4.1	0.751	0.040	1841
Costa Rica	3.4	7.0	0.757	0.039	1841
Nicaragua	1.0	1.0	0.762	0.037	1841
China	1.0	1.0	0.764	0.037	1841
Mexico	1.0	1.0	0.766	0.036	1841
Siam	1.0	1.0	0.847	0.014	1841
Guatemala	1.4	2.7	0.906	0.002	1841
Persia	1.0	1.0	0.950	0.013	1841
United Kingdom	7.0	7.0	0.995	0.026	1841
Ottoman Empire	1.0	1.0	1.007	0.029	1841
Oman	1.0	1.0	1.035	0.036	1841
Denmark	3.4	3.0	1.041	0.038	1841
Greece	2.7	7.0	1.075	0.047	1841
Belgium	5.8	7.0	1.112	0.057	1841
Netherlands	4.9	6.6	1.116	0.058	1841
Norway	3.0	6.7	1.122	0.060	1841
Sweden	3.3	5.0	1.203	0.082	1841
Austria-Hungary	1.0	3.0	1.208	0.083	1841
France	3.2	7.0	1.212	0.084	1841
Spain	3.2	7.0	1.217	0.086	1841
Morocco	1.0	1.0	1.255	0.096	1841
Portugal	3.2	4.6	1.267	0.099	1841
Russia	1.0	1.0	1.283	0.103	1841
Mean	2.4	3.6	0.900	0.056	1841

groups, small-shock and large-shock, based on whether their trade shocks are respectively below or above the mean. The cumulative distribution functions in Figure 5 weight each observation by the absolute value of the difference between the country's trade shock and the mean trade shock. These weights are normalized to sum to 1 within the two groups of countries.

Figure B.2 plots the relationship between executive constraints scores and the size of the trade shock before and after the shock. In the pre-shock period 1841–1860, the distribution of Polity scores does not seem to depend on the size of the shock. Several European and Latin American countries have scores around 3, a few European and many Latin American and Asian countries have scores close to 1, and a small number of countries were at the maximum score of 7. Matters look different by the post-shock period 1881–1900. In the set of countries exposed to large shocks, few of them have intermediate scores with most being close to 1 or 7. In contrast, in the set of countries exposed to small shocks, there is a substantial number of countries with scores close to 3.

Figure B.2: *Executive constraints and trade shock relationships in the two sub-periods*
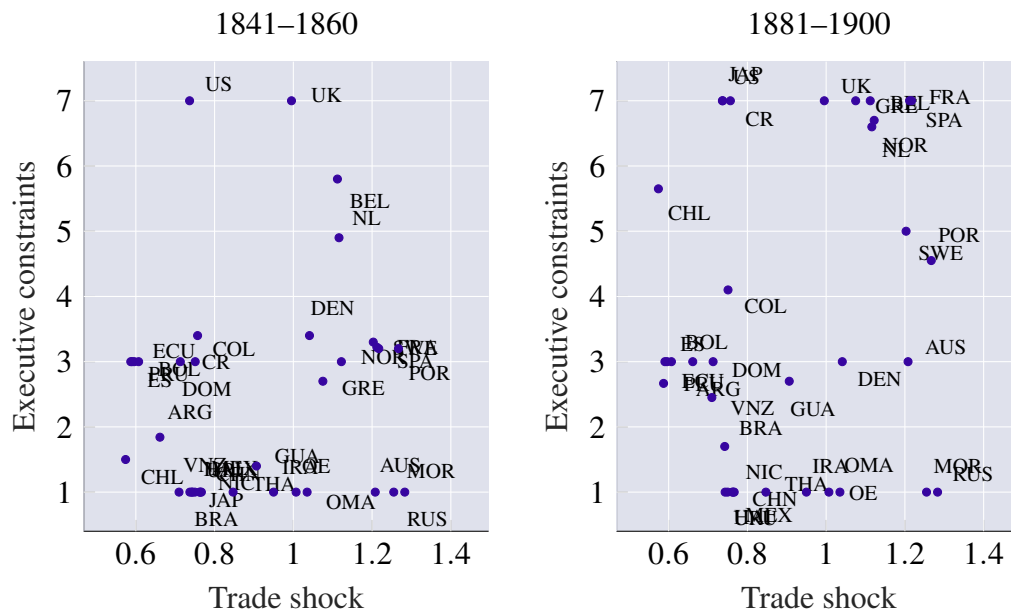
Sources: Predicted trade data from Pascali (2017); Executive Constraints data from the Polity IV Project, Center for Systemic Peace (http://www.systemicpeace.org/inscrdata.html).

B.2 Robustness exercises

This section repeats the estimation of (30) using different specifications of the pre- and post-shock periods and the transitional period between the two. Table B.2 shows specifications with narrower and wider pre- and post-shock periods. Table B.3 has specifications with shorter transitional periods. Finally, Table B.4 shortens both the transitional and pre- and post-shock periods.

Table B.2: *Regression results with narrower and wider pre- and post-shock periods*

P_{jA}	Pre: 1846–1860	Post: 1881–1895		Pre: 1841–1865	Post: 1881–1905	
	OLS	Tobit	Probit	OLS	Tobit	Probit
1	1.79	1.58	1.78	3.47	3.60	4.71
	(1.93) [0.36]	(2.29) [0.49]	(1.84) [0.33]	(2.31) [0.14]	(2.60) [0.18]	(2.52) [0.06]
P_{jB}	0.21	0.30	−1.26	−0.41	−0.44	−2.30
	(0.57) [0.72]	(0.82) [0.71]	(0.76) [0.10]	(0.69) [0.56]	(0.98) [0.66]	(1.04) [0.03]
Z_j	−0.46	−0.50	−3.33	−2.64	−3.52	−6.22
	(2.44) [0.85]	(2.86) [0.86]	(2.62) [0.20]	(2.40) [0.28]	(2.69) [0.20]	(3.02) [0.04]
P_{jB} $\times Z_j$	0.84	1.00	2.13	1.58	2.09	3.07
	(0.70) [0.23]	(1.01) [0.33]	(1.12) [0.06]	(0.74) [0.04]	(1.10) [0.07]	(1.27) [0.02]
N	37	37	34	36	36	34

Notes: Standard errors are in parentheses and *p*-values are in brackets under the coefficients.

Table B.3: *Regression results with shorter transitional periods*

P_{jA}	Pre: 1846–1865	Post: 1881–1900		Pre: 1846–1865	Post: 1876–1895	
	OLS	Tobit	Probit	OLS	Tobit	Probit
1	2.07	1.81	2.00	1.39	1.13	1.28
	(2.09) [0.33]	(2.50) [0.48]	(1.98) [0.30]	(1.65) [0.40]	(2.00) [0.58]	(1.49) [0.40]
P_{jB}	0.14	0.26	−1.14	0.47	0.61	−0.95
	(0.62) [0.83]	(0.90) [0.78]	(0.82) [0.17]	(0.48) [0.34]	(0.72) [0.40]	(0.63) [0.13]
Z_j	−0.78	−0.77	−3.77	−0.01	0.00	−2.77
	(2.69) [0.77]	(3.20) [0.81]	(2.73) [0.17]	(2.54) [1.00]	(3.05) [1.00]	(2.46) [0.26]
P_{jB} $\times Z_j$	0.92	1.05	2.07	0.60	0.72	1.92
	(0.76) [0.23]	(1.11) [0.35]	(1.23) [0.09]	(0.70) [0.40]	(1.04) [0.50]	(1.08) [0.08]
N	37	37	34	37	37	34

Notes: Standard errors are in parentheses and *p*-values are in brackets under the coefficients.

Table B.4: *Regression results with narrower transitional and pre- and post-shock periods*

P_{jA}	Pre: 1851–1865	Post: 1876–1890		Pre: 1851–1865	Post: 1881–1895	
	OLS	Tobit	Probit	OLS	Tobit	Probit
1	0.30	−0.28	−0.51	0.65	0.04	0.30
	(1.44) [0.84]	(1.81) [0.88]	(1.17) [0.66]	(1.69) [0.70]	(2.11) [0.99]	(1.32) [0.82]
P_{jB}	0.94	1.24	−0.11	0.78	1.08	−0.31
	(0.41) [0.03]	(0.62) [0.05]	(0.47) [0.81]	(0.47) [0.11]	(0.72) [0.15]	(0.55) [0.58]
Z_j	2.58	3.36	0.09	1.88	2.65	−1.51
	(3.10) [0.41]	(3.89) [0.40]	(2.25) [0.97]	(3.19) [0.56]	(4.00) [0.51]	(2.33) [0.52]
P_{jB} $\times Z_j$	−0.31	−0.52	0.73	−0.04	−0.23	1.09
	(0.79) [0.70]	(1.18) [0.66]	(0.91) [0.43]	(0.82) [0.96]	(1.22) [0.85]	(1.00) [0.28]
N	37	37	34	37	37	34

Notes: Standard errors are in parentheses and *p*-values are in brackets under the coefficients.