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**Trade Openness, Institutional Change and Economic Growth**

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# Trade Openness, Institutional Change and Economic Growth

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**Abstract**

This paper creates a theory of endogenous growth with endogenous institutional change to analyse the impact that trade openness has on economic growth through a change in institutions in pre-industrial societies. An elite (landowners) controlling the political power expropriates another social group (capitalists). This reduces investment in physical capital, the source of endogenous growth. The rival group (capitalists) can take a military action to expel the group in power. I study optimal expropriation, growth and institutional change under two scenarios, autarky and free trade. The simulation results suggest that for a vast majority of cases economies open to trade generally experience higher growth and earlier institutional change. This is the consequence of the fact that the elite reduces the expropriation rate when the economy opens up to trade. In addition, economies specialising in manufacturing products tend to grow more and introduce institutional change earlier. This is consistent with the divergent pattern in growth and institutions that Western European Economies were experiencing during the modern era and the industrial revolution.

JEL Codes: F43, O43

Keywords: Trade, Institutions, Growth in the very long run.

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## 1 Introduction

The history of modern economic growth shows that sustained long-run growth is a recent phenomenon. During the largest part of human history annual per capita income growth was nearly zero. However, income per capita has enormously accelerated in the last two centuries (Galor, (2005)). This process, known among economists and historians as the "takeoff", has been far from homogeneous across countries. A recent literature outlines the importance of the differences in the timing of the takeoff in determining the observed differences in income per capita across countries nowadays (Galor (2005) and more recently Basso and Cuberes (2013) and Dalgaard and Strulik (2013)).

While Western European countries and the Western Offshots turn out to be the pioneers in the takeoff process, there is substantial heterogeneity across countries within this group. During the last decade the Unified Growth Theory has provided successful explanations for the long-run evolution of income per capita from the old regime, characterized by Malthusian growth, to the modern economic growth regime (Galor and Weil (2002), Galor and Moav (2002), Hansen and Prescott (2002)). However, there have been very few attempts to explain the differences in the timing of the takeoff across these early escapers. At the heart of these theories is technological progress and the interaction between population growth, human capital and technology. In these models variations in technological progress across countries are either exogenous or explained by differences in population levels and educational attainment.

In this paper I build a theory in which differences in technology, explained by differences in economic and political institutions, account for the takeoff process. In my setup, an elite which holds the political power creates institutions that generate distortions in the allocation of productive resources across sectors and reduce the returns on investment. Under this setting, I introduce international trade and I show that trade and more precisely, the factor-content of trade, may be succesful in explaining both, the divergent patterns in the evolution of income per capita across countries from the $16^{th}$ century until the $19^{th}$ century, and the takeoff process. More precisely, trade affects technological progress on the one hand through its impact on the fundamentals of the economy, and on the other hand, through its impact in the current economic institutions. Both effects have consequences for the evolution of the institutional system in the long run.

The model builds on two main frameworks. The first one is used to model institutions and institutional change. This paper adopts the social conflict view, which was formally developed by Acemoglu (2006). According to this theory, there is a conflict of economic interests among different groups in a society which leads to different preferences for economic institutions. The group in power determines the established institutional system, and the other social groups can take military actions to expel that group from power to establish their own preferred institutions.[1] To this framework I add a dynamic dimension and I show that the landowners' fear to lose the political power and consequently the fiscal rents associated with it, will start an unavoidable gradual process of institutional improvement. I call the latter institutional change.

The second framework is used to model the structure of production, trade and the engine of growth. This paper builds on a dynamic version of the Ricardo-Viner specific factor model in which endogenous growth results from a Learning by Doing externality that is associated with

[1] This framework has been particularly useful in explaining a variety of political experiences such as the emergence of democratic institutions in The United States and Western Europe in the $19^{th}$ century or the Latin American experience at the end of that century (Acemoglu and Robinson (2006)).

capital accumulation.[2] From the political side, my model distinguishes three main social groups according to factor endowments and the allocation of political power: the landowners, the capitalists and the workers. The model starts with a situation where an elite of landowners extracts rents from the capitalists through expropriation of part of the manufacturing output. This expropriation reduces capital accumulation, which is the source of endogenous growth. These initial conditions reflect the situation of the Western European economies in pre-industrial societies. On the other hand, capitalists can finance, with a certain amount of their capital stock, a military intervention that places them in power. The model explores how trade changes the landowners' incentives to expropriate and the capitalists' incentives to acquire the political power and its consequences for economic growth.

This study finds that for the vast majority of cases: First, trade openness boosts economic growth. The fact that trade boosts growth even when countries are not specialising in the technology leading sector is unique as compared to other models of trade and dynamic comparative advantage (Matsuyama (1992), Redding (1999), Grossman and Helpman (1991), Galor and Mountford (2008)). In my model, trade boosts growth even when the country is not specialising in the technology leading sector, because trade reduces the incentives of the elite to expropriate. Second, for those countries engaged in trade, the latter accelerates institutional change. The second result is a consequence of the fact that trade accelerates capital accumulation which increases the benefits of acquiring the political power. Third, Not all countries benefit equally from trade. Compared to a country specialising in agricultural products, a moderate specialisation in manufacturing products fosters growth and accelerates institutional change. Consequently, this model predicts that trade openness accelerates growth and institutional change for most of the countries engaged in trade but it also predicts divergence among them. This divergence is associated with trade specialisation patterns.

To investigate the implications of the model on the takeoff process, I calibrate the model according to the Western Europe's experience of Atlantic Trade in the Modern Age ($16^{th}$ century-$18^{th}$ century). Applied to this particular historical case, the model predicts that Atlantic Traders, should have experimented higher growth and earlier institutional change than the other european counterparts. However, I should observe divergence among the Atlantic Traders based on specialisation patterns. Following the historical evidence,[3] England and the Netherlands which specialised in manufactured goods should have experimented higher growth and earlier institutional change than Spain and Portugal which specialised in agricultural products. I find empirical support for this prediction.

This paper is related to several literatures. The first one is the already mentioned Unified Growth Theory (UGT). Galor and Mountford (2008) propose a theory in which trade plays a central role in the time of the demographic transition, crucial to the take-off in UGT models. I stress however, the impact that the creation of institutions ensuring property was having on technological progress.[4] The inclusion of imperfect institutions in my set-up allow us to obtain a positive

[2] The Ricardo-Viner specific factor model is commonly used in international trade to illustrate the distributional effects of trade. Notice that distribution is at the heart of the political conflict in this model. Learning by Doing is one of the simplest ways to introduce endogenous growth and it is consistent with the literature on growth in preindustrial societies (Mokyr, 1990).

[3] We discuss the historical evidence in the following section.

[4] We are not the first to support the idea that the change in institutions ensuring property is at the roots of the takeoff process. The importance of good institutions in the growth acceleration process of the last two centuries have been pointed out by numerous researchers from the early contributions of North and Thomas (1973) to the more recent contribution of Jones (2001). In this paper we provide a theory in which trade through endogenous institutions leads the takeoff process.

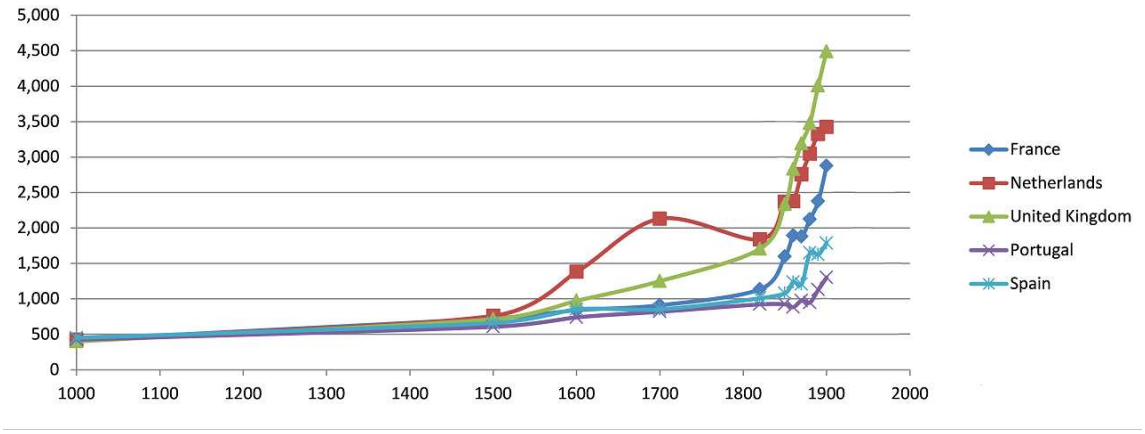



Figure 1: GDP p.c. from a sample of selected countries. The values are expressed in 1990 International Geary-Khamis dollars. Data comes from Maddison (2005)

effect of trade openness on growth even when the country specialises in agricultural goods, which is consistent with the empirical evidence cited above. The second one is the theoretical literature on growth and institutions (Eicher and García Peñalosa, (2008), Bourguignon and Verdier, (2000), Galor, Moav and Vollrath (2009), Falkinger and Grossman, (2005)). The first three papers, are endogenous growth models with endogenous institutions. These papers focus on different institutions (intellectual property rights, policies toward promoting public education), and different historical episodes. While some of the political economy elements of my model are common to their frameworks, they do not explore the impact of trade on the creation of growth-promoting institutions. Falkinger and Grossman (2005) analyze the interaction between all three, by focusing on the elites' incentives to promote public education in a model where human capital accumulation is the source of growth. Finally, this paper is also connected to the theoretical literature on the impact of trade on institutions (Levchenko (2009)). Unlike that paper, I establish a connection between trade, institutions and technology in a dynamic context to allow the analysis of the effects of trade openness on economic growth.

The paper is organized as follows. Section 2 describes in detail the empirical motivation and it also discusses the empirical and historical literature. Section 3 lays out the main elements of the model: technology, preferences and decisions. Section 4 discusses the results of the autarkic model. Section 5 presents the small open economy version of the model and describes the main implications of trade openness on growth and institutional change. In Section 6 I discuss the evidence in support of my model. Section 7 concludes.

## 2 Empirical Motivation and Literature Review.

Figure 1 shows the evolution of income per capita across Western European economies from 1000-1900 (Maddison, (2001)). Countries like England and the Netherlands show an earlier takeoff at the beginning of the $19^{th}$ century while Spain and Portugal experienced the takeoff later (around the mid of the $19^{th}$ century).

This figure reveals that before these countries were taking off, there were already differences in per capita income growth rates among them.[5] More precisely, these differences appear in the

[5]The use of GDP p.c. figures before 1820 has been always controversial for growth economists due to the lack

early $16^{th}$ century. In fact, this is the beginning of a period that economic historians defined as the first era of world globalization. The discovery of America and new Asian trade routes increased dramatically the volumes of world trade at an annual rate of 1%, which was around three times the average annual growth rate for Europe (O'Rourke and Williamsom (2002).

The idea that Spain and Portugal's positions in the Global Trade did not contribute to their economic success is not new in economic history. Acemoglu et al. (2005b) provide empirical support to the fact that these new trade routes, and more precisely trade with the Americas (Atlantic Trade), was accelerating growth through its impacts on institutions. According to the authors, Atlantic Trade created in England and the Netherlands a growing rich class of merchants and manufacturers that invested substantially in the control of the political power and consequently the institutional setting in the following decades. The resulting change in institutions promoted growth through a more secure system of property rights.

However, Atlantic Trade did not bring the same benefits to all countries involved like Spain or Portugal. Acemoglu et al. (2005b)'s main hypothesis is that those countries were organizing trade through crown monopolies that were used as a fiscal instrument. This paper contributes to this literature by theoretically exploring a new link between trade openness and the economic (un)success of Western European countries: the impact of trade on institutions. The theory reveals that trade may have contributed to the growth and institutional divergence experiences observed across Western European countries, through a different link: Specialisation patterns. More precisely, the current paper emphasizes that the specialisation pattern of England and The Netherlands in the New World Market fostered growth and institutional change in these countries, while the Spanish and Portuguese one delayed the emergence of growth promoting institutions.

Spain, as most of the Atlantic Traders, was organising overseas trade through state monopolies. In 1503 the Spanish Crown created the *Casa de Contratacion* a royal institution in charge of inspecting and regulating trade with Spain's overseas possessions. This institution granted the monopoly of trade operations to the Consulado of Seville, a corporation of merchants from the city of Seville and they only allowed Spanish products to be traded in the Americas. This monopoly was bringing a unique opportunity for Spanish manufacturers to have access to a vast market in which they can sell their products and obtain large profits.

However, in reality very few manufacturing products traded in the Americas had Spanish origins from the very beginning and frequently, European and specially English and Dutch merchants sent their own products through legal procedures (selling their products directly to the members of the Consulado) or more circumvent procedures (bribing officials, buying intermediaries names' etc...) to the Americas. As Hamilton (1934), Chaunu (1955), Kamen (1984), and more recently, Marquez (2006) and Finlay and O'Rourke (2007) point out Spanish trade with the Americas was mostly in agricultural products (wine, sherry, olives, oil) and by the late $16^{th}$ century non-Spanish manufacturing products dominated shipments to the New World. This suggests that the Spanish manufacturing products were not competitive enough to be exported to the Americas, and Spanish

of accurate data. An alternative way of measuring standards of living before 1820 is the use of urbanization rates. In Appendix 1 I show urbanization rates for the same sample. I show that the evolution of both measures is very similar. For the case of England the urbanization rates and the GDP p.c.are not strictly comparable since the urbanization rates includes the territory of England and Wales (Britain), while the GDP p.c. growth rate is for the United Kingdom. Both trends however show a dramatic change in the $16^{th}$ century and since Scotland was not a very populated country at that time these trends can not change dramatically with the inclusion of Scotland in the former one.

merchants preferred to buy the more competitive Dutch and British manufacturing products to resell them to the colonies rather than buying domestic products. My model suggests that this was precisely the reason why Spain did not benefit as much from the trade with the Americas in the $16^{th}$ century and that this may be the reason for the late Spanish industrialization due to its negative impact on the evolution of institutions.

In a recent paper, Acemoglu et al. (2011) stress the idea that the Napoleonic invasion may have contributed significantly to the institutional change that certain economies of Western Europe (i.e. Spain, Portugal, German Republics before the unification) were experiencing by the first half of the nineteenth century.[6] This paper consequently suggests that the institutional change in Spain and Portugal in the $19^{th}$ century could have been the result of an historical accident. The current paper is also consistent with this evidence since it claims that trade and more precisely, the factor-content of trade, favors institutional change in The Netherlands and Britain, while it delayed it in Spain and Portugal. By the early $19^{th}$ century, England and the Netherlands have already undertaken institutional improvement while that was not the case for Spain and Portugal (Acemoglu 2005b) until the arrival of Napoleon.

## 3 The model

### 3.1 The structure of the game

Consider an economy that is inhabited by a continuum of individuals. These individuals live for one period that in this model is interpreted as a generation. Each of these individuals has one child that forms the next generation in the next period. Capital accumulation is guaranteed by bequests to the future offspring.[7] The inhabitants have homogeneous preferences but differ in their sources of income, access to asset markets and the initial endowment of political power. According to these characteristics I can identify three kind of agents: landowners, workers and capitalists. For simplicity I assume that the three groups are equal in size, constant along time and normalized to one.

At time $t = 0$, there is an equal distribution of land among the landowners who monopolise the political power. At the beginning of each period, the landowners inherit a certain amount of land from their ancestors and the political power. Landowners use their power to expropriate a proportion $\tau_t$ of the total production of the manufacturing sector which is equally distributed among them.[8]

At the beginning of the period, capitalists inherit an amount of capital from their predecessors. Capitalists can react to expropriation by investing part of the capital stock in a military action to acquire political power. If they do not carry undertake a military action, the landowners remain in power.

[6] These authors explore the role played by the Napoleonic invasion on several indicators related to the institutional quality and income per capita in a panel of German regions. In their conclusions the authors suggest that a similar story could be behind the institutional experiences of Spain and Portugal during the same period.

[7] This paper considers "Joy of giving " preferences: Individuals derive direct utility from leaving bequests by itself. This is substantially different from the standard Barro type preferences in which individuals leave bequests because they care about the utility of their descendants. Altonji et al., (1997) provide empirical evidence supporting this type of preferences.

[8] Following the voluminous recent literature on property rights we represent an imperfect system of property rights as a proportional tax on output. (Acemoglu (2006), Gonzalez (2005)).

In each period the order of the events in the decision tree is as follows:

1. Landowners decide the expropriation rate.
2. Capitalists decide whether to undertake military action to acquire the political power.
3. Consumption and production decisions are carried out.

The expropriation rate is chosen before the production and consumption decisions are made to avoid holdup problems, which are not the focus of the paper. An alternative decision tree in which the capitalists take their political decision before landowners decide the amount of expropriation does not alter qualitatively the main results of this paper.[9]

### 3.2 Production

In the economy there are two final goods: agricultural and manufactured. Each sector uses a specific factor of production (land and capital respectively) and competes for labour which is perfectly mobile across sectors. The following functional forms characterize the technologies that are used in each sector:

$$Y_t^A = (X_t T_t)^{\alpha} \left(X_t L_t^A\right)^{1-\alpha}, \tag{1}$$

$$Y_t^M = K_t^{\alpha} \left(X_t L_t^M\right)^{1-\alpha}, \tag{2}$$

where I denote $Y_t^A$ as the production in the agricultural sector. The production of agricultural goods depends on the stock of land available in the country $T_t$, the knowledge externality, $X_t$, and $L_t^A$ which represents the labour used in agriculture. I denote $Y_t^M$ the production in the manufacturing sector that depends on the stock of capital $K_t$ , the knowledge externality $X_t$, and the labour in the manufacturing sector, $L_t^M$.

In this economy technological advances are the result of a knowledge externality associated with capital accumulation:

$$X_t = \theta K_t, \tag{3}$$

This assumption is based on the early works by economic historians (Mokyr (1990)).[10] I consider that this knowledge externality not only makes workers more efficient in production as in the classical specification of Romer (1986) but it also increases the efficiency in the usage of the land in the agricultural sector.[11] This is consistent with the very well-known stylized fact that at the early stages of development technological progress was having a strong impact in productivity on the agricultural sector (Mokyr (1990)).[12]

[9] Available on request.

[10] The classic work of Mokyr, "The lever of riches" provides a good survey on the history of technological progress during that time. The chapter provides many examples of technological improvements that were the result of experience, or a learning process. For example, when talking about the instrumenting industry, the author claims that "Most improvements were the result of serendipity and trial and error searches. Learning and training took place mostly through apprenticing and informal contact" (p.72)

[11] One of the most important changes at the industry level during the late medieval time but mostly in the modern era was the migration of certain parts of the industry from the cities to rural areas, a phenomenon that was baptised by economists and historians as proto-industrialization (Kamen (1984)). Certainly, this process was promoted by urban enterpreneurs. The increase in the number of contacts between urban enterpreneurs and rural workers may have helped the diffusion of technological knowledge in rural areas. (Mokyr, 1990).

[12] The qualitative predictions of the model do not change under an alternative scenario in which the productivity in the agricultural sector is growing at a lower path than the one in the manufacturing sector.

In this society, the access to specific production factors is contingent on an individuals' membership in a particular social group. Access to capital goods is restricted to the capitalists, access to the land is restricted to the landowners and workers are the only ones supplying labour in this economy. This is consistent with the empirical evidence on the minor role played by landowners during the early stages of the industrial revolution.[13]

At the beginning of each generation, the capitalists inherit the capital their parents left to them. After the landowners decide on the level of expropriation, they decide whether to undertake military action to acquire the political power by investing a part of their stock of capital. The remaining capital is the full capital stock when no conflict has taken place. Each of the capitalists use their remaining capital stock and hire labour to produce competitively manufactured goods. Since all capitalists are identical I solve for the general problem. More precisely, the capitalists, as producers, solve the following problem:

$$\max_{L_t^M} (1-\tau_t)p_t Y_t^M - w_t L_t^M.$$

for a given expropriation rate $\tau_t$. I use the agricultural good as the numeraire so, $p_t$ is the price of the manufacturing good in terms of the agricultural good. I denote with $r_t$ the implicit returns per unit of capital dedicated to the production of manufactured goods. Consequently the returns to capitalists as a group are given by:

$$r_t K_t = (1-\tau_t)p_t Y_t^M - w_t L_t^M. \tag{4}$$

Each of the landowners use their own stock of land and hire workers to produce competitively the agricultural good. More precisely, the landowners, as producers, solve the following problem:

$$\max_{L_t^A} Y_t^A - w_t L_t^A,$$

I denote with $d_t$ the implicit rents obtained from using one unit of land in agricultural production. Consequently, the returns to landowners as a group are given by:[14]

$$d_t T_t = Y_t^A - w_t L_t^A. \tag{5}$$

[13] Crouzet (1985) finds that for the case of the British Industrial revolution, during the period (1750-1850) only 3% of the enterpreneurs were part of the upper class and less than 10% were descendants of landowning elites. Doepke and Zilibotti (2005) discuss the small role played by the landowners elite and aristocracy in the early stages of the Industrial Revolution.

[14] Notice that since all agents are identical I have just defined the capitalists and landowners' production problem in terms of the representative agent within their social group for expositional clarity. The results are identical to an alternative structure in which I assume that each agent cannot cultivate its own land or use its own stock of capital and she needs to rent it to another landowner or another capitalist.

### 3.3 Consumption

In this section I describe how each type of agent decides on their consumption and bequest. I denote with subscript $i = T, K, L$ the variables associated with landowners, capitalists and workers, respectively.

Since landowners are identical in preferences and endowments and land is a fixed factor, in equilibrium, each landowner will bequeath her entire endowment of land. I can abstract from that problem and focus only on the landowners' consumption decision which is given by the solution to the following maximization problem

$$\max_{c^A_{Tt}, c^M_{Tt}} \ln\left(\left(c^A_{Tt}\right)^{\gamma}\left(c^M_{Tt}\right)^{1-\gamma}\right) \tag{6}$$
$$s.t. \;\; c^A_{Tt} + p_t c^M_{T_t} \leq d_t T_t + \tau_t Y^M_t$$

for a given tax, where, $c^A_{Tt}, c^M_{Tt}$, are respectively the agricultural and the manufacturing consumption bundles of the landowners; $\gamma$ is the proportion of expenditure spent on agricultural goods.

The capitalists decide how to split their resources between consumption and bequests ($B_{Kt}$) to the next generation. These bequests are used to cover the depreciation of existing capital, and to build new capital that passes to the future generation. Capitalists solve:

$$\max_{c^A_{Kt}, c^M_{Kt}, B_{Kt}} \ln\left(\left(c^A_{Kt}\right)^{\gamma}\left(c^M_{Kt}\right)^{1-\gamma}\right) + \beta \ln B_{Kt}$$

$$s.t. \quad c^A_{Kt} + p_t\left(c^M_{Kt} + B_{Kt}\right) \leq r_t K_t$$

$$B_{Kt} = K_{t+1} - (1-\delta)K_t \tag{7}$$
$$K_0 > 0, \; given.$$

Workers do not have access to either capital or land and therefore, they cannot leave bequests to the future generations. Each worker is endowed with one unit of labour. They solve:

$$\max_{c^A_{Lt}, c^M_{Lt}} \ln\left(\left(c^A_{Lt}\right)^{\gamma}\left(c^M_{Lt}\right)^{1-\gamma}\right)$$

$$s.t. \quad c^A_{Lt} + p_t c^M_{Lt} \leq w_t$$

## 4 The Equilibrium in Autarky

### 4.1 Consumption and production decisions

The preference structure allow us to concentrate on sub-game perfect equilibrium within each period. Therefore, I solve the model by backward induction. In this section I analyse the optimal consumption bundle, the optimal bequest and the optimal allocation of workers across sectors, given $\tau_t$ and the political decision. Cobb-Douglas preferences imply that the consumption of each good for each group is given by the following demand functions:

$$c^A_{it} = \gamma E_{it}, \quad i = T, K, L \tag{8}$$

$$c_{it}^{M} = (1-\gamma)\frac{E_{it}}{p_t}, \quad i = T, K, L \tag{9}$$

where $E_{it}$, is expenditure dedicated to consumption. For workers and landowners I have that consumption expenditure is equal to income:

$$\begin{aligned} E_{Tt} &= d_t T_t \ + \tau_t p_t Y_t^M \\ E_{Lt} &= w_t L_t. \end{aligned} \tag{10}$$

However, for capitalists, I have that:

$$E_{Kt} = \frac{1}{1+\beta} r_t K_t \tag{11}$$

$$B_{Kt} = \frac{\beta}{1+\beta}\frac{r_t K_t}{p_t} \tag{12}$$

since they also leave bequests to their descendants. Using equation 7, yields

$$\frac{K_{t+1}}{K_t} = \frac{\beta}{1+\beta}\frac{r_t}{p_t} + (1-\delta) \tag{13}$$

Let $C_t^j = \sum_{i=T,K,L} c_{it}^j, \ \ j = A, M$ I have that:

$$\frac{C_t^A}{C_t^M} = \frac{\gamma}{1-\gamma} p_t. \tag{14}$$

Labour is perfectly mobile across sectors. Solving the production problem for each type of agent, I obtain:

$$w_t = \frac{(1-\alpha)Y_t^A}{L_t^A} = \frac{(1-\alpha)(1-\tau_t)p_t Y_t^M}{L_t^M} \tag{15}$$

substituting the previous equation in the definitions for $d_t$ and $r_t$ yields,

$$r_t = \frac{\alpha(1-\tau_t)p_t Y_t^M}{K_t} \tag{16}$$

$$d_t = \frac{\alpha Y_t^A}{T_t} \tag{17}$$

To close the model I impose market clearing conditions for labour and final consumption goods:

$$L_t^A + L_t^M = 1 \tag{18}$$

$$C_t^A = Y_t^A \tag{19}$$

$$C_t^M + B_{Kt} = Y_t^M \tag{20}$$

where,

$$B_{Kt} = \frac{\beta\alpha\left(1-\tau_t\right)Y_t^M}{1+\beta}. \tag{21}$$

and condition (3) which must hold in equilibrium.

Using (14), (19), (20) and 21 I obtain:

$$p_t = \left(\frac{1-\gamma}{\gamma}\right) \underbrace{\left(\frac{1+\beta}{1+\beta(1-\alpha(1-\tau_t))}\right)}_{\textit{demand} \text{ channel}} \underbrace{\left(\frac{Y_t^A}{Y_t^M}\right)}_{\text{supply channel}} . \tag{22}$$

The expropriation rate affects the price of the manufactured goods through two channels: the demand channel and the supply channel. The first one is the effect of expropriation on the demand of manufactured products: an increase in expropriation reduces the demand of capitalists' bequests. The latter decreases the relative demand of manufactured products reducing $p_t$. The second one is the effect of expropriation on the optimal allocation of workers across sectors, which affects the relative supply of each good. Expropriation reduces the marginal productivity of labour in the manufacturing sector, which shifts workers to the agricultural sector. The latter increases the relative supply of agricultural goods and decreases the relative supply of manufactured goods. Consequently $p_t$ increases. Taking (15) and (22) and combining them:

$$\frac{L_t^M}{L_t^A} = \left(\frac{1-\gamma}{\gamma}\right)\left(\frac{(1+\beta)(1-\tau_t)}{(1+\beta(1-\alpha(1-\tau_t))}\right) \tag{23}$$

Substituting (23) in (22), I have:

$$p_t = \left(\left(\frac{1-\gamma}{\gamma}\right)^{\alpha}\left(\frac{(T_t)^{\alpha}}{(1-\tau_t)^{1-\alpha}}\right)\left(\frac{1+\beta}{(1+\beta(1-\alpha(1-\tau_t))}\right)^{\alpha}\right) \tag{24}$$

where the first term accounts for the supply effect discussed above. It can be shown that the relative price, is monotonically increasing in taxes for reasonable values of $\alpha$.[15]

**Proposition 1** $\frac{dp_t}{d\tau_t} > 0$, *if* $\alpha < \alpha^* = \frac{1+\beta}{1+\beta(2-\tau_t)}$.
***Proof.*** *See appendix.* ■

The latter becomes an important result since as it will become apparent, trade will have an impact on expropriation through this channel.

Substituting (2) and (16) in (21), I obtain the law of motion of capital which is given by:

$$\frac{K_{t+1}}{K_t} = \frac{\alpha\beta\theta\,(1-\tau_t)\left(L_t^M\right)^{1-\alpha}}{1+\beta} + (1-\delta) \tag{25}$$

Total output is given by:

$$Y_t = \left(\theta T_t^{\alpha}\left(L_t^A\right)^{1-\alpha} + \theta p_t\left(L_t^M\right)^{1-\alpha}\right) K_t. \tag{26}$$

Looking at condition (25) it can be seen that the level of $\tau_t$ is crucial in the dynamics of the model. Equation (26) shows that expropriation creates a distortion in production. In a further section I will see that the expropriation rate that maximizes aggregate output growth is $\tau_t = 0$.

[15] Notice that the supply channel comes through the effect that expropriation has on the allocation of labour across sectors. The more important labour is as a production factor in the economy (the lower is $\alpha$), the larger will be the effect of these reallocations on the equilibrium price (the stronger will be the supply channel). Since $0 < \tau < 1$, $0 < \beta < 1$, then the possible values for $\alpha^*$ are $\frac{1}{2} < \alpha^* < 1$. For $\tau > \frac{1}{2}$ which is going to be the case later, the set of possible values of $\alpha^*$ for the calibrated model is $0.85 < \alpha^* < 1$.For $\tau = 0$, $\alpha^* = 0.75$. Data do not report such a high values for $\alpha$

## 4.2 Political decisions

### 4.2.1 Capitalists' political decision.

Capitalists have access to a technology that allows them to take power by investing $m$ units of their capital stock. This cost $m$ takes the following expression:

$$m = \varphi\left(K_t\right)^{\varepsilon},\ 0 \leq \varepsilon < 1,\ \varphi > 0 \tag{27}$$

The function $m$ can be intepreted as the cost of financing an army, that with probability one removes the landowners from power. I allow $m$ to change with the country's stock of capital, a proxy to the country's level of income. This reflects the possibility that a change in the political regime could be more costly in more economically advanced economies.[16] The parameter $\varepsilon$ measures the elasticity of the conflict cost with respect to a country's level of development. The larger $\varepsilon$, the more sensitive this cost is to changes in the level of development. The parameter $\varphi$ captures differences in initial political conditions. In economies with a strong state infrastructure (i.e. with a large military force) capitalists require more resources for a change in the political regime, so the cost is higher.

When deciding whether to undertake military action, capitalists take two factors into account: Firstly, the change must be profitable and second it must be financed. In order to keep the model simple, I assume that capitalists cannot expropriate the landowners after they acquire the political power.[17] The capitalists undertake military action if:

$$V_{Kt}(\tau_t = 0,\ K_t = K_t^* - \varphi(K_t^*)^{\varepsilon}) - V_{Kt}(\tau_t = \tau_t^*, K_t = K_t^*) \geqslant 0 \tag{28}$$

$$K_t^* \geq m(K_t^*) \tag{29}$$

where I denote the variables with "$*$", the variables at the time of the military action with the landowners in power. Substituting the optimality conditions and rearranging terms I obtain the capitalists' indirect utility function:[18]

$$V_{Kt} = \ln\left(\frac{R_{Kt}\left(\xi_K\right)^{\frac{1}{1+\beta}}}{p_t^{1-\frac{\gamma}{1+\beta}}}\right)^{1+\beta}$$

where $R_{Kt} = r_t K_t$ is the income of the capitalists and $\xi_K$ is a constant.[19] Substituting the latter in the utility function and using (28), I obtain that the capitalists undertake military action when the following condition holds:

$$Ln\left(\left(\frac{r_t(K_t - m(K_t)) - (1-\delta)p_t m(K_t)}{r_t^* K_t}\right)\left(\frac{\left(p_t^*\right)^{\frac{1+\beta-\gamma}{1+\beta}}}{\left(p_t\right)^{\frac{1+\beta-\gamma}{1+\beta}}}\right)\right) \geqslant 0 \tag{30}$$

provided that $K_t^* \geq m(K_t^*)$. On the left hand side of equation (30) I can clearly distinguish two elements: The first one compares the relative income of the capitalists in both regimes. In the

[16] Although in this model, for simplicity, I have not included the possibility that landowners repress the capitalists' military action, repression from the elite could be easier in more advanced economies. This could be modelled as an increasing cost of undertaking a military action. Allowing for this possibility helps us to get a richer set of results. Notice that when $\varepsilon = 0$, we will be in the case in which the cost of a military coup is independent of the level of development. I thank an anonymous referee for this suggestion.

[17] A case in which I allow for this possibility will not alter considerably the results. (Available on request).

[18] The derivation of the indirect utility functions for the different social groups is provided in the appendix.

[19] $\xi^K = \frac{\gamma^{\gamma}(1-\gamma)^{1-\gamma}\beta^{\beta}}{(1+\beta)^{1+\beta}}$.

numerator the capitalists have undertaken the military action so they enjoy full returns per unit of capital ($r_t$). However, the revolution has been costly ($m(K_t)$), so they lose the returns on these units ($r_t m(K_t)$ and the residual value of these units, $(1-\delta)p_t m(K_t)$. In the denominator, the capitalists have not undertaken military action and consequently their income is given by their returns on capital considering the expropriation. The second element takes into account the effects on the utility of the change in the price of the manufactured goods under both regimes. Substituting (16) and (24) in (30) and rearranging terms I obtain the following result:

**Proposition 2** *When $\varepsilon < 1$, there exists a threshold level of capital $K^{**}$ such that:*
*If $K_t \geq K^{**}$ the capitalists want to undertake military action.*
*If $K_t < K^{**}$ the capitalists decide not to undertake military action.*
*The threshold level of capital is given by:*

$$K_t \geq K^{**} = (\mu\varphi)^{\frac{1}{1-\varepsilon}} .$$

*where:*

$$\mu = \left( \frac{1}{\left(1 - \left((1-\tau_t)\left(\frac{L_t^{M*}}{L_t^M}\right)^{1-\alpha}\lambda\right)\right)\left(\frac{\alpha\theta\left(L_t^M\right)^{1-\alpha}}{1-\delta+\alpha\theta\left(L_t^M\right)^{1-\alpha}}\right)} \right)$$

$$\lambda = \left( \left(\frac{1}{1-\tau_t}\right)^{1-\alpha} \left(\frac{(1+\beta(1-\alpha))}{1+\beta(1-\alpha(1-\tau_t))}\right)^{\alpha} \right)^{\frac{\gamma}{1+\beta}}$$

**Proof.** See appendix. ■

The benefits of a military action are proportional to the capital stock, however the costs also increase with the capital stock. As long as $\varepsilon < 1$, the costs of undertaking military action increase more slowly than the benefits as the capital stock increases. This implies that there is a threshold level of capital stock above which undertaking military action is always profitable. In an autarky, the larger the interest rate, the larger the threshold level of capital stock that is needed for a military action to occur. It should be noted that if (28) holds, (29) holds (since $\mu > 1$). This implies that whenever the military action is profitable capitalists could finance it.[20]

Proposition 2 implies that, provided that the economy is on a positive Balanced Growth Path (BGP), there would be a finite point in time in which the threat of a coup becomes binding for the landowners. The next proposition shows that if the expropriation rate decreases the capitalists prefer to delay the political change. This comes from the fact that the decrease in expropriation, decreases the benefits of acquiring the political power and consequently mitigates the incentives of the capitalists to undertake the military action.

**Proposition 3** *The capitalists reaction function is declining in the amount of expropriation (i.e. When $\tau_t$ increases $K^{**}$ decreases).*
***Proof.*** *See appendix.* ■

[20] The special case of $\varepsilon = 1$ is discussed in the appendix.

### 4.2.2 The expropriation decision

To obtain the landowners' indirect utility I substitute (8) and (9) in (6) and I rearrange terms. This yields:

$$V_{Tt} = \ln\left(\frac{R_{Tt}\xi_T}{(p_t)^{1-\gamma}}\right) \tag{31}$$

where $R_{Tt}$ is the landowners' income and $\xi_T$ is a constant from the point of view of expropriation.[21] The landowners decide on the level of expropriation by maximizing

$$\max_{\tau_t} V_{Tt}$$

I consider first, the choice of the amount of expropriation when the constraint is not binding ($K_t < K^{**}$). Substituting the value of $R_{Tt}$, in (31) I find that:

$$V_{Tt} = \ln\left(\alpha Y_t^A + \tau_t p_t Y_t^M\right) - (1-\gamma)\ln p_t + \ln \xi_T \tag{32}$$

The expression shows that initially an increase in the level of expropriation produces an ambiguous effect on the utility level.

First of all, an increase in expropriation produces a direct effect on utility. Keeping constant the relative price $p_t$, a rise in expropriation generates an ambiguous effect on fiscal income: Keeping constant $Y_t^M$, a rise in expropriation increases fiscal income. However, the rise in expropriation reduces the marginal productivity of labour in the manufacturing sector. This reduces the output in the manufacturing sector, since workers move from the manufacturing sector to agriculture. The latter clearly reduces fiscal income.

Second, and novel to this paper, an increase in expropriation has an indirect effect on utility through the relative price $p_t$.[22] An increase in expropriation, increases the price of the manufactured goods. The latter, has a positive effect on the utility due to the rise in the value of fiscal income, and a negative one since manufactured goods are more expensive. The increase in $p_t$ has also an indirect effect on the reallocation of labour across activities (the increase in $p_t$, decreases the value of the marginal productivity of labour in the agricultural sector and it raises it in the manufacturing sector). A quick look at equation (32) reveals that the net direct effect and the net indirect effect of taxes on landowners' indirect utility are initially ambiguous. However, the production in the agricultural sector will unambiguously increase with the level of expropriation while the volume of production in the manufacturing sector will unambiguously decrease with the level of expropriation.

This second indirect effect is crucial in this paper because international trade induces landowners to change the optimal expropriation rate, which has consequences for growth, mainly through the price channel. When a small open economy opens up to international trade, the rest of the world determines the price $p_t$ and landowners cannot affect the price level with their expropriation decisions.

[21] $\xi_T = \gamma^{\gamma}(1-\gamma)^{1-\gamma}$.

[22] Since the effects already discussed are complex, it is generally assumed in the literature that both final goods are perfect substitutes so changes in expropriation will not lead to changes in the relative price in equilibrium. Due to the fact that my focus in this paper is trade openness, the perfect substitution assumption is no longer appropiate. In addition, as we will see later, the price channel will play a crucial role on the effects of openness on growth.

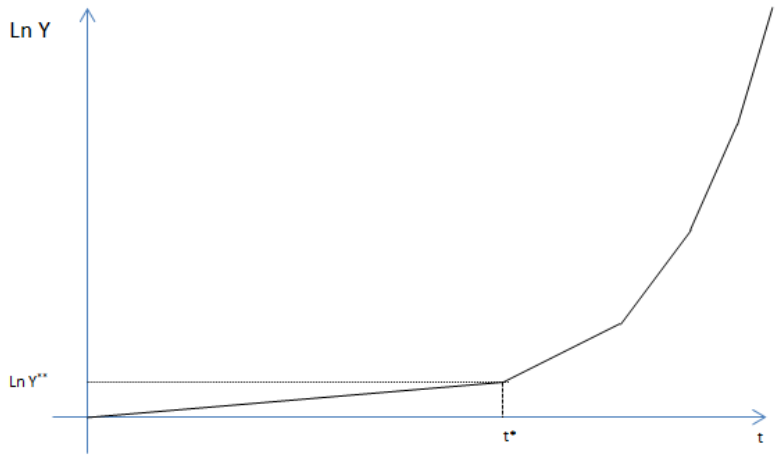



Figure 2: The evolution of income in Autarky

When the constraint is binding ($K_t \geqslant K^{**}$), landowners simply choose the highest expropriation level $\tau_t = \bar{\tau}_t$, that allows them to avoid the military coup ($V_{Kt}(\tau_t = 0,\ R_{Kt} = r_t(K_t - m_t) - p_t\,(1-\delta)\,m_t) - V_{Kt}(\tau_t = \bar{\tau}_t, R_{Kt} = \bar{r}_t K_t) = 0$). I know that $\bar{\tau}_t < \tau_t^*$ when $\tau_t^*$ is the optimal expropriation rate when the constraint is not binding. I know the latter because of the monotonicity of the capitalists' reaction function. Notice, however, that the next generation faces a similar problem, since capital grows during the previous generation and so does the benefits of acquiring the political power. The next generation reduces the level of expropriation again to deter the military intervention. This process is repeated until the economy eventually gets rid of expropriation.

Therefore the model predicts that the expropriation slowly dissappears. This is due to the fact that once the threat of conflict becomes credible, the ruling elite has the incentive to reduce the expropriation rate to discourage military conflict and keep the political power. However, a partial reduction in expropriation will not remove entirely the political tension. The incentive that each generation of landowners has to reduce expropriation in order to keep the political power leads the economy to a situation in which landowners remain in power but expropriation is gradually removed from the manufacturing sector.[23]

### 4.3 Dynamic Evolution of the Economy

The assumption of a Cobb-Douglas functional form for preferences and technologies allows us to define a BGP when all variables grow at a constant rate, provided that the capitalists' constraint is not binding ($K < K^{**}$). For the growth rate to be positive I need to assume that the economy starts with a sufficiently high level of technology.[24]

[23] Notice that when the constraint is binding there is no other solution to discourage conflict. The warm-glow preferences assumed in the paper rule out a situation when the landowners may increase the expropriation rate before it is binding to avoid a future threat of revolt. We leave this possibility for further research.

[24] More precisely, the following needs to be assumed: $\theta > \frac{\delta}{\alpha(1-\tau^*)(L_t^M)^{1-\alpha}} \frac{1+\beta}{\beta}$. An analogous condition is assumed in standard AK models to derive positive growth. Since the focus of the paper is to study the impact of trade on the quality of institutions and the growth rate we are not interested in negative growth equilibria. A detailed proof is provided in the appendix.

Figure 2 illustrates the dynamics of the model. I denote with $t^*$, the time at which the threat of the military action becomes binding and with $Ln\ Y^{**}$, the logarithm of income associated with the stock of capital $K^{**}$. Before $t^*$, the economy is on a low growth path since the landowners expropriate the capitalists and this reduces capital accumulation and growth. When the constraint becomes binding ($t^*$), the capitalists' threat of conflict becomes credible, and the landowners reduce the amount of expropriation to discourage conflict. The reduction in expropriation boosts capital accumulation and growth. The increase in the growth rate will be smooth as the ruling class will eliminate the expropriation gradually until the latter is no longer in place. I refer to this process of gradual improvement of property rights as institutional change.

The main focus of this paper is the impact of trade openness on the timing of the institutional change. Since, before the constraint is binding, the economy exhibits a unique BGP with no transitional dynamics, I can compute the number of years necessary to reach the threshold level of capital $K^{**}$. Consider an arbitrary period $t$. The number of years from period $t$ necessary to start the process of institutional change is given by:

$$n = \left[ \underbrace{\frac{1}{\ln(1+g)}}_{\text{Growth}} \left( \underbrace{\frac{\ln(\mu\varphi)}{1-\varepsilon}}_{\text{Incentives}} - \ln K_t \right) \right] \tag{33}$$

where $g$ is the growth rate of the economy and $K_t$ is the value for period $t$ capital stock.[25]

In the next section I distinguish between two different channels through which trade affects institutional change. The first one, denoted as *the growth mechanism,* is the effect that trade has on the income growth rate and therefore on the speed of capital accumulation. The higher the growth rate, the faster the economy accumulates capital, and the earlier it reaches the threshold level of capital $K^{**}$. The second one, denoted as *the incentives mechanism*, captures how trade affects the threshold level of capital necessary to undertake political change.

The appendix shows that the optimal tax chosen by landowners is always interior and unique for all numerical exercises carried out. It was not possible to find an analytical expression for the value of $\tau_t$. Hence, I solved it using numerical methods. To choose the parameter values $\alpha, \gamma, \delta, \theta$ and $\beta$, I have calibrated the model to be consistent with historical data on the Western European experience during the Modern Age.

I obtain the parameter $\gamma$, which measures the proportion of consumption expenditure on agricultural products, from Hoffman et al. (2002)'s [26] database on European consumption baskets, and it takes the value of 0.5. To calibrate the depreciation rate, $\delta$, I take a weighted average of the annual depreciation rates of the different types of capital in the Spanish economy in the $19^{th}$ century and then compute the residual value of one unit of capital after a generation.[27] Then one minus the residual value will constitute the depreciation rate of the whole generation. I find an annual depreciation rate of $\delta = 0.02$.[28] To calibrate the parameter $\beta$ I use data on capital shares

[25] See appendix for a formal proof.

[26] This database collects data on individual consumption patterns belonging to different social classes in several countries across different periods of time. The data reports differences by social groups and by countries showing that these differences are large across social groups but not across countries. Expenditure on food and drink represents 49% of the total national consumption expenditure in the UK in the $17^{th}$ century. This quantity is similar for France in the $18^{th}$ century. (Data is from (Hoffman, Jacks, Levin and Lindert (2002)).

[27] I use estimates of stock of capital and depreciation rates for Spain in the $19^{th}$ century from De la Escosura and Rosés (2007).

[28] The same value is also used in Voigtlander and Voth (2006).

| **regime** | $\boldsymbol{\tau}_t$ | $L_t^M$ | $L_t^A$ | $g$ |
|---|---|---|---|---|
| expropriation | 0.81 | 0.17 | 0.83 | 0.13 |
| No expropriation | 0 | 0.56 | 0.44 | 1.60 |

Table 1: The economy in Autarky

and saving rates obtained for Britain in the $19^{th}$ century.[29] The evidence suggests that by that time England had already undergone institutional change, so I calibrate these parameters using a version of the model with no expropriation. This gives a value for $\beta = \frac{1}{2}$ and a value for $\alpha = 0.62$.[30]

To find the technological constant $\theta$, I use Maddison (2005)'s estimate for the average per capita GDP growth rate in Western Europe in the $15^{th}$ century which was 0.13% per year. Given that each period in the model represents a generation, it is necessary to determine the duration of each generation's life. Life expectancy is a poor measure for my purposes here because child mortality was very high at that time. However, my model does not include this feature, as all my individuals are assumed to be adult.[31] I use the estimates provided by Nicolini (2004) for the life expectancy of the English population over 25 in the $16^{th}$ century, which leads to an average adult life expectancy of 55 years.[32]

Table (1) reports the optimal expropriation rate, the sectoral composition of the labour force and the growth rate of output in autarky. The first row provides data for an initial situation in which the elite is expropriating ($K < K^{**}$). It should be noted that the landowners in autarky expropriate a substantial amount of manufacturing output (81%). This is a consequence of the fact that the increase in expropriation has a positive effect on the value of manufacturing production and fiscal income. Therefore, for the landowners, it is optimal to expropriate even when the volume of manufacturing production falls because the rise in the price more than compensates the decline in production. In autarky with expropriation, the percentages of the labour force used in each activity are 17% in manufacturing and 83% in agriculture. I use the proportion of the population living in medium sized cities, as a proxy for the share of the labour force in the manufacturing sector to verify that the model matches the data. Recent revised estimates for urbanisation rates across Europe for the beginning of the $16^{th}$ century suggest that the average urbanisation rate (percentage of population living in cities with more than 10,000 inhabitants) was 5.3 %. This percentage is definitely lower than the one proposed by the model. However, there is heterogeneity across european regions at that time and countries like The Netherlands (18.9%), Belgium (21.7%) or Northern and Central Italy (16.4%) are closer to the one predicted by the model.

[29] This has been the earliest source I have found to calibrate this parameter.

[30] These parameters are based on Feinstein's estimation of the saving rate (the most commonly used) and Crafts (1985) estimation of the capital share. Crafts gives a value for $\frac{rK}{Y} = 0.35$. This value is also consistent with the one used in Stokey (2001) and Voigtlander and Voth (2006). Feinstein gives a value for the saving rate of 12% in 1780. Crafts reviewed the estimates for the saving rate giving a value of 8%. Under this second value $\beta = 0.2963$, $\alpha = 0.57$. The quantitative predictions of the model do not change substantially across these alternative parameter values (available on request).

[31] In a similar exercise, Hansen and Prescott (2002) choose an average duration of 35 years for each period of an overlapping generation model in which a generation lasts two periods. This would lead to a life expectancy of 70 years. Instead we use a more precise estimation for the period studied taken from Nicolini (2004). Using the Hansen and Prescott time duration for a generation, our model reports even more plausible results.

[32] Sensitivity analysis for alternative possible values of $\gamma, \delta$ and $\alpha$ is available on request. The results do not change significantly.

The second row in Table (1) provides data for a situation in which expropriation is no longer in place. The table reveals that expropriation is costly for society. Without expropriation, GDP's growth rate will be 1.6%, that is slightly more than 12 times the growth rate that the economies experience when landowners are ruling the political power.

In the next section the open economy case is studied. Particularly, I focus on answering two questions: 1. Does trade foster growth? 2. Does trade accelerate the transition from a low-growth steady state to a high-growth steady state?

## 5 Small open economy

I consider the case of a small open economy that opens to trade.[33] I assume that when the economy opens to trade the constraint is not binding ($K < K^{**}$). I also assume that the constraint is not binding for the generation that opens to trade.[34] I denote with $p_t^f$ the equilibrium price for the manufactured goods of the rest of the world which, given the small open economy assumption is exogenously given. Consumer decisions are not altered by trade openness. The economy allocates labour according to the following condition:

$$\frac{L_t^A}{L_t^M} = \left( \frac{(T_t)^\alpha}{(1-\tau_t)p_t^f} \right)^{\frac{1}{\alpha}} \tag{34}$$

The latter equation shows that when the relative price $p_t^f$ rises, the economy switches resources from agriculture into manufacturing. As in autarky, the landowners' indirect utility function is given by:

$$V_{Tt} = \zeta' + Ln\left( \alpha\theta \left(p_t^f\right)^{\gamma-1} \left(L_t^A\right)^{1-\alpha} K_t T_t^\alpha + \tau_t \theta \left(p_t^f\right)^{\gamma} K_t \left(L_t^M\right)^{1-\alpha} \right) \tag{35}$$

Taking the first order condition for the optimal expropriation rate and combining with the labour market clearing condition, I can characterize the dynamics of the economy with the following two equations:

$$T_t\left[(1+\alpha(1-\alpha))\tau_t + \alpha\left(\alpha-2\right)\right] = \alpha(1-\tau_t)^{\frac{1+\alpha}{\alpha}} \left(p_t^f\right)^{\frac{1}{\alpha}} \tag{36}$$

$$\frac{K_{t+1}}{K_t} = \left( \frac{\beta\alpha\theta(1-\tau_t)^{\frac{1}{\alpha}}}{1+\beta} \right) \left( \frac{\left((1-\tau_t)\,p_t^f\right)^{\frac{1}{\alpha}}}{T_t + \left((1-\tau_t)\,p_t^f\right)^{\frac{1}{\alpha}}} \right)^{1-\alpha} + 1 - \delta \tag{37}$$

The following proposition presents the properties of the optimal tax, $\tau_t^*$.

**Proposition 4** *$\tau_t^*$ is interior, monotonically decreasing with the stock of land, $T_t$, and monotonically increasing with $p_t^f$.*

[33] We only analyse the case of the small open economy for simplicity. When we consider the more general case we need to look at the strategic interaction between different governments expropriating their own producers (since all of them affect the general equilibrium price). This complicates substantially the analysis.

[34] Trade Openness will affect directly $K^{**}$. What I mean with this assumption is that no matter what the change in $K^{**}$ is, the constraint will never be binding for the generation that opens to trade. This is consistent with the empirical evidence discussed below. The case where trade makes this constraint binding is discussed in the appendix.

**Proof.** See Appendix. ■

It should be noted that when the price of the manufactured goods increases, $L_t^M$ and the value of fiscal income increases. This effect creates incentives to impose a higher tax and is caused by the fact that as the value of output in the manufacturing sector increases, the production becomes less sensitive to changes in expropriation.

### 5.1 Numerical Results

I can express the world price, as a function of the the initial autarky price, $p_t^f = \psi p_t$,[35] where $p_t$ is the autarkic price at the time of openness $t$. For expositional purposes, using (24), I can rewrite $p_t = \eta (T_t)^{\alpha}$, where $\eta = \left(\frac{1-\gamma}{\gamma}\right)^{\alpha} \left(\frac{(1+\beta)}{(1+\beta(1-\alpha(1-\tau_t^*))}\right)^{\alpha} \left(\frac{1}{1-\tau_t^*}\right)^{1-\alpha}$, and $\tau_t^*$ is the value of the optimal tax in the autarkic case. Substituting the latter in (34) I obtain the intersectoral labour allocation, which is given by:

$$\frac{L_t^A}{L_t^M} = \left(\frac{1}{(1-\tau_t)\,\psi\eta}\right)^{\frac{1}{\alpha}} \tag{38}$$

and is constant over time. The intersectoral labour allocation depends now on $\psi$. When $\psi = 1$, the autarkic price coincides with the international price and the intersectoral labour allocation is the same as in autarky if $\tau_t = \tau_t^*$. When the economy opens to trade, if $\psi$ is larger than one (i.e. trade has increased $p_t^f$), then labour shifts from the agricultural sector to the manufacturing one, and the economy produces less food and more manufactured goods. The opposite case occurs if $\psi$ is less than one. Substituting the new expression for $p_t^f$ in (36) and (37) I obtain:

$$[(1+\alpha(1-\alpha))\tau_t + \alpha\,(\alpha-2)] = \alpha(1-\tau_t)^{\frac{1+\alpha}{\alpha}}\,(\psi\eta)^{\frac{1}{\alpha}} \tag{39}$$

$$\frac{K_{t+1}}{K_t} = \left(\frac{\beta\alpha\theta(1-\tau_t)^{\frac{1}{\alpha}}}{1+\beta}\right)\left(\frac{1}{1+((1-\tau_t)\,\psi\eta)^{\frac{1}{\alpha}}}\right)^{1-\alpha} + 1 - \delta \tag{40}$$

This new system of equations characterizes the optimal expropriation rate and the growth rate of capital. Since the solution to this system of equations is not closed-form I turn to the numerical simulations.

The results are shown in Figures 3 and 4. Figure 3 displays the optimal expropriation rate while Figure 4 shows the growth rate of the economy as a function of $\psi$. In both cases, the dotted line indicates the values in autarky while the continuous line indicates the corresponding value in free trade.

Depending on an economy's specialisation pattern, trade has different effects on its growth rate. First, it should be mentioned that as a consequence of trade openness landowners in general, turn to expropriate a smaller proportion of the manufacturing output. I see clearly this effect when $\psi = 1$; the relative price $p_t$ is the same as in autarky but the landowners set the expropriation rate 7.5 percentage points lower as Figure 3 shows. As discussed above, this effect occurs because landowners consider that they cannot affect the relative price $p_t^f$. In autarky, landowners take into account the positive effect that a rise in expropriation produces in the value of the manufactured goods, with the latter inducing them to set a larger expropriation rate. This mechanism is absent now, so this leads the landowners to reduce the expropriation rate.

[35] This assumption is made for illustrative purposes since this allows me to simply compare the results with the autarkic situation. The results are not altered if instead of this we introduce a random vector of world prices.

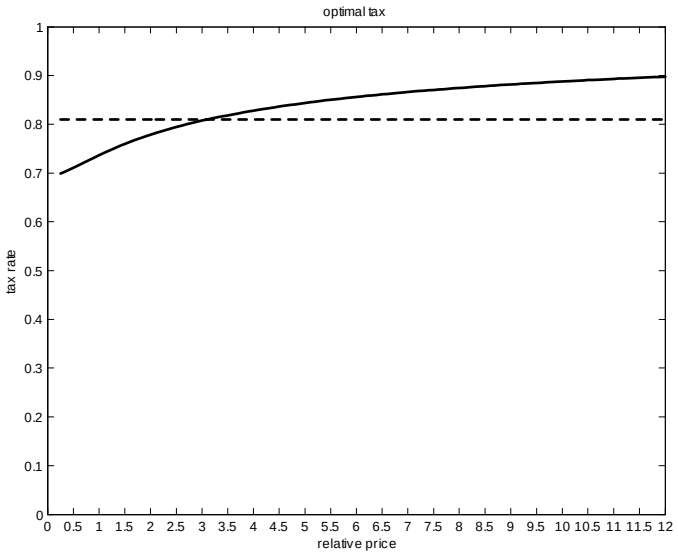



Figure 3: Level of Expropriation

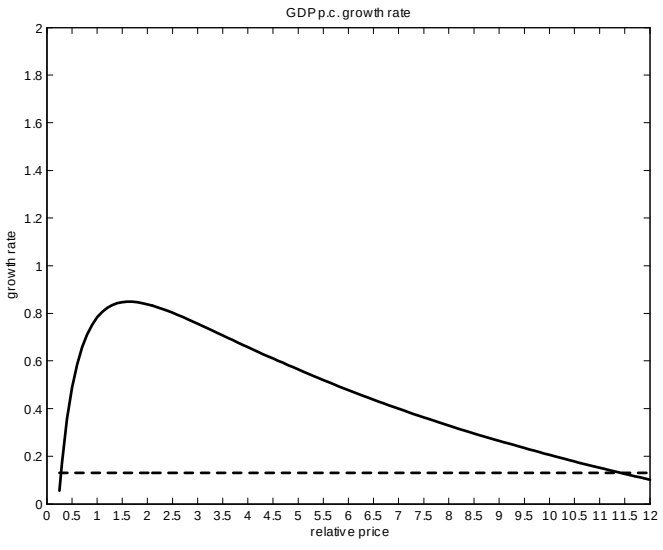



Figure 4: Output Growth Rate.

However, when the price in free trade is not equal to the autarkic price, there are important reallocation effects in the labour market that have significant effects on growth and the landowner's incentives to expropriate. As shown in the previous section, whenever the price $p_t^f$ increases (i.e. the economy specialises in manufactured goods), labour flows from agriculture into the manufacturing sector. The rise in the value of manufacturing production, raises the marginal income of taxation which creates an incentive to raise expropriation. Interestingly, as long as the relative price does not move very far away from the autarkic price ($\psi < 2$), expropriation does not rise as much as to overcome the price effect, and thus there is a positive effect on growth.

This effect, however only dominates up to a certain point. If there is a large increase in the relative price of the manufacturing good, the rise in expropriation becomes the dominant effect and further specialisation decreases the growth rate of output, although for the vast majority of cases, the growth rate is above the corresponding one in autarky.[36]

When an economy specialises in agriculture, the reverse occurs. The decrease in the relative price $p_t^f$, increases the marginal productivity of labour in the agricultural sector. This effect reduces the marginal income of taxation, and thus reduces expropriation, as figure 3 shows ($0 < \psi < 1$). However, the reduction in expropriation is not enough to compensate for the drop in the value of manufactured production leading to a fall in capital accumulation and the growth rate of the economy. The more the economy specialises in agricultural goods, the more its growth rate declines but over a large range of prices, the growth rate exceeds the one in autarky.[37]

Unlike previous models of trade and dynamic comparative advantage, as long as trade does not lead economies to strong specialisation trade generates a positive effect on economic growth through the joint effect of a reduction in expropriation and an increase in specialisation even if the economies specialise in a technology stagnant sector (i.e. agricultural sector in my model). In the next section I discuss the implications for the institutional change process.

### 5.2 The effects on institutional change.

As discussed above, opening up to international markets accelerates institutional change through two mechanisms: *the growth mechanism* and *the incentive mechanism*. The first one is related to how trade alters the speed capital accumulates. As international trade generally reduces expropriation, this raises the returns on capital and promotes capital accumulation.

The second one refers to how trade alters the incentives capitalists have to take the political power. Trade affects ambiguously the incentives to enter into conflict. On the one hand, international trade through the reduction in expropriation generally increases the returns on capital. This could act as a disincentive mechanism: Because the returns on capital are higher under free trade, capitalists may find entering into conflict less profitable.[38] However, international trade also affects

[36] For this exercise trade has always a positive effect on the growth rate of output as long as $\psi < 11.5$ (i.e. the price in the open economy is smaller than 11.5 times the autarkic price). When this does not hold, the expropriation rate is very high and the economy is dedicating more than 90% of the labour force to produce manufacturing goods. This result is interesting from a theoretical point of view but very unlikely in reality.

[37] This will be generally the case provided that $\psi \leq 0.25$ (i.e. the price in the open economy scenario is one fourth the autarkic price). This corresponds with a case in which more than 90% of the labour force is dedicated to the production of agricultural goods. This result is interesting from a theoretical point of view but it is unlikely in reality.

[38] This is easy to see considering the case of $\psi = 1$. In this case the price does not change after trade openness and the returns on capital after the revolt are the same when the economy is open to trade than when the economy is closed to trade. In free trade, the returns on capital before the institutional change process starts are higher so the gains from acquiring the political power are reduced.

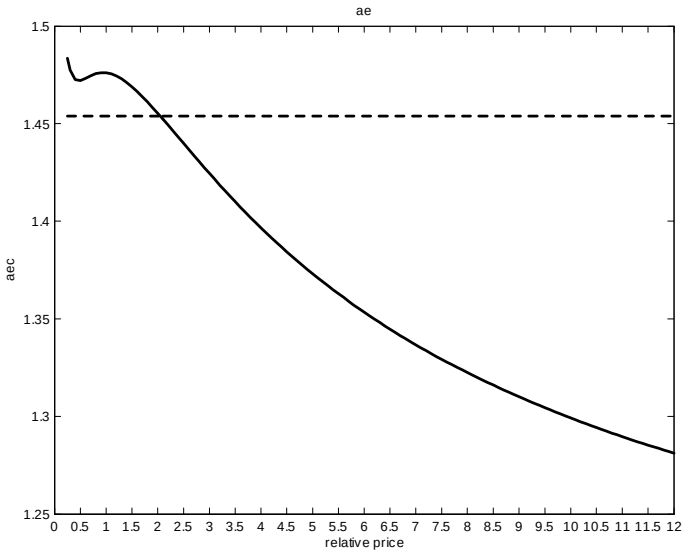



Figure 5: The incentive Mechanism $\left(\frac{\ln(\mu\varphi)}{1-\varepsilon}\right)$

this mechanism through the relationship between prices and expropriation. The way in which this relationship is altered under free trade generates complex effects: In autarky, the elimination of expropriation has a cost since lower expropriation implies a lower $p_t$ and therefore a lower value for the returns on capital but it has also a benefit since a lower $p_t$ implies a higher level of utility. All of these effects disappear under free trade, since the world price is not affected by expropriation.

Figure 5 shows how *the incentive mechanism* evolves under free trade (continuous line) and under autarky (dotted line). What can be observed is that the incentive mechanism is larger in free trade when the price is below a certain level. When the economy specialises in agricultural goods or moderately specialises in manufactured goods, trade openness discourages conflict. However as the economy specialises more in manufactured goods, landowners increase the expropriation rate, which increases the incentives to undertake military action. This implies that, if specialisation in manufactured goods is strong enough, trade openness will encourage rather than discourage institutional change. [39]

On the other hand, trade openness promotes capital accumulation due to a combination of a reduction of expropriation and for some cases further specialisation in manufactures. Since capital accumulates faster, this implies that the capital threshold will be reached earlier. This is what I call the growth mechanism. Figure 6 illustrates this effect.

The dotted line represents *the growth mechanism* in autarky. This mechanism is above the corresponding one in free trade, as long as the growth rate of output is larger in free trade, which corresponds to most of the cases.

The effects of trade openness on the timing of institutional change are initially ambiguous due to the presence of these two effects: the incentive mechanism and the growth mechanism. The

[39] The parameter $\varphi$ is a constant and we have considered $\ln\varphi = 0.5$ for simplicity. Allowing $\varphi$ to take different values will not alter the qualitative conclusions of the model. Robustness checks allowing for different values of $\varphi$ are provided on request.

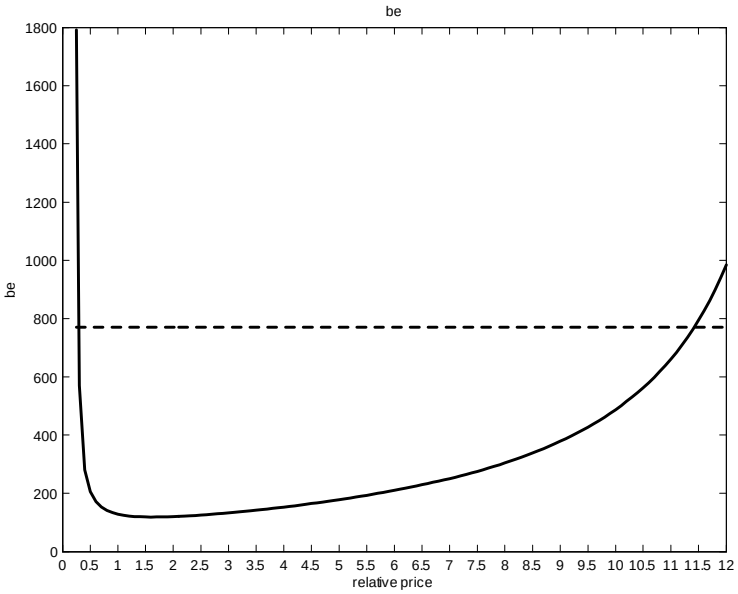



Figure 6: The Growth Mechanism

numerical results, however show, that the former effect is of second order, and that the growth effect is the dominant one. This finding is confirmed by Figure (7), which shows the combination of both.

As noted above, the dotted line indicates the autarkic values. Faster growth as a consequence of free trade promotes earlier institutional change, as long as it raises the growth rate of output, which is the case for moderate specialisation patterns (changes in the relative price).

Since the effect on the growth rate is the dominant one, my conclusions on an economy's specialisation pattern discussed above, apply to the institutional change argument. In other words, economies specialising in manufactured goods generally experience larger growth and earlier institutional change than economies specialising in agriculture. This theory outlines the importance of trade patterns and specialisation for the creation of a good system of property rights. In the studied economies, differences in trade patterns create divergent growth and institutional experiences across countries.[40]

## 6 Anecdotal evidence

In the previous sections I have described the main results of the theoretical model. In this section I discuss the main predictions of the model and how these predictions find support in the data.

Figure 8 summarizes the main results of the paper. The black line illustrates the economy in autarky. The green and the blue line describe how the economy in autarky would be if at time

[40] These qualitative results are robust to changes in parameter values. To verify this robustness, I have carried out the same exercise for reasonable values of the parameters $\gamma$, $\alpha$ and $\beta$. For example for the parameter $\gamma$ we have allowed values between 0.5 and 0.7 as suggested by Hoffman (2002). The results are qualitatively unaltered. The results do not vary significantly in quantitative terms too. (Available on request).

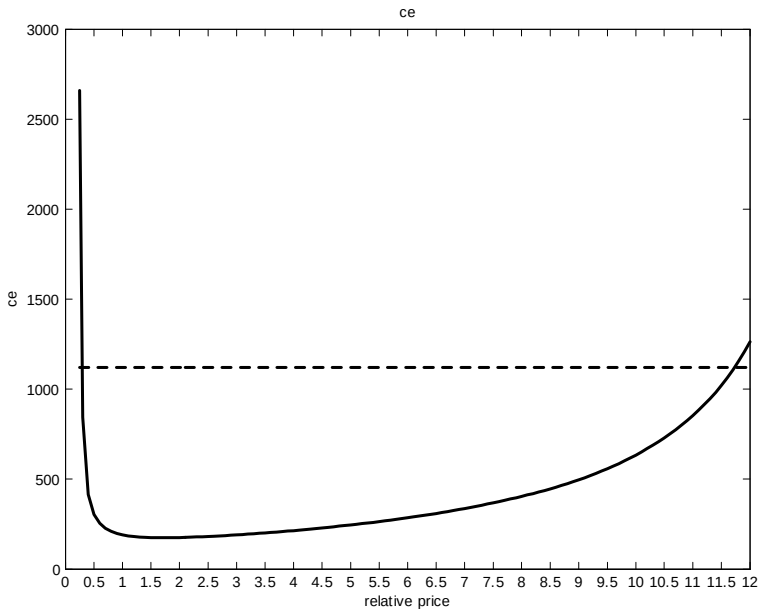



Figure 7: Time to institutional change.

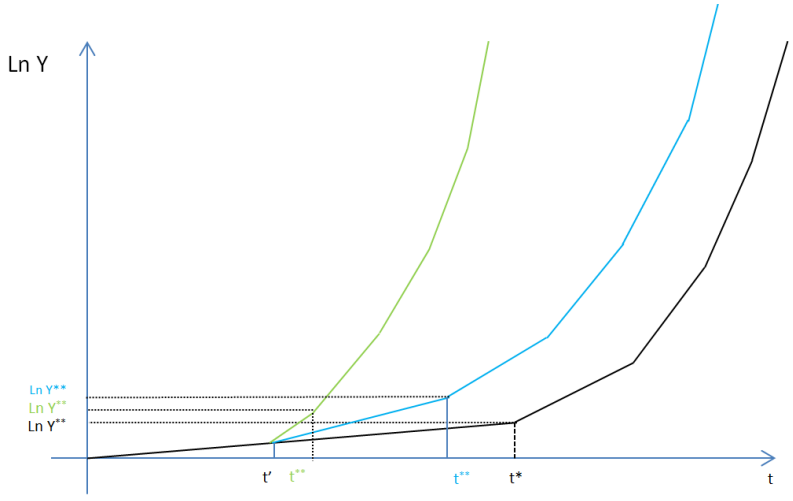



Figure 8: The open economy scenario

$t'$ the economy opens to trade. The difference between both economies is the result of different specialisation patterns. The green line represents an economy specialised in manufactured goods and the blue line represents an economy specialised in manufactured goods. When the economy opens to trade the growth rate of output increases due to the positive effect that a general reduction in expropriation and in some cases further specialisation has on capital accumulation. However, for a similar change in the relative price with respect to the autarkic one (assumed in the figure), the economy specialising in manufactured goods grows more so after trade openness the income green line becomes steeper than the blue line. The fact that both economies grow at a higher rate implies that the capitalists' threat of political change becomes binding earlier in both economies. I denote with $t^{**}$ the period in which the capitalists' constraint becomes binding in the open economy scenario. Notice that this date varies across both countries, being earlier in the economy specialising in manufactured goods. Once the constraint becomes binding, as in autarky, the landowners start a gradual reduction in expropriation to discourage conflict, what I have called institutional change.

Acemoglu (2005b) provides extensive evidence on the fact that the Netherlands and England were undertaking political changes during the $17^{th}$ and the $18^{th}$ century that would lead to a more secure system of property rights, while it was not the case of Spain and Portugal. In this paper I will focus more on specific evidence related to the predictions regarding the specific role of trade which is the focus of this paper.

Historical time series for the GDP and its components for Western Europe have been relatively scarce until recent times. The following evidence is, as most of the historical evidence at this time, indirect and it should be taken carefully. Maddison (2005)'s estimates for the growth rates of Western European economies (1500-1820) turn out to be 0.80 and 0.56 for the United Kingdom and the Netherlands, respectively, and 0.51, 0.31 for the case of Portugal and Spain respectively. A similar pattern has been established for the urbanisation rates.[41] While these numbers have been recently challenged by other economic historians (Alvarez Nogal and Prados de La Escosura (2013), Broadberry et al. (2010), Malanima (2009)), there is a general consensus on the fact that England and the Netherlands were experiencing higher GDP growth rates than Spain and Portugal for the period 1500-1820 and that the latter economies were experiencing an increase in their GDP growth rates in the $16^{th}$ century. This is consistent with my first prediction: The growth rate of output is larger as a consequence of trade openness. This is also consistent with my second prediction the growth rate of output should be larger in England and The Netherlands.

For the case of Spain, Alvarez Nogal and Prados de La Escosura (2013)), provide, to the best of my knowledge, the most complete updated database. Their work reveals that the relative price of manufactured goods was declining in Spain in the second half of the $16^{th}$century (1530-1620). The latter came together with an increase in the share of agriculture in the GDP. The urbanization rate increased from 1530 until 1591 (an early increase as a consequence of a rise in trade opportunities), but it declined from 1591-1611. This is consistent with the Spanish economy moving resources from industry to agriculture as a consequence of a change in the relative price of manufactured goods probably due to trade openness. This change was stronger when the role of Spanish trade in manufactured products was falling (the end of the $16^{th}$ century) (Marquez (2006)).[42] This is

[41] As discussed above, Urbanisation rates for this period are provided in the Appendix.

[42] During the first years of trade with the Americas, Spain was able to keep the market in a monopoly and consequently some manufacturing products from spanish origins were shipped to the Americas. This trend changed from 1580 onwards as documented by Marquez (2006).

consistent with the third prediction of the model: As a consequence of the Spanish's specialisation in agricultural products in international markets, the increase in the GDP's growth rate was smaller for Spain.

England's trade with the Americas started to play a notable role in the second half of the 16th century. However, the golden period of english trade with America came during the next century (Kamen (1984)).[43] The recent article by Broadberry et al. (2010) reveals that, during the 17th century, the english share of the GDP in agricultural goods declined in favor of manufacturing and services. The latter is also consistent with the increase in the urbanization rates this economy experienced in the $17^{th}$ century. English real GDP growth started to take-off in the second half of the 16th century but it is in the second half of the 17th century when the change in GDP p.c. growth was the strongest one. This is consistent with the third prediction of the model: As a consequence of the England's specialisation in manufactured goods , the increase in the GDP's growth rate was larger.

## 7 Conclusions

I have developed a model to understand the role that international trade plays in economic growth through the evolution of institutions. When a social group, whose interests are in conflict with economic growth holds the political power (e.g. the aristocracy in Europe in the Modern Age), this group establishes an institutional environment that reduces growth. This group, however, creates institutions that do not lead to full expropriation, because such institutions would wipe out production and fiscal rents. The process of capital accumulation over time allows the rival group to pose a credible threat of acquiring the political power. Given that, the group in power starts to improve property rights as a concession to discourage the rival group from conflict. The latter process leads to a gradual improvement in property rights until expropriation is no longer in place.

In this context I examine the role played by international trade. I consider the case of a small open economy where the equilibrium price is given and not affected by individual decisions. I find that international trade plays a role in the evolution of the institutional environment by changing the relative price of the final goods (and consequently the returns to production factors) and having general equilibrium price effects. The first mechanism promotes capital accumulation as long as the economy specialises in manufactured goods. This acceleration also speeds up the process of institutional change. The second channel could also generate a positive effect on economic growth through a reduction of expropriation. This improvement in economic institutions allows the country to increase the growth rate as a consequence of trade openness, even if it specialises in agricultural goods for a large range of prices. This result is not found in earlier two sector endogenous growth models with dynamic comparative advantage.

Although the model predicts positive effects of trade openness on growth for a broad range of cases, it also predicts divergence across countries based on specialisation patterns. In general, those countries which specialise in manufactured goods, tend to grow faster, accelerating the process of institutional change.

I suggested that a similar story might explain the divergent experience of Spain and Portugal on the one hand, and England and the Netherlands on the other hand in the first era of globalization.

[43] Data on british shipments to America before the 16th century are not available due to the fact that these were done through Spanish (above all) and Portughese intermediaries.

While Spain and Portugal specialised in trading agricultural products in the global world, English and Dutch manufacturers and merchants were improving their economic position by exporting manufactured goods. My model suggests that world trade enhanced institutional change in the four countries provided that no strong specialisation occurs. However, countries specialising in manufactured goods (i.e. England and the Netherlands), should have experienced higher growth and earlier institutional change. These predictions are consistent with historical evidence.

## References


[1] ACEMOGLU, D., JOHNSON S., ROBINSON J., (2001): The Colonial Origins of Economic Development: An Empirical Investigation. *American Economic Review, 91 pp. 1389-1401*

[2] ACEMOGLU, D., JOHNSON, S. (2004): Political Looses as a Barrier to Economic Development. *American Economic Review, 90,126-130*

[3] ACEMOGLU, D. & JOHNSON, S. & ROBINSON, J. A., (2005): Institutions as a Fundamental Cause of Long-Run Growth. *Handbook of Economic Growth, in: Philippe Aghion & Steven Durlauf (ed.), Handbook of Economic Growth, edition 1, volume 1, chapter 6, pages 385-472 Elsevier.*

[4] ACEMOGLU, D., JOHNSON, S., ROBINSON, S. (2005b): The rise of Europe: Atlantic Trade, Institutional Change and Economic Growth. *American Economic Review, 95 vol (3) pp. 546-579*

[5] ACEMOGLU, D.(2006): A Simple Model of Inefficient Institutions. *Scandinavian Journal of Economics 108 (4) 515-546*

[6] ACEMOGLU, D. and ROBINSON, S. (2006): The Economic Origins of Dictatorship and Democracy, *MIT Pres*s.

[7] ACEMOGLU,D. (2008): Democratic versus Oligarchic Societies.*Journal of the European Economic Association, 6 p. 1-44*

[8] ACEMOGLU, D., CANTONI,D. JOHNSON, S. and ROBINSON, J. (2011): The Consequences of Radical Reform: The French Revolution, *American Economic Review, American Economic Association, vol. 101(7), pages 3286-3307, December.*

[9] ALVAREZ NOGAL,C. and PRADOS DE LA ESCOSURA, L. ( 2007): The Decline of Spain (1500-1850): Conjectural Estimates, *European Review of Economic History 11, 3 pp. 319-366.*

[10] ALVAREZ NOGAL, C., and PRADOS DE LA ESCOSURA, L (2013): "The rise and fall of Spain (1270–1850)," *Economic History Review, Economic History Society, vol. 66(1), pages 1-37, 02.*

[11] ALTONJI, J.,HAYASHI, F., KOTLIKOFF, L.J., (1997): Parental Altruism and Inter Vivos Transfers: Theory and Evidence, *Journal of Political Economy, University of Chicago Press, vol. 105(6), pages 1121-66, December.*

[12] BAIROCH, P.,BATOU, J, CHEVRE P. (1988): La population des villes européennes : 800-1850 : banque de données et analyse sommaire des résultats (with Jean Batou and Pierre Chèvre) *Genève : Droz, 1988.*

[13] BASSO, A. and CUBERES, D. (2012): Human Capital, Culture and the Onset of the Demographic Transition, *Working Papers 2012024, The University of Sheffield, Department of Economics.*

[14] BOURGUIGNON, F., VERDIER, T. (2000): Oligarchy, Democracy, Inequality and Growth.*Journal of Development Economics, 62, vol. 2. pp285-313.*

[15] BROADBERRY, S.et al. (2013): British Economic Growth, 1270-1870: an output-based approach, *Studies in Economics 1203, Department of Economics, University of Kent.*

[16] CAMERON, R. (1997): A Concise Economic History of the World, *Oxford Univ. Press.*

[17] CASELLI, F. (2005): Accounting for Cross-Country Income Differences. *Handbook of Economic Growth, in: Philippe Aghion & Steven Durlauf (ed.), Handbook of Economic Growth, edition 1, volume 1, chapter 9, pages 679-741 Elsevier.*

[18] CROUZET, F., (1985): The First Industrialists. The Problems of Origins, *Cambridge University Press.*

[19] CHAUNU, P. (1955): Seville et l'Atlantique. *Paris, SEVPEN*

[20] DALGAARD, C.J. and STRULIK, H. (2013): The history augmented Solow model, Center for European, *Governance and Economic Development Research Discussion Papers 151, University of Goettingen, Department of Economics.*

[21] DE LA ESCOSURA, L., ROSES, R.J.(2007): "The Sources of Long-run Growth in Spain 1850-2000," *CEPR Discussion Papers 6189, C.E.P.R. Discussion Papers.*

[22] LA PORTA, R. GLAESER, E., LOPEZ DE SILANES, F. (2004): Do Institutions Cause Growth? *Journal of Economic Growth, 2004*

[23] DE LONG, J BRADFORD & SHLEIFER, ANDREI. (1993). Princes and Merchants: European City Growth before the Industrial Revolution, *Journal of Law and Economics, University of Chicago Press, vol. 36(2), pages 671-702, October.*

[24] DRELICHMANN, M. (2005): The Curse of Moctezuma: American Silver and the Dutch Disease *Explorations in Economic History* 42(3): 349-380. July 2005.

[25] DE VRIES, J. (1984): European Urbanization 1500-1800. *Harvard Studies in Urban History, Methuen 1984.*

[26] DOEPKE, M., ZILIBOTTI, F.,(2005): Social Class and The Spirit of the Capitalism. *Journal of the European Economic Association April-May (2005),516-524.*

[27] EASTERLY, W. LEVINE, R. (2001): It's Not Factor Accumulation : Stylized Facts and Growth Models. World Bank Economic Review, Volume 15, number 2.

[28] EICHER, T. GARCIA-PEÑALOSA, C. (2008) : Endogenous Strength of Intellectual Property Rights: Implications for Economic Development and Growth. *European Economic Review Elsevier, vol. 52(2), pages 237-258, February.*

[29] FALKINGER, F., GROSSMAN, V. (2005): Institutions and Development: The Interaction between Trade Regime and Political System.*Journal of Economic Growth, 2005 pages 231-272.*

[30] FINLAY, R. O'ROURKE, K. (2007): Power and Plenty:Trade, War, and the World Economy in the Second Millennium. *Princeton University Press*

[31] GALOR, O., WEIL, N. D. (2000):. Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond, *American Economic Review, American Economic Association, vol. 90(4).*

[32] GALOR, O., MOAV, O., (2002): Natural Selection And The Origin Of Economic Growth, *The Quarterly Journal of Economics*, *MIT Press, vol. 117(4), pages 1133-1191, November.*

[33] GALOR,O., (2005): From Stagnation to Growth: Unified Growth Theory, *Handbook of Economic Growth, in: Philippe Aghion & Steven Durlauf (ed.), Handbook of Economic Growth, edition 1, volume 1, chapter 4, pages 171-293 Elsevier.*

[34] GALOR, O., MOUNTFORD, A. , (2008):. Trading Population for Productivity: Theory and Evidence, *Review of Economic Studies, Oxford University Press, vol. 75(4), pages 1143-1179.*

[35] GALOR, O., MOAV, O., VOLLRATH, D. (2009): Land Inequality, The Emergence of Human Capital Promoting Institutions and The Great Divergence *Review of Economic Studies, 76(1), January 2009, 143-179.*

[36] GONZALEZ, F. (2006): Effective Property Rights, Conflict and Growth, *Journal of Economic Theory, Elsevier, vol. 137(1), pages 127-139, November*

[37] GROSSMAN, G., HELPMAN, E.(1991): Innovation and Growth in The Global Economy.

*MIT press*

[38] GROSSMAN, G. HELPMAN E (1994): Protection for Sale. *American Economic Review, 84, 833-850.*

[39] HAMILTON (1934): American Treasure and the Price Revolution in Spain (1503-1660). Cambridge Harvard University Press. 1934

[40] HALL S. , JONES. C.:, (1999): Why Do Some Countries Produce so Much More Output per Worker Than Others? *Quarterly Journal of Economics, 114, pp. 83-116*

[41] HANSEN, G.., PRESCOTT, E., (2002): From Malthus to Solow. *American Economic Review, 92,1205-1217*

[42] HYBEL,N. (2002): The Grain Trade in Northern Europe Before 1350. *Economic History review, 55, pp. 219-247*

[43] HOFFMAN, P.T., JACKS, D. LEVIN, P., LINDERT, P. (2002): Real Inequality in Europe since 1500 *The Journal of Economic History vol. 62, n. 2. pp. 322-355*

[44] JONES, C.,(2001): Was an Industrial Revolution Inevitable? Economic Growth Over the Very Long Run, *The B.E. Journal of Macroeconomics, De Gruyter, vol. 1(2), pages 1-45, August.*

[45] KAMEN, H. (1984): European Society 1500-1700. *Unwyn Hyman Ltd.*

[46] KEEFER, KNACK (1997): Why Don't Poor Countries Catch up? A Cross-National Test of an Institutional Explanation

[47] KRUGMAN, P. (1987):. The narrow moving band, the Dutch disease, and the competitive consequences of Mrs. Thatcher : Notes on trade in the presence of dynamic scale economies. *Journal of Development Economics, Elsevier, vol. 27(1-2), pages 41-55, October.*

[48] KRUSELL, P., RIOS-RULL, V., (1996): Vested Interests and Long-Run Growth. *Review of Economic Studies, 63, 301-330.*

[49] LEVCHENKO (2008): International Trade and Institutional Change *Working Papers 579, Research Seminar in International Economics, University of Michigan*

[50] LYNCH, J. (1991): From Nation State to World Empire, Cambridge, Basic Blackwell

[51] MADDISON, A. (2001): The World Economy: A Millennial Perspective. *Paris: OECD DevelopmentCentre Studies, 2001. Pp. 383.*

[52] MALANIMA, P. (2007): Decline or Growth? European Cities and Rural Economies 1300-1600, *mimeo.*

[53] MATSUYAMA, K. (1992): Agricultural Productivity, Comparative Advantage, and Economic Growth, *Journal of Economic Theory 58 (December 1992): 317-334.*

[54] MARQUEZ, G. (2006): Commercial Monopolies and External Trade, *The Cambridge Economic History of Latin America: Volume 1, The Colonial Era.*

[55] MOKYR, J. (1990): The lever of Riches. *Oxford University Press.*

[56] NGAI, R. PISSARIDES, C. (2006): Structural Change in a Multisector Model of Growth, *American Economic Review, American Economic Association, vol. 97(1), pages 429-443, March.*

[57] NICOLINI,E. (2004): Mortality, interest rates, investment, and agricultural production in 18th century England, *Explorations in Economic History, Elsevier, vol. 41(2), pages 130-155, April.*

[58] NORTH, D., THOMAS, E., (1973): The Rise of Western World: A New Economic History.Oxford University Press.

[59] O'ROURKE, K. , WILLIAMSOM, J. (2002): When Did Globalization Begin?, *European Review of Economic History 6(2002), 23-50*

[60] OLSON, M. (1965): The Logic of Collective Action. *Harvard University Press. Cambridge.*

[61] PARENTE, S., PRESCOTT, E., (1999): Monopoly as Barriers to Riches. *American Economic Review,89 1216-1233.*

[62] REDDING, S. (1999):Dynamic Comparative Advantage and the Welfare Effects of Trade. *Oxford Economic Papers, Oxford University Press, vol. 51(1), pages 15-39, January.*
[63] RIVERA-BATIZ, L. ROMER, P. (1991): Economic Integration and Endogenous Growth, *Quarterly Journal of economics, 106, 531-556.*
[64] ROMER, P. (1986): Increasing Returns and Long-run Growth, *Journal of Political Economy, University of Chicago Press, vol. 94(5), pages 1002-37, October.*
[65] SEGURA-CAYUELA, R. (2006): Inefficient Policies, Inefficient Institutions and Trade, (mimeo).
[66] STOKEY, N. L., 2001. A quantitative model of the British industrial revolution, 1780-1850, *Carnegie-Rochester Conference Series on Public Policy, Elsevier, vol. 55(1), pages 55-109, December.*
[67] VOIGTLANDER, N. VOTH, H.J.(2006). Why England? Demographic Factors, Structural Change and Physical Capital Accumulation during the Industrial Revolution. *Journal of Economic Growth, 11(4): 319-361.*
[68] WEIL, D. (2005): Economic Growth, *1st Edition Pearson Editorial.*
[69] YOUNG, A. (1991): Learning by Doing and the Dynamic Effects of International Trade. *The Quarterly Journal of Economics, 1991, 106(2), pp. 369-405.*
[70] YUN, B., (2002): El Siglo de la Hegemonia Castellana en COMIN, F. HERNANDEZ,M. LLOPIS, E,: Historia Economica de España.

# 8 Appendix A : Autarky

## 8.1 Urbanization Rates

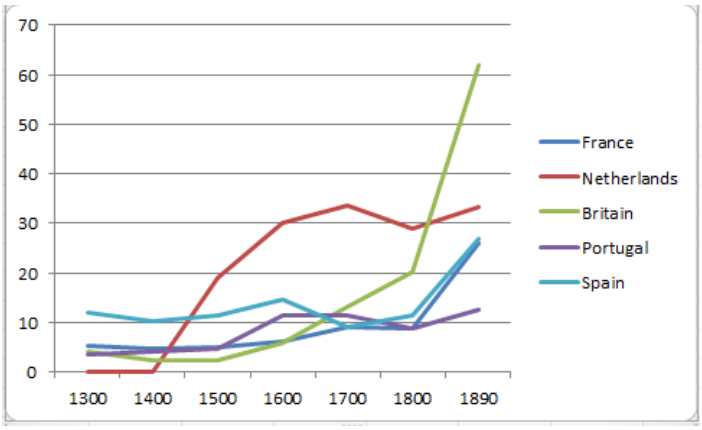



Figure 9: Urbanization rates (percentage of the population living in cities with more than 10,000 inhabitants) for different European Countries (1300-1900). Revised estimates from the original works of Bairoch, Batou and Chevre (1988) and De Vries (1984). Source: Malanima (2007)

## 8.2 Proof of Proposition 1

Taking logs and derivatives in 24 I have:

$$\frac{dp_t}{d\tau_t} = \frac{(1-\alpha)}{(1-\tau_t)} - \frac{\beta\alpha^2}{(1+\beta(1-\alpha(1-\tau_t))}$$

Rearranging terms I find that:

$$\frac{dp_t}{d\tau_t} > 0, \quad iff \quad \beta\alpha^2(1-\tau_t) - (1-\alpha)(1+\beta) + \beta\alpha(1-\tau_t) - \beta\alpha^2(1-\tau_t) < 0$$

Rearranging terms I have:

$$\beta\alpha(1-\tau_t) < (1-\alpha)(1+\beta)$$

which implies

$$\alpha < \frac{1+\beta}{1+\beta(2-\tau_t)}$$

## 8.3 Indirect utility functions

The utility function of the landowners is given by :

$$U_T(c_{Tt}^A, c_{Tt}^M) = \ln\left(\left(c_{Tt}^A\right)^\gamma \left(c_{Tt}^M\right)^{1-\gamma}\right)$$

Using (8), (9) and rearranging terms, I have:

$$V_{Tt} = \ln\left((E_{Tt})^\gamma \left(\frac{E_{Tt}}{p_t}\right)^{1-\gamma} \gamma^\gamma(1-\gamma)^{(1-\gamma)}\right) = \ln\left(\left(\frac{R_{Tt}\xi_T}{(p_t)^{1-\gamma}}\right)\right)$$

where the latter comes from the fact $E_{Tt} = R_{Tt} = d_t T_t + \tau_t p_t Y_t^M$. I obtain $\xi_T = \gamma^\gamma(1-\gamma)^{(1-\gamma)}$.

The utility function of the capitalists is given by: $U_K(c_{Kt}^A, c_{Kt}^M, B_{Kt}) = \ln\left(\left(c_{Kt}^A\right)^\gamma \left(c_{Kt}^M\right)^{1-\gamma}\right) + \beta \ln B_{Kt} = \ln\left(\left(c_{Kt}^A\right)^\gamma \left(c_{Kt}^M\right)^{1-\gamma} (B_{Kt})^\beta\right)$.

Remember that $R_{Kt} = r_t K_t$. Substituting (11) in (8) and (9) I get: $c_{Kt}^A = \frac{\gamma}{1+\beta} R_{Kt}$, $c_{Kt}^M = \frac{1-\gamma}{1+\beta}\frac{R_{Kt}}{p_t}$. Substituting the latter ones in the utility function I have:

$$V_{Kt} = \ln\left((R_{Kt})^\gamma \left(\frac{R_{Kt}}{p_t}\right)^{1-\gamma} \left(\frac{R_{Kt}}{p_t}\right)^\beta \frac{\gamma^\gamma(1-\gamma)^{(1-\gamma)}\beta^\beta}{(1+\beta)^{1+\beta}}\right) = \ln\left(\frac{(R_{Kt})\,(\xi_K)^{\frac{1}{1+\beta}}}{(p_t)^{1-\frac{\gamma}{1+\beta}}}\right)^{1+\beta}.$$

where $\xi_K = \frac{\gamma^\gamma(1-\gamma)^{(1-\gamma)}\beta^\beta}{(1+\beta)^{1+\beta}}$.

### 8.4 Capitalists reaction function (Proof of Proposition 2)

In this case I can distinguish two main cases: $0 < \varepsilon < 1$ and the special case in which $\varepsilon = 1$. I proceed first to discuss the first case.

In order for (30) to be satisfied, I need that:

$$\frac{r_t(K_t - m(K_t)) - p_t\,(1-\delta)\,\varphi\,(K_t)^{\varepsilon}}{r_t^* K_t}\left(\frac{(p_t^*)^{\frac{1+\beta-\gamma}{1+\beta}}}{(p_t)^{\frac{1+\beta-\gamma}{1+\beta}}}\right) \geqslant 1$$

Substituting equation (27) and rearranging terms I obtain:

$$\left(\frac{r_t}{r_t^*}\right)\left(1-\left(1+\frac{p_t\,(1-\delta)}{r_t}\right)\varphi\,(K_t)^{\varepsilon-1}\right)\left(\frac{(p_t^*)^{\frac{1+\beta-\gamma}{1+\beta}}}{(p_t)^{\frac{1+\beta-\gamma}{1+\beta}}}\right) \geqslant 1$$

Substituting equation (16) in the previous condition I get:

$$\left(1-\left(\frac{\alpha\theta(L_t^M)^{1-\alpha}+(1-\delta)}{\alpha\theta(L_t^M)^{1-\alpha}}\right)\varphi\,(K_t)^{\varepsilon-1}\right) \geqslant \left(\frac{(p_t)^{\frac{1+\beta-\gamma}{1+\beta}}}{(p_t^*)^{\frac{1+\beta-\gamma}{1+\beta}}}\right)\left(\frac{r_t^*}{r_t}\right)$$

Notice that $\left(\frac{r_t^*}{r_t}\right) = (1-\tau_t^*)\left(\frac{p_t^*}{p_t}\right)\left(\frac{L_t^{M*}}{L_t^M}\right)^{1-\alpha}$. Substituting this and rearranging terms I have:

$$1-\left(\frac{\alpha\theta(L_t^M)^{1-\alpha}+(1-\delta)}{\alpha\theta(L_t^M)^{1-\alpha}}\right)\varphi\,(K_t)^{\varepsilon-1} \geq \underbrace{\left(\frac{p_t^*}{p_t}\right)^{\frac{\gamma}{1+\beta}}}_{\lambda}(1-\tau_t^*)\left(\frac{L_t^{M*}}{L_t^M}\right)^{1-\alpha}$$

Rearranging terms I obtain:

$$K_t^{**} \geq (\mu\varphi)^{\frac{1}{1-\varepsilon}} \tag{41}$$

where:

$$\mu = \left(\frac{1}{\left(1-\left((1-\tau_t)\left(\frac{L_t^{M*}}{L_t^M}\right)^{1-\alpha}\lambda\right)\right)\left(\frac{\alpha\theta(L_t^M)^{1-\alpha}}{\alpha\theta(L_t^M)^{1-\alpha}+(1-\delta)}\right)}\right)$$

$$\lambda = \left(\left(\frac{1}{1-\tau_t}\right)^{1-\alpha}\left(\frac{(1+\beta(1-\alpha))}{1+\beta(1-\alpha(1-\tau_t^*))}\right)^{\alpha}\right)^{\frac{\gamma}{1+\beta}}$$

Consequently, he reaction function is given by the following expression:

- If $K_t \geq K^{**}$ then undertake military action.
- If $K_t < K^{**}$ then do not undertake military action.

### 8.4.1 The special case $\varepsilon = 1$.

In this case the costs and the benefits of the military action increase at the same rate. Considering this special case,.the necessary condition for having a revolt is given by:

$$(K_t^{**})^{1-\varepsilon} \geqslant (\mu(\tau_t)\varphi)$$

and substituting the value of $\varepsilon$ in the previous expression, I have:

$$1 \geq \mu(\tau_t)\varphi$$

and after rearranging terms, for a given level of expropriation for the landowners, $\tau_t$,I can have two possibilities:

- $\mu(\tau) \leq (\varphi)^{-1}$. In this case, the military action is profitable independently of the current capital stock (the constraint is binding at time $t = t_0$). Consequently the reaction of the capitalists is to undertake the military action in $t = 0$.
- $\mu(\tau) > (\varphi)^{-1}$. In this case the military action is not profitable independently of the current capital stock. Consequently the reation of the capitalists is not to undertake military action provided that the condition holds.

## 8.5 Monotonicity of the Capitalists' Reaction Function in Autarky (Proof of proposition 3)

The threshold level of capital necessary to undertake a revolt is given by (28) and takes the following form:

$$K_t \geq K^{**} = (\mu(\tau_t)\varphi)^{\frac{1}{1-\varepsilon}}.$$

where

$$\mu(\tau_t) = \left( \frac{1}{\left(1 - \left((1-\tau_t)\left(\frac{L_t^{M*}}{L_t^M}\right)^{1-\alpha}\lambda\right)\right)\left(\frac{\alpha\theta\left(L_t^M\right)^{1-\alpha}}{1-\delta+\alpha\theta\left(L_t^M\right)^{1-\alpha}}\right)} \right) \tag{42}$$

In autarky I have an extra effect given by the term $\lambda$, which measures the ratio between the relative price of the manufacturing good when landowners are in power and when the capitalists are in power. The parameter $\lambda$ is increasing with $\tau_t$.I know that $L_t^{M*}$ depends on the expropriation rate so for this proof I use the notation $L_t^{M*} = L_t^{M*}(\tau_t)$.

Let us denote with $\Omega(\tau_t) = \left((1-\tau_t)\left(\frac{L_t^{M*}(\tau_t)}{L_t^M}\right)^{1-\alpha}\lambda\right)$. Since $L_t^M$ does not depend on $\tau_t$, showing $\mu'(\tau_t) < 0$ is equivalent to show that $\Omega'(\tau_t) < 0$.

Substituting the value of $\lambda$ in the previous expression I obtain:

$$\Omega(\tau_t) = \left((1-\tau_t)\left(\frac{L_t^{M*}(\tau_t)}{L_t^M}\right)^{1-\alpha}\left(\frac{p_t^*}{p_t}\right)^{\frac{\gamma}{1+\beta}}\right)$$

Notice that $L_t^M, p_t$ are not dependent on $\tau_t$. Consequently

$$\Omega'(\tau_t) < 0 \leftrightarrow \frac{dh}{d\tau_t} < 0 where h = (1-\tau_t)\left(L_t^{M*}(\tau_t)\right)^{1-\alpha} {p_t^*}^{\frac{\gamma}{1+\beta}}.$$

Using (1), (2) and (24) and rearranging terms I get:

$$h = (1-\tau_t)\left(L_t^{M*}(\tau_t)\right)^{1-\alpha}\left(\left(\frac{1-\gamma}{\gamma}\right)\left(\frac{1+\beta}{1+\beta(1-\alpha(1-\tau_t))}\right)\left(\frac{L_t^{A*}(\tau_t)}{L_t^{M*}(\tau_t)}\right)^{1-\alpha}T^{\alpha}\right)^{\frac{\gamma}{1+\beta}}.$$

Substituting (23) in the latter I have that:

$$h = (1-\tau_t)^{\frac{1+\beta-\gamma}{1+\beta}}\left(L_t^{M*}(\tau_t)\right)^{1-\alpha}\left(\left(\frac{L_t^{M*}(\tau_t)}{L_t^{A}(\tau_t)}\right)^{\alpha}\right)^{\frac{\gamma}{1+\beta}}T^{\frac{\alpha\gamma}{1+\beta}}.$$

Notice that the first term is decreasing in $\tau_t$ and the second term is decreasing in $\tau_t$. Taking logs and partial derivative with respect to $\tau_t$ in (23), I have that:

$$\frac{d\left(\frac{L_t^{M*}(\tau_t)}{L_t^{A}(\tau_t)}\right)}{d\tau_t} = -\frac{1}{1-\tau_t} + \frac{\beta\alpha}{1+\beta(1-\alpha(1-\tau_t))} < 0.$$

Consequently $\frac{dh}{d\tau_t} < 0$ and I have shown the property.

### 8.6 Expropriation in autarky when the constraint is not binding ($K < K^{**}$)

**Proposition 5** *Let $V_{Kt}$ be the indirect utility function of the capitalists.Then:*
$\frac{dV_{Kt}}{d\tau_t} < 0$

**Proof.** Developing the expression of the indirect utility function I have:

$$V_{Kt} = \ln\left(\frac{(r_t K_t)}{(p_t)^{1-\frac{\gamma}{1+\beta}}}\right)^{1+\beta}$$

where I have ignored the constant term $\xi^k$. Substituting (2), (23) and (16) in the latter and rearranging terms I get:

$$V_{Kt} = \alpha(1-\tau_t)^{\left(\frac{1-\gamma+\beta}{1+\beta}\right)}\left(L_t^M\right)^{\frac{(1-\alpha)(1+\beta)+\alpha\gamma}{(1+\beta)}}\left(L_t^A\right)^{-\frac{\alpha\gamma}{1+\beta}}$$

Then it is straightforward to see that the derivative of the indirect utility function with respect to taxes is equal to zero, since $\frac{dL_t^M}{d\tau_t} < 0, \quad \frac{dL_t^A}{d\tau_t} > 0.$ ■

**Proposition 6** $\tau_t^* = \max V_{Tt}(\tau_t) \neq 0, 1$ *, and it is independent of $K_t, T$. and unique for the parameter case studied.*

**Proof.** The landowners' utility function is given by:

$$V_{Tt} = \ln\left(\alpha Y_t^A + \tau_t p_t Y_t^M\right) + \ln Y_t^A - (1-\gamma)\ln p_t$$

I can express the previous equation as:

$$V_{Tt} = \ln\left(\alpha\left(\frac{Y_t^A}{p_t Y_t^M}\right) + \tau_t\right) + \ln p_t Y_t^M - (1-\gamma)\ln p_t$$

Rearranging I have that:

$$V_{Tt} = \ln\left(\alpha\left(\frac{Y_t^A}{p_t Y_t^M}\right) + \tau_t\right) + \ln Y_t^M + \gamma \ln p_t$$

Using (22) I have:

$$V_{Tt} = \ln\left(\alpha\left(\frac{\gamma}{1-\gamma}\right)\left(\frac{(1+\beta(1-\alpha(1-\tau_t))}{1+\beta}\right) + \tau_t\right) + \ln Y_t^M + \gamma \ln p_t$$

Substituting the functional forms for $Y_t^M$ and $p_t$ I obtain:

$V_{Tt} = \ln\left(\alpha\left(\frac{\gamma}{1-\gamma}\right)\left(\frac{(1+\beta(1-\alpha(1-\tau_t))}{1+\beta}\right) + \tau_t\right) + \ln K_t + \ln(L_t^M)^{1-\alpha} +$

$\gamma \ln\left[\left(\frac{1-\gamma}{\gamma}\right)\left(\frac{1+\beta}{1+\beta(1-\alpha(1-\tau_t))}\right)\left(\frac{L_t^A}{L_t^M}\right)^{1-\alpha}(T_t)^{\alpha}\right]$

and rearranging I have:

$$V_{Tt} = Ln\left(\alpha\left(\frac{\gamma}{1-\gamma}\right)\left(\frac{1+\beta(1-\alpha(1-\tau_t))}{1+\beta}\right)^{1-\gamma} + \tau_t\left(\frac{1+\beta}{1+\beta(1-\alpha(1-\tau_t))}\right)^{\gamma}\right) +$$
$$Ln\left(\left(L_t^M\right)^{(1-\alpha)(1-\gamma)}\left(L_t^A\right)^{\gamma(1-\alpha)}\right) + \underbrace{\ln K_t - \gamma \ln\left[\left(\frac{1-\gamma}{\gamma}\right)(T_t)^{\alpha}\right]}_{\ln \zeta}$$

It is important to realize that $\frac{d\ln\zeta}{d\tau_t} = 0$, since $K_t$ it is a predetermined variable. Due to the assumption of Warm-glow preferences, landowners cannot affect $K_t$ by choosing the expropriation level today and they do not care about the future of their descendants. Substracting the constant terms and rearranging terms, the expression is as follows:

$$V_{Tt} = Ln\left(\left(\frac{(1-\tau_t)^{(1-\alpha)(1-\gamma)}}{(1+\beta(1-\alpha(1-\tau_t)))^{\alpha\gamma}}\right)\left(\frac{\alpha\gamma(1+\beta(1-\alpha(1-\tau_t))) + \tau_t(1+\beta)(1-\gamma)}{(\gamma\,(1+\beta(1-\alpha(1-\tau_t)) + (1-\gamma)(1+\beta)(1-\tau_t))^{1-\alpha}}\right)\right) + l \tag{43}$$

where $l$ is constant from the point of view of expropriation. Taking derivatives and rearranging terms I arrive at the first order condition (f.o.c.).:

$f = (1-\alpha)\left(\frac{(1-\gamma)(1+\beta)-\beta\alpha\gamma}{\gamma(1+\beta(1-\alpha(1-\tau_t))+(1-\gamma)(1+\beta)(1-\tau_t)} - \frac{1-\gamma}{(1-\tau_t)}\right) - \frac{\alpha^2\beta\gamma}{(1+\beta(1-\alpha(1-\tau_t))} +$

$+\frac{\alpha^2\gamma\beta+(1+\beta)(1-\gamma)}{\alpha\gamma(1+\beta(1-\alpha(1-\tau_t))+(1-\gamma)(1+\beta)\tau_t} = 0$

The latter condition goes to $-\infty$ when $\tau_t = 1$, and it is positive when $\tau_t = 0$.Moreover this function is continuous in $\tau_t \,\epsilon\, (0,1)$.The intermediate value theorem therefore says that there is an interior $\tau_t$, such that: $f = 0$.

Fig 10 represents the previous condition for the calibrated parameters discussed in the paper. As I can see the monotonicity and continuity of the function guarantees the existence of a unique interior solution for the value of $\tau_t$.

■

When I have the special case $\varepsilon = 1$, the constraint is binding from time $t = 0$. The landowners choose the highest expropriation rate such that $\mu(\tau) > (\varphi)^{-1}$ holds to avoid conflict. As long as $\mu(\tau) > (\varphi)^{-1}$ no change in the expropriation rate and no conflict will be observed in the economy.

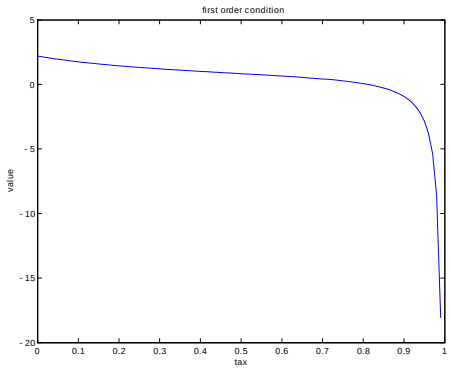



Figure 10: First order condition (endogenous prices)

### 8.7 Existence of the BGP when the capitalists' constraint is not binding

**Proposition 7** *A BGP for this economy exists and it is unique.*

**Proof.** From equation (43) see that $\tau_t$ is constant, since the value function only depends on parameters.

Looking at (23), it is easy to see that the allocation of workers across sectors is also constant because only depends on $\tau_t, \alpha$.

Then looking at (25), $\frac{K_{t+1}}{K_t}$ is constant. Let denote $\frac{K_{t+1}}{K_t} = 1+g$.

Substituting (22) in (26) and rearranging terms:

$$Y = \left( \frac{\gamma(1+\beta(1-\alpha(1-\tau_t)) + (1+\beta)(1-\gamma)}{\gamma(1+\beta(1-\alpha(1-\tau_t))} \right) p_t \left(L_t^M\right)^{1-\alpha} K_t = DK_t$$

which as it is standard in AK models, is linear in the capital stock. Then, $\frac{Y_{t+1}}{Y_t} = \frac{K_{t+1}}{K_t}$, since $p_t$ is constant (Equation (24)).

Looking at (19) it can be noticed that $\frac{C_{t+1}^A}{C_t^A} = \frac{Y_{t+1}^A}{Y_t^A}$. Using (1) I have that: $\frac{Y_{t+1}^A}{Y_t^A} = \left(\frac{K_{t+1}}{K_t}\right) = (1+g)$ is also constant.

Notice that $d_t = \frac{\alpha Y_t^A}{T_t}$ and $w_t = \frac{(1-\alpha)Y_t^A}{T_t}$are both linear functions of $Y_t^A$ and other constant variables. Consequently, both of them are also growing at the constant rate $(1+g)$.

Finally, the returns on capital $r_t = \alpha\left(1-\tau_t\right)\left(L_t^M\right)^{1-\alpha}$ are also constant since $\tau_t$, $L_t^M$ are constant.

When the constraint $K_t \leq K^{**}$ holds, the growth rate of the economy is given by $(1+g_1) = \frac{\beta\alpha\theta(1-\tau_t^*)\left(L_t^M\right)^{1-\alpha}}{(1+\beta)} + (1-\delta)$. Because $K^{**}$, does not depend on capital, and $K_t$ grows constantly and positive, then $K^{**}$ will be reached at a finite time.

To guarantee that the growth rate of the capital stock is positive, I must assume that $\frac{\beta\alpha\theta(1-\tau_t^*)\left(L_t^M\right)^{1-\alpha}}{(1+\beta)} - \delta > 0$. This condition will be satisfied as long as the economy starts with a sufficient high level of technology $\theta$ $\left(\theta > \frac{\delta}{\alpha(1-\tau^*)(L_t^M)^{1-\alpha}} \frac{1+\beta}{\beta}\right)$. This condition is similar to the condition $r > \rho$ in AK models.

When $K \geqslant K^*$, $\tau_t = 0$, in steady state and the growth rate of the economy is given by $1+g_2 = \beta\alpha\theta\left(\frac{(1+\beta)(1-\gamma)}{\gamma(1+\beta(1-\alpha))+(1+\beta)(1-\gamma)}\right)^{1-\alpha} + (1-\delta)$. I assume that the condition ,

$\beta\alpha\theta\left(\frac{(1+\beta)(1-\gamma)}{\gamma(1+\beta(1-\alpha))+(1+\beta)(1-\gamma)}\right)^{1-\alpha} - \delta > 0$ as well, to have a positive growth rate.

The preference assumption implies that capitalists will spend a fixed proportion of their income in final goods and a fixed proportion of their income in savings (investment) independently of the returns to capital. The dynamics of the model are given by the differential equation (25) in autarky and (40) in free trade. Notice that $\frac{K_{t+1}}{K_t} = (1+g)$ independently of $K_o$. I can then conclude that there are not transitional dynamics in this model.

**Corollary 8** *The number of years necessary to start the process of institutional change is given by:*

$$n = \left[ \underbrace{\frac{1}{\ln(1+g)}}_{Growth} \left( \underbrace{\frac{\ln(\mu\varphi)}{1-\varepsilon}}_{Incentives} - \ln K_t \right) \right]$$

■

**Proof.** Since the economy is in a BGP with no transitional dynamics the following expression can apply:

$$K^{**} = (1+g)^n K_t$$

Taking logs on both sides of the previous equation and rearranging terms yields:

$$n = \left( \frac{1}{\ln(1+g)} \right) (\ln K^{**} - \ln K_t)$$

Substituting the value for $K^{**}$ and rearranging terms I have:

$$n = \left[ \underbrace{\frac{1}{\ln(1+g)}}_{\text{Growth}} \left( \underbrace{\frac{\ln(\mu\varphi)}{1-\varepsilon}}_{\text{Incentives}} - \ln K_t \right) \right]$$

■

# 9 Appendix B Free Trade

## 9.1 Expropriation in free trade when the constraint is not binding (Proof of proposition 4)

**Proof.** Substituting (34) in (35) and rearranging terms I have:

$$V_{Tt} = \ln \left( \frac{\alpha T_t + \tau_t \left(p_t^f\right)^{\frac{1}{\alpha}} (1-\tau_t)^{\frac{1-\alpha}{\alpha}}}{\left( T_t + \left(p_t^f\right)^{\frac{1}{\alpha}} (1-\tau_t)^{\frac{1}{\alpha}} \right)^{1-\alpha}} \right)$$

To solve for the maximization problem when the constraint is not binding, I take the first order condition and I rearrange terms. That yields:

$$f(\tau_t^*) = (1-\tau_t)^{\frac{1-\alpha}{\alpha}} \left(p_t^f\right)^{\frac{1}{\alpha}} \left( \frac{\left(1-\left(\frac{1-\alpha}{\alpha}\right)\left(\frac{\tau_t}{1-\tau_t}\right)\right)}{\alpha T_t + \tau_t (1-\tau_t)^{\frac{1-\alpha}{\alpha}} \left(p_t^f\right)^{\frac{1}{\alpha}}} \right) +$$

$$+ \frac{\frac{1-\alpha}{\alpha}(1-\tau_t)^{\frac{1-\alpha}{\alpha}} \left(p_t^f\right)^{\frac{1}{\alpha}}}{T + (1-\tau_t)^{\frac{1}{\alpha}} \left(p_t^f\right)^{\frac{1}{\alpha}}} = 0$$

Notice that $V_{Tt}$ is continuous on the interval $\tau_t \in [0,1]$, and the first order condition is positive when $\tau_t = 0$, and $\lim_{\tau_t \to 1^-} f(\tau_t) < 0$, implying that $\tau_t$ must be interior.

Working on $f(\tau_t)$ I arrive at the following expression:

$$T_t \left[(1+\alpha(1-\alpha))\tau_t + \alpha(\alpha-2)\right] = \alpha \left(1-\tau_t\right)^{\frac{1+\alpha}{\alpha}} \left(p_t^f\right)^{\frac{1}{\alpha}} \tag{44}$$

Notice that the left hand side of condition (44) is monotonically increasing in $\tau_t$ where the right hand side is monotonically decreasing in $\tau_t$.Uniqueness is therefore obtained directly applying the intermediate value theorem.

Totally differentiating equation (44) and rearranging terms yields:

$$\frac{d\tau_t}{dT_t} = \frac{-\left[(1+\alpha(1-\alpha))\tau_t + \alpha(\alpha-2)\right]}{\left[\left(1+\alpha\right)\left(1-\tau_t\right)^{\frac{1}{\alpha}} \left(p_t^f\right)^{\frac{1}{\alpha}} + (1+\alpha(1-\alpha))T_t\right]} < 0.$$

where I have applied the fact that $\frac{dp_t^f}{dT_t} = 0$.

Totally differentiating (44) and rearranging terms (using the fact that $\frac{dT_t}{dp_t^f} = 0$) :

$$\frac{d\tau_t}{dp_t^f} = \frac{\left(1-\tau_t\right)^{\frac{1+\alpha}{\alpha}} \left(p_t^f\right)^{\frac{1-\alpha}{\alpha}}}{\left[\left(1+\alpha\right)\left(1-\tau_t\right)^{\frac{1}{\alpha}} \left(p_t^f\right)^{\frac{1}{\alpha}} + (1+\alpha(1-\alpha))T_t\right]} > 0.$$

Q.E.D. ■

### 9.2 Monotonicity of the capitalists' reaction function in free trade and the case in which the constraint is binding.

The proof of the monotonicity in free trade is rather trivial. The capitalists' reaction function in free trade is the same as condition (42) except for the fact that $\lambda = 1$ because prices are determined in the world market. An increase in expropriation decreases the current returns on capital and that reduces $\left(1-\tau_t\right) L_t^M(\tau_t)$, increasing the net returns of conflict.

Figure (11) represents the reaction function as a function of expropriation in both regimes, autarky and free trade for the current simulation (in this case I take $\varepsilon = 0.5$, $\ln \varphi = 2$ for expositional reasons and without loss of generalisation). Notice that the reaction function in free trade is not always below the one in autarky.

In the paper I have discussed the simplest case when the constraint is not binding at the moment of openness. Figure (12) shows the threshold level of capital for each case in trade openness, provided that the constraint is not binding in autarky.[44]

What I can observe in figure (12) is that when $p < 2$, the threshold level of capital in free trade is larger than in autarky. Consequently the constraint is not binding and the optimal expropriation rate at the moment of openness is the same as in the benchmark model. However, when $p > 2$, I could have two cases: The first case is the trivial one in which, despite the decrease in the threshold level of capital, the constraint is still not binding. The second case is the one in which, the constraint is binding in free trade but not in autarky. In this case trade openness will inmediately start the process of institutional change. The landowners choose an expropriation rate below the optimal one

[44] That is, the threshold level of capital for each price in autarky provided that in autarky the optimal level of expropriation is 0.8096.

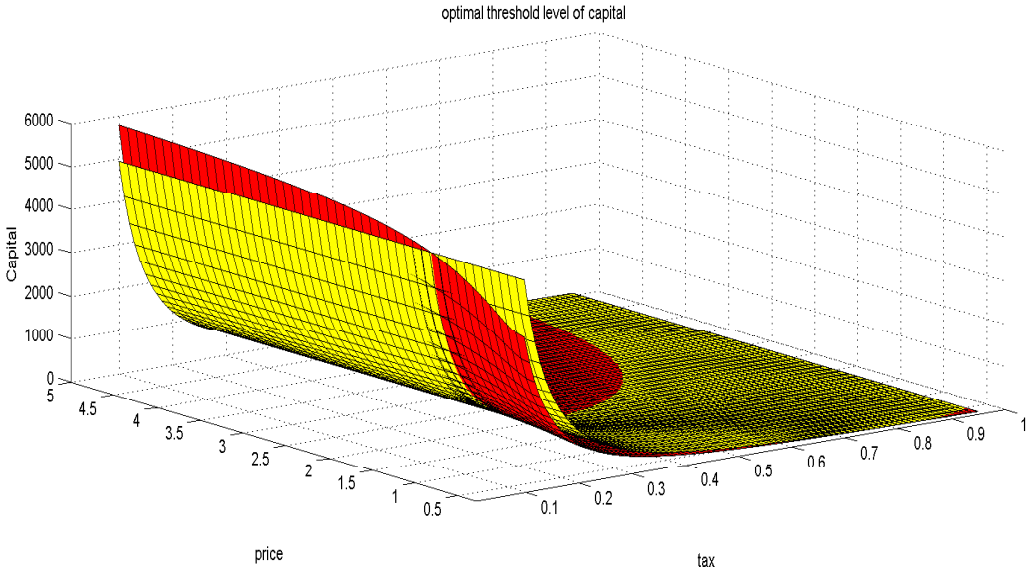



Figure 11: Capitalists Reaction Function

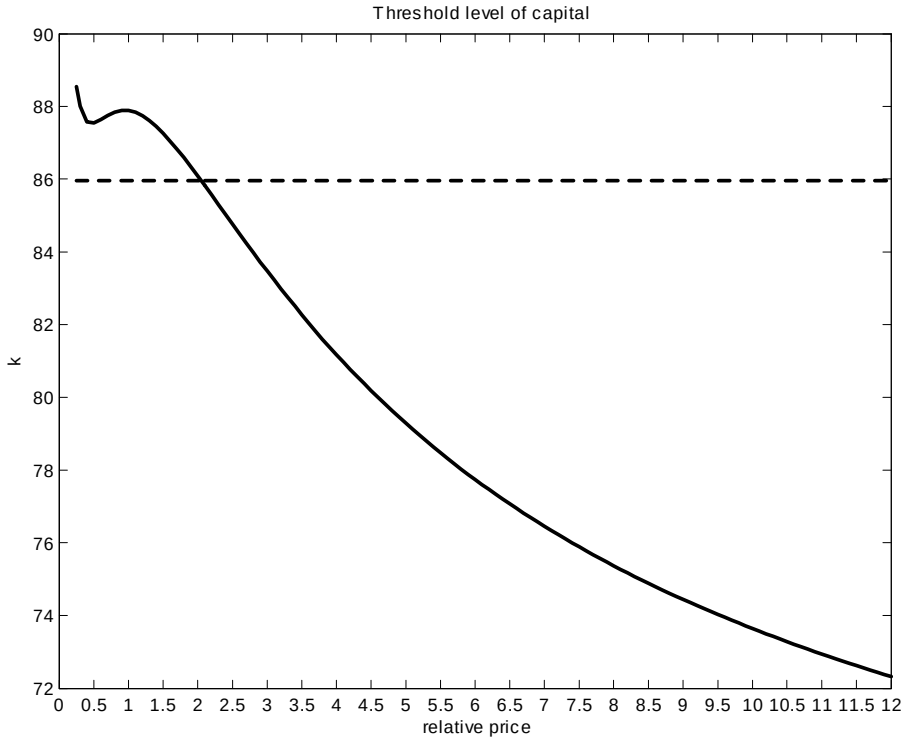



Figure 12: The threshold level of capital

to discourage the revolt and this process is repeated through generations until the expropriation is eliminated.

While the results mostly hold in qualitative terms when the constraint is binding in the generation in which the economy opens to trade, there is an important difference between both cases that I need to understand. When the economy becomes more specialised in manufacturing products, the capitalists are more willing to undertake military action (the capital threshold goes down as there is more specialisation in manufacturing). The latter implies that the reduction in expropriation becomes larger the more the economy specialises in manufactured goods. This is different to the benchmark case in which once you surpass the threshold that I called moderate specialisation, further specialisation in manufactured goods was in some cases reducing growth and delaying institutional change.

In the paper I have focused on cases in which the constraint is not binding at the dawn of the Modern Era because the empirical evidence suggests that this was the case, as in the evidence I do not observe any structural break inmediately after trade openness. Yet, my conclusions on the effect of trade openness on institutions are relatively kept even if the constraint is binding at that period.

### 9.3 The Special case $\varepsilon = 1$ Under Free Trade.

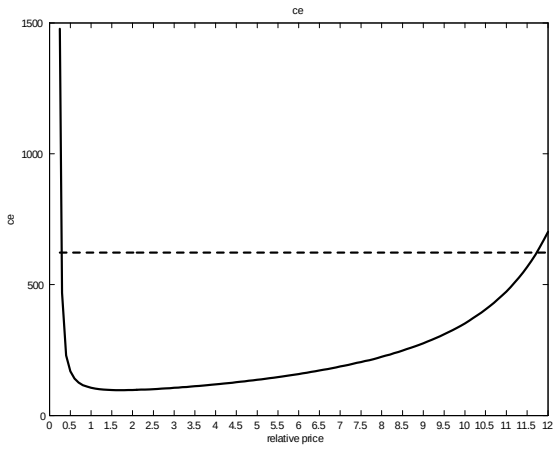
For the special case of $\varepsilon = 1$, it is useful to look at figure 5. The growth mechanism is no longer in place since institutional change does not depend on the capital stock so all the effects of trade on institutions will come through the incentive mechanism. If the economy specializes in agricultural products or moderately specializes in manufactured goods, the incentive mechanism discourages the institutional change ($\mu$ increases). Consequently, the landowners incentives to expropriate capitalists are the same as in the benchmark case because the constraint is not binding. I will see a change in expropriation depending on trade patterns, but no institutional change will be observed since the benefits of the conflict do not compensate the costs of entering into it.

When the economy strongly specializes in manufactured goods, $\mu$ decreases. This implies that the constraint could be binding in some cases when it was not binding in autarky. Landowners will respond to that by reducing expropriation up to the point at which the conflict is discouraged again.

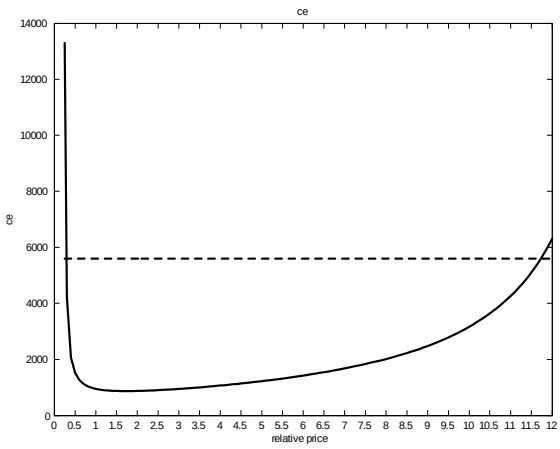
To sum up, in the extreme case of $\varepsilon = 1$, the main message of the impact of trade on the current set of institutions remains unaltered. However with $\varepsilon = 1$ trade can not implement institutional change.

## 10 Appendix C: Robustness

In this section I focus on robustness checks for the institutional parameter $\varepsilon$. In the text I have considered the case where $\varepsilon = 0.5$. The results are qualitatively robust to change in $\varepsilon$. For the quantitative implications I consider two different extreme cases $\varepsilon = 0.1$ (in this case the revolt cost is not very sensitive to changes in the current capital stock) or $\varepsilon = 0.9$ (in this case the revolt cost is very sensitive to changes in the current capital stock). The results are shown below:




$\varepsilon = 0.1$




$\varepsilon = 0.9$

The previous figures show the time to undertake the revolt for different levels of $\varepsilon$. An interesting observation is the fact that as $\varepsilon$ increases, the number of years necessary to undertake the revolt increases considerably. In relative terms, the necessary years to undertake the revolt do not change with this parameter. If the economy does not change the price level between autarky and free trade (relative price=1), the economy in free trade needs approximately 16% of the number of years necessary to undertake military action in autarky. Therefore, changes in the parameter $\varepsilon$ affect only the number of years the economy will need to undertake the revolt in both scenarios but it does not affect the relative number of years.