# The Institutional Dynamics of Colonial Exploitation

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**Abstract**

This paper focuses on the interaction between the legacy of institutional arrangements and incentives on long-term development. We recalled two studies focusing on the long term effects of geographic discontinuities in colonial practice in India and Peru and we confronted the two historical cases as to emphasise the role of capital accumulation and equality of distribution. Furthermore, we propose an evolutionary game model to capture the evolutionary dynamics of institutional assets defining egalitarian or iniquitous income divisions in a non-cooperative setting. This framework sheds light on the role of the colonial governments in the interaction between local institutions and foreign colonial rule in terms of distribution, resources extraction, social asymmetries and finalised investments.

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# 1 Introduction

The thesis according to which colonial policy and practice had an impact over its former subjects is robustly documented by many authors both empirically and theoretically. Some studies employed diverse historical examples as natural experiments trying to capture the lasting modifications in wealth, education or investments, correlated with the presence of a protracted time of colonial rule (Nunn 2009; Acemoglu et al. 2001; Huillery 2009; Berger 2008). Economic models at the same time try to explain several aspects of the institutional interactions in colonial and post-colonial economies. One aspect that draws attention is concerned with the impact of some exogenous institutions on development, which is inserted in the more broad discourse on institutional effects on long term growth (Acemoglu et al. 2005). Colonial European activities do fit in this framework: they are useful for the exogenous nature of their interaction with the colonised country and the usually richer data that can be collected both for colonial and post-colonial times. Understanding colonisation as a process and insulating some of its persistent features might then cast some light on its influence on the institutional setting of the colonised country. The reason for this enquiry is not only descriptive: unequal institutions seem to be responsible for suboptimal development patterns, and some of them might explain well a shift toward underdevelopment of previously promising regions. The implications are thus both of historical and economical interest.

One of the modelling approaches in use for institutional transition is concerned with the interaction of large populations trying to coordinate over a particular kind of "contract" (Belloc & Bowles 2013). These models display coordination failures leading to suboptimal choices in terms of development strategies and surplus optimization. Of similar fashion but different implications are models where the intergenerational evolution of traits selects a given pattern. On the other hand much of development economics modelled the dynamics of accumulation and in a rather mechanical way: the produc-

tion functions and the structural nature of an economy play a central role while the interaction among different actors is reduced to a minimal level.
The way by which we define the process of pay-off formation and the factors involved influence the coordination process and the connected dynamics. In order to specify their structure we must insulate some aspects deemed relevant. This to clearly define what are the influences colonization had over long term development. In this sense we should move to listing some peculiar features of colonisation by taking examples from the historical and economical literature.
Historical examples, even if non-exhaustive, are important for two reasons: firstly they provide well documented natural experiments; secondly they allow, by a comparison of the apparently different stories they tell, for a search of some common and underlying mechanics. These mechanics involve different levels of analysis, such as the nature of investments and economic efficiency, government regulations or geographical factors (Acemoglu 2005). Some elements however seem to be more relevant than others as they shape the very core of the capitalistic process of capital accumulation and investment. For example some attention has been devoted in the past to the question of whether legal systems (e.g. civil law systems or common law ones) had an impact on the development of many countries, but evidence suggests a modest impact (Acemoglu and Johnson 2004). Domestic institutions on the other hand seem to account well for many phenomena (Nunn 2009).

# 2 The example of colonial India and Peru

In the debate concerning the long effects of institutional and political choices on socio-economic trends, India is an interesting case as it offers good data over a relatively long period of time. Banerjee and Iyer (2005) studied the long term development effects of the land revenue system deployed by the British rule in colonial India. They carried out some econometric analysis

of data coming from different districts under British rule, which still almost persist in their original geographic shape. Their analysis displays evidence that divergence in their long term development is well explained by the institutional asset of land tenure that was chosen by the British Empire at the time it started taking a strong grip over India. In fact the land revenue systems and local political organizations might have had a key role in the development of some significant pattern features of current and past socio-economic indexes and performances, which greatly diverge and are correlated with these early regulations. As the authors note, land taxation was a fundamental source of revenue for governments in India, since Mughal times in the sixteenth and seventeenth centuries. Land tenure systems can be grouped into three branches, of which only two are analysed in depth in the article:

1. The *zamindari* or *malguzari* systems, landlord-based;
2. The *raiyatwari* system, an individual cultivator-based system;
3. The *mahalwari* system, village-based.

The third kind of system is not central in the authors analysis, but was present and implemented in many areas.
The landlord structure was rather feudal in form and revenue-rights could be transferred in ways not dissimilar to property rights. In a successive moment some norms to protect the peasants were introduced, as initially the land under the jurisdiction of landlords was administrated with little regard for the workers. Differently, where the *raiyatwari* system was adopted the revenue settlement was made directly with the individual *raiyat* or cultivator. The system, moreover, greatly favoured the development of a more complex, rights-oriented and cooperative environment because of the different and more centrally defined institutional and normative actions undertaken by the British.[1] Finally, the village-based system took different shapes: the

[1]In fact: "In these areas, an extensive cadastral survey of the land was done and a detailed record-of-rights was prepared, which served as the legal title to the land for

composition of the body responsible for the requested revenue varied from one-person managed villages, which were *de facto* landlords, to several people ones. In the several people arrangement each member was responsible for a given share of revenue, either based on ancestry or linked with the possession of land. The latter was calculated on fair criteria according to stated rules, in a similar manner as in the *raiyatwari* system.

What emerges from the description given is a well-defined and sharp difference between the landlord system and the *raiyatwari* system. The latter having more responsibilities, guarantees and managerial freedom on single cultivators than the locally and unequally centralized landlord form. The authors emphasise the relative better performance of non-landlord areas where the differences in development indexes are robust if checked for geographic or demographic factors, or for productivity. What is more, landlord areas were usually more fertile and productive, with higher population, and hence not *a priori* disadvantaged or poor in relative performance. We recall here some aspects that are worth analysing: firstly, landlords and non-landlords systems had differences in the distribution of wealth, with non-landlords being more equal in the distribution. This happened because of their possibility of appropriating most of the gains in productivity, with very little reinvestment (Albertini 1982, p. 27 and pp. 29-31). Secondly, in landlord areas the power given to the landlord might have discouraged investments.[2] The authors further suggest that the disequilibrium in powers and rights might have constituted a sense of distrust that persisted beyond the colonial time, influencing the development and coordination between agents, for actions of collective interest, of less equal districts. Finally, differences in the rela-

the cultivator. Unlike the Permanent Settlement areas [those of landlords], the revenue commitment was not fixed; it was usually calculated as the money value of a share of the estimated average annual output. This share typically varied from place to place, was different for different soil types, and was adjusted periodically in response to changes in the productivity of the land." (Banerjee and Iyer 2005, p. 1193).

[2] "investments that made the land more productive were discouraged because of the risk of expropriation by the landlord" (Banerjee and Iyer 2005, p.1198).

tionship with the colonial state concerning investment in infrastructures or policies: in fact non-landlord areas had major investments in these sectors. It is noted however that investments in infrastructures account and explain very little of development in the case under analysis.

We are here more interested in the structure of institutional arrangements in these areas as a base for our theoretical analysis, rather than on the motives that brought about different institutional assets. What is interesting is the idea that some previous institutions might have favoured the choice of the new. This could have happened, for example, by ways of interaction with the given set of assumptions British officials had, for reasons of supposed political or economic convenience, for some random and contingent developments in the process of choice. We could devise a sort of dependence from previous conditions, as well as a certain amount of randomness, of what could otherwise seem to be a completely exogenous choice. It could be argued that even if the British decided on their own, they had to face the risk of revolts (and the connected human and economic costs) and other complex and potentially onerous transition problems from an institution to another. These transition costs had to be taken into account and influenced the final choice. It is not argued here that new institutions cannot be forced into the system, without being an emerging feature of it. In fact, theoretically, a Pareto-superior institution easily fits and overwhelms native ones as it brings strictly positive benefits. However, in more complex situations new institutions, introduced for some precise goals, might be mixed with or implemented on previous ones in order to get the maximum result under the transition costs (military control, suppression of revolts, less taxation etc.) and information discrepancies that might be necessary to face to get a "better" result.

More broadly the pattern and history of taxation under British rule of India is rather complex. If we take into account the historical evolution and praxis of taxation by the Colonial Government of India, no easy scheme concerning

a "colonialists exploit the country" paradigm emerges. In fact, the story is complex and much effort was made by the British Government to treat taxation as a mean of financing public expenditure and, when necessary, war expenses. One of the aims of the colonial forces in the land was to develop Indian market as producer and buyer of resources. In particular many nations where importers of India's agricultural and industrial goods, thus making Indian export unusual in composition for an underdeveloped country of the time.[3] Prices in agriculture also changed, fostering the generation of households surplus to be consumed in non-subsistence goods (McAlpin, 1989). We might not think thus of colonialism as a force plainly squeezing India, but rather one developing it for diversified needs. These needs where not in the sole or main interest of the country, but rather those of the British Empire. An analysis of public expenditure for matters such as education, for example, shows the focus of the time: material and industrial development, guided by foreign interests, rather than Indian welfare.[4]

It might be noted however that Taxation here is not plain surplus extraction. The role of colonialism as oppressive extractive force might not be so fundamental in explaining underdevelopment. In a sense, an inefficient government taxing with uneven structures might have well been a cause of underdevelopment different from the one we have evidenced. This means that when we consider development issues, we must look at how central forces interact with local ones shaping future interactions between agents and their productive and social activities. This is the same when we consider India.
Finally, we might consider, as stated at the beginning of this paragraph, the

[3] "Although the Indian economy is generally considered today as [...] underdeveloped [...] it is by no means easy to categorize her international trade as such. [...] the commodity composition of India's trade was much wider [than other underdeveloped countries]." (Chaudhuri, 1989, p. 804).

[4] "The government spent very little on public health or education in the nineteenth century" (Kumar, 1989, p. 935) and "Very little was spent on other social or economic developments, such as extensions of research in agriculture, or on industry" (ibid., p. 937).

way in which Britain thought of taxation in India and its role in the British Empire. India was used as market and producer. The extractive policy was one of guided development and careful design of exports and taxation. Taxes played a great role, but might not be where to look at; policies might be the answer: "The nationalist writers [...] treated the entire amount of export surplus as a net drain from the country and emphasized its impoverishing effects. But it is clear that, in order to measure the actual magnitude of the 'drain' [...] the cost of producing the exports must be subtracted from their final sales value. This difference, in so far as it was paid for through internal taxation, represents the real income leakage. In the long-run it was not so much the capital payments as the absence of active measures for economic development which was probably most responsible for the continuing poverty of India." (Chaudhuri, 1989, p. 877).

What emerges from our discussion on India, then, is the pivotal role played by the cultural and political feelings actors formed in their minds concerning their community and country. In fact many authors are more prone, in their conclusions, to explain much of the differences in development as an effect of political environment. [5] Depending on political conditions, however, some institutions might be helpful rather than harmful, even if not intentionally so.

A good example of this difference is given by Dell (2010). In 1545 the Potosì mines where discovered in Peru, in an area close to current Bolivia. Containing the largest silver deposit in the Spanish Empire, and close to the mercury mines of Huancavelica,[6] the Potosì mines started a flourishing extraction of the rare product that went on for more than two centuries. Because of the growing demand for workers, some peculiar institutions where created to serve the scopes of supplying silver to the empire. With little care for local equilibria, the Spanish started a process of exploitation that lasted until the

[5] " We therefore feel that the biggest piece of the story is probably the differences in the political environment" (Banerjee and Iyer 2005 p.1209).

[6] Mercury was used in the process of silver refinement.

early nineteenth century. The whole of the process influenced development patterns in the region and country and constitutes an interesting counter example to some potential claims on institutions that might be derived from other historical events. In fact we will see that institutions such as *haciendas*, i.e. a landlord-based tenure system, where beneficial for long term development whenever they where implemented, contrarily to what seems to result from other studies. After the mines discovery, villages located in the contiguous region where required to provide a quota of their adult male population, usually one-seventh, as rotating *mita* labourers for extracting and delivering the minerals. This process started in 1573 and kept working for centuries. The fraction of the population involved in the process was consistent. Local native elites were responsible for collecting conscripts and checking the logistic and control duties involved. If these community elites where not capable of giving the required number of workers, they had to pay in silver the sum needed to hire the labourers. Historical evidence, as reported by the author, suggests that this rule was strictly enforced. Some communities where able to pay rather than give conscripts, but the study from Dell focuses on regions that did not usually pay, giving rather conscripts as primary contribution.
When the Silver deposits where depleted in 1812, the *mita* was abolished, after almost two centuries and a half. Looking at the data, which comes from records of the Spanish Empire and Peruvian Republic, Dell brings evidence that the *mita* districts paid a greater price in terms of underdevelopment after the end of the Spanish extracting institutions. In fact these areas are currently afflicted by chronic underscoring when checked for some indexes of well-being and consumption. In particular data on stunting and household consumption shows that former *mita* districts behave in a sensibly worse way than their counterparts. Because of the nature of what seems to be a strong feature of *mita* on Peru's history, this work is perfectly in line with the vast literature on the extractive institutions influence on long-run economic prosperity. The emergence of discrepancies between *mita* and non-*mita* regions in terms of development can be possibly explained by referring to two distinct

channels: one is that of the capability of non-*mita* areas to get provision of public goods; the other is the effects of land tenure systems and their evolution after the end of silver extraction activities. It is important to start from the land tenure systems implemented in the areas. Haciendas where widespread in areas that did not feature *mita* policies. When the mines where discovered the landed elite had not yet formed. As the author notes "to minimize the competition the state faced in accessing scarce mita labour, colonial policy restricted the formation of haciendas in mita districts, promoting communal land tenure instead" (Dell 2010, p. 1865). The difference in land tenure systems created differences in policies: haciendas where less equal but granted secure property rights which where not so strong in *mita* areas and did not protect from exploitation. These effects of security and protection might have been beneficial for creating a humus favourable for development, which did not exist in *mita* areas, where the situation worsened after the Spanish ended the extractive processes. What is more, haciendas where able to lobby for better infrastructures and connections. Even if not with any public enhancement in mind, they allowed for more connections with other markets and lasted when previous institutions collapsed, allowing small farmers a wider access to other markets and lower costs in terms of connections. *Mita* areas at the contrary did not receive any particular attention in terms of infrastructures, becoming less market-connected. In addition to this after the abolition of the Spanish mining institutions, the property rights where not modified in *mita* areas and extensive land confiscation, responding peasant rebellions and banditry, which lasted till the twentieth century, started in the area undermining secure property rights, which discouraged public goods investments. The argument here is that landlords provided the set for some goods and links that persisted and allowed for a better starting condition for development: one with good infrastructures and political stability.

It is important to note that Landlords might have not been the better institution for successful non-*mita* regions, that is other institutions could have been designed with the capability of fostering development of rights, stability, public goods and connections, all suited for explosive economic development. Anyhow these are just conjectures, as we have very little capability of exploring the potential interactions and institutions that could have emerged, were extractive and coercive policies not implemented. We can point however that one of the key aspects in the period subsequent to the abolition of *mita* policies was great political instability and social conflict, in an area that had been exploited in a severe way. Given this, as already stated, what is important is not describing the processes of institutional interactions alone, but also that of transition and persistence. The main lesson the Peruvian case seems to suggest is that transition policies implemented after the depletion of the silver mines played much in pushing toward an underdevelopment pattern already partially traced. What would have happened if peculiar transitional institutions emerged, having in mind connection, cooperation and security, lies in the realm of unrealised events and speculation.

Looking at the two phenomena, the success of certain institutions in fostering development can be explained mainly by looking at their effects on economic dynamics. These are specific to some areas where understanding other institutions and their coordination, looking at incentive structures and repressive phenomena, at conflicts between social groups and so on, can create the right picture on which we can build a model of institutional effects on development. Therefore in our example Landlords might build the base, both material and behavioural, for incentives toward development, or rather destroy them by encouraging conflict, non-cooperative behaviours and unequal distribution persisting after they are death. Institutions matter in explaining development for their mediated economic impact, but we have not analysed their ability to persist, and the mechanics that allow this and create the transmission mechanism between the previous institutional con-

dition and the new one. India and Peru then show us that what matters is the effects on security, capital accumulation and cooperation, which in India brought about better infrastructures and more dynamic markets, characterised by trust, while landlords where worse in creating sub-institutions and learned behaviours that persisted and affected politics; In Peru, at the contrary, the discourse can be reverted because of the extractive policies in the *mita* districts. In Peru, it could be argued, it is not inequality or equality *per se* that doomed the region, but an egalitarian extraction of resources which depleted material and immaterial capital factors. Its legacy has been misery and the predatory effects not so different from other phenomena of severe exploitation (Nunn 2008). Additionally, landlords and their haciendas might have granted investments and a minimal level of accumulation and investment which later brought their regions to higher development paths.

Another silent and constant actor, that created initial exogenous shocks and then reshaped the behaviour of economic actors, is the State. In our examples it is more a third institution that coexists with the colonial forces or can be identified with them. For practical reasons we can name "State" any political force, partially-exogenous and hierarchically superior to regions and their norms, capable of reshaping formal institutional assets and some incentive structures. It does so for its own reasons and scopes, that might be contrary to the interests of both the dominant and lower class of a given region. The state is thus able to influence the dynamic of institutional evolution and selection. To understand much of colonial rule and its consequences is then to give a right form to the three actors usually involved: the colonial state, the intermediate privileged class and the lower producing mass.

Are we comparing a minor and a major evil? In a certain sense: yes. The real difference between the two systems is in the nature of extraction, not of institutions. However, the pre-existence of some sort of institutions (egalitarian or non-egalitarian) did influence the result of the extraction in the sense

that some institutions were selectively favoured or adversed, or channelled one result or another. Two channels of change are shared by the narratives: a given degree of modified social cohesion, as a result of stronger or weaker extraction, and horizontal or vertical institutions, as the consequence of the bargaining of the agents in the model. They all depend on the interaction between classes and the role of colonial forces.

# 3 The model

We devise an ideal country, which is composed of two social groups interacting in an evolutionary non-cooperative setting. They must agree on two possible contracts, one of which is more equal than the other. The system employs a very simple Solow growth model to allow for some considerations on the impact of different surplus distributions over long term development. We distinguish between three phases in our paradigm: before, during and after colonisation. In the first one the two classes interact in the system trough the game and decide for one equilibrium or another. A minimum level of capital is needed in order to start the accumulation process. This might be due to the need for a certain exceeding amount of produce to be reinvested in the initial capitalistic development of agriculture or other sectors, as the under threshold level is equivalent to subsistence. Depending on the distribution of capital it might be possible that not all the forces involved are active, or even none of the social groups. As we will see, in this condition an equality/inequality trade-off emerges which then evolves in peculiar ways as the economy develops.

In the second phase of our model a third actor appears: the colonial state. This force acts trough an extraction of surplus which can then be redistributed or sent out of the system to the motherland. The choice of the state for different levels of taxation depends on many factors, the main being the political stability of the region (an unstable area brings many costs), which

we assume is partially represented by the stability of the contractual scheme adopted.[7] Naturally, another factor is the demand of resources fuelling colonial appropriation. The choice for redistribution of surplus and taxation adopted follows some patterns which are similar to those of the pre-colonial condition: an efficiency/equality trade-off emerges with some consequences for the system as it evolves.

Finally, the effects of colonial rule are explored in their implications, as the extractive policy ends giving rise to a sort of "rebound-effect". We will explore in detail this phase and its potential legacy for successive development in the concluding remarks for this work. It might be remarked here that our model does not try to capture mathematically all the subtleties of the different interactions recalled in the literature, but might give a way of thinking about the relationship between development patterns, institutions and colonialism.

## 3.1 Pre-colonialism

Let $\alpha$ and $\beta$ be two political groups playing strategies $(a_i, a_i) \quad i = 1, 2$, namely the peasants and the elite, which must play in an evolutionary non-cooperative setting. Now, $y$ being the output of a production process, payoffs $a_1 = \frac{y}{2}$ and $b_1 = \frac{y}{2}$ for the egalitarian strategy $(a_1, b_1)$ split $y$ equally. For the non egalitarian strategy, $(a_0, b_0)$ payoffs are different as $a_0 = \sigma y$ and $b_0 = (1 - \sigma)y$ with $\sigma \in [0, 1]$. For any strategy $(a_i, a_{-i})$ the payoff is zero for both players. This simple model tries (in line with Belloc & Bowles 2013) to capture the essentials of an interaction and potential impasse of the bar-

[7] The idea of the costs of instability is pretty intuitive. If we consider revolts as phenomena with disruptive consequences on the productive sector and some connected costs of military and police intervention, it becomes clear that a force which is only partially involved in the national affairs, will protect its interests independently of many aspects of well-being. Additionally, having as main objective stability, partial development and colonial trade (or even colonial exploitation), the state will protect those mechanics which allow to maximise their efficacy.

gaining process in action in society. If modelled in a stochastic frame it tells something concerning the speed of convergence to potential equilibria.

The output in the system is given by a Solow function in the form $y =$

| | | Class $\beta$ | |
|---|---|---|---|
| | | $\frac{y}{2}$ | 0 |
| Class $\alpha$ | $\frac{y}{2}$ | | 0 |
| | | 0 | $(1-\sigma)y$ |
| | 0 | | $\sigma y$ |

Table 1: The contractual bargain before colonialism

$f(k) = Ak^{\chi}$ where $k$ is capital, $\chi$ and $A$ parameters. There exist a given level of output $\bar{y}$ such that a class starts the process of capital accumulation and capitalistic expansion. Below that level we can either imagine that we are close to subsistence, or that the output is not sufficient to cover the initial costs of activation of the process. We suppose that the initial level is such that $\bar{y} > \frac{y}{2}$ and thus the way surplus is distributed influences the initial development of capitalism in the kind of countries we model. This seems a reasonable way of setting output levels as clearly had the level been inferior, a process of accumulations would have already been occurring. It does not imply the absence of other patterns: for example output might depend on particularly favourable climatic factors, or on gradual modifications of the optimal condition allowing for a sufficient technological innovation, or again on endogenous political and economic factors other from our iniquitous original division, such that $\bar{y}$ emerges for at least one class. With that in mind we can calculate the levels of capital for which the growth process starts. Reminding that the level of capital changes according to $\dot{k} = sf(k) - \delta k$ with $s \in [0, 1]$ investment rate and and $\delta \in [0, 1]$ depreciation of capital.
For class $\beta$ the minimal level is given by the following value:

$$\bar{k} = \left( \frac{\bar{y}}{(1-\sigma)A} \right)^{\frac{1}{\chi}}$$

which is the one such that $f(\bar{k}) > \bar{y}$ and thus starts the accumulation process for the whole system. At equilibrium the level of capital is given by

$$\tilde{k} = \left( \frac{s(1-\sigma)A}{\delta} \right)^{\frac{1}{1-\chi}}$$

Now for this level of capital we get two possibilities: either the second class has a share big enough for it to participate in the capitalistic process, or it is below such a level. This for $\alpha$ is given by

$$\bar{\bar{k}} = \left( \frac{\bar{y}}{(\sigma)A} \right)^{\frac{1}{\chi}}$$

Thus for $\bar{\bar{k}} > \tilde{k}$ there is no further growth, while for $\bar{\bar{k}} < \tilde{k}$ the jump to the superior path of growth starts at $\bar{\bar{k}}$ leading to the equilibrium level

$$k^* = \left( \frac{sA}{\delta} \right)^{\frac{1}{1-\chi}}$$

The kind of patter we describe is based on two original conditions and then evolves in a rather deterministic way: one, stated in the model, is that different levels of equality might trigger or not the process of development; the other is that the way $\sigma$ varies in time might allow the barriers to move as both $\bar{\bar{k}}$ and $\tilde{k}$ are functions of equality. This egalitarian impact disappears in the highest level of the Solow model, which does not take into account distribution.[8]

[8]The idea of an original unequal distribution of capital such that the process of growth might endogenously start, is not a novelty in economics. In fact and as an example the evolution of pre-industrial agrarian Europe might give and idea of other factors which did account for the passing from Malthusian societies to capitalistic ones. Brenner (1976 and 1982) and the debate on class structure and the agrarian roots of European capitalism (Aston & Philpin 1990) are a good reference together with a more general overview as in Hatcher & Bailey (2001). Medieval and modern Europe did differ of course from pre-colonial societies, yet they are inspiring for many phenomena which could have started in the east, had the interaction with external forces been less brutal.

The model so far tells very little of long term development. It is just a frame capable of describing something of the original distributional arrangements in the economy and their role in starting accumulation. However the scheme becomes interesting as the colonial forces come in. We neglect here any transition dynamic and simply suppose that some variables are added to the pre-colonial framework as to make it account for the interests of the colonial state and the connected policies devised for the collection of resources. Before proceeding it is important to point to some aspects of institutional stochastic stability in our evolutionary framework (Young 1998).

We focus on the long-term levels of capital. Figure 1 shows an illustration of the results of the model, where $\underline{k} \equiv (\frac{\bar{y}}{A})^{\frac{1}{\chi}}$ is the minimum level of the of initial capital necessary for any process of growth to start, independently of $\sigma$; $\hat{k} \equiv (\frac{2\bar{y}}{A})^{\frac{1}{\chi}}$ is the level of capital above which the egalitarian institution leads to the highest level of income in the long-run. We summarize the results of the pre-colonial society in the following Proposition.

PROPOSITION **1.**

- *If $k_0 \leq \underline{k}$, the only ESS steady state is the egalitarian institution with a capital equal to 0 and no income for both the classes.*
- *If $\underline{k} < k_0 < \hat{k}$, for any $\sigma \in [\hat{\sigma}, \underline{\sigma}]$, the uneven institution is ESS, and the steady state level of capital is $k = \tilde{k}$.*
- *If $\underline{k} < k_0 < \hat{k}$, for any $\sigma < \hat{\sigma}$, the uneven institution is ESS when $k_t \leq \hat{k}$; however, as long as $k > \hat{k}$ then the only ESS steady state is the egalitarian institution which reaches the maximum capital level $k^*$.*
- *If $\hat{k} < k_0$, the egalitarian institution is the only ESS equilibrium where the income of the economy is at the maximum steady state level.*

By looking at figure 1 then, we can study the long term consequences of the dynamic in object. The main result is that there exist an interval of stochastically stable equilibria for $\sigma \in [\hat{\sigma}, \underline{\sigma}]$ such that inequality is persistent. What

is more inequality is necessary to start the process of accumulation according to our assumptions. In such a condition severe levels of inequality make the alternative of more equal distribution stronger as the process develops, leading to a shift to egalitarian distributions. The other SSE are in fact for equality. The process so captured is consistent with the idea of a "passive" elite coordinating in a non repressive way with the subordinate portions of the population. For extreme inequality the pressure for a shift as payoffs evolve sounds consistent and is indirectly captured by the model. The idea of "repressive" elites might find its way here, after a modification of the model or a qualitative comment, where we try to account for a myopic elite or some costly containment of the gradual push for another institutional scheme. However equality might not lead to the higher level of development for a given "stable inequality" interval, evolution to the new equilibrium does not happen because of the uneven but originally necessary distribution of resources: the economy is trapped in a suboptimal equilibrium.

## 3.2 Colonialism

| Class $\alpha$ \ Class $\beta$ | | |
|---|---|---|
| | $\frac{y}{2}(1-t)$<br>$\frac{y}{2}(1-t)$ | $0$<br>$0$ |
| | $0$<br>$0$ | $(1-\sigma)(1-t)y$<br>$\sigma(1-t)y$ |

Table 2: The contractual bargain under colonialism

Colonialists get a share $t$ of the total income. A fraction $\phi$ of tax revenue is invested in the colony. Inhabitants have to share the remaining income, that is $y_C = (1-t)Ak^{\chi}$. During colonialism the degree of inequality, $\sigma$, leads to the payoffs in Table 2.[9] In this case even if the initial level of capital is

[9]In a previous version of the paper, we also assumed that tax revenues can be shared

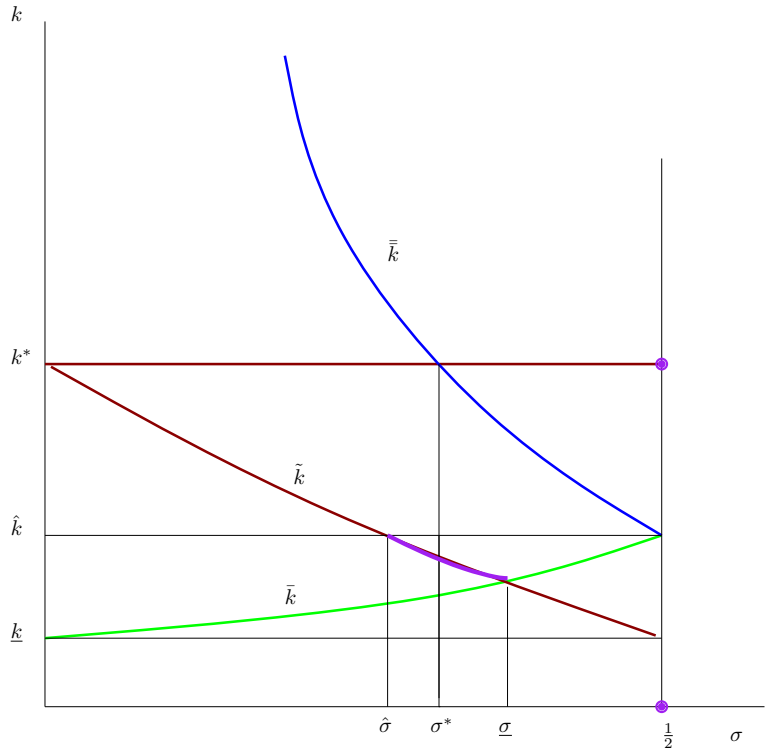


Figure 1: Evolutionary stochastically stable steady state as a function of inequality. Purple segments and points indicates the ESS equilibria.

very low, a sufficient level of colonial investment insures a positive long-run steady state. In particular,

$$\tilde{\tilde{k}}_C = \left(\frac{\phi t A}{\delta}\right)^{\frac{1}{1-\chi}}$$

that holds if and only if $k_t \in (0, \underline{k}_C]$, where

in different ways between the two classes. Let $\rho$ measure the division of tax revenue in the unequal contract, in this case the payoffs would be $((1-\sigma)-(1-\rho)t)y$ and $(\sigma-\rho t)y$. Although this parameter can help to take care of different institutional arrangements, since the main results of the model are not crucially affected by $\rho$, for the sake of argument we assume that $\rho = \sigma$.

$$\underline{k}_C = \left(\frac{\bar{y}}{A(1-t)}\right)^{\frac{1}{\chi}}, \tag{1}$$

Note that as long as $\phi$ and $t$ increase, it is possible that for some values of $\sigma$, $\tilde{\tilde{k}}_C > \underline{k}_C$ (See Figure 2). The presence of colonialism induces changes in both the threshold levels for investment and the possible steady states. Indeed for class $\beta$ the minimal level of $k$ is given by:

$$\bar{k}_C = \left(\frac{\bar{y}}{(1-\sigma)(1-t)A}\right)^{\frac{1}{\chi}}$$

which is the one such that $f(\bar{k}_C) > \bar{y}$ and thus starts the accumulation process through the investment of the richest class. At equilibrium the level of capital is given by

$$\tilde{k}_C = \left(\frac{[s(1-\sigma)(1-t)+\phi t]A}{\delta}\right)^{\frac{1}{1-\chi}}$$

Now for this level of capital we get two possibilities: either the second class has a share big enough for it to participate in the capitalistic process, or it is below such a level. This for $\alpha$ is given by

$$\bar{\bar{k}}_C = \left(\frac{\bar{y}}{\sigma(1-t)A}\right)^{\frac{1}{\chi}}$$

Thus for $\bar{\bar{k}}_C > \tilde{k}_C$ there is no further growth, while for $\bar{\bar{k}}_C < \tilde{k}_C$ the jump to the superior path of growth starts at $\bar{\bar{k}}_C$ leading to the equilibrium level

$$k_C^* = \left(\frac{[s(1-t)+\phi t]A}{\delta}\right)^{\frac{1}{1-\chi}}$$

Different levels of $\sigma$ determine the feasibility of poor class investment. However, this is true if and only if $k_t \geq \hat{k}_C$ where

$$\hat{k}_C \equiv \left(\frac{2\bar{y}}{A(1-t)}\right)^{\frac{1}{\chi}}$$

Figure 2 clarifies the comparison with the "pre-colonial" case. For any positive value of $t$, $\bar{k}_C$ and $\bar{\bar{k}}_C$ move upwards. That is, for a give level of inequality, the economy during colonialism needs a higher value of capital in order to induce the two classes to save. Moreover, $k_C^* > k^*$ if and only if $\phi > s$ which is independent of $\sigma$. On the other hand, $\tilde{k}_C > \tilde{k}$ if and only if $\phi > s(1-\sigma)$.

Following the same argument of Proposition 1, we find qualitative similar ESS steady states. However, if the economy is initially very poor, the presence of colonial investment moves the lowest ESS equilibrium to $\tilde{\tilde{k}}_C > 0$. Furthermore colonialism leads to a significant increase in the stability of inequality. This can be easily argued from Figure 2 by comparing the two curve segment before and during colonialism. High levels of inequality are easily ESS during colonialism, that is $\hat{\sigma}_C < \hat{\sigma}$.

In this setting, parameters $\phi$ and $t$ characterize the colonial institutions. Given a certain value of $t$, any increase in $\phi$ does not influence the threshold values $\bar{k}_C$ and $\bar{\bar{k}}_C$, but moves upwards all the three steady state. On the other hand, an increase in $t$ moves upwards the threshold values $\bar{k}_C$ and $\bar{\bar{k}}_C$, by making more difficult the internal process of accumulation. However, the effect on the three steady states is not obvious. If $\phi > s$, any increase in $t$ would move upwards the three steady states. By contrast, if $\phi < s$, $\tilde{k}_C$ shifts down and becomes flatter, $\tilde{\tilde{k}}_C$ moves upwards, and $k_C^*$ shifts down.

We can study how changes in $t$ or $\phi$ affect the steady states of the model and use this analysis to derive some explanations of the stylized facts described in the historical part of the paper. Depending on the policy inspiring colonial forces we can construct a narrative of colonialism which is historically coherent even if simple. Some simplified "kinds" of colonialism can be devised depending on how we mix the equality/inequality factor, strong/low taxation (extraction) and the degree of investment by the colonising force. For example, British rule in India is one kind of colonialism where we assist to different

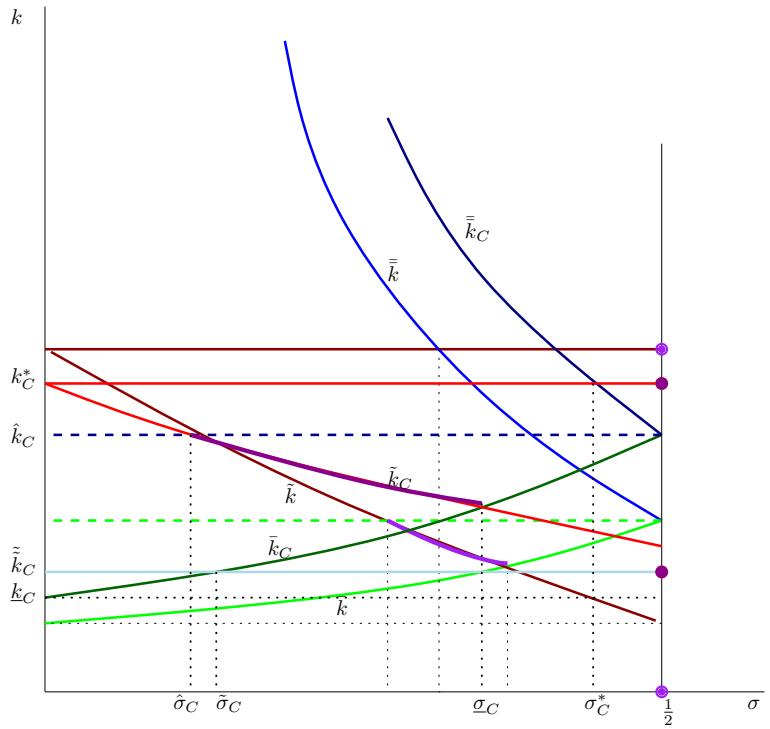


Figure 2: Evolutionary stochastically stable steady state as a function of inequality. Comparison between before and during colonialism. The magenta curve segment and the two points indicates the ESS equilibria during colonialism.

levels of extraction or internal investment depending on the primitive level of inequality. Keeping in mind the hypothesis for which the colonial state is adverse to any shift of institutional asset (as it brings unwanted costs), for unequal landlord regions investment is lower as there would be an incentive for the elite toward an increase in inequality and appropriation of resources; egalitarian institutions however do not present this kind of problem and allow for both a highly extractive regime (which would be more evenly distributed) and centrally led reinvestment.

On the other hand, the case for Peru is different: here unequal institutions are those starting a minimal investment process, as they can avoid to give manpower and claim some minimal infrastructures, while the colonial state

is extracting manpower and resources (we can capture this as a sort of very strong tax with no reinvestment). For this reason the possibility for Haciendas to emerge was adversed in *mita* areas. Other combinations are possible but the central idea is there: the interaction between colonial forces and the institutional pre-colonial *datum* can either exacerbate some conditions or make room for tensions which explode long-after the foreign rule. For example we stated that unequal distributions can be increased in a colonial rule system making room for the rise of stronger elites, however when colonisation ends, depending on the level of capital, parameters and the connected shape of curves, either we jump to higher levels of capital (even if at a cost of a transition) or fall back to lower ones.

Finally, when representing the interaction between classes and the state we avoided any consideration concerning the level of information the colonising force has when assessing for the first time the institutional and political equilibria between different social classes. This is rather important in giving account of some choices the colonial forces might have done. If we consider the existence of some information asymmetries between any social class and the state, we can then construct some interesting relationships. In fact if the colonial forces have to extract a given $t$ but are unable to understand the culture and composition of social forces, that is they cannot distinguish or understand correctly the shape of the associated payoffs of a given equilibrium, a class might propose itself (or being chosen) as intermediate in the relationship state-peasants. Let say that the ruling class is $\beta$ as in our example, and that $\beta$ is the class which can discuss the extractive policy with the state. What is more it is endowed with the control of the class $\alpha$, that is it collects the resources $\alpha$ has to pay to the government. Then because the government is unable to know the exact payoff associated with a given level of production for class $\alpha$, it must rely on the information filtered by the $\beta$s. Therefore there is an incentive for the elite toward a misrepresentation of the payoff structure, as by doing so the $\beta$s can retain an higher share of re-

sources and then increase their payoff. In this sense, because of the aversion for institutional shifts of the State, they can signal higher shift risks than necessary and hence "contract" a lower level of $t$.
From this example we get an interesting insight: some equilibria endure as they reshape the incentives for a social class by using some asymmetries in their favour. This happens as long as the negative effect on the exploited class are not such that a deviation is almost necessary or highly probable. Thus we are in the case where a true lower $\sigma$ is used while the central government sets a level of $t$ as if capital levels and the sensibility of he system was lower. This example applies well to the case we described for landlord systems in India, where they had incentives to retain resources. At the same time it explains also the indemnity *mita*-landlords paid the Spanish as they could get a higher payoff from the exploitation of their lands. In this last case they reduced their payoff but by doing so avoided an inferior equilibrium for their social class while indirectly protecting the other. The mechanics of transfer and compensation under information asymmetries and diversified payoffs are an interesting variation in our model mechanic, as this example shows, as they do account with little modifications for the persistence of some equilibria.

Colonial forces once an equilibrium is set might introduce some incentives that contrast potential changes as they are adverse to shifts. The incentives might be benefits for a social class (e.g. the ruling $\beta$) or in more egalitarian regions some investments expanding surplus extraction possibilities while increasing in time the levels of payoffs. As some remarks on the case of India and Peru showed, the existence of connected investments of colonial forces in regions that adopted a certain convention was a key feature that might have accounted for later development. The advantage for such a strategy is twofold: it increases the potential gains from exploitation and allows for the prolonged persistence of a given equilibrium. Of course in the case of strong information asymmetries much of the effort of the State will not lie in invest-

ing in a region, as apart from some requests of the intermediating class $\beta$, the incentive for an increase in production is weakened by the risks of a distorted request and the consequent share that is retained by the elite. This might be the case for the Indian non-Landlord systems where the possibility to define exactly the shares of $t$ requested and the share for each farmer created an incentive for the British Empire to invest in an increase in production, or allow for flexible taxation.

## 3.3 Colonial legacy

We conclude our *excursus* by exploring the effect of the death of colonialism on our idealised cases. The behaviour of the model is rather simple. If we do not change the rules of the game, we assist simply to the disappearance of colonial taxation and reinvestment policies. Therefore we somehow come back to the pre-colonial condition but with some potential modifications in capital levels and inequality: either we are at a different level such that some evolutionary dynamic takes off, or we are still captured into pre-colonial lack of momentum and cannot escape underdevelopment. The role of colonial policies is that of having set or reinforced some levels of inequality and capital which might endure in our condition, long after colonialism. We move from our previous cases. Recalling the statements of Proposition 1, Figure 2 and the fact that transitions are costly, we can proceed to list some aspects related with our model.

In the kind of strategy describing British rule over India, if the investment levels are sufficiently high and we are in an egalitarian condition (or quasi-egalitarian) we reach a level such that, with no institutional transitional effects (which are additional costs, *latu sensu* in the form of time of coordination for example), there is a movement toward upper equilibria. As mentioned in the historical part, some authors express doubts on the degree of reinvestment carried out by the colonial forces. At the same time it is stressed that other cultural and stability factors might account for long term development. Other effects such as investments in immaterials, better taxa-

tion policies and consequent coordination in the social network, might have the same inflating nature of $\phi$. The parameter might simply capture this. It sound as forcing the model, but yet a non oppressive disposition by the colonial force might still be such that, even if under-threshold in colonial times, the base for a subsequent capital accumulation is set as when $t$ disappears we move to a higher level of capital.
On the other hand the strategy of unequal distribution with no strong reinvestment can for some values be stable under post-colonial conditions, or lead to a shift toward egalitarian structures which however take time and additionally, under our assumptions, are socially costly to obtain. For some values we might even fall in a path of no investment. There is then the emergence of some ESS poverty traps at non top-values of capital or even the fall back to pre-colonial levels of capital.
The case of Peru, being harshly extractive, follows an evident pattern: if the investment is almost null and taxation is high, equality leads to a poverty trap both during and after colonization. What is interesting is the condition of haciendas where, after the colonial rule ends, they might be able to keep working on a development pattern more favourable that the one *mita* regions have to follow.

The rebound effect of post-colonialism then has different consequences depending on the strategies adopted and the institutions enforced. The pursuit of stability, sporadic investments or original unequal institutional choices, have unlikely effects in terms of development and, as pointed out in the discussion so far, depend on a mix of parameters internal to the economy, the social contractual dynamics and historical contingencies which are partially captured by the model.

# 4 Final remarks

The legacy of institutional arrangements, and their connected incentives on long-term development, is without doubt an important channel affecting economic growth. We recalled two studies focusing on the long term effects of geographic discontinuities in colonial practice in India and Peru over prolonged periods of time. We confronted the two historical cases as to emphasise what we felt was part of the underlying process: capital accumulation and its interaction with equality of distribution. We indirectly defined colonial extraction in terms of taxation or depletion, by using mainly the given examples. In this sense we proposed a model trying to capture the evolutionary dynamics of institutional assets defining egalitarian or iniquitous income divisions in a non-cooperative setting. The role of the colonial governments and its personal strategies showed that what seems to explain well development is the interaction between local institutions and foreign colonial rule in terms of distribution, resources extraction, social asymmetries and finalised investments. The key to read institutional dynamics is not the kind of social institution in use at a given moment, but its interaction with the underlying features of the economy. The right institution at the right time, and even its evolution under the shock of colonisation, is the one that allows a smooth transition into the different phases of capitalistic development.

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