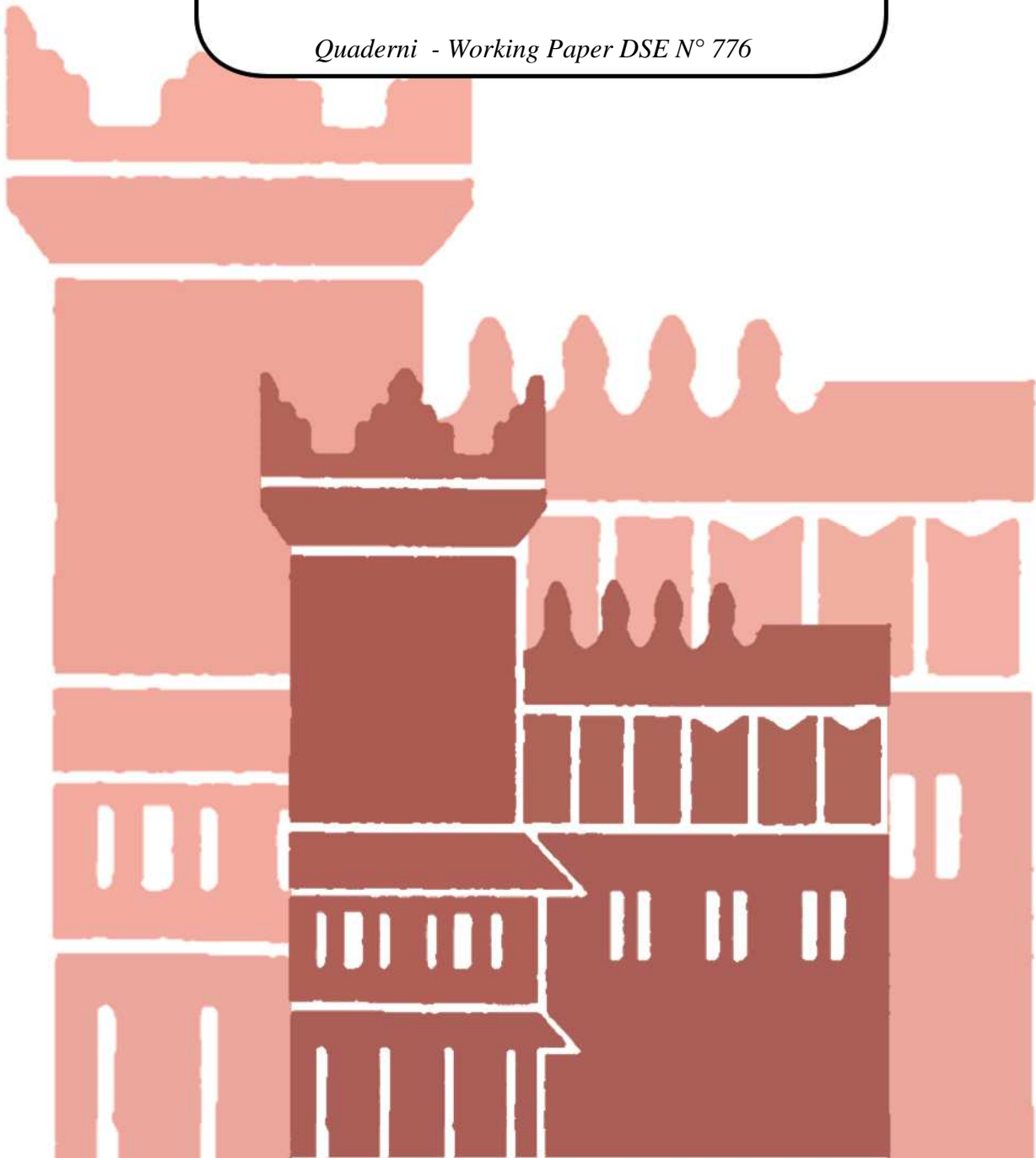Alma Mater Studiorum - Università di Bologna
DEPARTMENT OF ECONOMICS

The Grand Experiment of Communism: Discovering the Trade-Off between Equality and Efficiency

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Cultural Transmission and the Pendulum of Economic Systems: The Case of Communism

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Abstract

This paper aims to explain the rise and fall of communism by exploring the interplay between economic incentives and social preferences transmitted by ideology. We introduce inequality-averse and inefficiency-averse agents and analyze their conflict through the interaction between leaders with economic power and followers with ideological determination. The socioeconomic dynamics of our model generate a pendulum-like switch from markets to a centrally-planned economy abolishing private ownership, and back to restoring market incentives. The grand experiment of communism is thus characterized to have led to the discovery of a trade-off between equality and efficiency at the scale of alternative economic systems. While our focus is on the long-run transitions from capitalism to communism and back observed in the course of the 20-th century, the model also derives conditions under which each of the systems can remain stable.

Key words: capitalism; communism; inequality; inefficiency; ideology transmission; economic transitions

JEL classification codes: C72, D31, D63, D74, D83, P51

February 1848: "The Communists disdain to conceal their views and aims. They openly declare that their ends can be attained only by the forcible overthrow of all existing social conditions. Let the ruling classes tremble at a Communistic revolution. The proletarians have nothing to lose but their chains. They have a world to win." Karl Marx and Frederick Engels, *Manifesto of the Communist Party.*[1]

September 2010: "There were many odd things about my recent Havana stopover [...] but one of the most unusual was Fidel Castro's level of self-reflection. [...] I asked him if he believed the Cuban model was still something worth exporting. 'The Cuban model doesn't even work for us anymore,' he said." Jeffrey Goldberg, "Fidel: 'Cuban Model Doesn't Even Work for Us Anymore'," *The Atlantic.*[2]

1 Introduction

Communism was the grand experiment of the 20-th century. It also seems to have been its grand illusion. In terms of utopian vision, radical implementation and socioeconomic impact, communism has left a lasting mark in history. Its rise and fall as a possible alternative to capitalism is a complex and multi-faceted theme, interpreted from different theoretical and methodological perspectives in social sciences. Works from many disciplines, going beyond politics and economics, have tried to portray or, more ambitiously, explain the various manifestations of communism across the map of the world – from nascent and militant through mature and oppressive into stagnating and decaying.

So why another attempt to reconsider the key driving mechanisms behind the genesis of the revolutionary communist project and the gradual mass disillusionment with its realities? This paper aims to study how the economic system affects the evolution of beliefs and preferences through the endogenous socialization efforts of the various social classes. Can this lead to cycles in economic systems, if a system gradually builds opposition to itself? To analyze these questions, we rely on economic theory to examine the interactive dynamics of economic incentives and social preferences through cultural transmission.

In what follows, we build a tractable model to formalize the role of socioeconomic factors in the process that led to the rise of communism via a forced revolution and nationalization of capital, as well as its reversal back to markets. In essence, this grand experiment has led to a trade-off between equality and efficiency in terms of productivity and saving at the scale of alternative economic systems.[3] Our theoretical account of the rise and fall of communism, from the revolutionary enthusiasm of Marx and Engels through the disillusionment of Castro quoted above, is framed as a stylized game of class struggle involving economic decisions and transmission of ideology across generations. This is along the lines of North (2005), who interprets the experience with communism in Russia as "a story of perceived reality → beliefs → institutions → policies → altered

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[1] Chapter IV. Position of the Communists in Relation to the Various Existing Opposition Parties, translated by Samuel Moore in cooperation with Frederick Engels, 1888, http://www.marxists.org/archive/marx/works/1848/communist-manifesto/ch04.htm

[2] http://www.theatlantic.com/international/archive/2010/09/fidel-cuban-model-doesnt-even-work-for-us-anymore/62602/

[3] For instance, Stretton (1976) writes: "Equalities can always be ill-designed, or enforced by oppressive methods. When they are, they may reduce productivity, as well as freedom. Some communist countries have flattened their margin for skill or hard work too far, with apparently bad effect on economy efficiency."

perceived reality and on and on" (p. 4).[4] The model also shows conditions under which communism remains stable that can explain the persistence and the success of the Chinese social market economy.

While the chain of logic by North is framed along purely descriptive argumentation in the tradition of the new institutional economics, it is certainly compatible with a learning perspective formalized in works such as Piketty (1995) and Buera et al. (2011). Recent evidence has however uncovered the role of indoctrination (Alesina and Fuchs-Schündeln, 2007) and history (Roland, 2009) in this phenomenon. Interestingly, recent empirical studies also provide direct evidence on the intergenerational transmission of beliefs and cultural resilience. These include Patacchini and Zenou (2011) on religion, and Klasing (2011) and Dohmen et al. (2012) on attitudes towards risk and trust and how they interact with changes in institutions.

We therefore emphasize the role of socialization and the transmission of preferences, social norms, and beliefs, following a strand of literature stemming from Bisin and Verdier (2001) that explores the role of intergenerational transmission of attitudes to explain the persistence of socioeconomic status across generations.[5] Our goal is to show how this same mechanism can paradoxically lead to a pendulum-like swing between economic systems. Only few theoretical works focus on the interrelation between the intergenerational transmission of ideological preferences and institutional change. The closest to our work is Döpke and Zilibotti (2008), which studies the role of the intergenerational transmission of taste for leisure and patience in the success of institutional changes brought about by the industrial revolution. Also, Saint-Paul (2010) analyzes the impact of the evolution of beliefs about the workings of the market economy on ideological bias in the society and political reform.

The incentive structure under the two economic systems is captured in our model by the (mis)alignment of ownership and control. This is in line with the large literature on the key weaknesses of socialism: one strand dealing with the pervasive problems arising from the 'soft budget constraints' of socialist enterprises (e.g., Kornai, 1980) – what Roemer (2008) labels 'lack of incentives'; another pointing to the overambitious task of central planning, given 'dispersed and local information', to ensure better allocative decisions than markets (e.g., von Hayek, 1940, 1945) – what Roemer (2008) labels 'lack of coordination'. Our approach highlights these two familiar disadvantages of a communist economy at their crucial link, the intertemporal optimization decision, at which the (mis)alignment of ownership and control manifests itself. The choice of consumption and accumulation out of one's own wealth given the signals of competitive markets and locally relevant information under capitalism sustains efficiency but generates inequality. Delegating this choice to an egalitarian planner forces equality by revolution but erodes economic efficiency, thus making everyone equal in their poverty.[6]

In this paper, we combine the above lines of thought and use the transmission and evolution of preferences to shed light on the dynamics of regime switches across economic systems. We devise a non-cooperative game between agent types that takes place in every period of an overlapping-generations (OLG) framework to demonstrate how the equilibrium strategies drive the long-run socioeconomic dynamics and can generate such

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[4]This view somewhat departs from earlier seminal works on communism versus capitalism, and related studies on the comparative efficiency of the two systems. Among many others, see Lange (1956 [1936]), von Hayek (1940, 1945), Tinbergen (1960), Lancaster (1973), Kornai (1980), Roemer (1980, 1985).

[5]See Bisin and Verdier (2010) for a thorough survey of the literature on cultural transmission and socialization that followed.

[6]Note that we ignore neither that inequalities were *de facto* existing in communist countries, nor that they were creating resentment (see, e.g., Joo, 2005, for an account). However, considering explicitly the nomenklatura would only complicate the model without changing the substance of the results (in effect, only accelerating the swing back from plan to market).

pendulum-like switch from markets to an egalitarian economy abolishing private ownership, and back to rebuilding market incentives to sustain society. We focus on a large region of the world where capitalism was less developed and, perhaps more importantly, any democratization of the society was avoided or much delayed.

In particular, we model two types of agents, inequality-averse and inefficiency-averse ones, responding to economic incentives and transmitting their values as they are affected by evolving economic outcomes. We first show how capital accumulation by the minority elite and the resulting inequality leads to increasing social discontent over time and, eventually, the overthrow of the system. We then show how a centrally-planned system aimed at equality also fades away due to misalignment of individual incentives and aggregate targets, lower well-being and the gradual redirection of ideas towards a market system. The economic literature, and the literature on communism or social evolution more generally, has not provided so far a consistent theory on the institutional change experienced by the Soviet Union and its satellite countries in Eastern Europe throughout the 20-th century accounting for both these transitions. In this consists the contribution of our stylized but history-based formal analysis of the rise and fall of communism and the conditions under which it remains stable.

We support our results and the underlying assumptions by providing a number of related historical (anecdotal and empirical) evidence in the relevant world regions. In so doing, we focus on the bifurcation of the transition path observed in Russia and China. The transmission dynamics of our model also match some of the findings of Alesina and Fuchs-Schündeln (2007), who explore the possibility of a feedback effect from communism on preferences by assessing the dynamics of support for state intervention among individuals in East Germany compared to those in West Germany. Looking at the preferences of different age groups after the reunification, they find state support to be higher in some areas for the age group whose older generation lived most of their lives before the start of communism. Support then decisively fell from one generation to the next for subsequent age groups who lived under communism.[7] We also present and discuss evidence on the incentive problem faced in centrally planned economies compared to those in which agents were free to choose output targets as well as means to meet them. Among others, Bergson (1991) provides figures on the remarkably lower output and consumption per worker in the USSR compared to the rest of the world.

The paper is organized as follows. In the next section we construct our model, presenting the types of agents, their objectives, constraints, ideological conflict, and the transmission of their beliefs across generations. Section 3 then solves the optimization problems of the agent types and the von Stackelberg game they play every period. Section 4 derives the intergenerational dynamics and highlights the resulting economic outcomes in terms of regime transitions or stability. Section 5 situates our theory in historical context, justifying the key assumptions we employ in our model. The last section concludes by summarizing the insights from our model and draws parallels between our findings and the related literature.

2 The Model

2.1 Economic Systems, Agent Types and Conflict

We consider two economic systems under which society can evolve: one is based on the market (capitalist), denoted by M, and the other on an egalitarian planner (communist), denoted by E. True to the historical genesis of communist ideas, our analysis begins with a market-based system founded upon property rights over the means of pro-

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[7]See Alesina and Fuchs-Schündeln (2007): Figure 1, p. 1516.

duction and the corresponding private incentives to capital accumulation. Our interest is in a particular region that at some point in time splits apart and experiments with communism. Its total adult population is normalized to 1.

There are two types of agents in the initial capitalist society. The large majority are born without inheriting capital: they are the 'workers'. They are 'unprivileged' in the sense that they can only sell their labor force in the market in order to subsist, as Marx argued. Being the have-nots, they care about inequality in the capitalist society, whose victim they are by birth. We call them inequality-averse agents and denote their type as A. A minority of agents are born with inherited capital: they are the 'capitalists'. They extract rents from their private capital, and care about the relative inefficiency between the two systems. We call them inefficiency-averse agents and denote their type as B.[8]

Initially, types (A and B) and 'classes' (workers and capital owners) coincide, by definition. In a conventional way, this can be interpreted in terms of the class struggle between capital and labor. However, over time preference types evolve, so that class and preference type diverge. We consider an OLG model, where agents live for two periods. During childhood (in the first period of life), they are 'socialized' acquiring a particular type when they become adult. When mature (in the second period of life), they perform active economic and ideological roles in the society, and die at the end of the period, investing any capital wealth they have accumulated.

Under both systems, M and E, economic power belongs to the preference type who decides upon – and enforces – the intertemporal allocation between capital accumulation and consumption. The other preference type can then only try to change the economic system through ideological influence. We denote the degree of strength of each type relative to the other by the conflict function $q_t(\cdot)$ and $1 - q_t(\cdot)$, respectively for types A and B in any period t, and measure it by an index, $0 < q_t(\cdot) < 1$. More precisely, this index can be defined to be some increasing function of the relative intensity of the preference itself (social resentment or ideological determination), $0 < m_t < 1$, and the relative size (or fraction) of each preference type in the total adult population, $0 < n_t < 1$: $0 < q_t(m_t, n_t) < 1$, with $\frac{\partial q_t(\cdot)}{\partial m_t} > 0$ and $\frac{\partial q_t(\cdot)}{\partial n_t} > 0$. It also captures the probability of a regime shift in any period t.

2.2 Preferences

The utility of agent i for $i = A, B$ under each system $j = M, E$ takes the form

$$U^i(c^i_{j,t}, b^i_{j,t+1}, v_{t+1}, \chi_{t+1}, \tau^i_t) = c^i_{j,t} + \beta b^i_{j,t+1} - E^i_t[v_{t+1}, \chi_{t+1}] - \frac{(\tau^i_t)^2}{2}, \qquad (1)$$

with $c^i_{j,t}$ denoting individual consumption levels, $b^i_{j,t+1}$ income in the subsequent period achieved from savings by individuals under market and the state under communism, and $0 < \beta < 1$ the discount factor assumed to be identical for all agents.[9] The third term generally represents the disutility in terms of relative status with respect to other individuals or the other system, depending on the agent's type. More precisely, $E^A_t[v_{t+1}]$ and $E^B_t[\chi_{t+1}]$ are the expected regime-dependent inequality and inefficiency

$$E^A_t[v_{t+1}] = q_{t+1} \ln v_{E,t+1} + (1 - q_{t+1}) \ln v_{M,t+1}, \qquad (2)$$

$$E^B_t[\chi_{t+1}] = q_{t+1} \ln \chi_{E,t+1} + (1 - q_{t+1}) \ln \chi_{M,t+1}, \qquad (3)$$

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[8] See also Fehr and Schmidt (1999, 2000) and Olcina and Peñarrubia (2004) for alternative explanations of the agent types.

[9] It will be made clear below that the same results obtain both qualitatively and quantitatively if the bequest term $b^i_{j,t+1}$ is replaced by next-period consumption $c^i_{j,t+1}$.

where $\upsilon_{j,t+1}$ measures income of type B relative to A, or inequality within the society as perceived at t, and $\chi_{j,t+1}$ the relative efficiency of individual optimization under free market over a centrally-planned economy in terms of productivity and potential growth possibilities as perceived at t. Note that communism forcefully proclaims complete equality in the society, $\upsilon_E = 1$, yielding $\ln \upsilon_E = 0$. Similarly, inefficiency is initially normalized under capitalism, $\chi_M = 1$, and so $\ln \chi_M = 0$. $\upsilon_{M,t}$ and $\chi_{E,t}$ will be defined further below. The relative strength of the preference types, q_{t+1}, determines the probability of a regime change in period $t+1$. Finally, utility depends on costly socialization effort functions τ_t^i, with $0 \leq \tau_t^i \leq 1$, to be discussed in section 2.5.

The utility function places a trade-off between capital accumulation and the risk that the group with a different ideology takes control of the society. For capitalists, this implies altruistic bequests to their offspring versus the possibility of the latter living in a less efficient system. For an egalitarian planner, the trade-off arises between building capital in order to maximize output from one generation to the next, and losing the centralized system to an unequal society.

2.3 Production and Income

We consider a one-sector real model where a single good is produced using a constant-returns-to-scale linear technology. The output produced at time t in regime j is

$$H_{j,t} = A_j[\alpha K_{j,t} + \theta_{j,t}(1-\alpha)L] \tag{4}$$

for $j = M, E$ and depends on two productive factors, capital $K_{j,t}$ depreciating fully during t and labor L supplied inelastically by households. Total factor productivity (TFP) under each regime is denoted by A_j. Labor-augmenting productivity is measured by $\theta_{j,t} \equiv \theta(c)$ and is determined by the incentives of workers. We approximate these incentives by material well-being based on consumption in workers' families. Furthermore, $\theta'(c) > 0$ represents the incentive of workers as a function of consumption, and $\theta''(c) < 0$ implies that productivity gains are decreasing. The relative importance of capital and labor in producing output are denoted by α and $1-\alpha$, respectively. Under competitive factor markets, returns to labor and capital can then be written as

$$w_{M,t} = A_M(1-\alpha)\theta_{M,t}$$

and

$$r_{M,t} = A_M \alpha.$$

Both factor returns are j-indexed, because of the potentially different productivity levels under the two systems.

We consider a subsistence consumption level $\bar{c}$, never reached by the A type so that only capital owners can invest. In the market system, income of capital owners and workers in each period is respectively

$$y_{M,t}^B = r_{M,t} s_{t-1}^B = A_M \alpha s_{t-1}^B, \tag{5}$$

where s_{t-1}^B is savings in the previous period, and

$$y_{M,t}^A = w_{M,t} = A_M(1-\alpha)\theta_{M,t}. \tag{6}$$

Under communism, as capital is nationalized and capitalists are deprived of their ownership, investment decisions are no longer individual but made by the egalitarian planner. As a consequence, individual income becomes a centralized allocation of an

equal share of output to each member of the society as wages, which are not necessarily equal to the marginal product of labor:

$$y_{E,t}^B = y_{E,t}^A = w_{E,t}. \tag{7}$$

Note that in this case the whole population, including B types, forms the working class ($c_{E,t}^A = c_{E,t}^B = c_{E,t} = w_{E,t}$).

We define perceived income inequality arising from saving by capitalists in period t as the relative income from capital versus that from labor:

$$\upsilon_{M,t+1} \equiv \frac{y_{M,t+1}^B}{y_{M,t+1}^A} = \frac{\alpha}{1-\alpha} \frac{s_t^B}{\theta_{M,t+1}}, \tag{8}$$

where imposing the initial condition $y_{M,0}^B > y_{M,0}^A$ prevents a capitalist from switching types and becoming a worker.

2.4 Savings and Efficiency

A capitalist, type B, chooses individual savings (which we denote by lowercase s_t^B) to maximize utility in (1) given the budget constraint

$$c_t^B + s_t^B \leq y_{M,t}^B. \tag{9}$$

The timing of events during the accumulation process is as follows: the savings of the previous period, s_{t-1}^B, comprise the private capital stock in the present period, $k_{M,t}$, which will then be put into production given (4). The private yields from capital ownership $y_{M,t}^B = r_{M,t}s_{t-1}$ generated through the production process are finally divided between consumption c_t^B and savings s_t^B (forming the future capital stock, $k_{M,t+1}$).

An egalitarian planner instead maximizes utility (1) in the name of the type A agents under the national budget constraint

$$C_t + S_t \leq H_{E,t}. \tag{10}$$

The savings decision by the planner differs from private ones in that aggregate values are considered (which we denote by uppercase S_t). The same timing holds for the accumulation process under the communist regime: S_{t-1} comprises K_t, which is used for national production along with labor and yields $Y_t = r_{E,t}S_{t-1}$. Total output, $H_{E,t}$, is then allocated between further savings, S_t, and aggregate consumption in the society, C_t, divided equally among all agents via identical wages assigned to all workers, $w_{E,t} = c_{E,t}$. Note that under communism there is no market price of capital, therefore $r_{E,t}$ is the shadow price of capital referred to in period t by the planner.

We can now define the (inverse) inefficiency index of the communist system, $\chi_{E,t+1}$, in terms of perceived relative growth potential of the two regimes by means of savings or capital formation and labor productivity

$$\chi_{E,t+1} \equiv \frac{A_M \hat{S}_t \theta_{M,t+1}}{A_E S_t \theta_{E,t+1}}, \tag{11}$$

where S_t is savings by the egalitarian planner, and $\hat{S}_t$ a notional value of aggregate savings under a free market system referred to by individuals. Hereafter, we normalize θ_M to one as the productivity ceiling without a loss of generality. As workers are paid their marginal product under markets, they do not suffer the incentives problems that can occur under communism, discussed in the upcoming sections.

2.5 Intergenerational Transmission of Beliefs

We assume that type A agents always teach a communist ideology to their children to abolish inequality, while type B agents always teach a pro-market ideology favoring efficiency.[10] This is a first channel of transmitting beliefs that captures the influence on ideology intensity within the family, and corresponds to what is termed 'direct vertical transmission' in the literature (Bisin and Verdier, 2001, 2010). The evolution over time of the relative degree of ideological determination to change the status quo, however, is also affected outside the family. This second channel, known as 'oblique transmission', operates through the influence on ideology intensity by peers and the broader environment (see also Saint-Paul, 2010).

We assume a setting, where direct vertical transmission acts as a substitute to oblique transmission, i.e. parents have less incentives to socialize their children the more widely dominant are their traits in the society. Socialization efforts $\tau^i(\cdot)$ affect the determination of the next generation to mobilize in order to change the system. Socialization effort by type A is generated by resentment from inequality, $\tau_t^A \equiv \tau^A(\upsilon)$, and for type B by the inferior efficiency with respect to markets $\tau_t^B \equiv \tau^B(\chi)$. The properties of these socialization functions are standard:

$$\tau_t^i(1) = 0, \ \tau_t^{i\,\prime}(\cdot) > 0, \ \tau_t^{i\,\prime\prime}(\cdot) < 0. \tag{12}$$

Property $\tau_t^i(1) = 0$ in (12) states that socialization effort is only activated upon sufferance.[11]

The socialization process of the agents of each type, A and B, can be summarized as follows: the transition probabilities at time t, $P_t^{i\uparrow}$, that a parent of type i has a child with a stronger ($\uparrow$) or weaker ($\downarrow$) ideological determination can be written as

$$
\begin{aligned}
P_t^{A\uparrow} &= \tau_t^A + [1 - \tau_t^A]q_t; \\
P_t^{A\downarrow} &= [1 - \tau_t^A](1 - q_t); \\
P_t^{B\uparrow} &= \tau_t^B + [1 - \tau_t^B](1 - q_t); \\
P_t^{B\downarrow} &= [1 - \tau_t^B]q_t.
\end{aligned}
\tag{13}
$$

Given these transition probabilities, the relative strength of individuals of type A in period $t+1$ is

$$
\begin{aligned}
q_{t+1} &= q_t P_t^{A\uparrow} + (1 - q_t)P_t^{B\downarrow} \\
&= q_t + (q_t - q_t^2)[\tau^A(\cdot) - \tau^B(\cdot)].
\end{aligned}
\tag{14}
$$

The dynamics of the probability of a regime shift are endogenous to the present economic situation and depend on the disutility experienced by each type. The properties of the socialization functions imply that $\tau^A(\upsilon) = 0$ under communism while $\tau^B(\chi) = 0$ under a market economy. Accordingly, the law of motion in (14) simplifies to

$$q_{M,t+1} = q_{M,t} + (q_{M,t} - q_{M,t}^2)\tau_t^A \tag{15}$$

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[10]Landier et al. (2008) find empirically that ideological priors matter a lot in attitude formation.

[11]This is a special case of Bisin and Verdier (2001) that is based solely on resentment towards the status quo, i.e. only one agent type at a time engages in the transmission of his preferences. The use of this setting allows us to simplify our notation, without changing our results under cultural substitution. A Cournot setting also yields the same outcome as resentment and, hence, effort by an agent living under a regime s/he does not support is strategically higher.

under markets and to

$$q_{E,t+1} = q_{E,t} - (q_{E,t} - q_{E,t}^2)\tau_t^B \tag{16}$$

under communism.

Thus, in the market system the degree of ideological determination of type A to change the status quo, $q_{M,t+1}$, increases with any positive socialization effort by type A, $\tau^A(\upsilon) > 0$. Above the critical value $q_{M,t} = 0.5$, the threat to overthrow the capitalist regime becomes credible. Analogously, in the communist system the ideological determination of type B to change the status quo increases, i.e. $1 - q_{E,t+1}$ increases, with any positive socialization effort by type B, $\tau^B(\chi) > 0$. Above the critical value $1 - q_{E,t} = 0.5$, the threat to abolish the communist regime as type B agents promote market values becomes credible.

3 Economic Systems and Interaction of Agents

We consider a sequencing of actions appropriate for both economic systems, in which the agent type who exercises ownership and control (economic power) to decide on the split between consumption and savings moves first. The agent type who has no ownership and control rights can only have socialization (or ideological) power by instilling beliefs against the regime in force, that is, trying to teach the next generation in favor of his/her own values. The sequence of events at time t is illustrated in Figure 1 parallel to the process of capital accumulation in the same period (see Section 2.4).

[Figure 1 about here]

3.1 Market-Based Economy

In the market system, capitalists both own the capital stock and control the allocation of their income between consumption and savings, to be invested and used to produce in the next period by the next generation. In contrast, workers do not own and control anything apart from their labor force, which they supply inelastically in the model. It is therefore optimal savings and capital accumulation within the capitalist 'dynasties' (where ownership and control rights are aligned and effective) that drives the efficiency and sustainability of the market system, but deepens the social inequality.

Type B agents in this case are the first movers in a von Stackelberg leadership game and decide on savings, while taking into consideration in their maximization problem the socialization reaction of type A agents to the inequality caused by their own savings. Starting with type A agents (the working class), they take savings as fixed and maximize their utility using (1):

$$\max_{\tau_t^A} \quad U_{M,t}^A(\cdot) = c_{M,t}^A - \underbrace{E_t^A[\upsilon_{t+1}]}_{(1-q_{t+1})\ln \upsilon_{M,t+1}} - \frac{(\tau_t^A)^2}{2},$$

where we have substituted for $E_t^A[\upsilon_{t+1}]$ from (2) after noting that $\ln \upsilon_E = 0$. Replacing for $\upsilon_{M,t+1}$ from (8) and for $q_{M,t+1}$ from (15), the optimization problem becomes:

$$\max_{\tau_t^A} \quad c_{M,t}^A - \left\{1 - \left[q_t + q_t(1-q_t)\tau_t^A\right]\right\}\ln\left(\frac{\alpha}{1-\alpha}s_t^B\right) - \frac{(\tau_t^A)^2}{2}.$$

The first-order condition yields the optimal reaction of type A as follower:

$$\frac{\partial U_{M,t}^A (\cdot)}{\partial \tau_t^A} = q_t(1-q_t)\ln\left(\frac{\alpha}{1-\alpha}s_t^B\right) - \tau_t^A = 0$$

$$\Leftrightarrow \tau_t^{A*} = q_t(1-q_t)\ln\left(\frac{\alpha}{1-\alpha}s_t^B\right). \tag{17}$$

This equation delivers a preliminary insight on the mechanisms that drive the evolution from one system to another. It is easy to see that an increase in private savings (by the capitalists) leads to increased socialization effort by type A agents. The latter can only expect a growing inequality between the two types of agents, which reinforces their determination to instill their values in the next generation, and to potentially change the regime. More precisely, the higher the expected inequality, the higher the effort to transmit their preferences towards a more equal society.

Turning to type B agents, they move first by making a decision on the amount of their savings:

$$\max_{s_t^B} \; U_{M,t}^B (\cdot) = c_{M,t}^B + \beta y_{M,t+1}^B - E_t^B[\chi_{t+1}] - \frac{(\tau_t^B)^2}{2}$$

$$\text{s.t. } c_{M,t}^B + s_{M,t}^B \leq y_{M,t}^B.$$

Note that savings by capitalists have no direct negative externality on aggregate productivity because the decision is made at an individual level and consumption by workers $c_{M,t}^A$ is not affected by it. After a series of substitutions and omitting the M-subscript to savings due to the absence of individual savings under communism in our model, we rewrite

$$\max_{s_t^B} \; A_M \alpha s_{t-1}^B + (A_M\beta\alpha - 1) s_t^B - \left[q_t + (q_t - q_t^2)\tau_t^{A*}\right]\ln\left(\chi_{E,t+1}\right).$$

Replacing for τ_t^{A*} with the optimal reaction of type A agents from (17) and taking the first-order condition yields optimal savings by type B as leader:

$$\frac{\partial U_{M,t}^B (\cdot)}{\partial s_t^B} = A_M\beta\alpha - 1 - \frac{q_t^2(1-q_t)^2}{s_t^B}\ln\left(\chi_{E,t+1}\right) = 0$$

$$\Leftrightarrow s_t^{B*} = q_t^2(1-q_t)^2\frac{\ln\left(\chi_{E,t+1}\right)}{A_M\beta\alpha - 1}, \tag{18}$$

where $A_M > 1/\alpha\beta$ must hold for positive savings by the capital owners. The last equation reveals that increased expected inefficiency under the alternative (communist) system induces higher accumulation by capital owners in an effort to further consolidate the capital stock and, hence, the productive potential of the market economy. Savings can also be large when the strength of the two types are not too different so that $q_t^2(1-q_t)^2$ is near its maximum.

Substituting (18) back into (17) to derive the optimal socialization effort of the type A in its final form, we get

$$\tau_t^{A*} = q_t(1-q_t)\ln\left(\frac{\alpha}{1-\alpha}s_t^{B*}\right). \tag{19}$$

Substituting τ_t^{A*} from (19) into (14), next-period ideological determination of type A to change the status quo becomes

$$q_{t+1} = q_t + q_t^2(1-q_t)^2\ln\left(\frac{\alpha}{1-\alpha}s_t^{B*}\right). \tag{20}$$

It is seen from (20) that the evolution of q_t over time under a market system is triggered when $\tau_t^{A*} > 0$. This is true as long as

$$v_{M,t+1}(s_t^{B*}) \equiv \frac{\alpha}{1-\alpha}s_t^{B*} > 1, \tag{21}$$

which holds as long as $y_{M,0}^B > y_{M,0}^A$.

Lemma 1 *Given the initial condition $y_{M,0}^B > y_{M,0}^A$, optimal individual savings by capital owners s_t^{B*} always increase inequality, provoking type-A workers into more intensive transmission of their social discontent and more effort to instigate a regime change.*

   Proof. *See equation (21) where $\frac{\partial v_{M,t+1}}{\partial s_t^{B*}} > 0$ increases τ_t^{A*} in (19) and q_{t+1} in (20).*
■

In sum, capital owners allocate their income between consumption and savings, perpetuating inequality; workers then react by choosing their socialization effort, which in turn affects the ideological determination and strength of the next generation to change the status quo.

3.2   Centrally-Planned Economy

Under communism, the economic decisions are made by the egalitarian planner, who is of type A and splits total consumption equally across all members of society.[12] After the nationalization following the communist revolution the society, *de jure* (but not *de facto*) owning the capital, delegates control to the egalitarian planner. Individuals do not control the choice of aggregate consumption and investment out of national income, which is also national output. Thus, under communism, there is misalignment of ownership and control rights creating inefficiency. We capture and interpret it in comparing the optimization problems under central planning (aggregate, then disaggregated top-down by equal split) vis-à-vis the market (individual, aggregated bottom-up).

   The egalitarian planner is the first mover and takes into consideration the socialization reaction of type B agents to the relative efficiency of the system caused by his centralized decision. Starting with type B agents (market advocates), they take savings as fixed and maximize:

$$\max_{\tau_t^B} \quad U_{E,t}^B(\cdot) = c_{E,t}^B - \underbrace{E_t^B[\chi_{t+1}]}_{q_{t+1}\ln\chi_{E,t+1}} - \frac{(\tau_t^B)^2}{2},$$

where we have substituted for $E_t^B[\chi_{t+1}]$ from (3) after noting that $\ln\chi_M = 0$. Replacing for $\chi_{E,t+1}$ from (11) and for $q_{E,t+1}$ from (16), the optimization problem becomes:

$$\max_{\tau_t^B} \quad c_{E,t}^B - \left\{q_t + q_t(1-q_t)(-\tau_t^B)\right\}\ln\left(\frac{A_M\hat{S}_t}{A_ES_t\theta_{E,t+1}}\right) - \frac{(\tau_t^B)^2}{2}.$$

The first-order condition then yields:

$$\begin{aligned}
\frac{\partial U_{E,t}^B(\cdot)}{\partial \tau_t^B} &= q_t(1-q_t)\ln\left(\frac{A_M\hat{S}_t}{A_ES_t\theta_{E,t+1}}\right) - \tau_t^B = 0 \\
&\Leftrightarrow \tau_t^{B*} = q_t(1-q_t)\ln\left(\frac{A_M\hat{S}_t}{A_ES_t\theta_{E,t+1}}\right).
\end{aligned} \tag{22}$$

---

[12] This follows our assumption of inequality aversion characterizing type A agents, to conform with the preference for equality among the thinkers and pioneers of communism. Different from maximizing social welfare, it presumes that the central planner himself experiences a disutility from inequality.

Hence, an increase in the planner's aggregate savings directly reduces the socialization effort by type B agents. This is due to the fact that, as seen in (11), such an increase is perceived to give a boost to the efficiency of the communist system. While this effect *per se* could reduce inefficiency, it will be seen below that the command accumulation process has an adverse effect on labor productivity, leaving the total effect of aggregate savings on the relative efficiency of the communist system and the socialization effort by type B agents who share the values of capital owners ambiguous.[13]

The egalitarian planner as a first mover maximizes utility in the name of the type A agents taking into account aggregate values. Therefore, the egalitarian planner (not individual capitalists, whose capital has been nationalized) optimally chooses the level of aggregate savings, i.e. national investment. This also determines the allocation of output to be distributed equally among the total population for consumption.

$$\max_{S_t} \quad U_{E,t}^A(\cdot) \quad = \quad C_t + \beta Y_{t+1} - E_t^A[\upsilon_{t+1}] - \frac{(\tau_t^A)^2}{2}$$
$$\text{s.t. } C_t + S_t \quad \leq \quad H_{E,t}.$$

Parallel to the market economy, the planner takes βY_{t+1} as the value of the intergenerational transfer in his optimization problem using the shadow price of capital $r_{E,t+1}$ ($Y_{t+1} = r_{E,t+1}S_t = A_E \alpha S_t$).

Aggregate decision making by an egalitarian planner under a communist regime affects total and per capita levels of consumption, therefore changing productivity over time. This is because the national budget constraint implies $C_t + S_t = H_{E,t}$, that is, output in the aggregate has to be equal to the sum of consumption and investment in every period. Therefore, each individual gets an identical consumption level equal to the assigned allocation by the planner

$$c_{E,t} = \frac{H_{E,t} - S_t}{1} = C_t. \tag{23}$$

Since allocation between saving and consumption takes place after production in each period, consumption in t determines productivity in the following period $t+1$. There is an externality caused by productivity being a function of consumption, which is changing over time in the new economic system.

Lemma 2 *The budget constraint of an egalitarian planner in (10), $C_t + S_t = H_{E,t}$, implies that higher aggregate savings cut consumption by the whole population. This results in a negative effect on productivity $\theta_{E,t+1}$ and makes the latter time-dependent.*

Proof. *We can conclude from (23) and the properties of $\theta_{E,t+1}$ that*

$$\frac{\partial \theta_{E,t+1}}{\partial S_t^*} = -\frac{\partial \theta_{E,t+1}}{\partial C_t} = -\frac{\partial \theta_{E,t+1}}{\partial c_{E,t}} = -\theta'_{E,t+1} < 0.$$

∎

After a series of substitutions, we obtain:

$$\max_{S_t} \quad A_E[\alpha S_{t-1} + \theta_{E,t}(1-\alpha)L] - (1 - \beta\alpha A_E)S_t - \left(1 - \left[q_t - (q_t - q_t^2)\tau_t^B\right]\right)\ln\left(\upsilon_{M,t+1}\right).$$

---

[13] This ambiguity resembles historical evidence such as that in Broadberry and Klein (2011), who show Czechoslovakia's comparative productivity position under the central planning regime with respect to the UK to have initially improved before falling back to lower levels.

Replacing for τ_t^B with the optimal reaction curve by type B agents derived in (22) and taking the first-order condition yields:

$$
\begin{aligned}
\frac{\partial U_{E,t}^A (\cdot)}{\partial S_t} &= (\beta \alpha A_E - 1) + q_t^2 (1-q_t)^2 \ln (v_{M,t+1}) \left[\frac{1}{S_t} - \frac{\theta'_{E,t+1}}{\theta_{E,t+1}} \right] = 0 \\
&\Leftrightarrow \quad S_t^* = \frac{1}{\dfrac{1 - \beta \alpha A_E}{q_t^2 (1-q_t)^2 \ln (v_{M,t+1})} + \tilde{\eta}_{\theta_{E,t+1}}},
\end{aligned}
\tag{24}
$$

where $\tilde{\eta}_{\theta_{E,t+1}}$ represents the perceived lagged semi-elasticity of labor productivity in $t+1$ with respect to consumption in t. In the rest of the analysis, we assume imperfect information about the extent to which this value can be observed to analyze the different consequences of a centralized regime.

Equation (24) reveals that increased expected inequality under the alternative (market) system induces higher savings by the egalitarian planner in an effort to further consolidate the capital stock and, hence, the productive potential of the communist system. Savings can also be large when the strength of the two types is not too different so that $q_t^2 (1-q_t)^2$ is near its maximum. In addition, the planner adjusts savings inversely with respect to the sensitivity of labor productivity to consumption. Finally, $A_E < 1/\alpha\beta$ must hold to ensure positive savings by the planner.

Lemma 3 *If the conditions that ensure positive saving at all times hold under both systems, TFP under free market is necessarily higher than that under communism:*

$$
A_E < \frac{1}{\alpha\beta} < A_M.
$$

Proof. Follows directly from the intertemporal optimization problem of the leader in equations (18) and (24). ∎

Substituting (24) back into (22) to derive the optimal socialization effort of type B in its final form, we get

$$
\tau_t^{B*} = q_t (1-q_t) \ln \left(\frac{A_M \hat{S}_t}{A_E S_t^* \theta_{E,t+1}} \right).
\tag{25}
$$

And now substituting τ_t^{B*} from (25) into (14), the next-period proportion of the population in favor of a market-based system becomes

$$
q_{t+1} = q_t - q_t^2 (1-q_t)^2 \ln \left(\frac{A_M \hat{S}_t}{A_E S_t^* \theta_{E,t+1}} \right).
\tag{26}
$$

It immediately appears from (26) that the ideological stance of type A's relative to type B's under the communist system weakens when $\tau_t^{B*} > 0$. This is true as long as

$$
\chi_{E,t+1}(S_t^*) \equiv \frac{A_M \hat{S}_t}{A_E S_t^* \theta_{E,t+1}} > 1,
\tag{27}
$$

which will turn out to be the initial condition at the moment of the communist revolution, T, due to destruction of some fraction of the capital stock (see section 3.3.1). Perceived inefficiency increases when the direct positive effect of aggregate savings S_t^* on efficiency of communism relative to markets is dominated by its negative effect via productivity in the next period, $\theta_{E,t+1}$. In words, when the egalitarian planner increases

aggregate savings S_t^* to trigger an acceleration of the accumulation process and a perceived fall in $\chi_{E,t+1}$, he must assign a lower consumption level to all workers according to Lemma 2. Since productivity depends positively on consumption in workers' families, next-period worker incentives and therefore productivity under communism, $\theta_{E,t+1}$, are reduced. If the latter effect dominates, inefficiency increases and type B agents recruit intertemporally by intensifying their socialization effort.[14]

Lemma 4 *Savings by the egalitarian planner increase inefficiency if the indirect negative effect on next period labor productivity dominates the direct positive effect on efficiency ($\frac{\partial \chi_{E,t+1}}{\partial S_t^*} + \frac{\partial \chi_{E,t+1}}{\partial \theta_{E,t+1}} \frac{\partial \theta_{E,t+1}}{\partial S_t^*} > 0$), leading type B agents into more proliferation of market ideas to instigate transition.*

Proof. *Inefficiency in period $t+1$ increases if the direct positive effect of saving in t on efficiency in $t+1$ is dominated by its negative lagged effect on labor productivity via a reduction in $\theta_{E,t+1}$:*

$$\underbrace{\frac{\partial \chi_{E,t+1}}{\partial \theta_{E,t+1}}}_{-} \underbrace{\frac{\partial \theta_{E,t+1}}{\partial S_t^*}}_{-} > \left| \underbrace{\frac{\partial \chi_{E,t+1}}{\partial S_t^*}}_{-} \right|,$$

where we know $\frac{\partial \theta_{E,t+1}}{\partial S_t^*} < 0$ from Lemma 2. This condition holds if and only if

$$\frac{\theta'_{E,t+1}}{\theta_{E,t+1}} > \left| -\frac{1}{S_t^*} \right|$$

is true. ∎

The results suggest that the central planner faces a trade-off between building capital through saving to ensure output growth and causing inefficiency in the subsequent period by reducing labor productivity. He must sacrifice consumption and next period productivity to save and increase output, which may lead to more discontent in the society and an increased probability of transition. Solving out the inequality in Lemma 4 and replacing for optimal savings from (24) shows that in order for the lemma to hold the condition

$$\eta_{\theta_{E,t+1}} > \frac{1 - \beta \alpha A_E}{q_t^2 (1 - q_t)^2 \ln(v_{M,t+1})} + \tilde{\eta}_{\theta_{E,t+1}} \tag{28}$$

must be satisfied. Condition (28) suggests that if the actual lagged impact of saving on labor productivity is sufficiently larger than that predicted by the central planner, savings made at an aggregate level can increase inefficiency. This would be in line with stylized facts provided in Brixiová and Bulíř (2003) on how (i) planning authority did not know the true production function of individual firms and their capacity utilization, and (ii) firms had vested interest to hide this information, while the planner possessed only primitive monitoring technology. Knowing this and without loss of generality, we set $\tilde{\eta}_{\theta_{E,t+1}} = 0$ in the remainder of the analysis for the sake of notation.

[Figure 2 about here]

Condition (28) and hence Lemma 4 is more likely to be satisfied when either S_t^* or $\eta_{\theta_{E,t+1}}$ are sufficiently large. Savings can be large due to: (i) the planner perceiving

---

[14]Lindbeck and Nyberg (2006) discuss the disincentive effects on work of welfare-state arrangements, stressing in particular that the "negative effects of the poor incentives for work in former socialist countries in Eastern Europe also seem to have materialized with a time lag".

inequality under an alternative (market) regime $\ln(\upsilon_{M,t+1})$ to be high; (ii) TFP A_E being large and closer to that under markets; (iii) the strength of the two types being not so different so that $q_{t+1}^2(1-q_{t+1})^2$ is near its maximum. On the other hand, the concave nature of labor-augmenting productivity as a function of consumption implies that the lagged negative effect of savings on labor productivity is large when aggregate consumption availability C_t is limited. This can, for example, be due to a large loss of capital caused by revolution and corresponds to the left region in Figure 2, where $c_{E,t} < c^*$.

The ambiguity the central planner faces lies hidden in the productivity function. While the negative dependence of productivity on lagged consumption is known, the *magnitude* of this effect is uncertain, implying that agents do not have perfect foresight, although they are effectively rational in the context of the game they play.

With a highly elastic response of labor productivity to savings, the planner's choice of savings in the preceding period leads to a lower efficiency, an analogy to the instability of communism in Lemma 4. We interpret the extent of this elasticity as the sacrifice that the population of the communist region is willing to endure in the name of an egalitarian system, i.e. to what extent their working morale is reduced by lower consumption. This tolerance may have to do with the cultural values, social norms, or strong ideological conviction.

Thinking along such lines brings in an interesting parallel with the cross-cultural psychology literature that allows us to compare Russia and Eastern Europe with China and East Asia. Hofstede (2001) defines individualism versus collectivism as one of his well-known cultural dimensions. In individualistic societies, people are expected to pursue individual interests, whereas in collective societies they are expected to place collective interests over personal ones. Indeed, Russia (estimated value) and the former Eastern block countries score twice as much as China and other East Asian countries on individualism. Such an analogy would, for instance, associate Russia and Eastern Europe with a lower tolerance level and place it to the left of China and East Asia in Figure 2.

Finally, recalling $S_t^* = K_{t+1}$ and substituting S_t^* into the production function in (4), we get an expression for next period output in terms of optimal savings:

$$H_{E,t+1}(S_t^*) = A_E[\alpha \frac{q_t^2(1-q_t)^2 \ln(\upsilon_{M,t+1})}{1-\beta\alpha A_E} + \theta_{E,t+1}(1-\alpha)L]. \tag{29}$$

It is easy to see that a strong negative externality on productivity in Lemma 4 also prevents production $H_{E,t}$ in (4) from growing over time. This rules out the possibility of investments raising total output over time and creating higher consumption possibilities.[15]

In sum, the egalitarian planner allocates national income between consumption and savings at the aggregate level, and type B agents react by choosing their socialization effort to influence the ideology of the next generation, thus determining the proportion of type B agents in the next period, $1 - q_{t+1}$. However, if Lemma 4 does not hold, an inelastic negative response of productivity to savings across generations under communism will not undermine it as a sustainable economic system in the long run. Such a scenario, ultimately depending on particular properties and parameters, can then stabilize communism, delaying or avoiding transition to markets.

---

[15]For an insight on the reduced consumption opportunities delivered by communist regimes, see for example Bergson (1991).

3.3 Regime Switches and the Shift of Property Rights

3.3.1 The Moment of Revolution

Before analyzing the dynamics of capital accumulation, it is helpful to have a closer look at the first period immediately following the communist revolution, T. Aggregating all capital stock in the hands of the individual capitalists, a proportion $1 - n_T$ of the adult population, that has been nationalized at the beginning of T and taking into account the costs of the revolution in terms of a destroyed fraction of capital, $0 < 1 - \mu_T < 1$, we write:

$$s_{T-1}^B = k_T \overset{\text{revolution}}{\underset{\text{cost (loss)}}{\Rightarrow}} \mu_T k_T = K_T. \tag{30}$$

The left-hand side of this expression is the capital stock invested by the individual capitalists just before the revolution and aggregated at the national level, s_{T-1}^B; the right-hand side is the same capital stock after accounting for the capital losses during the revolution and the nationalization of all the inherited and surviving capital, $\mu_T k_T$. The latter capital stock, K_T, is what remains for the egalitarian planner to put into production in period T and, obviously, $K_T < k_T$. Note that productivity in T does not change, leaving the planner with unchanged productivity, θ_M, but a lower capital stock, K_T. This results in reduced output in T relative to $T - 1$, inducing the planner to increase savings in his very first intertemporal allocation decision. Such a decision could, of course, be motivated by the need to rebuild the capital base and compensate for the loss from the revolution, or to catch up with the rest of the world.

From then on, in essence, period T has a lagged effect on output in period $T + 1$ via two channels: increasing the capital stock, $K_{T+1} = S_T$, through more savings in the preceding period, (i) increases output, H_{T+1}, but also (ii) decreases wages and consumption that are equally assigned to all workers as from period T; this reduces working morale and, hence, productivity in the next period $\theta_{E,T+1}$ resulting in a lower output H_{T+1}. To sum up, if Lemma 4 holds, an elastic negative response of productivity to savings across generations is ensured and communism is not sustainable in the long run.

3.3.2 The Post-Communist Transition Period

By symmetry, it is also important to have a closer look into the first period immediately following the transition of the post-communist society back to a market-based system. We assume that market transition takes place through a process of privatization of the capital stock in the beginning of period $T + N$. The capital stock that has been accumulated by that time, K_{T+N}, is then allocated to the new capital owners, who now have to manage it, by a legal change into property rights. Historically, several ways of ownership transfer have been applied in post-communist transition economies, from mass privatization, via restitution to the heirs of capitalists with nationalized factories, to communist nomenklatura grabbing. In our context, it suffices to assume without loss of generality that the new capital owners will be the agents most eager to get into this new role. Such agents may be of both types, as type A's will be converting fast to type B's. We assume that at the beginning of period $T + N$, just after privatization, the new capital owners represent a proportion $1 - n_{T+N}$ of the adult population. We also assume that there will be certain costs of privatization in terms of the lack of entrepreneurial and managerial skills of the new capital owners or because of inheriting inefficient or outdated enterprises and equipment. We measure these costs by a fraction, $0 < 1 - \mu_{T+N} < 1$, of lost capital, and we thus write:

$$S_{T+N-1}^* = K_{T+N} \overset{\text{privatization}}{\underset{\text{cost (loss)}}{\Rightarrow}} \mu_{T+N} K_{T+N} = k_{T+N}^B. \tag{31}$$

The left-hand side of this expression is the optimal savings, S_{T+N-1}^*, invested into capital stock, K_{T+N}, by the egalitarian planner just prior to the transition to markets; it is given directly at its aggregate national level (which also coincides in our model, with a unit mass of adult population, with the per-capita mature-generation capital stock). The right-hand side of (31) is the same capital stock after accounting for the capital losses during the transition to markets and the privatization of all the inherited and surviving capital, $\mu_{T+N} K_{T+N}$. The latter capital stock, k_{T+N}^B, is what remains, in the aggregate, to be allocated to the new capital owners and put into production in period $T + N$, and $k_{T+N}^B < K_{T+N}$. With this lower capital stock and productivity in $T + N$ predetermined by the lagged effect of savings operating via consumption in workers' families, $\theta_{E,T+N}$, output in $T + N$ falls relative to $T + N - 1$. Once the first period of the return to markets elapses, individual decision-making on the split between consumption and savings by the new capital owners eliminates the negative externality in the intertemporal optimization problem, typical for communism, we highlighted. This allows higher output in the next period and aligns invested savings with individually-consistent decisions of capital owners. It also restores the higher level of consumption characterizing the more efficient market system, yet reintroducing and perpetuating inequality.

4 Intergenerational Dynamics and Economic Outcomes

In this section, we highlight our principal analytical findings derived from the dynamics of q_t and the resulting economic outcomes. That is, having precedingly analyzed the within-period leadership game equilibrium strategies of our two agent types, we are now well equipped to proceed to the analysis of the feedback from ideological strength q_t to strategies across generations. Given that agents only live one period of adulthood, players in the von Stackelberg game change every period. In other words, the same game is played by the next generation, with the level of strength q_t attained by socialization of agents in the previous period as the initial condition. This allows us to observe the law of motion of q_t and potential economic transitions over time.

4.1 Capitalism and the Communist Revolution

We first consider the dynamics underlying the transition from a market-based to a centrally-planned economic system. We can state:

Proposition 1 (Communist Revolution) *Suppose type A is initially weaker than type B ($q_0 < 0.5$). Given τ_t^{A*}, s_t^{B*}, and the law of motion of q_t, the optimal savings increase in q_t ($\frac{\partial s_t^{B*}}{\partial q_t} > 0$). This implies that a higher $q_{M,t+1}$ caused by τ_t^{A*} will result in more savings by type B's in the next generation von Stackelberg game ($\frac{\partial s_{t+1}^{B*}}{\partial q_{t+1}} > 0$). This trend continues until $q_t > 0.5$ where the threat of a communist revolution becomes credible.*

Proof of Proposition 1. We derive the effect of the relative strength of workers in some period t on the saving behavior of the capital owners in that period:

$$\frac{\partial s_t^{B*}}{\partial q_t} = 2q_t(1 - q_t)(1 - 2q_t)\frac{\ln\left(\chi_{E,t+1}\right)}{A_M\beta\alpha - 1} \begin{cases} > 0 & \text{if } q_t < 0.5 \\ < 0 & \text{if } q_t > 0.5 \end{cases}. \tag{32}$$

Thus, for any low $q_t < 0.5$, we have $\frac{\partial s_t^{B*}}{\partial q_t} > 0$. In words, the optimal reaction functions of the two types in the von Stackelberg game of class struggle under markets lead to a progressive increase of q_t until it surpasses some 'critical mass'. Beyond this threshold type A's become sufficiently strong and ideologically determined to represent a credible threat to overthrow the existing capitalist social order. For $q_t > 0.5$, a communist revolution occurs with probability q_t; if this does not happen, the optimal savings by type B's, s_t^{B*}, become decreasing in q_t potentially stabilizing the capitalist market-economy system. ∎

Proposition 1 can be interpreted as follows: a capitalist system is only feasible when type A's are weaker than type B's ($q_0 < 0.5$). The mobilization of the working class caused by inequality increases the ideological motivation of the next generation to overthrow the system. This induces more savings by capital owners, but increases inequality, feeding the resentment of type A agents. The reinforcing effect of social resentment on capital accumulation and inequality could eventually lead the market system towards its fall. Historically, this could be relevant to the case of the uprising of the working class in Russia, on which we focus the analysis.

Corollary 1 (Stable Capitalism) *Should a communist revolution not occur when $q_t > 0.5$, a substantial threat from strong type A's revolting induces the leader to accommodate his strategy in search of a compromise by decreasing savings, s_t^{B*}, mitigating inequality and potentially stabilizing the market system.*

Proof. See the proof of Proposition 1 ∎

The alternative in Corollary 1 arises because for relatively strong type A's the probability of a regime change is perceived by type B's as credible, thus the latter adapt their behavior. An increase in the probability of a regime change ($q_{t+1} > q_t$) induces a reduction in capital accumulation by type B's. By reducing income inequality and, hence, the ideological determination of type A's to change the status quo, such a reaction by capital owners can avoid slipping towards communism. Although we do not explicitly model redistribution, a part of the increase in capitalists' individual present consumption brought about by lower savings can be thought of as a transfer to the poor that takes place when the latter gain sufficient strength.[16] Historically, this seems to have been the case of social democracies and the welfare state, where democratization of capitalism and redistribution of income have preserved the market system.

4.2   Communism and the Transition to Markets

We turn to the dynamics underlying the transition from a centrally-planned to a market-based economic system in another proposition:

Proposition 2 (Market Transition) *Suppose type B is initially weaker than type A ($q_T > 0.5$) and Lemma 4 holds. Given τ_t^{B*}, S_t^* and the law of motion of q_t, the optimal savings increase in $1 - q_t$ ($\frac{\partial S_t^*}{\partial q_t} < 0$). This implies that a lower $q_{E,t+1}$ caused by τ_t^{B*} will result in more savings by the egalitarian planner in the next generation von Stackelberg game ($\frac{\partial S_{t+1}^*}{\partial q_{t+1}} < 0$). This trend continues until $q_t < 0.5$ where the threat of a transition back to a market-based economy becomes credible.*

Proof of Proposition 2.   We derive the effect of the relative strength of market advocates in some period t on the saving behavior of the egalitarian planner in that

---

[16]This is a concept similar to Galor and Moav (2006), in which capitalists find it optimal to invest in the human capital of the poor.

period:

$$\frac{\partial S_t^*}{\partial q_t} = 2q_t(1-q_t)(1-2q_t)\frac{\ln\left(\upsilon_{M,t+1}\right)}{1-A_E\beta\alpha}\begin{cases} >0 & \text{if } q_t < 0.5 \\ <0 & \text{if } q_t > 0.5 \end{cases}. \qquad (33)$$

Thus, for any high $q_t > 0.5$ (i.e. any low $1 - q_t < 0.5$), $\frac{\partial S_t^*}{\partial q_t} < 0$ (i.e. $\frac{\partial S_t^*}{\partial(1-q_t)} > 0$). In words, the optimal reaction functions of the two types in the von Stackelberg game of conflicting beliefs under communism lead to a progressive increase of $1 - q_t$, i.e. a progressive decrease of q_t until it drops below certain 'critical mass'. Beyond this threshold type B's become sufficiently strong and ideologically determined to represent a credible threat to bring down communism by pro-market transition reforms. For $q_t < 0.5$, a market transition occurs with probability $1 - q_t$; if this does not happen, the optimal aggregate savings, S_t^*, becomes increasing in q_t (that is, decreasing in $1 - q_t$) potentially stabilizing the communist system. ∎

Proposition 2 can be interpreted as follows: a communist system is only feasible when type B's are weaker than type A's ($1 - q_T < 0.5$). Market propaganda that arises from lower relative efficiency under communism results in a shift of ideology in the next generation towards the market-oriented type. This induces more savings by the egalitarian planner as an attempt to restore efficiency through more investment and accumulation. But more savings at the aggregate level creates a negative externality on productivity as it is necessarily accompanied by lower available consumption and wages. Responding to more discontented people by further increasing savings under Lemma 4 only exacerbates the relative inefficiency of the communist regime, making it less and less sustainable.[17] As the convergence of beliefs toward the market ideology continues, the probability of economic transition increases, and the regime may eventually revert to the market system. Historically, this could be relevant to the Soviet and East European case, on which we focus the analysis.

Corollary 2 (Stable Communism) *Should market transition not occur for $q_t < 0.5$, a substantial threat from strong type B's to overturn the regime induces the leader to accommodate his strategy in search of a compromise by decreasing aggregate savings, S_t^*, increasing longer-run efficiency (via higher wages and consumption) and potentially stabilizing the communist system.*

Proof. See the proof of Proposition 2. ∎

The alternative in Corollary 2 arises because for relatively strong type B's the probability of a regime change is perceived by the egalitarian planner as credible, thus the latter adapts his behavior. An increase in the probability of a regime change ($q_{t+1} < q_t$) induces a reduction in aggregate savings by the egalitarian planner. This increases consumption allocations (material well-being), hence productivity and ultimately the efficiency of the communist system for the range of parameter values where Lemma 4 holds. By maintaining efficiency and reducing the ideological determination of type B's to change the status quo, such a reaction by the egalitarian planner can prolong the life of a communist regime and, potentially, avoid surrendering central planning. Historically, this resembles the Chinese social market economy, where pro-market economic reforms were undertaken widely in coexistence with the centralized political system.

[Figure 3 about here]

Figure 3 summarizes the dynamics of the model across generations. To elucidate it, we briefly revisit the events that lead to revolution and back to transition. Under

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[17]Essentially, such a set-up resembles the overinvestment experience in communist countries during their period of initial industrialization and subsequent attempts to increase future production (and, in historical context, catch up with the West).

markets, initial (relative) inequality $v_{M,0} > 1$ and capitalist savings $s_t^{B*} > 0$ in (21) leads to $\ln(v_{M,1}) > 0$ and $\tau_0^{A*} > 0$ from (19), which itself brings about an increase in the strength of type A's in the next period q_1, via (20). According to equation (18) and Proposition 1 this increases optimal savings by capitalists in the following period, s_1^{B*}, raising inequality. This creates a continuing cycle towards a communist revolution that can be summarized as

$$s_t^{B*} \uparrow \rightarrow v_{M,t+1} \uparrow \rightarrow \tau_t^{A*} \uparrow \rightarrow q_{t+1} \uparrow \rightarrow s_{t+1}^{B*} \uparrow \rightarrow v_{M,t+2} \uparrow \rightarrow \tau_{t+1}^{A*} \uparrow \rightarrow q_{t+2} \uparrow ...$$

until $q_t > 0.5$, after which either revolution occurs (Proposition 1) or the system stabilizes (Corollary 1). In the case of revolution, initial (relative) inefficiency $\chi_{E,T} > 1$ and central planner's savings $S_t^* > 0$ satisfying condition (27) gives $\ln(\chi_{E,T+1}) > 0$ and $\tau_T^{B*} > 0$ from (25), which itself leads to a higher proportion of B type agents in the following period q_{T+1}. According to equation (24) and Proposition 2, this increases optimal aggregate savings by the egalitarian planner in the following period, S_{T+1}^*, raising inefficiency with respect to the market system as long as Lemma 4 holds. This triggers a continuing cycle towards transition back to the market system that can be summarized as

$$S_t^* \uparrow \rightarrow \chi_{E,t+1} \uparrow \rightarrow \tau_t^{B*} \uparrow \rightarrow q_{t+1} \downarrow \rightarrow S_{t+1}^* \uparrow \rightarrow \chi_{E,t+2} \uparrow \rightarrow \tau_{t+1}^{B}{}^* \uparrow \rightarrow q_{t+2} \downarrow ...$$

until $q_t < 0.5$, after which either transition occurs (Proposition 2) or the system stabilizes (Corollary 2).

[Figure 4 about here]

Recall that if a regime change occurs when q_t is near 0.5, then optimal saving and hence the probability of a shift back to the previous regime are at their highest. On the other hand, when the regime change occurs for lower or higher values of q_t away from 0.5, then optimal saving is relatively lower as stated in the corollaries and stability more likely. But also if transition does occur when q_t becomes low, then the perceived post-transition inequality $\ln(v_{M,t+1})$ tends to be lower: many people are involved in the regime change as opposed to a sudden transition led by a smaller group of people as in Russia, so capital would be shared among a larger group, higher $1 - n_t$. Therefore, there would not be much difference between communism and markets in terms of inequality: only ownership becomes private, but the wealth is in the hands of many and individual savings, s_t^{B*}, will be low. This can be thought of as another example for a successful social market economy that applies to China. The phase diagram in Figure 4 summarizes the overall dynamics of regime switches in propositions 1 and 2, and stability obtained from Lemma 4 and corollaries 1 and 2 in the space of consumption and the balance of power between the two types in the society. The shaded area illustrates the region of instability, where the pendulum restores force and accelerates back to the alternate regime.

5 Historical Evidence

Our model critically relies on the three following assumptions: (i) the use of aggregates in the planner's economic calculus, (ii) the lower productivity delivered by a centralized economy (under Lemma 4), and (iii) the willingness of the lagging economy to catch-up with the market system. This section shows that these assumptions merely reflect commonly observed facts, grounding our model on historical accounts.

Our first assumption is that the calculus in a centrally-planned economy is not of consent, to paraphrase Buchanan and Tullock's (1962) well-known book title, but of

command: economic decisions are taken by higher authorities, which give orders (objectives) to the lower-tier entities such as farms or plants (Ericson, 2008). As such, a command or planned economy does not consider individual (or individual-based) decisions, but nation-wide aggregates. The debate about the virtues of one versus the other has received a lot of attention as early as the well documented debates between Lange (1956 [1936]) and von Hayek (1940, 1945). Lin (2009) shows how this Soviet-style planning has endured, notably in the developing countries that have been influenced by the ideology or the country (the USSR) that largely sponsored it. Recent studies confirm that what we have referred to as a misalignment of ownership and control is prevalent in such systems. Among others, Brixiová and Bulíř (2003) or Bajona and Locay (2009) show that basing decisions on economic aggregates is prone to deficiencies and lower efforts by private individuals, which results in lower productivity performance. Everywhere, the same ingredients delivered the same recipe, but aggregate planning failed to deliver a consistent dish. In the words of Li and Yang (2005), probably nowhere else but in China did such economic management result in a (human) disaster as large as the one during the 'Great Leap Forward' (1959–1964), which is an example of communist orthodoxy trying to harness capital to catch-up with the West.

This logically guides the choice of our second main assumption: the lower productivity (relative growth potential) of the planned economy described in Lemma 4. Although it is very difficult to compare the two systems (if only because the Net Material Product, not the GDP, was used in communist countries, excluding as a consequence the services), it has been shown that the Soviet-type economies were less productive than their Western counterparts. The USSR, for example, obtained a 2.1 per cent trend annual productivity growth per head after WWII, which compares badly with the West, even after taking into account the losses (and bounce back) due to the war (Harrison, 1998; Bergson, 1991). Broadberry and Klein (2012) confirm that the situation can be generalized to the 'Eastern bloc countries', which they compare to the EEC6 and 9. Wu (2001) considers the productivity of the Chinese industry, comparing it with the US, and finds that China was strongly lagging behind. Even more strikingly, he shows that the average productivity in the nineties (i.e., after the beginning of the reforms) was almost twice larger than what had been reached since 1952. And the inferior productivity relative to market economies is commonly attributed to the deficiencies of a command economy (see, for instance, Litwak, 1993), among which the weakening workers' morale, due to low consumption possibilities (Bergson, 1991), as in our own modeling and interpretation.

The last main assumption of our analytical set-up is the willingness to catch-up with the West, an objective which historically led to overinvestment and to a focus on industry as a lever to reach that goal. USSR leaders repeatedly stated that their goal was to bring as much comfort to their population as what existed in the West (Bergson, 1991). Harrison (1985) measures the degree of overinvestment and shows this feature to be even more important in China than in the USSR, while Bergson (1991) draws the link between the insistence on industry (and especially heavy industries) and the lower consumption possibilities delivered by the Soviet economy. Easterly and Fischer (1995) go as far as attributing the decline of the Soviet economy to such overinvestment bursts.

The challenge here is, thus, to consider how China fits in this landscape, given that its savings rate has been high for the last decades, since the start of the reforms, and stands at levels that are higher than either in the other developing countries or in the developed ones (Yang et al., 2012). Although it may not have reached the productivity level of the Western economies, China has at least been able to follow a particular reform path that has permitted maintaining such a high level of savings without creating too much resentment, or 'reform without losers' as referred to in Lau et al. (2000). The

reform has compensated the expected decay of the old industries by aligning incentives in the collective farms and state-owned firms, hence soothing the impact of the changes on people, and by liberalizing the more promising industrial sectors, thus promoting the country's growth along a 'dual-track approach' (Lau et al., 2000; Lin, 2009). Such accounts explain why China may be a good case in point with regard to Corollary 2, with the Communist Party making concessions in unleashing entrepreneurial spirits and accommodating the strive for economic profit and higher consumption.

6 Discussion and Concluding Remarks

Our theoretical analysis above summarized the rise and fall of communism as a process of experimenting with a new economic system that failed in most world regions, while reaching stability – under some concessions – in few others. It also showed how the same general mechanism we emphasized as driving social evolution could generate, under certain conditions and under minor regime-dependent specificity, not just the advent of communism but also its demise, or sometimes prolonged stability. That is, we proposed a model of long-run economic dynamics as one possible explanation for a principal insight from the history and the turn of events during the last century and a half.

Our work is in line with the few related formal accounts of political economy nature regarding the processes leading to successful democratization or to dictatorships succeeding democracy and democracy succeeding dictatorships in unstable societies, in particular the book by Acemoglu and Robinson (2006). Our approach is close to their framework in that we employ all of their three 'fundamental building blocks', namely:

1. "economic-based approach", emphasizing "individual economic incentives as determining political attitudes" and that "people behave strategically in the sense of game theory" (p. xii);

2. "the fundamental importance of conflict", where "different groups, sometimes social classes, have opposing interests over political outcomes" (p. xii);

3. "political institutions" that "play a central role in solving problems of commitment by affecting the future distribution of *de jure* political power" (p. xii).

It is interesting to note as well that their example of stable democracy, Britain, corresponds to our stable capitalism under Corollary 1 and the hypothesis in Acemoglu and Robinson (2000) that the extended franchise in the West prevented communism to happen. Their case of repeated cycles of democratization and dictatorship, Argentina, relates to our more general metaphor, in propositions 1 and 2, of the pendulum of economic systems. Their example of a stable nondemocratic regime, Singapore, parallels our Corollary 2, and its likely relevance to China.

Moreover, our work is also in line with North's (2005) arguments on the process of long-run economic change, where institutions are, according to Aoki (2011), "social artifacts that cognitively mediate agents' strategic interactions and their individual beliefs in societal games". North characterizes succinctly the nature of this social evolutionary process as follows:

> "In contrast to Darwinian evolutionary theory, the key to human evolutionary change is the intentionality of the players. (...) Economic change, therefore, is for the most part a deliberate process shaped by the perceptions of the actors about the consequences of their actions. The perceptions come from the beliefs of the players – the theories they have about the consequences

of their actions – beliefs that are typically blended with their preferences."
(North, 2005, p. viii)

Our goal with this paper was to capture the 'perceived reality → beliefs → institutions → policies → altered perceived reality' chain North (2005) emphasized in words into a coherent and general theoretical construct capable to highlight the social pendulum across economic systems using the specific case of communism.

Our model begins with a perceived reality that is unjust for our type A agents, as they are born unequal and poorer. Their beliefs are thus shaped out by the ideal of achieving equality, and are propagated by socialization and the spread of ideology across society in our model. At this initial point, however, the world has never operated a communist economic system, to which the A types strive. In other words, the society faces huge (aggregate) ambiguity if it decides to attempt a change in the status quo. The experiment accordingly creates its own institutions and policies, forcing equality in incomes and a central planning system to replace the role of capitalists and markets. But the social realities imposed by the revolution and nationalization turn out simply not to work: all members of the communist region suffer lower and lower material well-being due to misaligned incentives resulting from a distorted ownership and control structure. By abolishing private property and market signals communism forces equality of ownership through a centralized allocation that comes at the cost of lower productivity and poor coordination. While observing as a reference point the rest of the world that has remained market-based and is performing better, a drive to pro-market reforms – the altered perceived reality – reverts the society back to sustainability. Although we conclude modeling the chain of social evolution at this point, the pendulum certainly does not stop here and can continue to swing back and forth.

Sometimes – if not often – in history, the society faces the unavoidable challenge to experiment with its own existence and future under huge ambiguity. With heterogenous agents, information sets, expectations and interests, it is not always easy to converge to a commonly shared plan, or at least hope for such a plan to possibly end up successfully. Doubts, conflicts and ideologies emerge naturally, values and institutions evolve, responding to evolving realities. At times, the experiment discovers a positive outcome. And then society finds and settles into a new equilibrium, until the next unprecedented vital change of the environment. However, when the outcome of such a social experiment is negative, the pendulum of history swings back, or along a spiral, whose circles constitute a gradation of hard-to-acquire knowledge.

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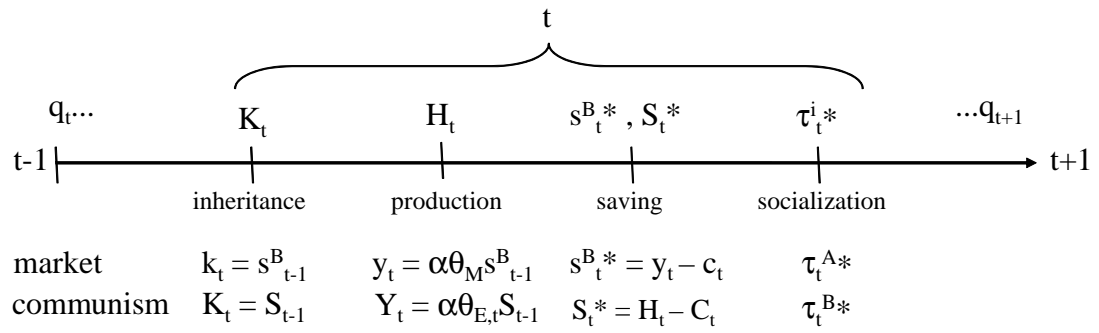
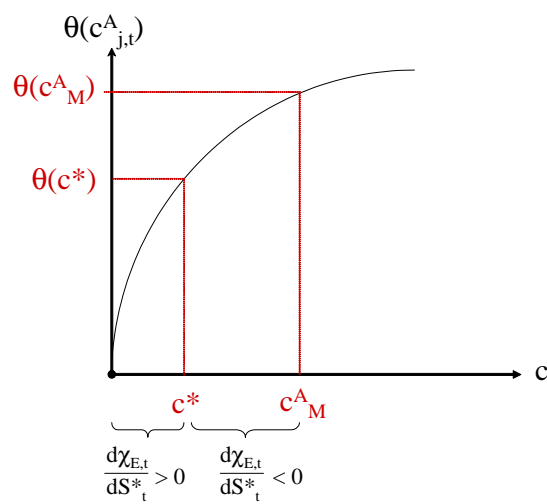Figure 1: Sequence of Events in Period t

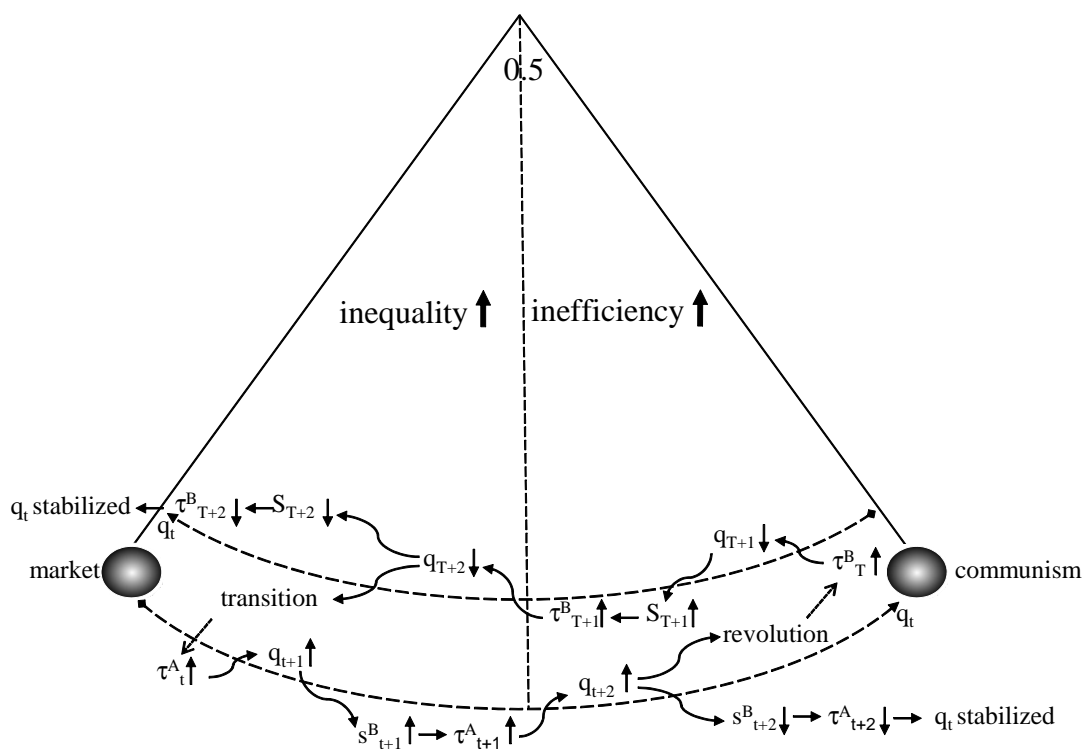Figure 2: The Impact of Centralized Savings on Inefficiency

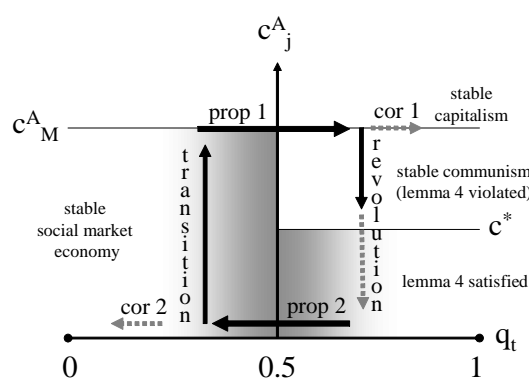Figure 3: Dynamics of Ideology Across Generations

Figure 4: Dynamics of Regime Switches and Stability

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