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Economics and Politics: A Unifying Framework

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Abstract. This paper deals with economic growth, distribution and politics. The principal feature of this paper, which distinguishes itself from most existing literature, is that it integrates economic growth and political equilibria into a unifying framework. We study the distribution of power between the owners of capital ("the capitalists") and the owners of human capital ("the workers") and its relationship with the fundamental economic variables including capital market imperfections, economic growth, and inequality. We then develop a new model of politico-economic equilibrium in which economic power constitutes a key linkage between politics and economics. We show that all the fundamental economic variables, including economic power distribution, are in fact dependent on political conditions. We show that the performance of the economy is likely to be cyclical because of cyclical behavior of political conditions and *vice versa*, political cycles are in part originating in economic cycles. The model provides unique testable predictions, some of which we illustrate using US political and economic data for the period 1885-2016.

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Economics and politics: A unifying framework

Introduction

This paper deals with economic growth, distribution and politics. The principal feature of this paper, which distinguishes itself from most existing literature, is that it integrates economic growth and political equilibria into a unifying framework. The worker-capitalist contest for sharing a pie is centerpiece to this story from which it ramifies into an amazing number of fundamental issues, including economic power determination, capital market failure, and economic growth. Behind these economic variables underlie the politico equilibrium which determines the fundamental economic equilibria through its effect on economic power distribution, and politico equilibrium, in turn, evolves in response to the economic forces themselves.

We start with the workers and capitalists contest. Many decades ago, John Nash taught us the role of bargaining in the distribution of a given pie (Nash, 1950). Nash recognized that key determinants of the resulting distribution of the pie between the contestants are their respective *economic or bargaining powers*.[1]

But this perspective brings us to several mostly unanswered questions which serve to enunciate the specific objectives of this paper: (1) If economic or bargaining power is a key determinant of distribution between workers and capitalists, what determines their respective bargaining powers? (2) How to reconcile the Nash distribution, in which power plays such a central role, with the marginalist theory of factor distribution in which capital-labor distribution depends exclusively on factor productivity? (3) What (if any) is the role of ubiquitous capital market imperfections likely to interact with power distribution? (4) How recognizing a role for power and capital market imperfections in distribution affects the existing economic growth paradigms? And last, but certainly not least, (5) How politics

[1] While the bargaining literature focusses on "players" as individuals, as several authors have argued, one may interpret the term player as organizations or agents representing groups with similar interests such as capitalists and workers (e.g., Muthoo, 2001; Bush and Muthoo 2003; Bardhan, 2005, and others).

affect economic growth and distribution patterns and how economic growth and distribution , in turn, affect the dynamics of political equilibrium?

This paper has two central objectives. The first objective encompasses the first 4 questions enumerated above while the second objective concerns question 5. The first objective focusses on providing insights to question (1) by examining the determination of power distribution between the owners of capital ("the capitalists") and the owners of human capital ("the workers") and its relationship with capital and human capital accumulation, capital market imperfections, and economic growth.[2] We consider questions (2) and (3) by introducing an integrated theory of factor distribution which combines the marginal and Nash theory of distribution, where factor returns are determined in a context of capital market imperfections. This theory of distribution enriches the conventional marginal distribution paradigm, showing that factor rewards depend on their adjusted marginal productivities modified by their respective degree of bargaining power. We use the Nash asymmetrical bargaining power model as generalized by Rubinstein, (1982), Muthoo (2001) and Busch and Muthoo (2003), as the starting point of this analysis.[3]

Question 4 is dealt with -following an old tradition of classical development economics- by focusing on discovering long-run patterns of economic growth and distribution of income between capitalists and workers.[4] Consistent with this tradition we focus on the balanced growth equilibrium of the fundamental economic variables rather than on their transitional dynamics.

Thus, the first contribution of this paper is to answer questions 1 to 4 by constructing a generalized multi asset endogenous growth model which considers economic power in a context of endogenous capital market imperfections. Growth models rarely consider

[2] Capitalists here do not include only the direct owners of capital, but also those "workers" such as top executives and financial traders whose income directly depends on the returns to capital. While many individuals are neither "pure" capitalists nor "pure" workers, we shall categorize them as either capitalists or workers if they obtain most of their income from capital or work, respectively.

[3] Another relevant model examines economic power distribution in a context of predation and conflict among private individuals or firms (e.g., Hirschleifer, 1991; and Grossman and Kim, 1995 and 1996a). However, their model ignores the role of politics.

[4] Piketty (2014), following the steps of Marx, Ricardo and other classical economists, is of course the most acclaimed modern work in this respect.

economic power as a factor affecting the rate and orientation of economic growth.[5] Moreover, while some models do consider the implications of market imperfections for economic growth, most of them assume that they are exogenous. However, as we show below, economic power and market imperfections are closely linked, which suggests that a proper treatment of power needs to account for endogenous market imperfections.

The concept of balanced growth equilibrium that we emphasize here differs from the one used in standard endogenous growth theory. Our idea of balanced growth equilibrium may be better denominated as *temporary equilibrium*.[6] Temporary equilibrium was originally devised to describe imperfect or incomplete equilibria due to absence of future markets in an intertemporal context. Here we use this concept considering the intertemporal incompleteness of economic equilibrium due to endogenously changing political states. Endogenous political changes may feedback into the initial economic equilibrium, thus causing its change, change which itself may induce further political changes, often leading to mutually fed political and economic cycles. We thus integrate economics and politics using a sequential series of temporary economic and political equilibria which alternate as state variables to each other.

This brings us to the second central objective of this paper, which addresses question (5), the integration between politics and economics. Importantly, unlike studies that examine the transition across various institutional stages our focus is on established democracies with stable political institutions. Studies by Acemoglu and Robinson (2008, 2014, 2019) and Acemoglu (2008), use a somehow similar concept to our sequential determination of economic and political variables, but in a context of changing political institutions and structures. Also, while power in these analyses plays a central role, their focus is on *political power* which emanates from imperfect (often non-democratic) institutions which foment rent seeking. By contrast, we consider *economic power* rooted in the economic and political interaction in a context of democratic institutions. We argue that even under fully democratic institutions often considered as ideal for a matured capitalistic society,

[5] An exception is an article by Grossman and Kim (1996b) which considers certain aspects of power in the accumulation of capital.

[6] Temporary equilibrium (sometimes also referred to as moving equilibrium) has a long history in economics going back to the classic works by Hayek (1937) and Hicks (1939), among many others.

economic power distribution plays a key role in affecting most of the fundamental economic variables.

Our second contribution is to develop a political economy model that copes with question 5 in the context of stablished democracies. We show that the political regimes and their interventions, impacting the distribution of economic power in a democratic society, may not converge to a unique stable political equilibrium but rather follow long cyclical processes over time, which in turn lead to economic cycles. Thus, leading to perpetuate interdependent politico and economic cycles.

The growth analysis in this paper is related to Galor and Moav (2006) who argue that human capital accumulation is fundamental to sustain the returns to physical capital because these factors are complementary to each other. In our growth model human capital is also essential to sustain the returns to physical capital despite that we assume that capital and human capital are gross substitutes in production. The fact that their respective marginal productivities are increasing in the level of the other factor (a feature that is perfectly compatible with gross substitutability), implies that in balanced growth equilibrium there are economic incentives to expand physical and human capital in coordination without requiring capitalist to promote pro-human capital policies as is necessary in the Galor and Moav approach. As physical capital expands, the marginal productivity of human capital tends to increase (and the marginal productivity of physical capital to decline) eventually reaching levels above those of physical capital. This triggers investment in human capital which allows to sustain capital productivity, and vice-versa when the marginal productivity of human capital declines. This mechanism allows to maintain a stable equilibrium factor ratio (and sustaining the profit rate as Galor and Moav argue), a key feature of balanced growth equilibrium. However, this does not mean that capitalists and workers cease bargaining to obtain as high a share of the pie as their economic power allows them.

Galor, Moav and Vallrath (2009) argues that higher inequality among landownership is detrimental for pro-human capital expenditures (such as education and others). These authors also argue that the complementarity between human capital and physical capital motivates capitalists to support pro-human capital policies. Our analysis also considers a

negative role for inequality in human capital accumulation, the link being determined by endogenous imperfections of the capital market. There is an equilibrium degree of imperfection over the long run or balanced growth stage. Regardless of the equilibrium degree of capital market imperfection, the market mechanism that causes coordination between the investment in the two assets to sustain the equilibrium asset ratio remains in operation.

Also, our context of market failure is closely related to Dal bo and Dal bo (2011). In this paper, the effect of economic conflict is introduced as appropriative activities in two canonical models of trade in an open economy. In this context, policies that are distortion-free that are optimal under perfectly secured property rights could decrease economic growth by increasing the incentives to appropriation activities. In our paper, some distortionary pro-human capital policies can increase economic growth by reducing the amount of power that capitalist own (or vice-versa) and reducing the degree of market failure presented in the economy. A key feature of our model is that the human capital policies are endogenously generated within our integrated politico/economic model.

The political model developed in this paper departs quite considerably from the standard models of political competition (Downs, 1957; Roemer, 2001 and 1995; Wittman, 1990; Schultz, 1995). First, we argue that established political parties representing either workers' or capitalists' interests have a very limited space for strategic games to access or retain power because the electorate would be hard-pressed to believe overly drastic departures from the parties' well-known reputation as defenders of such interests. This is in sharp contrast with the assumptions used by the standard Downsian literature which assumes that politicians are opportunistic and play Nash to maximize their chances to access or retain political power, thus leading to a convergence of policy proposals.[7]

Second, we allow preferences of the median voter to endogenously change over time, which is a key source of political cycles. The median voter´s preference is in fact a moving target which, given its dynamics, is very difficult to predict by a political party. By contrast,

[7] See also Wittman (1990), who using somehow different assumptions reach the same conclusions. There is a literature allowing for uncertainty regarding the median voter, which concludes that ideological political parties play Nash but that their proposals do not entirely converge (Roemer, 1995). In this case political cycles are predicted, but the cycles merely originate in stochastic factor

most of the standard literature assumes that the median voter's preferences are fixed and known *ex-ante*.

Our approach to politics is loosely inspired in the studies by Osborne and Slivinski (1996) and Besley and Coate (1997), which assume that candidates commit to policies and have well-defined and well-known policy preferences. Our approach is also motivated by the fact that several empirical papers have obtained conclusions that are generally inconsistent with the predictions the Downsian approach. For example, Lee et. al. (2004), using US data, found that politicians would not be able to make credible promises of moderating their policies. Similarly, Pettersson-Lidbom (2008), using data for Sweden, concludes that there is an economically significant party effect; left-wing governments spend and tax 2-3% more than right-wing parties and induce lower unemployment.

Some of the most influential studies in the politico-economic field have focused on how politics, particularly political instability, affects mainly short-term economic variables, implicitly assuming a one-way causality from political to economic conditions (Alesina and Sachs, 1988; Rodrik, 1991; Alesina et.al., 1996; Jong-a-P, 2009; Campos and Nugent, 2002; and Aisen and Veiga, 2011). Similarly, there is a broad literature examining the effects of election outcomes on the macroeconomic performance (Blinder and Watson, 2016; Alesina et.al., 1997; Comiskey and Marsh, 2012). Others have looked at the effect of opportunistic politicians trying to increase their likelihood of reelection inducing economic shocks (e.g., Rogoff, 1990 and Alesina et.al., 1997, respectively). Still other studies focus on the inverse channel, how exogenous shocks impact political leadership (e.g., Ales et.al, 2012).

In contrast, our analysis considers political behavior as both cause and effect of long-term economic variables. We consider economic and political cycles which are truly endogenous and self-generating, their existence not depending on exogenous shocks nor opportunistic politicians striving to remain in power.

The contribution of our politico/economic model is also related to Dal Bó et al. (2019). This paper finds that the recent surge in the extreme right observed in Sweden is due to economic shocks and the increase of perceived insecurity. Dal Bo et al. (2019) finds that the surge in the extreme right is directly related to the election of right-wing politicians

caused by poor economic performance. In addition, Piketty (2018) documented trends for political voting, he shows that human capital owners change its vote preferences from right to left during the recent century changing the economic and the high income- high wealth elites votes for the right. These arguments give support to our emphasis on the connection between economic performance and distribution and political outcomes. We argue that tension between human-capital owners and physical capital owners is a key driver of interdependent economic and political cycles.

The economic model

Production. We consider two productive assets or factors of production, physical capital (K) and human capital (H), which jointly produce a single good through an aggregate constant-returns-to-scale production function, $F(K,H)$, assumed to be CES,[8]

$$\mathrm{F(K,H)} = \left[\mathrm{aK}^{\frac{\sigma-1}{\sigma}} + (1-\mathrm{a})\mathrm{H}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \qquad (1)$$

where $0 < \mathrm{a} < 1$ is a parameter and σ is a fixed parameter representing the elasticity of substitution. We assume that human and physical capital are gross substitutes ($\sigma > 1$).[9] While most empirical studies have found that capital and labor are gross complements, studies that allow for embodied technological change (as we consider here by using endogenous human capital rather than merely labor) and that focus on long-run estimates (as we also do here), find that these factors are in fact gross substitutes (Duffy and Papageorgiou, 2000; Karabarbounis et. Al., 2014).

Capital market distortions. Here, we examine the existence of *endogenous* capital market imperfections which introduce a wedge between factor rewards and their marginal productivities. It has long been recognized that capital markets are subject to distortions mostly associated with imperfect and asymmetric information (Stiglitz and Weiss, 1981). One common mechanism to deal with asymmetric information is the requirement for collateral when borrowing in the capital market (Bhattacharya, 1998; Piketty, 1997).

[8] Here "human capital" is an asset that is owned by workers (which may include education, health, and skills that affect the productivity of workers), who are most of the population.

[9] However, gross substitution does not prevent that the marginal productivity of each factor be increasing in the level of the other factor. Some authors refer to this phenomenon as weak complementarity. Of course, the function (1) does imply this form of "weak" complementarity.

However, lenders are often unwilling to accept intangible assets as debt collateral because assets such as human capital are extremely difficult to appropriate by lenders in the case of default. By contrast, secondary markets for physical assets often exist and hence they can more easily be appropriated by lenders in the case of default. These considerations justify the following assumption, which we maintain throughout the analysis,

Assumption 1 (intrinsic capital market imperfection). *Collateral debt requirements often prevail when capital markets are imperfect and discriminate in favor of agents investing in tangible assets (such as physical capital) in detriment of agents investing in intangible assets (such as human capital).*

This is what we call intrinsic capital market imperfections, which give an advantage to individuals whose income depends primarily on physical capital investments *vis-a-vis* individuals whose main asset is human capital. That is, the effective cost of credit tends to be lower to finance investments in K than in H.

Government policies may either attenuate or worsen the intrinsic distortion of capital markets. Governments may worsen the intrinsic distortion by using policies that directly or indirectly subsidize capital returns or, alternatively, may reduce such intrinsic distortion by compensating workers through subsidies to human capital acquisition. Policies could also overshoot by more than compensating H-owners by excessive subsidies to them.

Let $g > 0$ denote a summary representation of the net effect of the intrinsic distortion modified by the policy intervention. A value $g = 1$ indicates that policy interventions exactly compensate for the intrinsic capital market distortion, thus inducing neutral incentives for K and H investments, while $g > 1$ ($g < 1$) indicates a pro-human capital (pro-physical capital) net effect. In general, and as we shall see in the next section, there is no reason *a priori* why government policies would exactly compensate for the intrinsic capital market distortion. We thus expect that at any point in time $g \neq 1$.

A fundamental temporary equilibrium balanced growth condition. The following analysis is based on a generalization of the standard multi asset endogenous growth models (e.g., Barro and Sala-I-Martin, 2004). The model considered here generalizes their model, allowing for the existence of distortions in the capital market. We assume that the economy

maximizes the present value of consumption subject to a budget constraint and the two asset dynamic equations and initial conditions. Both production factors may change over time as the economy invests in them. We assume that these assets have an equal rate of depreciation, which could be zero.

We allow for the cost of capital to be distorted (i.e., $g \neq 1$) . The cost of borrowing to invest in K is different from the cost to invest in H. Then we can write the current value Hamiltonian of the intertemporal maximization of the present value of utility as follows,

$$\max_{c(t),I(t)_k,I(t)_h} u(c(t)) - \Omega(t)\left[c(t) + gI(t)_k + I(t)_h - F\left(K(t), H(t)\right)\right] + \lambda(t)I(t)_k + \eta(t)I(t)_h \quad (2)$$

Subject to:

$$\text{(ii)} \quad \frac{dK}{dt} = I(t)_k; \qquad K(0) = K_0$$

$$\text{(iii)} \quad \frac{dH}{dt} = I(t)_H; \qquad H(0) = H_0$$

Where $u\left(c(t)\right)$ is the instantaneous utility level as a function of total consumption at time t, $I(t)_k$ is the level of investment in K, $I(t)_h$ is investment in H, $\lambda(t)$ and $\eta(t)$ are the co-state variables or shadow prices of K and H, respectively, and $\Omega(t)$ is the Lagrangean multiplier of the budget constraint. The only difference with the standard formulation is that we explicitly recognize the capital market distortion affects the relative price of the two investment goods by the factor $g \neq 1$.

The following proposition shows capital market equilibrium in balanced growth when capital markets are imperfect.

Proposition 1 (on balanced growth temporary equilibrium with capital market distortions)*. If capital markets are imperfect, a fundamental balanced growth condition for multi-asset endogenous growth models is the following:*

$$F_K(K/H, 1) = gF_H(K/H, 1); \qquad g > 0, \quad (3)$$

where g is a measure of the net distortion in the capital market.

Proof. *See Appendix.*

This extraordinarily simple result is a balanced growth equilibrium condition arising from generalizing a surprisingly large number of multi-asset, endogenous growth models, including Barro and Sala-I-Martin (2004), Lucas (1988), Aghion and Howitt (1998), Mino (1997), and several others.[10]

The equilibrium physical capital to human capital ratio. Using (1) and (3), it follows that the distorted $(K/H)^{e}$ equilibrium ratio is a decreasing function of g,

$$\left(\frac{K}{H}\right)^{e} = \left(\frac{a}{(1-a)g}\right)^{\sigma} \qquad (4)$$

As discussed earlier, it is possible that political conditions act against the intrinsic biases of capital markets inducing a perfect off-setting of such biases so that g =1 which would cause $(K/H)^{e} = (K/H)^{*} \equiv \left(\frac{a}{(1-a)}\right)^{\sigma}$, where $(K/H)^{*}$ is the undistorted ratio derived from (3) when evaluated at $g = 1$. Alternatively, political conditions may induce over-shooting, causing g >1 in which case $(K/H)^{e} < (K/H)^{*}$. On the other hand, if political conditions are insufficient to compensate the intrinsic anti-H bias of capital markets, meaning that $g < 1$, we have that $(K/H)^{e} > (K/H)^{*}$. As shown below, whenever $(K/H)^{e} \neq (K/H)^{*}$ the balanced growth equilibrium is inefficient causing sub-optimal balanced growth equilibrium.

Nash power and distribution. As a benchmark of the power component of the analysis, we use the asymmetric Nash bargaining model (Nash, 1950) focusing on the owners of physical capital (henceforth denoted "K-owners") and the owners of human capital (henceforth denoted "H-owners") having different degrees of bargaining power, and who bargain for a share of a given level of output that they may jointly produce. The fact that factor owners derive their respective incomes from the bargaining process justifies referring to it as the *Nash theory of distribution*.

Generalized Nash bargaining suggest that two participants bargain for the distribution of a given pie. We consider here that the participants are the capitalist and the worker who

[10] However, more complex models may have multiple equilibria and others may not even converge to any equilibrium (Gaspar et.al, 2014).

bargain for the appropriation of a share of a given output, $Y = F(K,H) = \left[\mathrm{aK}^{\frac{\sigma-1}{\sigma}} + (1 - \mathrm{a})\mathrm{H}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$ in every period, y_k and y_h, representing factor incomes of capitalists and workers, respectively. In large part the result of the bargaining or equilibrium distribution of the output depends on their respective bargaining power. Denoting as $0 < \tau < 1$ a measure of the degree of the bargaining power of K- owners and $1 - \tau$ the bargaining power of H-owners, the generalized version of the Nash (1950, 1953) bargaining model interpreted as a solution from cooperative game theory (see, for example, Binmore, 1987, 1992) is,

$$\max_{y_k y_h} y_k^{\tau}\, y_h^{1-\tau} \quad subject\ to: y_k + y_h = Y$$

The solution to this optimization problem implies that that the split of the given output between workers and capitalists depends on their bargaining power. Nash bargaining model implies that the relative factor payments should be proportional to the bargaining power of each agent. Thus, the solution of the generalized Nash bargaining model yields that the output is split proportionally to the bargaining power,[11]

$$\frac{\mathrm{y^k}}{\mathrm{y^h}} = \frac{\tau}{1-\tau} \qquad (5)$$

Thus, using (5), and the CES specification for the production function we obtain,[12]

$$\frac{\mathrm{a}}{1-\mathrm{a}}((K/H)^{e})^{\frac{\sigma-1}{\sigma}} = \frac{\tau}{1-\tau} \qquad (6)$$

Where the left-hand-side of (6) represents the relative factor income ($\frac{\mathrm{y^k}}{\mathrm{y^h}}$) evaluated at the equilibrium physical capital/human capital ratio shown in (4). The left-hand-side of (6) shows the factor income ratio following from the marginal theory of distribution (with $\frac{\mathrm{y^k}}{\mathrm{y^h}} = \frac{KF_K}{HF_H}$) while the right-hand-side provides the factor income ratio according to the Nash theory of factor distribution. Using (4) in (6) it follows that there is a level of the

[11] For algebraic simplicity we have assumed that the reservation utilities of the players are zero, which may be a reasonable assumption for an aggregative model of a closed economy. Of course, consideration of non-zero reservation utilities would not affect the ensuing qualitative results.

[12] The CES function is homogeneous of degree 1 and the Euler theorem can be applied.

endogenous capital distortion, g, which allows factor returns to be consistent with both the marginal distribution theory and the Nash approach emphasizing power as a source of distribution.[13] Equation (6) really describes a hybrid theory of distribution with factor payments reflecting both their marginal contribution to production and their relative bargaining power.

As shown by Muthoo (2001), the bargaining outcome that asymmetric Nash bargaining generates is identical to the outcome obtained by the widely praised alternating-offers model developed in Rubinstein´s seminal article (Rubinstein, 1982).[14] Thus, the bargaining outcome implies that the relative shares of K-owners and H- owners are proportional to their respective degrees of bargaining power. While Rubinstein in his original article interprets the relative bargaining power of each agent as exclusively dependent on his/her relative discount factor, the discount factor can have a broader interpretation reflecting various costs of haggling. This may include the influence of imperfect markets or third parties, including that of the state through public policies and other political institutions, all having the potential of biasing the bargaining power in favor of either capitalists or workers (Muthoo, 2001).

As can be seen below, we further generalize this model by allowing the bargaining powers to be endogenously determined by the prevailing political conditions. Political conditions allow governments which engender policies biased in favor of capitalists (thus directly or indirectly inducing a higher value of τ) or, alternatively, in favor of workers (inducing a lower τ).

Economic power and political conditions. In general, we postulate that the relative bargaining power of K-owners is a function of both political and economic factors,

[13] Relating this to the alternating offers model, one may argue that differential access to capital markets may affect the discount factors of K-owners and H-owners. Those who have greater access to capital markets may exhibit lower discount rates than agents who face greater restrictions in their access to capital markets. This, in turn, implies that the bargaining power of those who face better access to markets would be higher than agents facing greater restrictions.

[14] The bargaining literature focusses on "players" as individuals, but as Muthoo (2001), Bardhan (2005) and others emphasize one can interpret the term player as organizations or as agents representing groups with similar interests such as capitalists owning mostly physical capital and workers owning mostly human capital as we do here.

$$\tau = f(A(z), (K/H)^e),$$

where $\mathrm{A(z)} \geq 0$ is a *policy factor* related to a vector of political variables z and $(K/H)^e$ is the equilibrium factor ratio as defined in (3). We define the factor A(z) as an indicator of pro-capitalist biases of the policy environment and hence its effect on capitalists' market power is a positive. An increase of $A(z)$ reflects political environments which increase with the degree of bias towards capitalists and a low value of $A(z)$ indicates a political environment that is more pro-workers.

The effect of $(K/H)^e$ summarizes the economic effects on power. It reflects relative capital abundance. We allow for complete generality regarding its effect on capitalists' power, it could be positive, negative or neutral. As we show below the sign of this effect does not affect the qualitative results to be obtained.

Thus, with the only purpose of making the algebra more intuitive we specialize the function $f(A(z), (K/H)^e))$ as follows,

$$\boldsymbol{\tau} = \mathrm{A(z)}\ ((K/H)^e)^{\gamma}\ , \qquad (7)$$

Where γ e can attain any sign or be equal to zero. We shall discuss in detail below the implication of each of these cases.

As we shall see in the next section on political equilibrium, the political factor A is also affected by the K/H ratio. However, unlike the economic effect, the political effect is likely to be increasing in K/H. That is, an increased relative abundance of physical capital may have two effects on capitalist power: On the one hand there is a purely economic effect of capital abundance which may, at least under certain conditions, reduce capitalist power. On the other hand, there is the political effect: Capital abundance tends to increase the political clout and influence of capitalists on policymakers, inducing a rise of their power. The net effect of capital abundance on capitalist power is in general ambiguous. To determine the net effect of economic and political forces on capitalist power requires to ascertain the political effect, which in turn requires a specific political model, differed for the next section, which focusses on the political equilibrium.

Solving the temporary equilibrium of the economic system. The three equations — (4) representing *equilibrium in the capital markets*, (6) showing the *Nash bargaining-cum-marginal distribution equilibrium,* and (7) representing *power-political equilibrium*— constitute a system of equations that simultaneously solve for the system's equilibrium *conditional* on a given political environment. The three endogenous variables characterizing this temporary or conditional equilibrium are the equilibrium distribution level of bargaining power (τ), the equilibrium degree of the capital market distortion (g), and the capital-to-human capital equilibrium ratio ($(K/H)^{e}$).

Using (4) in (6) and (7) obtains,

$$\boldsymbol{\tau} = \mathrm{A}(z)\left(\frac{a}{(1-a)}\right)^{\gamma\sigma} g^{-\gamma\sigma} \qquad (8)$$

and

$$g^{1-\sigma} = \frac{\tau}{1-\tau}\left(\frac{a}{1-a}\right)^{-\sigma} \qquad (9)$$

Equations (8) and (9) simultaneously determine the equilibrium values of g and τ and then the resulting value of g recursively determines $(K/H)^{e}$ via equation (4),

$$\left(\frac{\mathrm{K}}{\mathrm{H}}\right)^{\mathrm{e}} = \left(\frac{\mathrm{a}}{(1-\mathrm{a})g}\right)^{\sigma} \qquad (4')$$

Where the only difference between equations (4) and (4') is that the latter is evaluated at the level of g obtained by solving equations (8) and (9).

The solution of this system allows us to *endogenously* derive the size of both the capital market distortion, g, and the level of bargaining power of capitalists, τ, (and, hence, of workers) as a function of the parameters of the economic model and of the political factor, A. That is, solution of (8) and (9) yields the equilibrium values $g^{e} = \varphi(A;\sigma,a,\gamma)$ and $\tau^{e} = \vartheta(A;\sigma,a,\gamma)$. The endogeneity of the capital market distortion and of bargaining power is a distinctive feature of this analysis. From (8) and (9) it follows that $g^{e}$is decreasing in A while τ^{e} is increasing in A; that is, $\partial g^{e}/\partial A < 0$ and $\partial \tau^{e}/\partial A > 0$.

Moreover, using (4'), the equilibrium factor ratio is also endogenously derived,

$$\left(\frac{\mathrm{K}}{\mathrm{H}}\right)^{\mathrm{e}} = \left(\frac{\mathrm{a}}{(1-\mathrm{a})\varphi(A;\sigma,a,\gamma)}\right)^{\sigma} \qquad (10)$$

Which is also a function of $A, \sigma, a \; and \; \gamma$. Also, from (10) noting that $\partial g^e / \partial A < 0$ it follows that $\frac{\partial (K/H)^e}{\partial A} > 0$.

Factor prices in an integrated theory of distribution. Integrating the Nash and marginalist theory provides, as we have seen so far, important results: Relative factor shares are determined by power, with the capital share being increasing in the capitalist bargaining power. Also, the factor ratio K/H is decreasing in the capital market distortion, g, and hence by (9) it is increasing in the capitalist level of power.

Now we look at the determination of factor rewards in the context of an integrated theory of distribution. Recognizing the endogenous nature of the capital market distortion implies that factor distribution is the result of both the marginal productivity of the factors and the Nash power distribution. From (1) and (4') it follows that the *wage rate per unit of H* is,

$$w = (1-a)[a^{\sigma}(1-a)g^{1-\sigma} + 1 - a]^{\frac{1}{\sigma-1}}.$$

Where the wage rate is equal to the distorted marginal product of H, which is a function of the degree of capital market distortion, g . Similarly, the price of physical capital is,

$$r = a\left[a + (1-a)\left(\frac{a}{1-a}\right)^{1-\sigma} g^{\sigma-1}\right]^{\frac{1}{\sigma-1}}.$$

Using (9) in the above two expressions, we obtain factor prices as a function of the distribution of power and production parameters,

$$w = (1-a)[1-\tau]^{\frac{1}{1-\sigma}} \quad ; \quad r = a^{\frac{\sigma}{\sigma-1}}\tau^{\frac{1}{1-\sigma}}$$

That is, equilibrium factor rewards are determined not only by the production technology (in this simple case represented by a and σ) as the marginal theory of distribution predicts, but also by the factors' relative bargaining power (represented here by τ).[15] Thus, the profit rate can be sustained over time as long as τ remains constant but if political conditions

[15] While capitalist power (τ) always raises the factor share of capital, the effect of τ on factor prices depends on the size of the elasticity of substitution.

change they will impact τ and hence r. The evolution of the capitalist-workers power contest (which may be akin to the concept of "class struggle") will depend on whether capitalists and workers will find the rates of return to human and physical capital acceptable.[16]

Economic growth. Here we show that the rate of economic growth can be recursively derived from the solution to equations (4), (6) and (7), specifically from the equilibrium capital to human capital ratio shown in (10). The equilibrium rate of economic growth is thus evaluated at the temporary equilibrium values of the endogenous variables. The following proposition characterizes the rate of economic growth.

Proposition 2 (on the rate of economic growth in distorted balanced growth equilibrium). *Conditional on a given level of A, the balanced rate of economic growth (G) is uniquely determined by the equilibrium* $(K/H)^e$ *ratio as obtained from (10), yielding a temporary equilibrium balanced growth rate,*

$$G = Min\{\beta[F_K((K/H)^e) - \rho]; \beta[F_H((K/H)^e) - \rho]\} \qquad (11)$$

Where β *is the inverse of the elasticity of marginal utility (which is assumed constant). Moreover, G exhibits an inverted U-shaped relationship with* $(K/H)^e$*, attaining a maximum at* $(K/H)^*$*. G achieves a maximum when* g *=1, which implies that* $F_K\left(\left(K/H\right)^*\right) = F_H\left(\left(K/H\right)^*\right)$.

Proof*. See appendix.*

An important implication of Proposition 2 is that the rate of economic growth crucially depends on the equilibrium capital/human capital ratio. In fact, there are two balanced growth equilibrium regimes: (i) Relative scarcity of human capital ($g < 1$) regime in which case $(K/H)^e > (K/H)^*$ and growth is dictated by the marginal productivity of physical capital, which is lower than that of human capital; (ii) Physical capital relative

[16] Returning to Galor and Moav (2006) hypothesis that class struggle may be suppressed due to the complementarity of human and physical capital, it is clear that such condition is necessary but not sufficient to eliminate class struggle, a phenomenon that critically depends on the political conditions which we examine in the next section.

scarcity ($g > 1$) in which case growth is dictated by the marginal productivity of human capital, which is lower than that of physical capital. There is a third case in which $(K/H)^e = (K/H)^*$ which yields the maximum growth rate.

This leads to an inverse U-shaped relationship between the rate of growth and the equilibrium K/H ratio, with growth attaining a maximum when $(K/H)^e = (K/H)^*$. Using (10) in the equilibrium growth rate (11) as shown in Proposition 2, it follows that $G = \psi(A; \sigma, a, \gamma)$. That is, the equilibrium economic growth rate critically depends on A, the political environment.

To assess the role of power and capital market distortions, we first characterize the economic-politico optimum in which political variables are set at levels that neutralize market failure and allow for an optimal distribution of power which permits to maximize the rate of growth of the economy.

Social Optimum. Consider the conditions required for an "optimal" temporary equilibrium. This requires g=1 which, in turn, using this value in (4), (5), (7) and (9) yields,

$$A^* = \frac{\left(\frac{a}{1-a}\right)^{\sigma(1-\gamma)}}{1+\left(\frac{a}{1-a}\right)^{\sigma}}; \quad \boldsymbol{\tau}^* = \frac{\left(\frac{a}{1-a}\right)^{\sigma}}{1+\left(\frac{a}{1-a}\right)^{\sigma}}; \quad \left(\frac{y^k}{y^h}\right)^* = \frac{\tau^*}{1-\tau^*} = \left(\frac{a}{1-a}\right)^{\sigma} \tag{12}$$

These conditions represent the political variables (A^*) that would exactly compensate for the intrinsic distortions of the capital markets and hence which would allow for an optimal distribution of power and income between K-owners and H-owners. Also, as shown in the Appendix, the optimal equilibrium rate of economic growth of consumption can be derived,

$$G^* \equiv \frac{dlnc(t)}{dt} = \beta[F_K((K/H)^* - \rho], \tag{13}$$

Where β is the inverse of the elasticity of consumers' marginal utility, which is assumed to be constant. Of course, the social optimum just described is not the natural outcome of the economic-politico system, it is merely provided as a reference or benchmark from which to evaluate the actual equilibria developed in the remainder of this paper.

Temporary equilibrium: a graphic illustration. Figure 1 shows the temporary equilibrium solution to the system of equations (4), (6) and (7). The upper right-hand panel

shows the simultaneous determination of g and τ, which are obtained from equations (8) and (9). Thus, the slope $\frac{\partial g}{\partial \tau}$ in equation (8) is positive, and the same slope from equation (9) is negative if $\gamma < 0$ as we assume in the figure. However, if $\gamma \geq 0$ then the slope of equation (9) becomes negative or vertical. The upper left-hand panel shows the resulting $(K/H)^{\mathrm{e}}$ ratio (given by equation (4')) associated with the equilibrium level of g.

Consider now the effect of an increase of the political bias in favor of capitalists, that is of an increase in A. This causes a shift of the curve leveled (8) in the figure to the right as shown by the curve (8↑ A). This brings about a new equilibrium with a higher level of τ and a lower level of g. If $\gamma \geq 0$ the curve labeled (9) in the figure is not affected, maintaining its negative slope, but the curve (8) would now be downward sloping or vertical if $\gamma = 0$ (in the latter case $\tau = A$). An increase of A would bring about a shift of curve (8) to the right. Since the curve (9) is not changed by the increase of A we have a new equilibrium with a higher level of τ and a lower level of g. That is, the qualitative effect of A on the equilibrium level of τ and g is not affected by the sign of γ. This means that the effect of A on the K/H ratio and hence on growth is also unaffected.

In summary, we have the following comparative static results in temporary equilibrium:

$$(i) \quad \frac{\partial \tau}{\partial A} > 0 \; ; \quad (ii) \; \frac{\partial g}{\partial A} < 0; \quad (iii) \quad \frac{\partial \left(\frac{K}{H}\right)}{\partial A} > 0 \qquad (14)$$

The relationship between G and $(K/H)^{\mathrm{e}}$ is shown in the lower left-hand panel in Figure 1, which, as shown by Proposition 2, has an inverted U shape, attaining a maximum rate of growth when $(K/H)^{\mathrm{e}} = (K/H)^{*}$. As the figure shows, $g < 1$ ($g > 1$) is associated with a higher (lower) level of power of capitalists relative to workers as well as with a higher (lower) K/H ratio, i.e. a slower rate of economic growth than in the case when $g = 1$. If the political conditions strongly favor human capital (the level of A is much lower than the one depicted in Figure 1) then g may become greater than 1, $\tau^{e} < \tau^{*}$, $(K/H)^{\mathrm{e}} < (K/H)^{*}$, and hence by Proposition 2, the rate of economic growth is reduced to below the optimal rate.

In general, we can express economic growth as a function of K/H, where the effect of K/H is ambiguous, reaching a maximum when $(K/H)^{\mathrm{e}} = (K/H)^{*}$. Then using (10) we have,

$$G = \tilde{G}\left[\left(\frac{\mathrm{a}}{(1-\mathrm{a})\varphi(A;\sigma,a,\gamma)}\right)^{\sigma}\right] = \hat{G}(A) = G(\tau) \qquad (15)$$

Where the function $\tilde{G}$ in the A space retains a U shape, reaching a maximum when $A = A^*$ where A^* is defined by (12). Since $\varphi(A;\sigma,a,\gamma)$ is not specified, and all other elements of the function $\tilde{G}$ are fixed parameters, there is no loss of generality in expressing G as a reduced-form function $\hat{G}$ of A, as we do after the second equality in (15). Also, the fact that, as shown in $(14i)$, A and τ move in the same direction allows us to express (15) as a function of τ instead of A, as we do in the second equality in (15). Importantly, the reduced form function $G(\tau)$ also retain an inverted U shape reaching a maximum at $\tau = \tau^*$ where $\tau^*$is defined in (12).

Figure 1 shows a case where initially $A > A^*$, which implies that $g < 1$. In this case, an increase in A exacerbates the capital market distortion thus reducing the equilibrium growth rate. Increases in A may reflect policy mechanisms that are favorable to K-owners, exacerbating the inherent distortion of capital markets. However, if initially $A < A^*$ then an increase in A may have the opposite effect, improving growth. This is the case when initially $g > 1$.

The fact that the economy grows implies that the equilibrium K/H ratio must be interpreted in a dynamic context. Balanced growth equilibrium implies that *both assets increase* over time at the same rate thus preserving the equilibrium K/H ratio, a rate which must also be equal to the economic growth rate. Thus, the maximum rate of growth occurs when the capital market is non-distorted, that is when g =1 and, therefore, $(K/H)^e = (K/H)^*$. If $g <$ 1 (g >1) then the economy becomes over intensive (under intensive) in K vis-à-vis H, and this has the cost of a reduced economic growth rate in either case (see Figure A1 in the Appendix).[17]

[17] Capital market neutrality does not correspond to the "free" market equilibrium because the free market has an inherent bias in favor of K investment and against H investment and therefore it does not maximize economic growth, nor promote an optimal level of relative power.

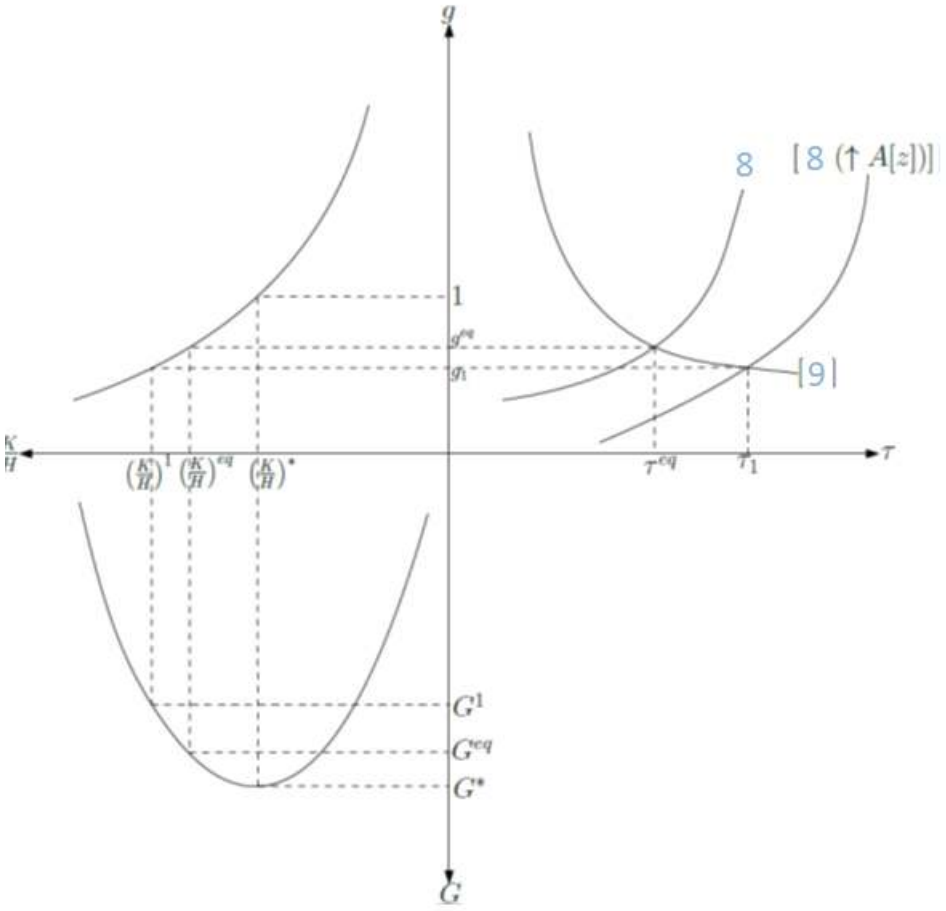

Figure 1.

The following proposition summarizes the key comparative static results arising directly from the previous analysis in this section.

Proposition 3 (On the comparative static of the temporary equilibrium). *If initially* $g < 1$ $(g > 1)$*, then:*

(a) Increasing power concentration in K-owners and the intensity of the capital market distortion move in the same (opposite) direction, conditions which are associated with a reduction (an increase) in the equilibrium rate of economic growth.

(b) Changes in the politico-institutional conditions in favor of K-owners (H-owners) worsen (improve) capital market distortions, raise (lower) inequality, and lower (higher) equilibrium rate of economic growth.

***Proof**. Follows directly from previous analysis illustrated by Figure 1.*

Several comments about Proposition 3 are in order. First, there is no causality in the relationships described in part (a) of Proposition 3, they are merely associations. Moreover, the direction of the associations critically depends on the initial conditions. If initially the capital market distortion favors K-owners, then rising power concentration on K-owners (which also means greater income inequality) is associated with increased distortion and a slowdown of the economic growth rate. *That is, increasing inequality and growth are in this case inversely related.* However, if the initial political conditions are such that initially the net capital market distortion favors H-owners, then greater inequality (a higher level of τ) is related to an amelioration of the capital market distortion and faster economic growth. In this case, *increasing inequality and growth are positively related.* Second, part (b) of Proposition 3 does reflect a causal relationship from political conditions to the economic equilibrium variables. The direction of this causal relationship also depends on the initial conditions.

The following result is a corollary to the analysis in this section.

***Corollary**. Political conditions (represented by A) completely dictate the conditional or temporary equilibrium achieved. They determine all the fundamental economic variables including the distribution of economic power, income distribution between K-owners and H-owners, the efficiency of capital markets, and the rate of economic growth. There is an optimal political equilibrium and deviations from it may worsen the temporary equilibrium.*

Given the vital importance of the political conditions it is essential to model their dynamics over time explicitly considering the feedback effects between A and the temporary economic equilibrium conditions. The new economic equilibrium itself feeds back into the political environment changing the political equilibrium, and so forth. That is, we conceive a sequential temporary equilibria series of economic and political states, a sequence that may continue over time indefinitely. We consider the dynamics of A in the next section.

The dynamics of politics

In this section we develop a simple model of political competition for an established and mature democracy with two parties, yielding a policy environment that in turn determines

the evolution of the fundamental economic variables. The classical and most influential model of political competition is based on Downs (1957) which portrays a competition between two candidates who have no specific ideology and whose sole objective is to win an election. Voters do have policy preferences which are known and fixed. The two candidates are opportunistic and strive to offer a policy menu as close to such preferences as possible. Downs models political equilibrium as the Nash equilibrium of a game in which each candidate maximizes his/her chances of being elected by choosing a policy proposal. Not surprisingly, the equilibrium of such game produces what has been called the principle of "minimum differentiation" in which the policies proposed by the two candidates converge towards the median voter-most-preferred point in the (linear) policy space. Thus, a unique equilibrium arises, and policies remain constant for as long as the voters' policy preferences do not change.[18]

Below we develop a model of political competition which assumes the existence of two political parties with clear and dissimilar ideological preferences arising from their representation of the two classes that we consider, workers and capitalists. Preferences by party and voters are entirely defined in the space of economic variables, particularly defining economic power. That is, the policy factor A defined in the previous section. However, given that as was shown in the previous section, A and τ are positively related with a stable relationship, we may indistinctly use either A or τ as the key factor determining voters´ preferences.[19] We choose economic power, τ, as the key factor determining the electorate preferences given the intuitive appeal of using it as the bridge linking economics and politics.

A feature of our analysis that distinguishes it from the Downsian model is that the electorate's characteristics and hence its voting patterns are not fixed, instead they

[18] Extensions of the Downs's model have followed several paths, including removing the assumption of a linear policy space and instead allowing for a higher dimension space. Unfortunately, if the policy space is multidimensional, an equilibrium may not exist (Ortuno-Ortin, 1997). An important extension is the recognition that there are parties with defined ideological preferences which propose policies according to their preferences in the space of feasible policies (Wittman, 1990; Roemer, 2001; Schultz, 1995). However, in the absence of uncertainty, these models engender similar results to the classic Downs' model (Roemer, 2001).

[19] Of course, there are several non-economic variables which may be part of the policy space that we do not include here.

endogenously change over time in response to the policies implemented by the party in power. Thus, preferences of the median voter are not known *ex ante* by the political parties. Another distinctive feature of our model is that, to the extent that the parties are assumed to represent well-defined class interests (workers or capitalists), there is a clear recognition by the electorate of their basic policy orientation, a feature that makes it futile for the parties to hide their real policy biases for the purpose of maximizing their chances of being elected or reelected.[20]

The model used here is related to the analysis by Ortuño-Ortin (1997) which shows that if parties care about the fraction of votes they receive, equilibrium with profound policy differentiation may occur even in the absence of uncertainty. We obtain the same result but for completely different reasons. Our model is also somewhat related to Roemer (1995), which by focusing on political uncertainty leading to random party turnover, predicts equilibrium with stochastic political cycles. Unlike Roemer´s analysis we predict non-stochastic political cycles which is consistent with certain empirical evidence for the US, showing that the hazard rates of defeat of incumbents rises over time, leading to a more cyclical behavior than would be expected if party turnover were merely random as in Roemer´s model (Lin and Guillen, 1998).

Dynamics of A in democracy: preliminaries. We postulate that there exist two political parties, each representing the interests of the capitalist elites and of workers. The general electorate, constituting most of the population, decides the elections.

Specifically we have: (1) Party E ("pro-elite"), whose main concern is to maximize the benefits of economic growth accruing to K-owners; (2) Party P ("progressives") which tries to maximize the benefits of economic growth accruing mainly to H-owners. (3) The electorate, which has no defined or stable ideological preferences, is highly heterogeneous comprised of people deriving their income from a variety of sources including human capital, physical capital and combinations of them in different proportions. The median voter constantly adjusts their political inclinations because when policies and economic

[20] This does not mean that parties may not use demagoguery and try to sell themselves, for example, as the party "of the majorities" while choosing policy programs that support mainly the capitalists. The point is that in established democracies and political parties with a long reputation supporting specific groups, such demagoguery may have only a minor effect in the electorate.

growth rates change the income composition of the median voter also changes becoming more dependent or less dependent on physical capital or human capital income. Depending on the prevailing economic conditions, the median voter may be more inclined to vote for either E or P. For example, slow economic growth with low levels of inequality is a condition favorable for party E because the median voter becomes a little more "capitalist".

In the next section we show that the dynamics of A (and, hence, of the full economic system) may exhibit a cyclical process. The cycles may be permanent and there is no reason to necessarily expect convergence to a socially optimum politico-institutional equilibrium.[21]

The nature of the political cycles

The boundaries of the cycles are in part determined by the behavior of parties E and P. These parties (or, better, the party leaders which propose policies) are homogenous, small in numbers, and fully committed to their ideology. While the two parties have diametrically opposite concerns about economic equity, both share a concern for economic growth, albeit to different extents. The difference lies in the weights that each party attaches to equity versus growth.

Below we present three basic assumptions used in the ensuing analysis with their respective justifications:

Assumption B. *B(a): The median voter represents a heterogenous population comprised of capitalists whose income depends mostly (but not necessarily completely) of physical capital income and workers who obtain their income mostly (but not necessarily completely) from the returns to their human capital. B(b): At least 50% of the median voter income is derived from human capital.*

Assumption M. *The level of τ and A adjust gradually as a new political regime takes office.*

Assumption Z. *Voters elect policies and politicians do not make credible promises to moderate or hide their preferred policies.*

[21] This is consistent with recent literature arguing that political institutions do not necessarily converge to efficient institutions (see, for example, Acemoglu, 2002; Bardhan, 2001; or Busch and Muthoo, 2003).

Assumption B simply reflects the fact that most of the population derives its income from human capital sources; "pure" capitalists are a small fraction of the population. Moreover, empirical studies have shown that across OECD countries, the share of labor in national income has consistently been much greater than 50% at least over the last century.[22]

A justification for assumption M is that changes in τ or A are complex, the resultant of adjusting many policy variables that often take time to implement. If, for example, party E is voted into power, increasing τ may involve financial deregulation, changing labor laws to make them more pro-business, reducing subsidies to health and education (note that these subsidies constitute a direct mechanism to reduce the pro-K biases of the capital market), and so forth, all of which take time to be implemented. Similarly, when P access power, dismantling many of those policies and reestablishing social subsidies to reduce the pro-capitalist biases of the capital market, may take time and hence the policy adjustment will be gradual. Also, as shown below, if a new government regime would instantaneously bring τ to its desired level (τ^E or τ^P) it would risk being booted out of office very quickly and its policy would be reversed.

Assumption Z is supported by several empirical studies, most prominently Lee et.al. (2004), which using US data showed that the hypothesis that competition for votes induces politicians to move toward the centre does not hold. Instead it showed that voters do elect policies. "Politicians cannot make credible promises to moderate their policies, and elections are merely a means to decide which one of two opposing policy views will be implemented." (Lee et.al. 2004, page 810*).* Also, Petterson-Libdom (2008) obtains similar conclusions for the case of Sweden. This evidence sharply contrasts the common assumption used by the Downsian approaches which predict that in equilibrium policies of both parties become indistinguishable.[23]

These plausible and well-founded assumptions, particularly assumption Z, leaves little room for a political equilibrium arising from a Nash game played by policy-uncommitted

[22] In the US, for example, it was above 60% throughout history, although it has fallen to about 57% over recent years (McKinsey Global Institute, 2019). Also, the average share of labor in the OECD countries, while also decreasing in recent times, has never been below 65% over the last century (O'Mahony et.al., 2018).
[23] At least two important theoretical papers also consider the assumption that political candidates commit to policies and have well-defined and well-known policy preferences is plausible (Besley and Coates, 1997; Osborne and Slivinski, 1996).

politicians as postulated by the Downsian approaches. How then is equilibrium being determined? The story that follows is in a sense simpler than the conventional one: Each party makes a policy offer consistent with its principles and the party whose offer is closest to the preferences of the median voter at the time of the election results elected. Is this the end of the story? No, because the preferences of the median voter being a representative of a mixed of heterogenous citizens which derive their income from both physical and human capital sources in different proportions (assumption B) endogenously change due in part to the very policies that the elected party gradually implements (gradual by assumption M). Often, as we will see, the policies induce changes in the income composition of the median voter eventually making her/his preferences less consistent with the party in power, thus gradually shifting towards those of the rival party. At some point the median voter preferences become sufficiently distant from those of the party in office (and closer to those of the opposition party). In this case in the new election the opposition is elected to govern.

Party E. We assume that E aspires to maximize the benefits of economic growth (G) accruing to K-owners. Using equation (15), economic growth can be written as a non-linear function of τ, $G(\tau)$. Thus, Party E aspires to a level of τ which would maximize the participation of K-owners in economic growth,[24]

$$\underset{\tau^E}{\text{Max}}\, \tau^E\, G(\tau^E) \qquad (16)$$

$subjet\ to\ \ 0 \leq \tau^E \leq 1\ and\ G(\tau^E) > 0.$

The optimal conditions for this problem are,

$$G(\tau^E) + \tau^E \frac{\partial G(\tau^E)}{\partial \tau^E} = 0 \qquad (17)$$

And the second order condition,

$$\tau^E \frac{\partial^2 G(\tau^E)}{\partial \tau^{E2}} + 2\frac{\partial G(\tau^E)}{\partial \tau^E} < 0 \qquad (18)$$

[24] Alternatively, one may postulate that E's objective function is to maximize the participation of K- owners in total production instead of economic growth. A justification for not doing this is that the output level at a specific point in time is already given, thus it might be difficult to change its appropriation by the asset owners. By contrast, the benefits of the forthcoming economic growth are more open to be appropriated by either group.

Where τ^E is the *desired* level of τ by party E. These conditions allow us to show the following lemma.

Lemma 1. *The desired level of capitalist power (τ^E) by party E is in the downward segment of the growth function.*

Proof. *By the constraint in (16) $G(\tau^E) > 0$, which using (12) implies that at the optimum chosen by E the slope of the growth function must be negative, $\frac{\partial G(\tau^E)}{\partial \tau^E} < 0$. This plus the required concavity of the growth function implies that the second order condition for a maximum is also satisfied.* ■

It must be emphasized that τ^E is merely a policy proposal by Party E to the electorate; unless E wins the election it cannot affect the actual level of τ, which, as we shall see below, a proposal that might not fully materialize even if Party E wins the election.

Party P. Party P seeks to maximize the benefits of economic growth accruing to H-owners. Thus, this party aspires to a level τ^P which would,

$$\underset{\tau^P}{\text{Max}}(1-\tau^P)G(\tau^P) \tag{19}$$

$$subjet\ to\ \ 0 \leq \tau^P \leq 1\ and\ G(\tau^P) > 0$$

The optimal condition for this problem is,

$$-G(\tau^P) + (1-\tau^P)\frac{\partial G(\tau^P)}{\partial \tau^P} = 0 \tag{20}$$

And second order condition,

$$\left(1-\tau^P\frac{\partial^2 G(\tau^P)}{\partial \tau^2}\right) - 2\frac{\partial G(\tau^P)}{\partial \tau} < 0 \tag{21}$$

These conditions lead to lemma 2.

Lemma 2. *The desired level of capitalist power by party P (τ^P) is low enough to be in the upward segment of the growth function.*

***Proof**. Follows directly from the constraint in (19) and condition (20). That is* $\frac{\partial G(\tau^P)}{\partial \tau^P} > 0$, *which, in turn, implies that the second order condition for a maximum must be satisfied given concavity of the growth function.* ■

Lemmas 1 and 2 lead us to the following proposition:

***Proposition 4.** The policy proposals of both parties are socially inefficient.*

***Proof**. Follows directly from Lemmas 1 and 2 noting that the socially optimum requires that* $\frac{\partial G(\tau)}{\partial \tau} = 0$.

Thus, the socially optimum level of τ always lies between the extremes of the levels of τ proposed by each party. The two levels of τ proposed by parties E and P can be regarded as the extreme values that τ may attain.

The electorate (group N). Individuals in group N vote according to their perceived economic interests. Group N is highly heterogeneous, comprised of individuals whose income depends only on H, others on H and K to different extents and finally — the smallest number — those whose income is completely dependent on K. The median voter's income reflects this heterogeneity. The median voter will choose politicians that offer policies most favorable consistent with its income composition. If the median voter has preferences closer to those proposed by E (P) then a government E (P) is elected.

We postulate that the desired level of τ by the median voter (τ^N) is determined to maximize the benefits of economic growth for her/him, where her/his objective function accounts for a factor related to the heterogeneity of N. We make a sharp distinction between the desired power distribution level by the median voter (τ^N) and the actual level of power distribution (τ).

The median voter maximizes his/her participation in economic growth,

$$\underset{\tau^N}{\text{Max}}(1-\tau^N)^{\theta(\tau)}G(\tau^N) \qquad (22)$$

$$subjet\ to\ \ 0 \le \tau^N \le 1; G(\tau^N) > 0\ and\ 0 \le \theta(\tau) \le 1$$

Where $\theta(\tau)$ is a factor that captures the diversity of group N, i.e. the median voter does not only represent H-owners but also all the subgroups described above; if θ=1 implies that N would be fully homogenous comprised only of H-owners and their preferred choices would coincide with P. In general, however, since this group also includes people whose income depends at least in part on capital income, the median voter must also partially consider the interests of K-owners. This causes θ to generally be less than 1.

We postulate that θ is an increasing function of the actual or prevailing level of capitalist power (τ) because as τ rises, income becomes more concentrated in the K-owners who are a minority in group N. An increase of τ would have a negative effect on those members of N whose income depends less on K. By Assumption B, the income of the median voter must fall when τ increases, and hence the median voter becomes more interested in worker needs, implying that θ also increases. Thus, we assume that $\frac{\partial\theta(\tau)}{\partial\tau} > 0$.

The first order condition of problem (22) is,

$$(1-\tau^N)\frac{\partial G(\tau^N)}{\partial\tau^N} = \theta G(\tau^N) \qquad (23)$$

We note that if $\theta = 1$ then $\tau^N = \tau^P$. From (20) and the second order condition for a maximum, it follows that $\frac{\partial\tau^N}{\partial\theta(\tau)} < 0$. Also, since $\frac{\partial\theta(\tau)}{\partial\tau} > 0$ we have that,

$$\frac{\partial\tau^N}{\partial\tau} = \frac{\partial\tau^N}{\partial\theta(\tau)}\frac{\partial\theta(\tau)}{\partial\tau} < 0. \qquad (24)$$

That is, a rise in the actual level of τ causes an increase of θ which, in turn, induces a lower desired inequality level by the voters in group N, a lower level of τ^N.[25]

Lemma 3 below shows an important implication following from these results.

Lemma 3. *Preferences of the median voter endogenously change over time. They change because of the very policy adjustments implemented by the party in power. The policy preference of the median voter moves in opposite direction of the preference of the party in power.*

[25] Appendix B shows an alternative path to show that $\frac{\partial\tau^N}{\partial\tau} < 0$.

Proof. *Follows directly from Equation (23) using* $\frac{\partial\theta(\tau)}{\partial\tau} > 0$ and *Assumption B.* ■

When Party E access power it will raise τ which causes a reduction of τ^N, and when Party P access power it will reduce τ which will induce an increase of τ^N. This result suggests that the parties in power will tend to reduce adherence among the electorate by the mere fact that they begin implementing their policy proposals.

The following lemma follows:

Lemma 4. *The desired levels of* τ *of the three groups considered can be ranked as follows:*

$$\tau^E > \tau^N \geq \tau^P$$

The desired levels τ^N *and* τ^P *are on the increasing segment of the growth function while* τ^E *is on the decreasing side of the growth function*. More*over,*

$$\textit{if } \dot{\tau} > 0 \rightarrow \ |\tau - \dot{\tau}^N| > 0 \textit{ and if } \dot{\tau} < 0 \rightarrow \ |\tau - \dot{\tau}^N| < 0.$$

Proof. *The first part of the Lemma 4 follows directly from lemmas 1 and 2. The last part follows when using (21) and assumption M.* ■

Elections and government regimes. There are only two possible government regimes, E or P. If E is in power, then $\dot{\tau} > 0$ provided that $\tau < \tau^E$ (which is always true because τ^E is the maximum level of τ). If P is in power, then $\dot{\tau} < 0$ (which is always true because τ^P is the minimum level of τ).

The following lemma describes the government regime chosen.

Lemma 5. *Assume that the median voter votes for either E or P, whichever is closest to her/his preference for* τ*, then we have the following election outcomes:*

(a) E is elected if $|\tau^E - \tau^N| < |\tau^P - \tau^N|$
(b) P is elected if $|\tau^E - \tau^N| > |\tau^P - \tau^N|$
(c) If $|\tau^E - \tau^N| = |\tau^P - \tau^N|$ *then the incumbent government remains in power.*

Proof. *Follows directly from the assumption that the median voter prefers the political party that is closest to her/his preferences.* ■

Thus, $\dot{\tau} > 0$ if E is in power, and $\dot{\tau} < 0$ if P is in power. If E is in power and the level of τ has already surpassed the level of τ^*, we have that G is suboptimal and declining. Then by Lemma 4 $|\tau^E - \tau^N|$ must be increasing and $|\tau^P - \tau^N|$ decreasing. Hence, the likelihood that E will lose power as time goes on increases. Similarly, if P is in power $\dot{\tau} < 0$, and if $\tau < \tau^*$ then $|\tau^P - \tau^N|$ increases and $|\tau^E - \tau^N|$falls over time. This implies that regime P eventually loses power.

Proposition 5 (on the cyclical dynamics of power and political cycles). I*f lemmas 1 to 5 are valid and if Assumption Z holds then the political process follows permanent cyclical dynamics which in turn implies that progressive and conservative governments will alternate in power. Economic growth, inequality, and economic inefficiency will also follow cyclical patterns.*

Proof*. Follows directly from lemmas 1 to 5.* ■

Figure 2 illustrates the dynamics of power in the upper right-hand panel and the associated dynamics of economic growth in the lower panel. At time zero we assume that E is in power and its policy is already suboptimal ($\tau > \tau^*$) which also implies that $A > A^*$ (see the left-hand side panel in Figure 2 which shows the unique relationship between A and τ). If Condition (a) in Lemma 5 still prevails, the government E can remain in power. Hence, τ may continue rising even if the rate of economic growth at that time is declining (see the lower panel of the figure). However, as this process continues, a turning point is reached at time T1 in the figure where Condition (a) no longer holds and Condition (b) from Lemma 5 dominates instead. At time T1 a government change occurs and, τ starts declining consistent with the preferences of party P. At first this not only reduces inequality but also improves economic growth. The P government then remains in power. However, as this process continues, at time T2 the economy reaches its maximum growth rate. Since τ continues to decline, economic growth falters. Discontent among voters grows until at time T3 there is a change in power to E as Condition (a) dominates again. At T4 a new political and economic cycle begins.

Figure 2 quite clearly shows our assertion given at the beginning of this paper; political cycles and economic cycles are mirror images of each other. The two right-hand panels illustrate the sequential temporary equilibria of economic and political states, a sequence

that may continue over time indefinitely. In particular, the change of government regime (in the top panel of the figure) is closely associated with the economic cycle (in the lower panel of the figure). As economic growth eventually falls within a given government regime, it reaches a level low enough to trigger political changes that lead to a change in government regime. But also, the economic cycles themselves are functions of the evolution of the relative power of capital and human capital owners (and, hence, of the changes in income distribution that they cause) which are originated in the political conditions.

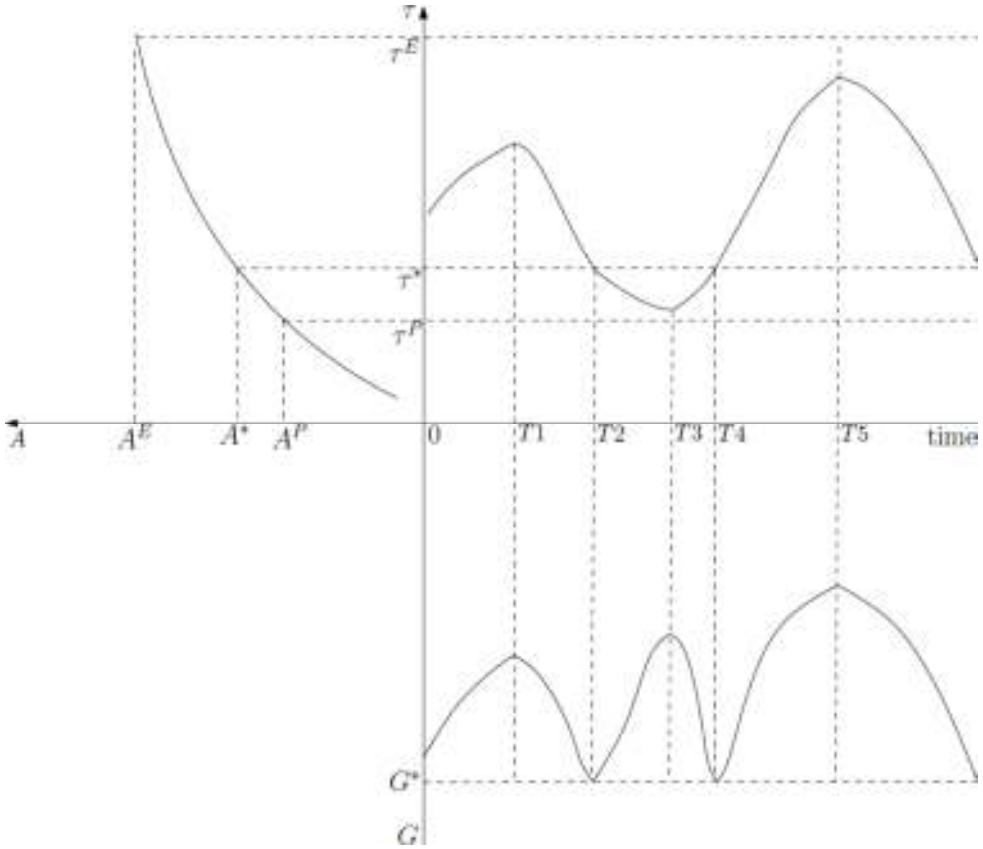

Figure 2. The cyclical dynamics of politics and economics

The following proposition emerges from the previous analysis,

Proposition 6 (average growth rate and the maximum amplitude of the cycles). *Ideological polarization, represented by the* $\tau^E - \tau^P$ *gap, may reduce the average rate of growth over time.*

Proof. *Using Lemmas 1 and 2 and Proposition 5 it follows that the optimal level of economic power distribution,* τ^**, is always between the boundaries of the cycles, between* τ^E *and* τ^P*. Since economic growth is at its maximum when* $\tau = \tau^*$*, lower ideological divergence between the parties (the smaller the* $\tau^E - \tau^P$ *gap), and hence a lower amplitude of political cycles implies that over time, on average, policies are closer to the socially optimal ones and hence growth is nearer its maximum rate. That is, there is an inverse relationship between political polarization and the average growth rate over long periods of time.* ■

The political cycles studied here concern long periods of time. Completing a full cycle (the time elapsed from the election of say party E, election of party P, to election of party E again) likely takes much longer than the time it takes to reach temporary equilibrium for the fundamental economic variables. In the empirical literature on political cycles, a study by Merrill et.al. (2010) concludes that in the UK the average length of a full political cycle takes about 28 years, an estimate very similar to the 30-year average cycles estimated for the USA (Lin and Guillen, 1998). That is, according to these studies, the length of the full political cycle, from T1 to T5 in Figure 2, is about 30 years.

In summary, the political model presented here predicts continuous political cycles over time which originate in endogenous changes in voters' preferences. This model can be regarded as a formalization of the thesis developed by Arthur Schlesinger, who explained the fluctuations in politics throughout American history. He contends that the political cycles are "self-generating and autonomous" (Schlesinger, 1999). Shifts in the national mood arise when discontent with present conditions drives Americans to pursue a new trend that promises to satisfy their interests. This inextinguishable discontent, according to Schlesinger, drives the cycles in national politics. Our model provides a theoretical foundation for Schlesinger' ideas; it shows that the "inextinguishable discontent" of the voters that leads to political change has an objective origin in the economic conditions that an excessively long permanence in power of a party can bring. The shift in the national mood therefore is not simply capricious feelings of voters as Schlesinger seems to believe.

Model predictions and some informal empirical illustrations

The model provides important and empirically verifiable predictions which are quite different from those of most other models. Some of these unique predictions are illustrated examining the patterns of economic growth rates in the USA under the two key political parties (Republican and Democrats) over the period 1885-2016. The main empirically testable predictions of the model are:

1. *Changes in government regimes entail a temporary acceleration of economic growth.* As shown in Figure 2 the access of a new party to office occurs when growth has deteriorated sufficiently, a trend that is temporarily reversed when there is a change in the party in office.

2. *Time structure of growth.* In both parties' governments, the rate of economic growth tends to exhibit a hump shape, increasing in the early part of their respective periods and then gradually declining.

3. *Inequality*. Inequality tends to decline over time during governments of the progressive party while it tends to increase when the conservative party is in office.

4. *Political polarization and economic growth patterns*. As shown by Proposition 6, ideological party polarization negatively affects the average growth rate over time. That is, there is an inverse relationship between political polarization and the average growth rate over long periods of time.

5. Systematic alternation in power. While conventional models of political competition also predict power alternation, this process is mostly aleatory because they assume that parties converge in their policy proposals and hence their chances of being elected are about 50% (this is of course also true for models that allow for uncertainty).[26] By contrast, our model predicts that parties in power gradually lose their support over time, increasingly becoming more likely to lose power. That is, the party alternation in power is not merely a stochastic phenomenon but rather a systematic process over time.

[26] A notable exception is Roemer (1995), who developed a model where voter preferences for current policies change adversely as a function of the length of time the incumbent party has been in power and the depth of the policy being implemented by the incumbent party.

Empirical illustration.[27] Here we provide some informal empirical illustration of Predictions 1, 2 and 5 for the US case in the period 1885 to 2016. During these years there were 16 presidential periods, 8 Democrat and 8 Republican.[28] A presidential political period is defined as a continuous period in which the president or presidents are members of the same party. Most of these political periods lasted 8 years with one president, but others lasted just 4 years, and a small number of them lasted more than 8 years, generally involving more than one president of the same party.[29]

The first observation is the rather amazing degree of alternation in power between Democrats and Republicans. Throughout the 131 years examined, there are only 3 periods in which the same party continuously remained in power for more than 8 years. These were the F.D. Roosevelt/Truman (RT) period which lasted 20 years, the Kennedy/Johnson/Carter period lasting 12 years, and the McKinley/T. Roosevelt/Howard period which lasted 16 years. If we disregard the RT period which was likely unusual as it included both the Great Depression and WWII along with the only president to serve more than two terms, out of 14 transfers of political power only in 2 of them was one party able to retain power beyond 8 years. Thus, as predicted by the model, the alternation in power seems to be quite systematic, a party in office has a decreasing likelihood of remaining in power.

With respect to Predictions 1 and 2, we consider 15 political periods (excepting the especial RT period) and thus 14 transfers of power. With the sole exceptions of the G.W. Bush and the second Cleveland regime, the rate of economic growth increased in the first or second year of the new regime (compared to the average rate in the last two years of the previous regime). Moreover, in all but 2 of the 15 regimes considered, growth tends to be fastest in approximately the middle of the period and a hump shape is perceptible.[30]

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[27] For the sake of restricting the length of this paper we provide the details of the empirical exercise reported here in an appendix available from the author.

[28] In this period 1885-2016 there were 8 full political cycles (as defined in the previous section); the average length of the full cycles was about 20 years, which is quite less than the 30 years estimated by Lin and Guillen (1998), based on an earlier historical period.

[29] An important caveat is that in 5 of the 16 presidential periods considered here there were years in which the party in the executive power had both legislative chambers under the control of the other party (Clinton, Nixon/Ford, Eisenhower, and parts of Wilson´s and Cleveland 2´s presidencies).

[30] In a few cases a double hump of the growth rate occurred, most clearly observable in the Harding´s and Reagan´s administrations.

Finally, statistical fit using a quadratic specification of the growth rate on time tends to have a good fit, yielding an inverted U-shaped relationship within each political period. In fact, the adjusted R^2 of the fitting formula tend to be quite high at about 0.52. This is consistent with the hump shape of economic growth over each political period as predicted by the model. Thus, this limited empirical exercise illustrates the fact that our model´s predictions appears to be consistent with some observed political patterns in the US over the last 131 years.

Conclusion

This paper has developed a sequential politico-economic model where economic and political variables alternate over time as state variables determining a sequence of temporary economic and political equilibria. We have integrated four strands of the economic development literature into our model: endogenous growth theory, marginal distribution theory, Nash distribution theory, and the market failure literature.

We have shown that all the fundamental economic variables — growth, distribution and economic efficiency — are to a large degree dependent on political conditions which dictate the most important economic policies. But those political conditions, in turn, are also dependent on economic conditions. We have shown that the distribution of economic power is a key bridge between political conditions and economic conditions. Ignoring economic power makes it very difficult to establish a satisfactory integration of economics and politics. Cyclical behavior of the political and economic variables exists, and they are closely interconnected. Political and economic cycles are mirror images of each other.

This suggest that theories predicting "secular" trends of capitalist economies towards stagnation and rising inequality as the famous Piketty (2014) book does, may require some qualifications. Periods of stagnation, even long ones, may be followed by periods of expansion, and periods of great inequality are likely to politically backfire leading to periods of increasing equality. Similarly, theories predicting fixed economic equilibrium arising from canonical growth models may also be unsatisfactory because they assume that political conditions are fixed or that they only change in an exogenous manner. Paradoxically, these two extremely opposing views share the same problem, their omission of economic power.

Returning to the important hypothesis regarding the end of class struggle due to the complementarity between physical and human capital raised by Galor and Moav (2006), we have shown two things: First, sustaining the profit rate occurs merely as a consequence of economic incentives to coordinate investment in both assets (which also sustain the rate of return of human capital). Second, despite this complementarity, we have shown that depending on politics and the distribution of economic power, it is possible that the resulting rate of profit may decline over long periods of time.

Finally, we have shown the closed connection between distribution and economic growth. Since these variables are endogenous the direction of these connection is in general ambiguous and unstable. Therefore, trying to ascertain relationships between them without referencing the underlying power and politico-institutional conditions may be futile and misleading. Depending on political conditions inequality and economic growth may be directly or inversely related.

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Appendix. Proof of Propositions

The optimal conditions of Problem (2) in the text are,

$$\frac{du(c(t))}{dc} = \Omega(t) \qquad A(1)$$

$$-\Omega(t)g + \lambda(t) \leq 0, \quad \big(-\Omega(t)g + \lambda(t)\big)I(t)_k = 0, \quad I(t)_k \geq 0 \qquad \text{(A2)}$$

$$-\Omega(t) + \eta(t) \leq 0, \qquad (-\Omega(t) + \eta(t))I(t)_h = 0, \qquad I(t)_h \geq 0 \qquad \text{(A3)}$$

$$\frac{d\lambda}{dt} = \rho\lambda(t) - \Omega(t)F_K\left(\frac{K}{H}\right) \qquad (A4)$$

$$\frac{d\eta}{dt} = \rho\eta(t) - \Omega(t)F_H\left(\frac{K}{H}\right) \qquad (A5)$$

Where ρ is the pure time discount rate, $F_K\left(\frac{K}{H}\right)$ and $F_H\left(\frac{K}{H}\right)$ are the net marginal products of K and H, respectively, $I(t)_k$ is the level of investment in K, $I(t)_h$ is investment in H, $\lambda(t)$ and $\eta(t)$ are the co-state variables or shadow prices of K and H, respectively, and $\Omega(t)$ is the Lagrangean multiplier of the budget constraint.

Proof of Proposition 1 (on balanced growth equilibrium with capital market distortions) *In balanced growth equilibrium the economy will invest in both assets if*

$$\eta = \Omega\,, \qquad \lambda = \Omega g\,. \qquad (A6)$$

Also, assuming a constant level of the degree of distortion, we have that the condition,

$$\frac{d\lambda}{dt} = \frac{d\eta}{dt} = \frac{d\Omega(t)}{dt} \qquad (A7)$$

is valid. Hence using (A4), (A5), (A6) and (A7), we obtain the generalized equilibrium condition,

$$F_K(K/H) = gF_H(K/H) \qquad (A8)\ \blacksquare$$

Thus, if g< 1 ($g > 1$) it implies that the cost of human capital is increased (reduced) relatively to the cost of physical capital because of said distortion. As a consequence of such capital market distortion (which is the net of the intrinsic market distortion and the distortion due to government intervention) we have that $F_K(K/H) < F_H(K/H)$ $[F_K(K/H) > F_H(K/H)]$. Only if g$= 1$ is the equilibrium undistorted, and $F_K((K/H)^*) = F_H((K/H)^*)$.

Proof of Proposition 2 (on the rate of economic growth in distorted balanced growth equilibrium). *The equilibrium growth rate is determined by two alternative regimes. If* $g < 1$ *then the growth rate is given by the marginal product of physical capital,* $F_K(K/H)$*, but if* $g > 1$ *then the growth rate of the economy is dictated by the marginal product of human capital,* $F_H(K/H)$*. Only if* $g = 1$ *is the growth rate determined by a single regime depending of either* $F_K(K/H)$ *or* $F_H(K/H)$ *which in such case are equal. Thus, we have*

$$G \equiv \frac{dlnc(t)}{dt} = Min\{\beta[F_K(K/H) - \rho]; \beta[F_H(K/H) - \rho]\} \qquad (A9)$$

Also, the maximum rate of growth (G^*) *occurs when* $g = 1$ *and hence,* $F_K((K/H)^*) = F_H((K/H)^*)$*. Clearly the relationship between* G *and* K/H *is an inverted U-shaped function reaching a maximum at* K/H^**.* ■

Figure (A1) below illustrates this proposition. The top panel of the figure shows the case when g<1. In this case,

$$G = \beta[F_K((K/H)^e) - \rho] = \beta(D - M). \qquad (A10)$$

The growth rate of the economy in this case is clearly less than the optimal one, which in the figure is represented by

$$G^* = \beta[F_H((K/H)^*) - \rho] = \beta[F_K((K/H)^*) - \rho] = \beta(A - B). \qquad (A11)$$

The lower panel of the figure shows the case when g>1, in which case

$$G = \beta[F_H((K/H)^{ee}) - \rho] = \beta(Q - H), \qquad (A12)$$

Which is also less than G^* as shown in (A11).

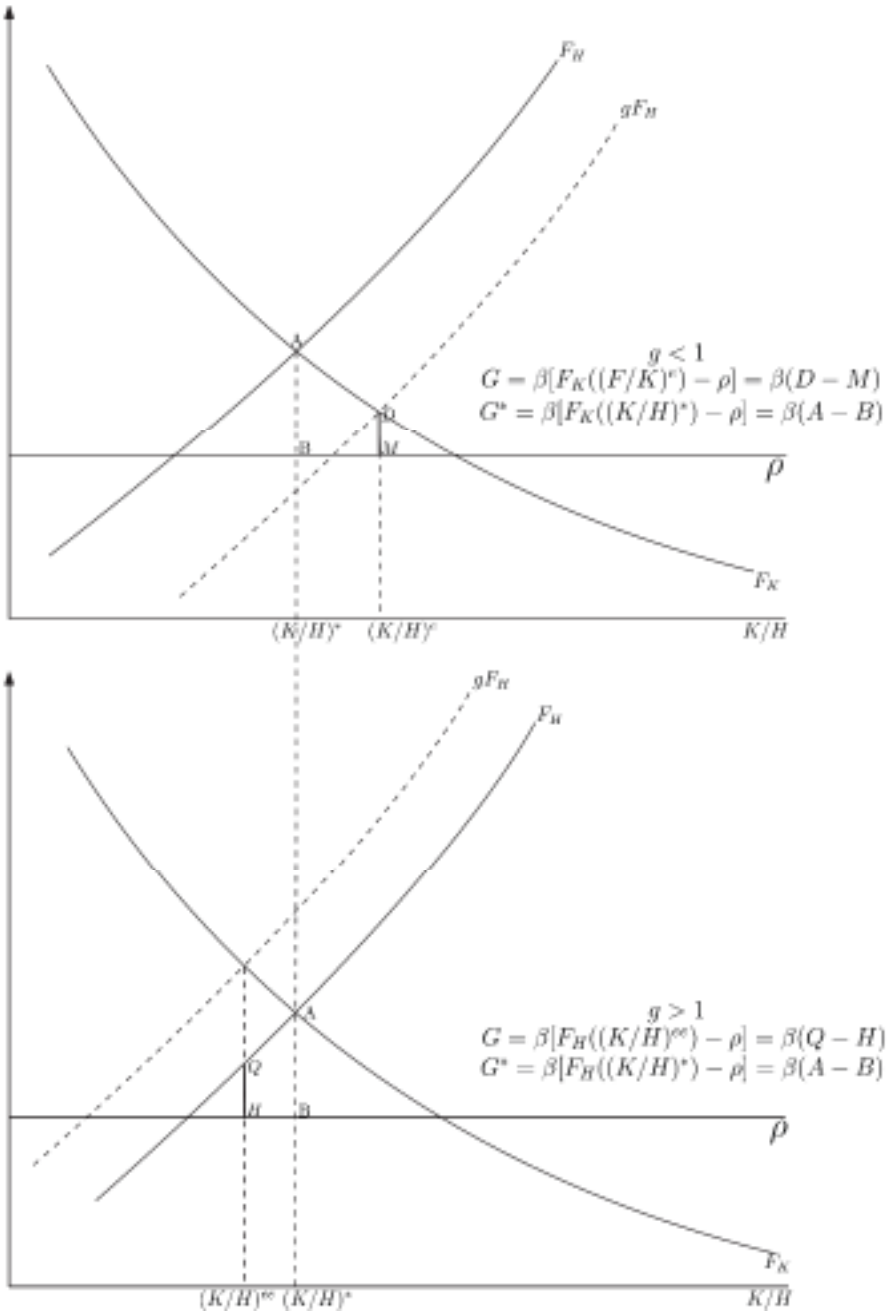

Figure A1. The determinants of balanced growth equilibrium under alternative patterns of capital market distortions